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Electronics

FIRST MAGAZINE OF GLOBAL ELECTRONICS MANAGEMENT

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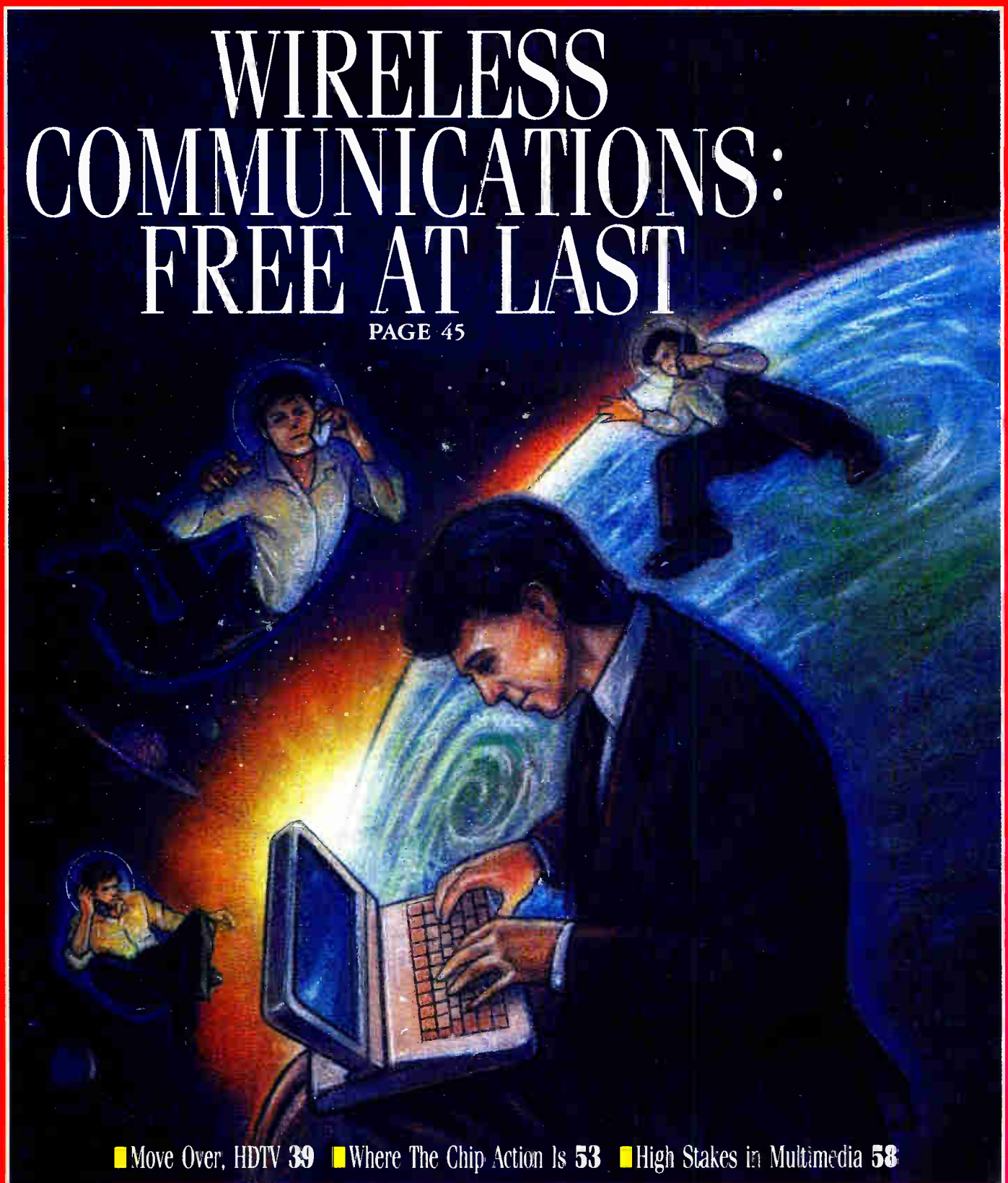

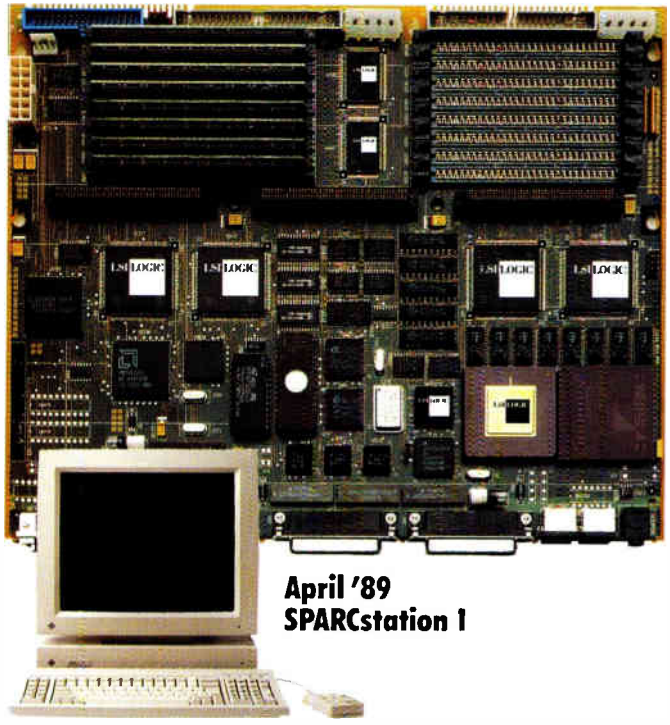

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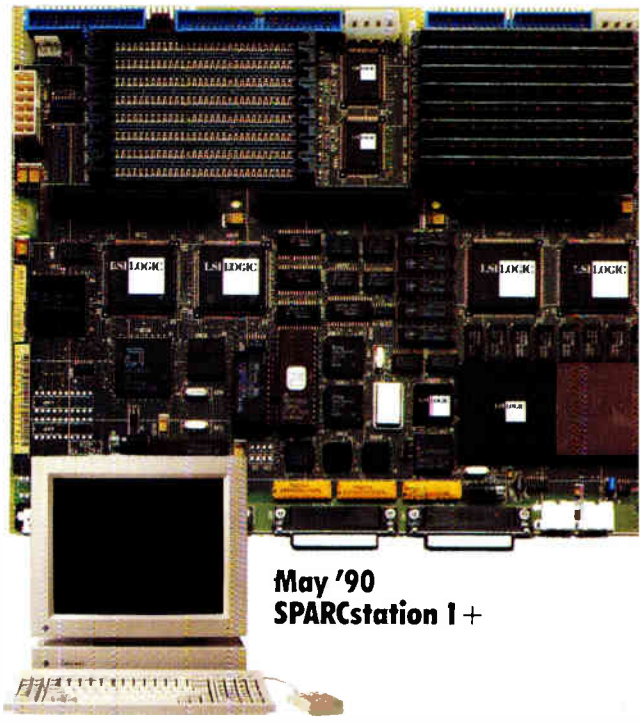

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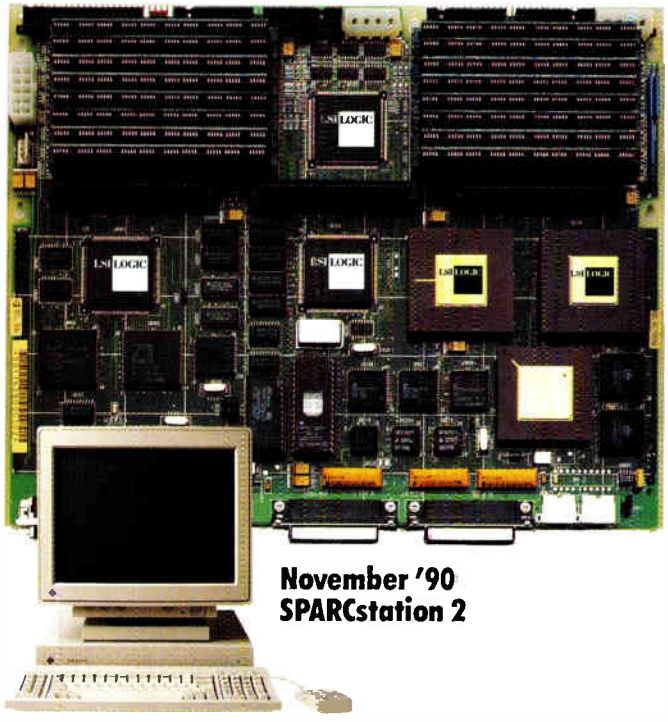

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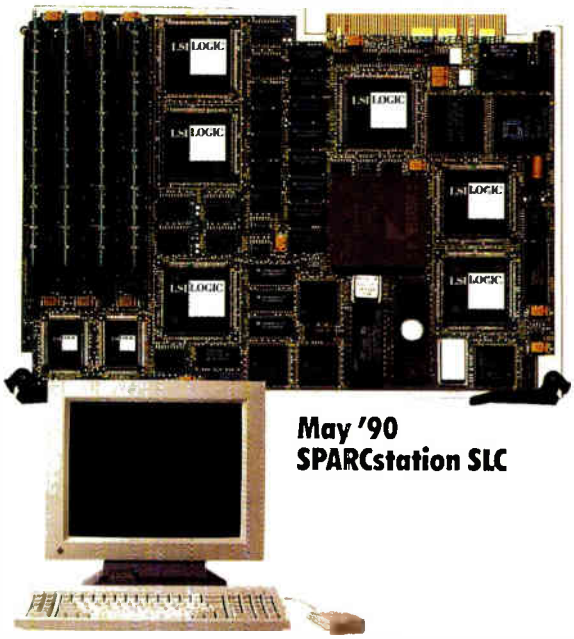

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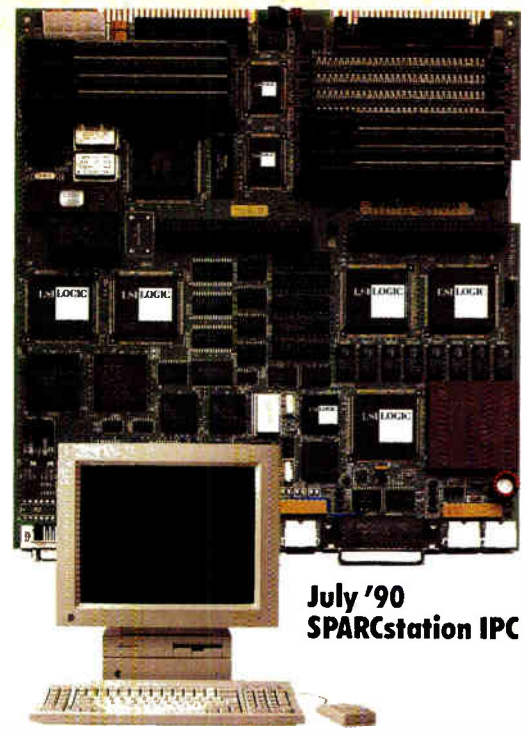

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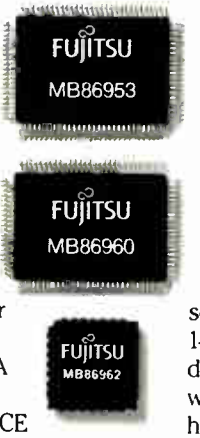

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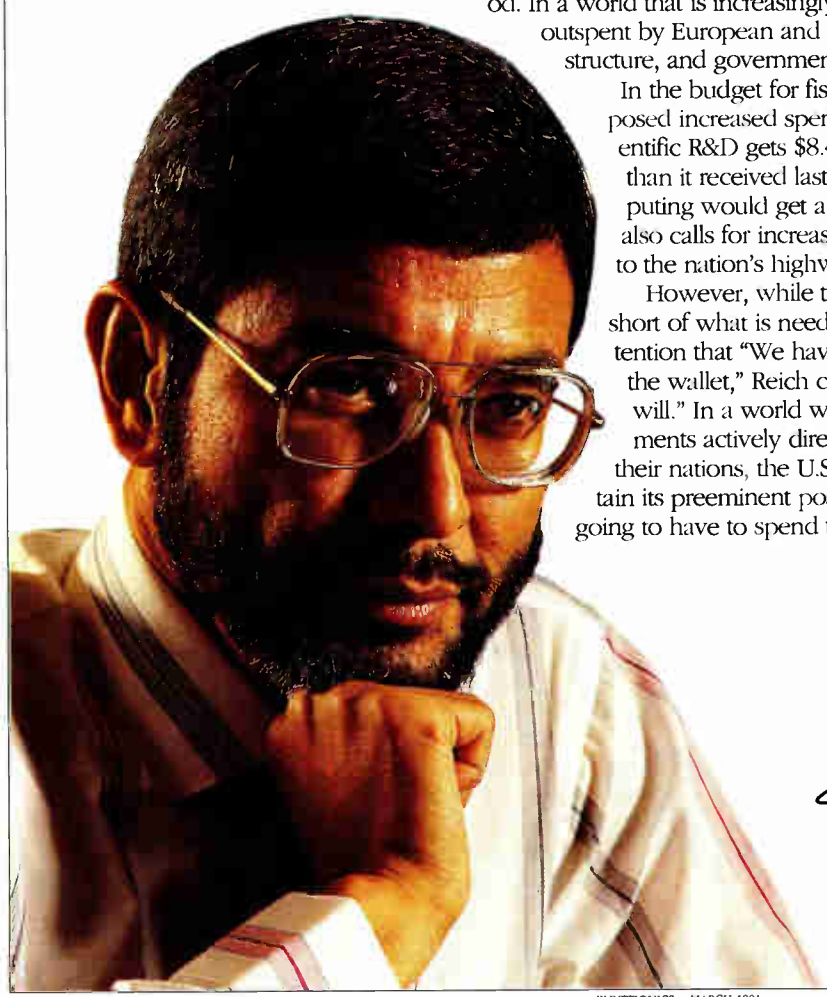
TO WIN MEANS TO SPEND

As the 21st century approaches, the proud young entrepreneur that the U.S. once was has grown into a rich, overweight, self-indulgent aging businessman. He has less ambition for new enterprise and little imagination to make it come into being. How did he come to this state? It was by a slow and unconscious process of disinvestment. That's the conclusion of the book *The Work of Nations: Preparing Ourselves for 21st Century Capitalism* by Robert B. Reich of the John F. Kennedy School of Government in Boston.

In an excerpt published in the February issue of *The Atlantic*, entitled "The Real Economy," Reich observes that neither the Republicans' ideology of private investment nor the Democrats' notion of spreading the wealth is appropriate for the new world economic order of the 21st century. This new order is based on developing a highly trained work force and a modern infrastructure—airports, highways, telecommunications systems, and so on—to support that work force.

To see if this theory holds water, one only has to look at the nations of Asia, particularly Singapore, Hong Kong, and Thailand. Here U.S. disk-drive manufacturers find skilled workers and an infrastructure that greatly facilitates the manufacture of disk drives. These countries have all the ingredients needed to build high-quality drives at competitive international prices along with the distribution systems to ship them anywhere in the world.

The problem with the U.S. is its disinvestment in infrastructure and work force, Reich says. He cites a study carried out by Charles L. Schultze of the Brookings Institution that shows investment in infrastructure declining from 1.14% of gross national product in 1980 to .75% of GNP today. It shows a decline in education spending as a percent of GNP from .51% in 1980 to .37% in 1990. Finally, spending on nondefense research and development fell from .42% of GNP to .31% of GNP in the same period. In a world that is increasingly more competitive, the U.S. is being outspent by European and Asian nations in education, infrastructure, and government-subsidized R&D.



In the budget for fiscal 1992, President Bush has proposed increased spending in all three of these areas. Scientific R&D gets $8.4 billion more in the new budget than it received last year, while high-performance computing would get a $149 million increase. The budget also calls for increases in education and improvements to the nation's highways and airports.

However, while the budget makes an effort, it falls far short of what is needed. Reich mocks the president's contention that "We have more will than wallet." "We have the wallet," Reich contends. "What we really lack is the will." In a world where Asian and European governments actively direct the economic development of their nations, the U.S. stands alone. If America is to maintain its preeminent position in worldwide commerce, it's going to have to spend to win. E

Jonah McLeod

JONAH McLEOD
EDITOR

CAE Technology Report

March 1991
Vol. 3, No. 3

Silicon Breadboards Arrive

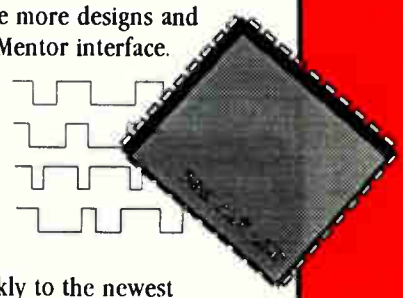
Silicon vendors got together with a leading CAE house and scored in a big way. They created silicon breadboarding that allows interactive simulation of multiple field programmable gate arrays (FPGAs), as if they were one piece of silicon. The user can display, next to each other, cells from different FPGAs and observe in real-time how a change in one cell affects operations of cells in other FPGA packages. This new technological advancement allows the user to break any design into multiple FPGAs and test them as one entity. This way, designers don't have to wait for the newest and biggest FPGAs; instead, they can design with the most economical and well established FPGA parts. Contact Actel at (800-227-1817) and XILINX at (408-879-5199) about FPGAs. For Silicon Breadboarding (SUSIE 6.0), contact ALDEC (805-499-6867). **CIRCLE 102**

OrCAD™ Users Benefit Again

Users of the popular OrCAD schematic capture program got a major support from SUSIE 6.0 which simulates their designs with 10 picosecond accuracy. OrCAD users can now directly interact with their designs as if they were real hardware breadboards. For example, they can toggle switches, move jumpers, replace ICs, change JEDEC fuse maps and hex files, modify layout delays, etc., all in real-time. The designers can also modify their designs and test vectors while they simulate. Since there are no compilations and the simulator behaves like a real hardware breadboard, it is easy to learn and use. The SUSIE simulator is finding broad applications, primarily among PLD and FPGA designers who urgently need such an interactive tool. SUSIE 6.0 sells from stock. **CIRCLE 103.**

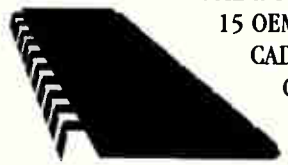
Mentor™ Designs - Run In Real-Time!

Mentor users can now verify their designs in real-time thanks to a new EDIF interface to SUSIE which is the industry's most popular logic simulator. SUSIE runs on 386/486 PC platforms and simulates designs in excess of 200,000 gates, with 10 picosecond accuracy. SUSIE comes equipped with a software accelerator, milestones, and an automatic design errors locator. The user can modify design and test vectors while he or she simulates, and working with SUSIE is much like working with real hardware. SUSIE frees Mentor workstations to handle more designs and costs only $9,995, including Mentor interface. **CIRCLE 104.**



Free Upgrade to VHDL Libraries

To help customers move quickly to the newest industry standard, SUSIE 6.0, ALDEC is upgrading all SUSIE installations at a straight price differential. The libraries are upgraded to the new VHDL standard at no cost. The new SUSIE has many improvements like a DOS extender, milestones, graphical test vector editor, software accelerator, powerful breakpoint editor and many other features that make it the most popular engineering tool.



SUSIE is resold or recommended by over 15 OEMs worldwide, including CADAM™, Racal-Redac™, Accel™, Omation™, CAD Software™, etc. It looks like everybody's betting on SUSIE these days. **CIRCLE 105.**

How To Shop For A Good Simulator

There are many benchmarks and comparison sheets that pit one simulator against another. However, newest benchmarks stress speed, real-time operation and test automation. Clearly, the most important trend is interactive, real-time simulation that allows the user to interact with the design and test vectors while simulating. This allows for the kind of interaction that designers used to have with a real hardware breadboard. The latest enhancements in speed is selective simulation which allows instant manual selection of design sections for simulation. This may speed simulation over 100 times. The latest in automation is "milestones" which allows instant resimulation of past cycles with new design and test vector changes. Simulators have considerably progressed during the last year, and if you're looking for a good buy, make sure that your simulator operates in **real-time** and comes equiped with **selective simulation** and **milestone functions**. Don't waste today's budget on yesterday's batch-style technology.

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MARCH 1991 VOLUME 64, NO. 3

Electronics

60 YEARS OF GLOBAL LEADERSHIP.

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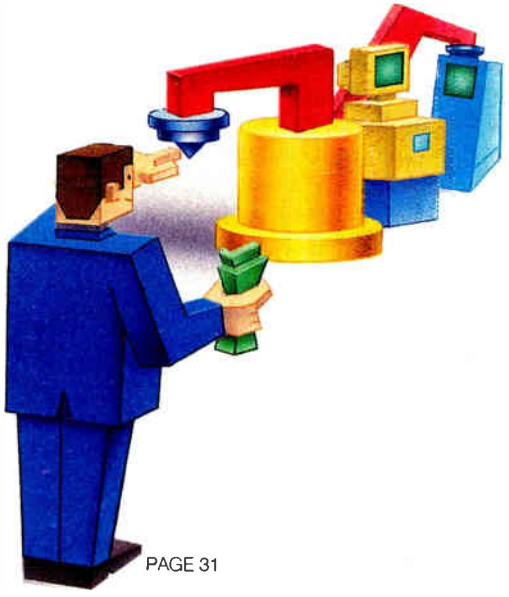

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DEPARTMENTS

NEWS ROUNDUP

WORLDWIDE NEWS

EXECUTIVE BRIEFING

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

*International only

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

It happened on a freezing Saturday in February.

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

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

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

True stories like this prove HP's dedication to responsive customer support throughout the world. We'll tailor our hardware, software and education services to your test and measurement needs. With one of the largest support organizations in the industry, we're committed to keeping your production line up and running. For more information, call your local HP sales office or circle the reader service number.

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CIRCLE 229

Don't keep your processor in suspended animation.

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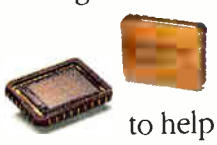

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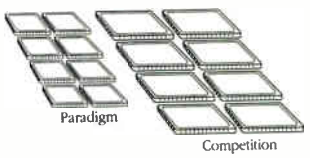

Most importantly, every chip is manufactured in our own MIL-STD-883 Class C compliant facility located in San Jose, California. And watch for our Processor Specific Memories to support Intel 486, MIPS R4000 and SPARC architectures—coming soon.

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CIRCLE 228

LETTER FROM

PRAGUE

WITHOUT HARD CURRENCY, CZECH ELECTRONICS INDUSTRY FOUNDERS

CHANGE BRINGS DOUBT—AND PAIN

BY DUNCAN GARDINER

A store window in Prague, Czechoslovakia's capital, displays a PC XT clone as well as some Western software.

These are hard times in Czechoslovakia. Like the rest of the former Soviet bloc, the nation has been struggling economically since the initial euphoria of getting out from under Moscow's thumb wore off. Consumer prices are soaring because of the abrupt dismantling of the state monopolies on retail outlets, and the pain is being felt by all segments of the population.

For the Czechoslovak electronics industry, the situation is even worse. Technology and capital from abroad are urgently needed, and whole market segments are dominated by distributors from Germany and Austria, only minutes across the border. But the Czechoslovak crown, barely convertible at low exchange rates, won't even buy most of the latest Western consumer electronics products, let alone know-how. Whole electronics plants, employing tens of thousands of workers, have a very doubtful future. Their managers are either busy trying to find Western partners with capital and modern technology, or waiting with bated breath for some miracle.

Even where technology is being updated, the efforts seem to be off center. Take telephones. The Tesla plant in Stropkov, in the northeastern corner of Czechoslovakia, manufactures the sets for every subscriber in the country while exporting more than 50% of its production to the Soviet Union. Most of the sets are analog rotary phones. The manager proudly displays a sample of Tesla's latest push-button phone with such features as redial, speaker, and a capacity of 20 programmed numbers. All in all, it's a modern, compact set—except for one detail. A thick cable connects the unit with a bulky box that contains most of the electronics. This, the manager explains, is designed to go in a desk drawer.

The plant's other products include power supplies for the Czechoslovak mainframe, an IBM 370-compatible machine, and small telephone switchboards based on Z80 chips imported from Germany. Tesla Stropkov employs 2,500 people, a large proportion of the town of less than 7,000.

Big changes are due. For one thing, the Stropkov plant will begin requiring payment from the Soviet Union in hard currency, although this may be a double-edged sword: it's quite possible that the Soviet Union may decide to do without the rotary phones rather than cough up the cash. Second, the Czechoslovak government has recently concluded licensing agreements with Western firms. Tesla will produce digital switches at three existing plants, reportedly under licenses with Siemens of Germany, Alcatel of France, and L.M. Ericsson of Sweden. Also participating financially in the 10-year modernization project will be Bell Atlantic, US West, British Telecom, and Deutsche Bundespost. Also, telephones with the most modern features and specifications, manufactured under a West European license, will be imported from the Mikola Tesla plant in Zagreb, Yugoslavia.

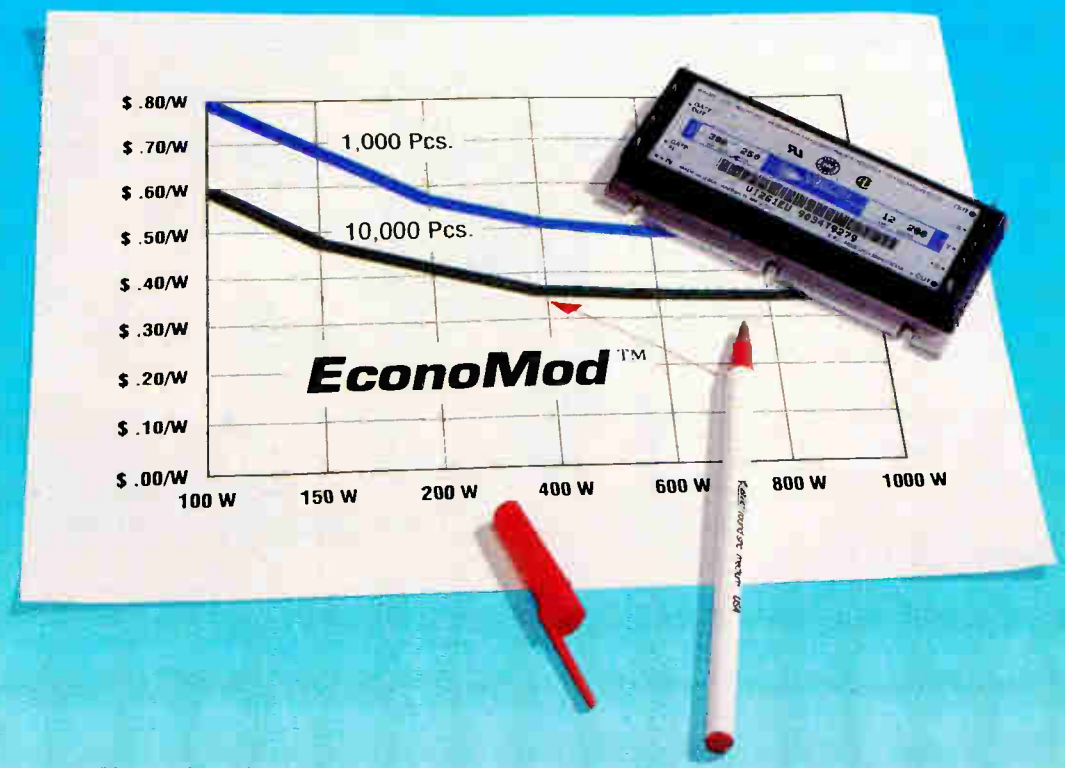
The new switches are desperately needed. Typical of those now running the phone system is Kosice's central telephone exchange. It boasts an electromechanical relay system imported from Germany at the end of World War II. Calling-unit counters are visually inspected or photographed at the end of each billing cycle. There are more modern exchanges in the city of 250,000: they are based on a 1974 printed-circuit-board design.

Even in Prague, the national capital with its 2 million people, the antiquated telephone system is overwhelmed at peak hours. It is common to dial a number and hear nothing at all on the line. It can take five or 10 redials to finally complete a call.

In computers, the equipment at the Stropkov plant is another indication of the changes that will overtake the Czechoslovak electronics industry as the marketplace gradually replaces the centralized command economy. The plant's 370-compatible mainframe system—with two 8-Mbyte central processing units and 16 Bulgarian disk drives, each with a capacity of 100 or 200 Mbytes—is one of the most advanced in Eastern Europe.

The computer itself, say maintenance technicians, is quite reliable. But the disks, produced under East Bloc economic cooperation agreements, tend to run eccentric after only 48 hours of operation. Stropkov is gradually re-

High Performance Power at Low Cost



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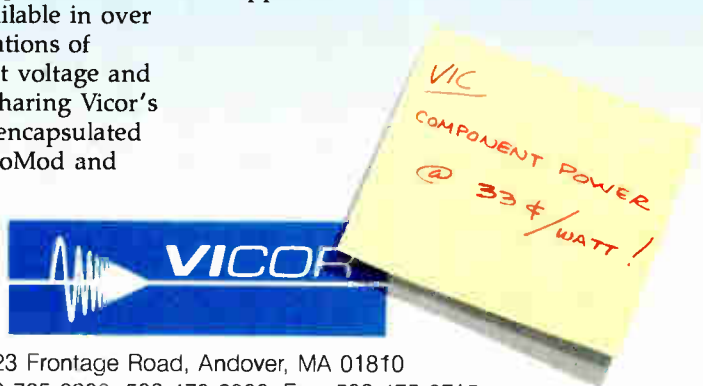

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Component Solutions For Your Power System

CIRCLE 175

placing them with Memorex media and is trying to replace the drives themselves. The operator's console and printer reveal a few Slovak or Czechoslovak cues, but are mostly in English.

The PP06, a line of IBM XT-compatible microcomputers, is produced at the ZVT plant in Banska Bystrice. They are reportedly quite reliable now that the Polish-manufactured floppy drives have been replaced by imports from the Far East. Even after dropping the price from $80,000 to $16,000, the plant is having difficulty selling these units. Businesses and consumers in Prague and other major cities are opting for Western 286 or 386 personal computers or clones.

For example, ComTech in Prague, a branch of a German firm just across the western border, sells Acer and Magix 826 and 836 microcomputers. Toshiba laptops, Colan networks, Fujitsu printers, Novell Netware, and other office-automation equipment for German marks. An Acer 286 model with 20-Mbyte hard drive, 1 Mbyte of RAM, and the English version of MS-DOS 3.3 sells for about $4,800. That amounts to almost 20 months of an average worker's wage, but it's a bargain compared with the price of a domestic PC.

FABS TURN OUT SOME TTL AND CMOS CHIPS, BUT THE TECHNOLOGY CAN DO NO BETTER THAN WIDTHS OF 2 μm

The chip industry is no more advanced than the communications and computer sectors. It produces a range of 8- and 16-bit semiconductors, their designs based on models from the U.S. For example, Tesla-Roznov produces bipolar analog and digital TTL chips, while Tesla Piest'any makes unipolar CMOS chips. Neither can produce line widths less than 2.0 μm, and the most common production units use 4.0-μm technology.

Consumer confidence in Czechoslovak electronic products is not high. Despite the fact that a plant in Bratislava manufactures good color TV sets, many people choose to spend a third more, in hard currency, for Sony or Daewoo products of comparable or slightly higher quality. A Czechoslovak plant also assembles a high-quality Philips video cassette recorder under license, but the hard-currency stores do a brisk business selling Sony and other VCR imports.

Design Duet

To the editor: In "Design Duet" (January 1991, p. 32), the obvious error was the use of the Schlumberger caption on an HP photo, but the body of the story also contained errors.

First, though the story implied that the two products discussed were the first to employ design-to-test links and concurrent-engineering capability, this movement is already well under way. More than a year ago, Schlumberger introduced its S790, which was based on the computer-aided test engineering workstation.

Second, the point about the S780 is that it is the first system to bring this unique CATE-based concurrent-engineering performance into the production environment on a highly cost-effective in-circuit tester.

Third, neither the S780 nor (as we suspect HP would agree) the HP 3078 is bringing design-to-test links and concurrent engineering to board testers for the first time.

Greg Geary
Schlumberger Technologies

To the editor: To clear up a potential point of confusion, the HP 3078 is a tightly integrated combination of design tools (simulators) and board test tools that work in concert. This enables design engineers and test engineers to work on the same board concurrently. The newsworthy part of this product is the time-to-market savings available by sharing data bases and using identical tools in design and test.

Ron Johnson
Hewlett-Packard Co.

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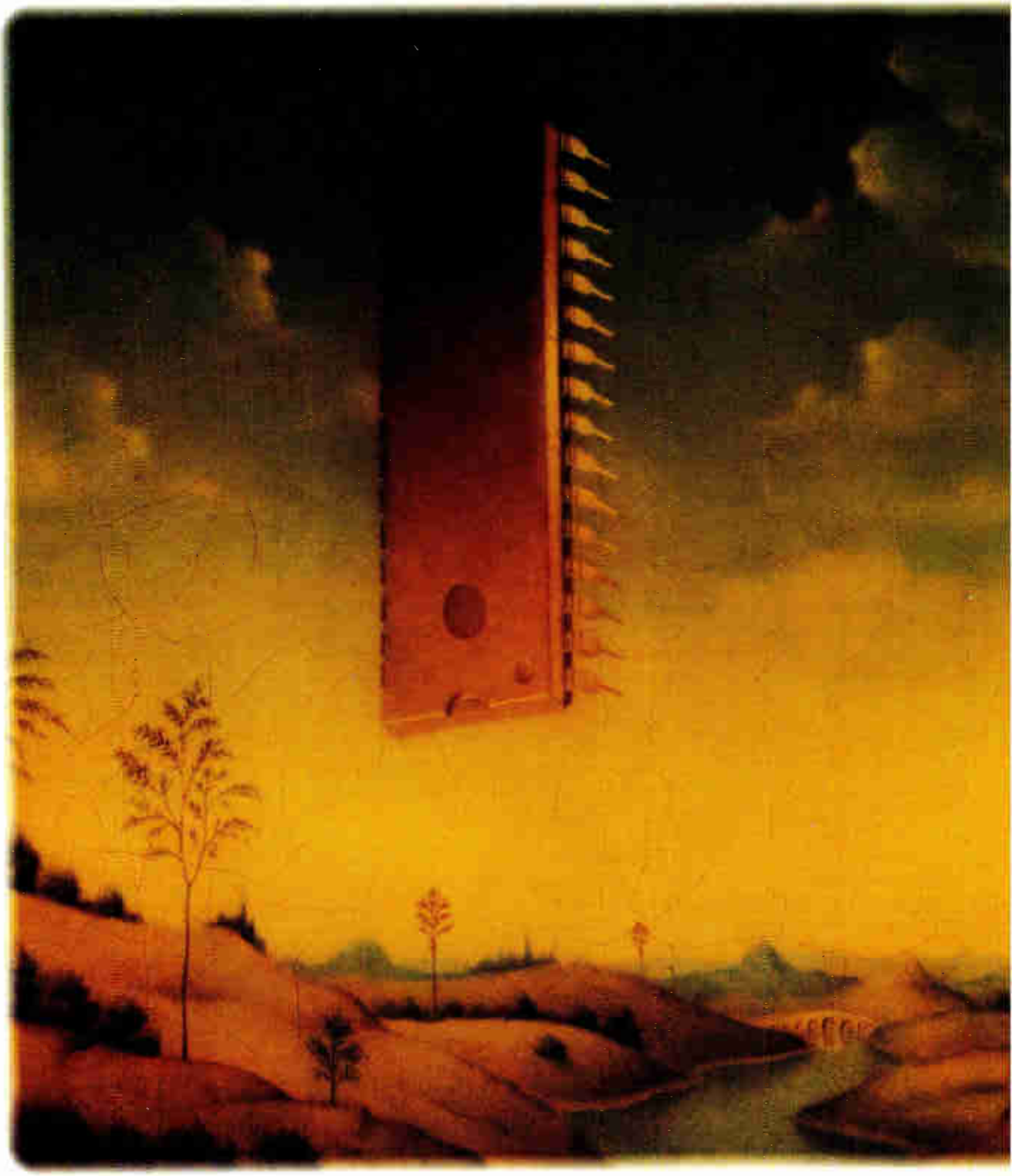
A MILLION TRANSISTORS ON A
UNTIL YOU CONTEMPLATE AN



MICROPROCESSOR IS IMPRESSIVE, SRAM WITH SIX TIMES AS MANY.

The recently introduced Samsung 1-meg SRAMs have a transistor count of 6.6 million.

In a day and age when makers of advanced microprocessors take understandable pride in the 1 million transistors on their chips, we think it's forgivable for us to be proud of the vastly greater number on these SRAMs.

They're among the most difficult of all semiconductors to produce, and only a few manufacturers can make them.

We offer the 1-meg slow SRAM in several speeds, several power ratings, and several package types. We're currently developing the part in the revolutionary TSOP packaging.

All those things—plus forthcoming high-density fast and ultra-fast SRAMs, plus additional slow parts for main store and buffer applications—give you an idea of Samsung's commitment to this demanding technology.

Besides the 1-meg slow SRAM, in the main-store and buffer areas we'll sample next year a 1-meg fast static RAM family, and go into production with a 1-meg pseudo-SRAM.

THE SAMSUNG 1-MEG SRAM

Speeds: 70°, 85, 100, 120 ns.

Package types: TSOP°, DIP, SOIC.

Power ratings: Low-low°, low, standard.

Organization: 128K x 8.

For information on the 1-meg SRAM or our 1-meg pseudo-static, write today to SRAM Marketing, Samsung Semiconductor, 3725 No. First St., San Jose, CA 95134. Or call 1-800-669-5400, or 408-954-7229.

After all, the best way to contemplate the 6.6 million transistors on the part, is to get your hands on one.

SAMSUNG Semiconductor

°Available 1991.

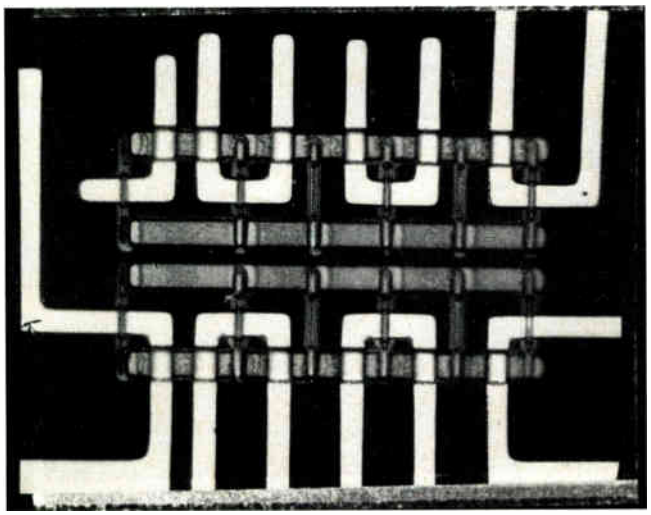
CIRCLE 214

FRONT

AN OLD ANSWER FOR BIG LCDs

Don't postpone buying a new TV set because you've heard that 1-meter-wide flat-panel LCDs are coming, but that's precisely the promise that is held out for an old technology that's been resuscitated by a Boston-area startup.

FPD Technology Inc., Wayland, Mass., has developed a magnetic switch that is expected to outperform conventional thin-film transistors in exciting very large active-matrix LCD panels. The so-called MAG-LCD switch draws on principles that Bell Laboratories developed and patented for possible use as logic building blocks, but then abandoned in the 1960s in favor of transistors. Bell Labs called the ladderlike switch structure a laddic, which is a contraction of ladder logic.



Developed at Bell Labs in the 1960s, laddic technology is aimed ay very large active-matrix LCD panels.

Now, says FPD president John Molitor, his company "needs to get in bed with a major manufacturer" that will scale up the technology for a 1-m flat screen, which is a production goal in Japan by 1996. Molitor figures it will take 18 to 24 months after that union to produce such a large screen.

On the horizon now for the company are some potential Japanese angels. A just-concluded visit to Japan resulted in solid interest from several companies, according to Molitor, among them the people at Matsushita Electric Industrial Co. and Dainippon Ink and Chemicals, which is a major supplier of liquid-crystal materials. E

LCD DUMPING: WILL EVERYONE LOSE?

A preliminary decision upholding the antidumping suit a handful of U.S. display manufacturers have brought against 13 Japanese mega-producers could spell trouble for U.S. laptop computer makers. The Commerce Department ruled late last month that the Japanese have been selling LCDs and other flat-panel displays below cost. A final decision is due April 29.

That could mean disaster for the U.S. computer industry, especially laptop vendors trying to muscle their way into the Japanese-dominated market. American laptop makers get all their LCDs from Japan. The displays account for 40% of the cost of a machine. If import duties send prices sky-high, the computer manufacturers will have to either charge more for their machines, at a risk of losing market share, or move assembly offshore, with a loss of American jobs. Moreover, the struggling U.S. display industry can't supply the computer makers with LCDs even if they win their case: they don't have volume manufacturing capacity.

But, counter the U.S. vendors, the Japanese didn't have much capacity, either, when U.S. computer makers first began cutting LCD deals with them in the mid-1980s. "They put the capacity in after they had the contracts," says Curtis Stevens, CFO at Planar Systems Inc., Beaverton, Ore., one of the complainants. Stevens argues that although the U.S. industry has no high-volume capability in LCDs, it might well be able to compete in electroluminescent or plasma displays. E

THE GALLIUM ARSENIDE FORECAST: IT'S STILL A MIXED BAG

Gallium arsenide may someday become a mainstream semiconductor material. However, signals from the industry last month indicate otherwise, confirming that most industry analysts are right when they maintain that GaAs, like silicon emitter-coupled logic, will always be limited to a high-performance niche.

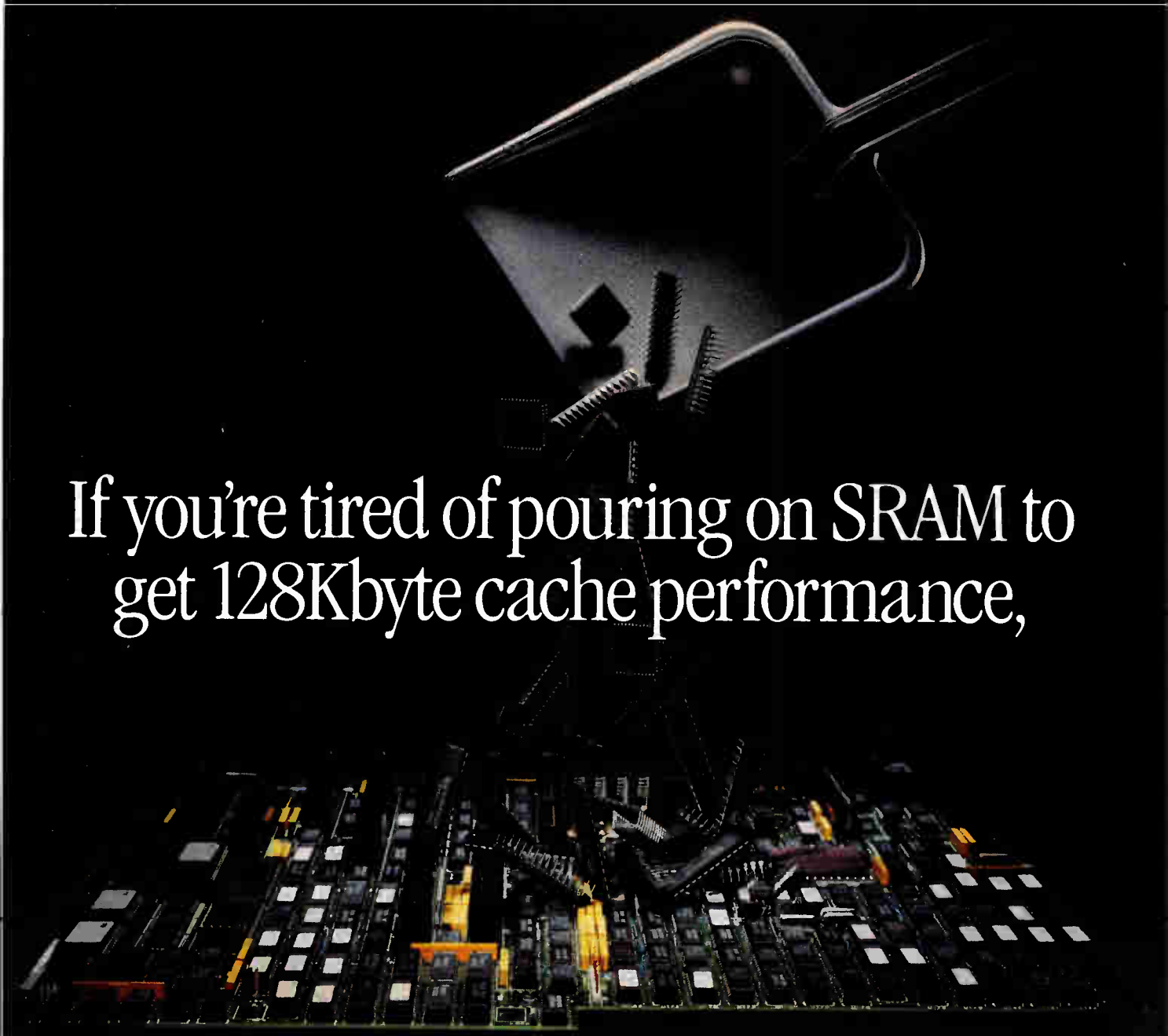
The latest signals are mixed. Even as one manufacturer reported its first profitable year, two others decided to merge. The profitable one is Vitesse Semiconductor Corp., the Camarillo, Calif., firm founded in 1984. For 1990, it had an operating profit of $1.7 million on revenues of $17.8 million.

On the other side of the ledger, TriQuint Semiconductor Inc. of Beaverton, Ore., and GigaBit Logic Inc. of Newbury Park, Calif., have merged under the TriQuint name. The new company becomes the biggest in the GaAs business. E

FROM IBM, A RECORD-SETTING 4-NS SRAM

IBM Corp. scientists are claiming the speed-for-size title in static random-access memories. Their 512-Kbit chip, unveiled in mid-February at the International Solid State Circuits Conference in San Francisco, boasts an access time of 4 ns and a cycle time of 2 ns. By contrast, today's fastest 256-Kbit SRAMs access in 10 ns. Thus, the IBMers have doubled the density while more than halving the access time.

They credit the advance to innovative CMOS circuit design and IBM's so-called pipelining process, with which the chip overlaps read and write operations rather than performing them one by one. Circuit elements follow 0.8 μm design rules. E



If you're tired of pouring on SRAM to get 128Kbyte cache performance,

Take a load off.

Introducing an amazing new cache chip that gives crowded motherboards a new lease on life.

It's called 386™ Smart Cache, a family of chips that integrate a cache controller with up to 16Kbytes of SRAM onto a single, one-million-transistor chip. The result is a 16Kbyte chip that really cleans up, equalling the performance of 128Kbyte caches.

Intel's 386 and 386SX Smart Cache are one-chip solutions that give you extra space on your motherboards for other applications.

And when you stack them up against other caching solutions, you'll find their innovative architecture costs substantially less.

Give your motherboard a lift. Send in the attached card today for a free copy of our unique 386 Smart Cache video, performance report and documentation. Or if the card's been ripped off, call 1-800-548-4725, dept. HA33.

Because the reasons to look into 386 Smart Cache are really starting to pile up.

intel®

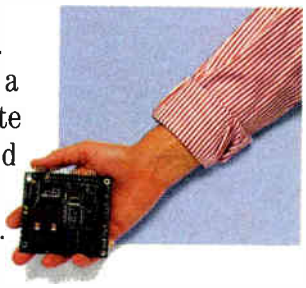
CIRCLE 185

AMPRO'S EMBEDDED SYSTEM MODULE FAMILY

Introducing The Erector Set for Embedded Control Applications

Remember the challenge of constructing "engineering marvels" with your Erector® set? That red metal box held a complete set of interlocking pieces — all that was needed to assemble just about anything. Your imagination was the only limitation.

That's the idea behind Ampro's new way for OEMs to build embedded control applications. Put your application together, simply and quickly, using Ampro Embedded System Modules



Our CoreModule™ family packs ready-made full PC- or AT-compatible intelligence into 3.6″ x 3.8″ x 0.6″. Just plug one into your circuit board — like plugging in a chip — to easily interface to your own logic. They operate over 0 to 70°C, and include a CMOS CPU, RAM, extended BIOS, Solid State Disk, serial and parallel I/O ports, keyboard and speaker interfaces, and a real-time clock.

Stack a CoreModule unit together with one or more of our expansion MiniModule™ peripherals (no backplanes or card cages needed). MiniModule products, also 3.6″ x 3.8″, can be used to add display controllers, more Solid State Disk capacity, network controllers, modem and facsimile features, additional I/O, and much more.

You'll get your product to market faster, with less risk, and at lower cost, because the CoreModule family is based on the most economical industry standard architecture. Now you can focus on the more challenging part of your system — the application itself.

Ultrasound monitors, point-of-sale terminals, robotics, network controllers — no matter what kind of "engineering marvel" you're building, you should be using Ampro's "Erector set" for your embedded control application.

Call **1-800-966-5200.** Get the Information Kit on CoreModule and MiniModule products today.

AMPRO®

Pioneering Solutions for Embedded Control

CIRCLE 211

FACE OFF

THE CELLULAR DEBATE:

We are coming to the end of an era—the era of "Dumb Radio." For 50 years, analog frequency modulation has been the basis for most mobile systems, including cellular radio. FM has its merits, but we are now acutely aware of its demerits: its lack of spectrum efficiency, its hardware-intensiveness, its often ragged voice quality, its lack of privacy, and its nontransparency to most new digital services now emerging from the "intelligent network."

But the greatest drawback is that FM has been bypassed by the microprocessor revolution. Where other communications sytems have embraced digital signal processing, FM transmission is still more a matter of raw power than intelligence—in essence, an FM radio bears a greater similarity to a light bulb than to a computer.

GEORGE M. CALHOUN

It's not good enough anymore. Today's large-scale multicellular networks for mobile telephony and personal communications need to reuse frequencies from one cell to the next, often over very short distances. In such "interference-limited" systems—as opposed to older single-cell, "noise-limited" systems—cranking up the power means raising the interference background, which reduces capacity. Fortunately, a new generation of "smart" digital techniques is about to transform the industry. These schemes involve some of the most powerful real-time software ever to reach the consumer.

At the system level, the architectural platform will be time-division multiple access (TDMA), an extension of the time-division multiplexing techniques used in the wire-line telephone network (see p. 45). TDMA is the access standard for all the major digital radio systems, including digital cellular radio in the U.S. and Europe, and PCN in the UK (the only country with a PCN standard). It has been chosen for good reason.

Unlike analog FM, digital TDMA is a software-intensive technology. That makes it so flexible that the TDMA radio terminal may be seen as a high-performance microcomputer, capable of reconfiguring itself to handle different user demands for fax, ISDN data, and so on.

One major enhancement comes from Hughes Network Systems, whose Extended-TDMA architecture will more than quadruple the capacity of the minimum TDMA standard and carry 15 times more mobile traffic than today's analog cellular. What's the trick?

E-TDMA incorporates an ultrafast speech-activity switch that turns the transmitter off during pauses and while the user is listening (about 60% of the total channel time, on average). This "idle" capacity can be reassigned to other users.

This smart radio technique, known as digital speech interpolation, has been used for decades in the wire-line network, so the implementation is low risk for the fast-growing cellular industry. And the innovation fits within the existing TDMA framework, ensuring backward and forward compatibility of equipment from different generations.

To summarize TDMA's advantages:

- It solves the capacity problem—at least 15 times more than analog. It reduces infrastructure costs by some 70% over analog FM, and dramatically improves signal quality and privacy.
- Above all, TDMA is low-risk. It builds upon the vast industry experience with time-division techniques. It can be implemented here and now. In contrast, the CDMA alternative (see opposite) is not ready for prime time. In all the world there is not a single CDMA telephone circuit in commercial operation; its performance is still shrouded in uncertainties.

Smart radio will open up so many possibilities that a lot of us believe the 21st century will be a wireless one, as the public networks take advantage of the economics, flexibility, and portability of radio. TDMA architectures will lead the way.—*GEORGE M. CALHOUN, senior vice president, IMM Corp.*

STATIC ON THE LINE

Qualcomm Inc. has been pioneering the development of code-division multiple access (CDMA) technology for digital cellular and PCN-type applications over the past several years. CDMA can provide not only high-quality digital cellular systems but also the true personal communications network of the future.

CDMA is the leading-edge technology to meet the requirements and opportunities of the 1990s and beyond. It provides high voice quality, high capacity, and digital control channels supporting a variety of voice and data services. It also offers inherent privacy, tightly controlled rf power transmission for long battery life and minimal interference to other users, and simplified frequency planning. Micro-portable phones, which will be available in 1992, can be used for mobile, pedestrian, and public wireless applications.

ALLEN SALMASI

CDMA will allow cellular service providers to launch PCN services much sooner than they otherwise could. In fact, the high quality of CDMA communications will appeal to the average consumer, thus unleashing a mass market for wireless communications services. What's more, CDMA should reduce the problems that many cellular network operators are now experiencing because of the low quality, congestion, and unreliability of analog systems.

The features and flexibilities afforded by CDMA will result in a large number of value-added services, such as facsimile, laptop PC communications, and position-location capabilities. All in all, CDMA should keep the cellular industry growing at its historic rates—or faster.

CDMA's major attributes include:

•**Capacity:** The capacity limits of CDMA are projected to be in the range of 15 to 20 times that of existing FM analog technology. That's because a wideband CDMA system offers such properties as improved coding gain/modulation density, voice-activity gating, sectorization, and reuse of the same spectrum in every cell. CDMA's capacity will double with the next generation of half-rate voice coders.

•**Availability:** With the full development of production mobile cellular radios and cell-site equipment now under way, CDMA can be ready for system implementation by early 1992.

•**Economies:** CDMA is a cost-effective technology that requires fewer, less expensive cells than TDMA and no costly frequency-reuse patterning. It offers competitively priced mobile and portable radios, and provides for low system cost per subscriber because of its large capacity.

•**Quality:** CDMA takes advantage of multipath techniques, enhancing call performance in urban areas and virtually eliminating fading and static. Also, CDMA transmission of voice by a high-bit-rate voice coder ensures superior, realistic voice quality. It provides for variable data rates, allowing providers to offer many different grades of voice quality that can be priced accordingly.

•**Privacy:** The "scrambled signal" of CDMA completely eliminates crosstalk and makes it very difficult to eavesdrop or track calls, ensuring caller privacy and immunity from air-time fraud.

•**Transition:** Because CDMA provides large performance improvements, the capacity of even the first digital systems deployed using only 10% of the current analog allocation is more than sufficient to ensure a low probability of blocking, even with a fairly significant population of digital subscriber units operating in the field.

Thus, CDMA will benefit both equipment manufacturers and service operators, and support the market value of cellular properties. End users will benefit even more through reasonably priced equipment and the highest-quality service that technology can offer.—*ALLEN SALMASI, vice president of digital cellular products, Qualcomm Inc.*

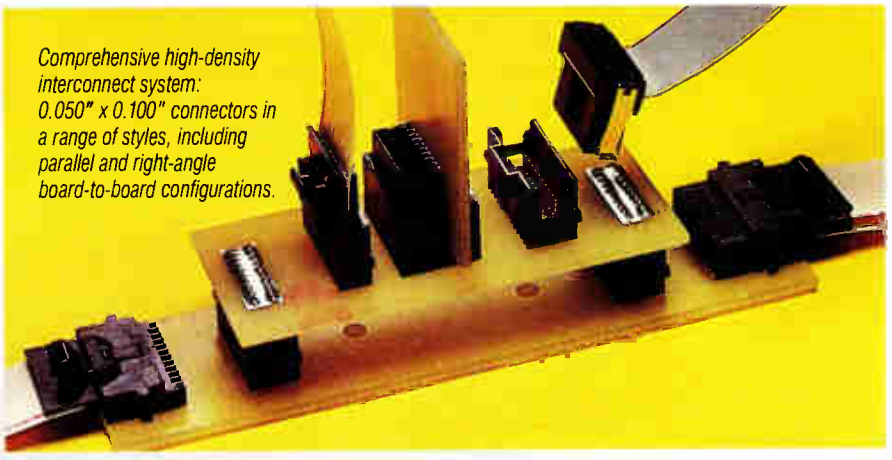
An idea this small

This is the AMPMODU System 50 connector.

Definitely worth getting close enough for a good look.

It comes in a comprehensive system. Everything you need for a 0.050″ x 0.100″ grid. Board-to-board, stacking, or mother/daughter. FFC to board. 0.050″ CL flex etched circuitry to board. 0.025″ CL ribbon cable to board.

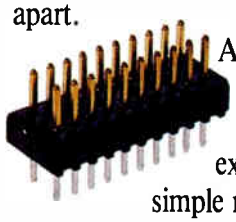
Special design innovations (such as putting the latch hardware on the *cable* side) shrink our System 50 line to the least board space of any connector in this class. Even 0.050″ x 0.050″ types.



Comprehensive high-density interconnect system: 0.050″ x 0.100″ connectors in a range of styles, including parallel and right-angle board-to-board configurations.

• is no small idea. •

Example: 2x25 position shrouded headers occupy 1.5″ x 0.284″ of board surface. And parallel boards mount with inside faces a mere 0.450″ apart.



Along with density, you also get the productivity you expect from AMP: simple mass termination, robotic handling features, high-temp housings, selective gold plating.

And of course, outstanding quality and reliability.

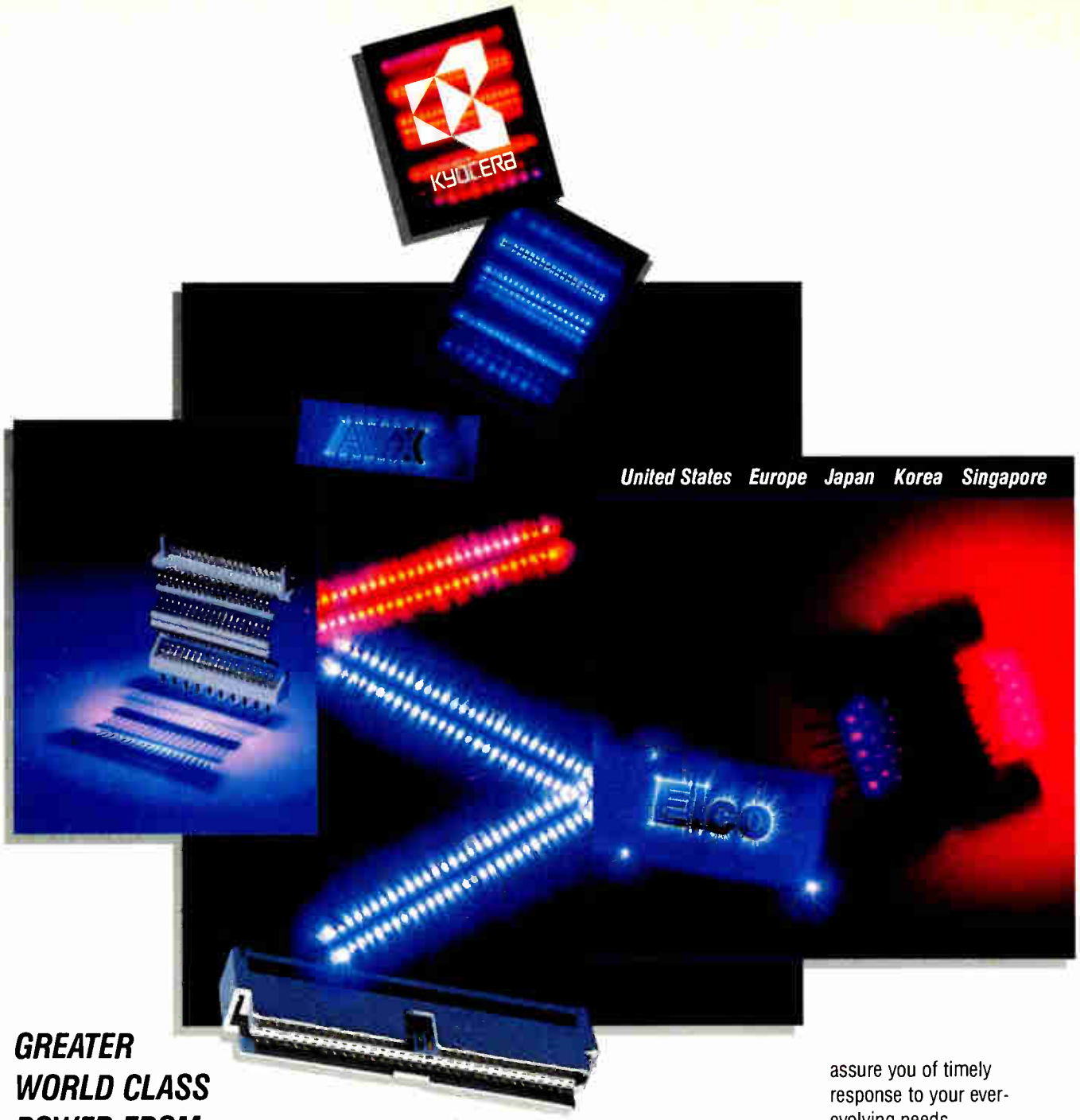
AMPMODU System 50 connectors are available in selected sizes of 4 through 30 single row positions, 8 through 100 in dual row, with shrouded or unshrouded headers. With all those variations, you could do almost anything your design requires.

Which is our whole idea.

Call the AMP Information Center at 1-800-522-6752 to ask about our AMPMODU System 50 line. For characterized backplane assemblies, contact AMP Packaging Systems Inc., P.O. Box 9400, Austin, Texas 78766, (512) 244-5100, or your AMP Sales Engineer. AMP Incorporated, Harrisburg, PA 17105-3608.

AMP Interconnecting ideas

CIRCLE 171



GREATER WORLD CLASS POWER FROM OUR NEW GLOBAL CONNECTIONS

The recent alliance of Elco and AVX with Kyocera forms a solid business relationship that gives us even stronger connections to today's exciting world of technology.

These connections strengthen our own high quality standards and link us to new sources of innovation throughout the world.

Together we combine our talents, energies, and experience to provide you with an ever-expanding line of advanced connector products of unsurpassed value. These new connections also contribute to a fresh spirit of efficient service and delivery and assure you of timely response to your ever-evolving needs.

From a new source of energy emerges a powerful new Elco.

Elco Corporation
A Kyocera Group Company

World Class Connections

CIRCLE 183

TO WATCH

AN ETHERNET IC FOR THE '90s

The migration from the small local-area networks typical of the 1980s to complex, interconnected LANs in the 1990s is likely to find a workhorse component in National Semiconductor Corp.'s latest repeater-interface-control chip (RIC).

The DP83950 is flexible enough to handle increasingly complex applications. Since it supports any cabling media, the RIC can be used as a standalone repeater connecting IEEE Ethernet LANs. By adding National's Sonic (Systems Oriented Network Interface Controller) chip, systems houses can implement a sophisticated network management hub, says the Santa Clara, Calif.-based company.

The RIC has 12 interface ports with integrated 10-Base-T transceivers and an AUI (attachment unit interface) port. The 10-Base-T transceivers can be bypassed to accommodate coaxial cabling. A common bus lets several of the chips communicate so they can be cascaded in complex networks. The chip also offers a microprocessor interface and can drive 60 LEDs for visual network management. E

National's repeater-interface-control chip handles twisted-pair wire as well and thick and thin coaxial cable.

AMD ADDS HIGH DRIVE CAPABILITY TO PLDs

By adding 64-mA output drive capability to the industry-standard 16V8-10 programmable-logic device architecture, Advanced Micro Devices Inc. has pushed its PLD line into a new market: bus applications.

The PALCE16V8HD can be used to drive signals to the PC bus, MicroChannel, VME-bus, Multibus Versabus and Nubus, as well as local custom bus structures. It can also drive DRAM arrays on memory boards. Besides its increased drive capability, the device offers selectable D- or T-type flip-flops, input hysteresis, and a programmable open-collector capability.

It is available in 24-pin plastic DIP and 28-pin PLCC packages. Unit pricing in 1,000-piece quantities is $3.95. E

POWER SUPPLY CHIP CUTS ENERGY LOSSES

The ML4815 power-supply-control IC from Micro Linear Corp., San Jose, Calif., dramatically reduces energy losses associated with high-frequency, high-density switching in low-voltage DC-to-DC converters such as are used in telecommunications, military avionics, mainframe computers and distributed power systems.

The device achieves its power savings by using a zero-voltage switching resonant topology. Competing devices use zero current switching topologies.

It is priced at $4.30 each in quantities of 100 and is available in a plastic DIP package. A surface-mount package is in the works. E

MOTOROLA'S 56000 DSP AND READY SYSTEMS GO REAL TIME

Instead of spending hundreds of man-hours writing a real-time operating system kernel, engineers using the Motorola Inc. DSP56000 digital-signal processor can now call on a Ready-made real-time operating system.

Called VRTX32/DSP56000, it's said by developer, Ready Systems Corp., Sunnyvale, Calif., to be the first off-the-shelf operating system for event-driven applications—from audio/video compression to industrial automation.

Ready Systems says some 1 million copies of VRTX32 are in use; the 56000 is an established DSP, especially in digital audio and speech-synthesis products.

The operating system is available immediately for IBM PC-compatible and Sun Microsystems Inc. hosts. E

XYLOGICS OFFERS A COMMUNICATIONS SERVER TAILORED TO UNIX

Low cost per port and easy compatibility with Unix-based computers and terminals are the main attractions of the Annex three communications server available now from Xylogics Inc., Burlington, Mass.

Housed in the same "pizza box" as the Sun Microsystems Inc. Sparcstation, the server accommodates from eight to 64 serial ports, which works out to about $110 per port for the 64-port version. Xylogics says that's almost $25 per port cheaper than the previous price leader.

While most competing servers employ some other user interface, often done in the format of Digital Equipment Corp.'s VAX/VMS, the Annex three copies the exact syntax of Unix commands, making it simple for Unix computer users.

But the server can easily interconnect VAX/VMS systems and other TCP/IP and LAT computers to a network, as well. The Annex three is available now. E

Here's where the barricades start to come down in the mixed signal revolution.

North American Locations & Dates

Cedar Rapids, IA
March 18

Cleveland, OH
March 19

Pittsburgh, PA
March 20

Atlanta, GA
March 25

Clearwater, FL
March 26

Orlando, FL
March 27

Huntsville, AL
March 28

Waltham, MA
April 1

Saddlebrook, NJ
April 2

Westchester, NY
April 3

Smithtown, NY
April 4

Cromwell, CT
April 5

Santa Clara, CA
April 8

Costa Mesa, CA
April 9

Los Angeles, CA
April 10

Woodland Hills, CA
April 11

San Diego, CA
April 12

McLean, VA
May 6

Baltimore, MD
May 7

Cherry Hill, NJ
May 8

Fort Washington, PA
May 9

Raleigh, NC
May 10

Toronto, Canada
May 13

Santa Clara, CA
May 14

Pleasanton, CA
May 15

Bellevue, WA
May 16

Beaverton, OR
May 17

Woburn, MA
May 20

Montreal, Canada
May 21

Bloomington, MN
May 22

Houston, TX
May 23

Dallas, TX
May 24

Phoenix, AZ
May 28

Denver, CO
May 29

Arlington Heights, IL
May 30

Rochester, NY
May 31

International Locations & Dates

Eindhoven, Netherlands
April 15

Copenhagen, Denmark
April 16

Stockholm, Sweden
April 17

Lyons, France
April 18

Paris, France
April 19

Rome, Italy
April 22

Milan, Italy
April 23

Hannover, Germany
April 24

Frankfurt, Germany
April 25

Munich, Germany
April 26

Edinburgh, Scotland
April 29

London, England
April 30

Vienna, Austria
May 2

Zurich, Switzerland
May 3

Seoul, Korea
June 3

Seoul, Korea
June 4

Taipei, Taiwan
June 5

Taipei, Taiwan
June 6

Hong Kong
June 7

Tokyo, Japan
June 10

Tokyo, Japan
June 11

Osaka, Japan
June 12

Osaka, Japan
June 13

Nagoya, Japan
June 14

Not too long ago, digital designers didn't need to know about analog. And the analog guys didn't need to worry about digital.

But with the revolution that's happening in mixed signal technology, that's far from true anymore.

You see, mixed signal technology is the only way to break down the barriers to higher levels of system integration, better performance, and faster time to market. And it accomplishes these difficult tasks by combining both signals on a single chip.

As the leader in mixed signal technology, Analog Devices has the most experience in assisting both analog and digital designers in applying it to their systems.

Which is why every designer from both camps should attend our Mixed Signal Design Seminar.

For example, in this comprehensive full-day seminar we'll cover such things as digital signal processing, interfacing converters to DSP, analog signal conditioning, digital and analog filtering, sigma delta converters, sampled data systems, and practical techniques for building a better board.

In short, you'll leave this seminar with a better idea of how to put mixed signal technology to work for you in a broader range of applications. And you'll leave with a design handbook, the industry's largest SPICE macromodel library, and more.

Admission is just $20, and includes all materials and lunch, but you must pre-register.

The mixed signal revolution has started, so make sure nothing stops you from attending this seminar. To reserve your space, return the coupon. For more information or to charge your ticket, call (617) 937-1430 or (800) 262-5643.

The Mixed Signal Design Seminar from Analog Devices.

_____ Yes, I want to be part of the revolution. So don't start the Mixed Signal Design Seminar without me.

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

I'd like to attend in the following City: _____ Date: _____

Please include a check for $20 payable to: Analog Devices
Return to: Analog Devices, Mixed Signal Design Seminar, 181 Ballardvale St., Wilmington, MA 01887.
For more information, or to charge your ticket, call (617) 937-1430 or (800) 262-5643.

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Actual output

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Now AC to DC

Actually meets

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MIL-STD-461C
MIL-STD-704D
NAVMAT GUIDELINES

Mil/Pac™ high-density military power supplies. Now you can order Abbott's full mil-qualified compact power supplies in both DC *and* AC input models.

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

DC-to-DC models accept input from 14V to 32V. AC-to-DC models accept 103.4 to 126.5V rms, 47-440 Hz single phase.

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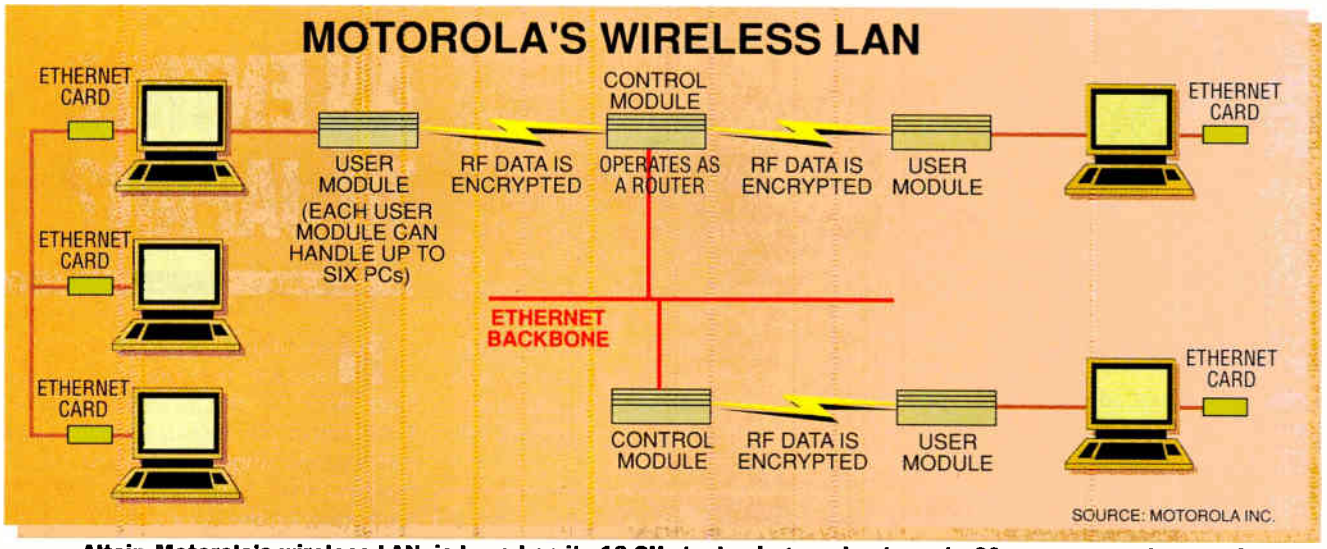
Mil/Pacs are available with or without MIL-STD-2000. Either way, the specs are worth reading. Just write us at 2727 South La Cienega Bl., Los Angeles, CA 90034. Or call (213) 936-8185.

abbott

WHEN RELIABILITY IS IMPERATIVE.™

CIRCLE 219



Altair, Motorola's wireless LAN, is based on its 18-GHz technology and puts up to 32 users on each control module. Each user module handles up to six wired nodes.

WIRELESS LANs EDGE INTO MARKET WITH GOOD PRICES, PLUG-AND-PLAY CAPABILITY

NO STRINGS ATTACHED

BY JACK SHANDLE

NETWORKS

Just when it looked as if the basic hardware issues in local-area networking had been settled, wireless technologies are making life complicated again for corporate decision makers.

Wireless LANs have been around for a while [*Electronics*, July 1989, p. 36], but the outfits now hawking the technology—actually three separate and distinct technologies—are not startups with bright ideas and small purses. They are big companies with money to burn for marketing, sales, and research.

In the latest round of introductions, Motorola Inc., Arlington Heights, Ill., last month rolled out a wireless product based on its 18-GHz technology [*Electronics*, November 1990, p. 32]. Two months ago, BICC Communications Corp., a subsidiary of BICC plc, a $7.5-billion, UK-based company, unveiled its infrared-light-based offering. And last September, NCR Corp., Dayton, Ohio, introduced a personal computer plug-in product based on spread-spectrum technology. Standards compatibility plays a big role in the marketing plans for all three products. So do cost comparisons with wired LAN solutions, and the ease of plug-and-play installation.

On the standards side, Motorola's 10-Mbit/s Altair provides a transparent connection to IEEE 802.3 Ethernet; BICC's 4/16-Mbit/s InfraLAN conforms with 802.5 Token Ring standards; and NCR's 2-Mbit/s WaveLAN runs seamlessly on Novell Inc.'s NetWare.

The cost per node of wireless LANs can depend heavily on the amount of resource sharing. Motorola's Altair puts up to 32 users on each $4,000 control module and up to six wired nodes on each $3,500 user module. BICC's CR also relies on resource sharing to moderate the cost per node, but NCR offers a PC add-in board for $1,400.

LAN ownership costs have become an important consideration in many corporations, says Jennifer Pigg, a senior analyst at the Yankee Group in Boston. "If an MIS manager has fairly free rein on his budget, there is not much doubt that he will buy into wireless technology. He is most familiar with the costs of moving people," she says. Since the marketing strategy for wireless LANs revolves around the moves-and-changes scenario, the new products basically configure themselves. Beta-site users have had InfraLAN up and running in less than a half hour, says Mike Noonan, BICC Communications' executive vice president. Motorola reports similar experience at its beta sites.

Despite the benefits, prospective users tend to be wary. The fear of some fatal, but as yet undiscovered, flaw in the respective technologies will retard market growth, says Pigg. Do sunrises affect IR LANs? Will microwave or spread-spectrum technologies encounter interference problems? "Those are just the questions we know to ask," she says.

As a result, analysts do not expect the wireless LAN market to ramp up quickly, and that could be a problem. Large companies such as Motorola, NCR, and BICC can survive the lean times, says Pigg. Smaller companies need the resources and credibility of a strategic partner or a deal with a large value-added reseller. E

HP COULD WIN RACE IN DIGITAL CELLULAR

NEW TEST CHALLENGE

BY JONAH McLEOD

TEST

The cellular telephone business is booming. By one estimate, callers last year spent $4.5 billion worldwide and the tab is growing at a 70% rate. That means that by 2000 the business will be worth upwards of a trillion dollars. The demand now is so great that cellular vendors are fast converting from analog to higher-capacity digital systems.

Among the big winners will be the manufacturers of test instruments for those digital systems. The market is attracting the likes of IFR Systems, Motorola, Marconi Instruments, Rhode & Schwarz, and Schlumberger Instruments. But Hewlett-Packard Co. may win the big prize.

The means will be HP's just-announced HP 8922A GSM RF Test System, HP 8922B GSM BS Test Station, and HP 8920 RF Communications test set. GSM stands for global systems for mobile communications, and also makes reference to Europe's Groupe Speciale Mobile digital cellular standard.

"HP's 8922A/B is the first new generation of digital radio testers for the new pan-European digital cellular phones and base stations," says Bob Rands, product marketing manager at the Spokane (Wash.) Division. "Some competitors offer high-feature, expensive testers; others, low-cost, low-function testers. But we have put together the right functionality at the right price."

The 8922A, which tests cellular phones, sells for $59,000, and the 8922B, which tests the base station, goes for $69,000. Competitive systems start at $60,000 and can reach $250,000. The 8920, a system for field service, sells for $13,800. It tests AM, FM, and single-sideband radios, pagers, repeaters, cellular phones, filters, duplexers, and combiners. Competitive units can run as high as $40,000.

Rather than using analog sources, the base-station transmitter digitally generates the rf signal to the phone. In testing the transmitter, the 8922B digitizes the output of the transmitter and then uses digital-signal-processing techniques to determine characteristics of the output signal.

A digital cellular base station uses DSP capability to produce packets that it transmits in short bursts. DSP logic in the receiver compensates for signal fading and reflection during transmission and performs error correction. The HP 8922A measures the DSP capability of receivers. E

NTT OFFERS A MAINFRAME DOS

AN ENTREE TO JAPAN?

BY JACK SHANDLE

ALLIANCES

Networking of another sort—business networking—was the buzz word at the Comnet show in Washington last month. Some of the partnerships announced were blockbusters. The biggest is likely to open the door to Japan's computer market wider. Spearheaded by Japan's telecom giant, NTT Corp., it is backed by five of the world's six largest mainframe makers.

The Multivendor Integration Architecture (MIA) will basically do for mainframes what MS-DOS did for personal computers. And since a lead-pipe cinch to adopt it is Japan's largest systems integrator—NTT Data Communications Systems Corp.—software and hardware vendors will likely follow.

MIA is not an operating system but a set of interface standards that will ensure interoperability of software. Helping NTT write the specs are IBM Japan, Digital Equipment Corp. Japan, NEC, Hitachi, and Fujitsu. E

LOOKING FOR MORE SPEED, USERS GIVE MULTICHIP MODULES A BOOST

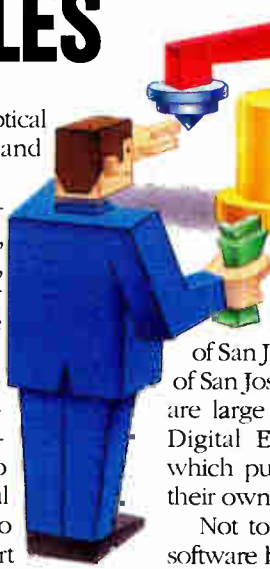
HERE COME THE MODULES

BY HOWARD WOLFF

SEMICONDUCTORS

There's nothing new about multichip modules. But there is something new in the way these packages—bare chips packaged together to function much like ICs—are finding their way into the mainstream commercial market. Their great appeal is performance, permitting designers to overcome delays inherent in today's one-chip IC packages.

Look at Nepcon West '91, perhaps the electronics industry's premier packaging and production show. Held last month in Anaheim, Calif., it showcased a strong complement of technical sessions devoted to multichip-module matters—eight in all. They covered subjects as varied as automatic optical insertion and materials and manufacturing techniques.



And no wonder: Dataquest Inc., the San Jose, Calif., market-analysis house, sees multichip as "a major emerging market," in the words of Howard Bogert, senior associate specializing in emerging technologies. "Eventually, the percentage of chips going into multichip modules will rival the percentage going into surface mount," Bogert adds. In fact, Bogert even forecasts a shortage. By 2000, he predicts, the multichip demand will be for 30% to 40% of chips, but only 8% will be available.

Actually, he adds, the upsurge can be credited to surface-mount technology, today's hot button.

"SMT woke up the packaging industry and got the people in it looking around them for other things," says Bogert. "The result is all the interest in multichip approaches.

Preparing to reap the windfall are companies ranging from Integrated Device Technology Inc. of Santa Clara, Calif., and Cypress Semiconductor Corp. of San Jose to startups like nCHIP Inc. of San Jose. Also building the packages are large systems houses the likes of Digital Equipment, IBM, and NEC, which put together logic modules for their own use.

Not to be outdone are the design-software houses: one, Mentor Graphics Corp. of Beaverton, Ore., is working with Hughes Aircraft, Motorola, Tektronix, and Unisys to develop multichip-module design tools. Another, Cadence

Design Systems Inc. of San Jose, is working with nCHP.

Generally acknowledged as the leader in the module business is Integrated Device Technology. There, the feelings about multichip modules are, unsurprisingly, bullish.

"Assuming a normal economic environment we expect strong growth in the sales of modules," says Ken Kwong, strategic marketing manager, "on the order of 10% to 20% a year in the next decade." Driving the market, he says, is the rapidly increasing speed requirements of central processing units. Today's CPU requirements get faster (now typically 33 MHz; "but that could be 50 MHz in two years, meaning that everything gets faster," he says).

Kwong places total sales last year of the devices at $80 million to $100 million. He sees the best potential in cache-type memories, especially for multiprocessing applications.

A big factor in the growth of the market will be processors for reduced-instruction-set computers, says Kwong. He expects these RISC processors to be a production item by 1992, leading to a dramatic increase in the value of a CPU on a board.

Kwong differs somewhat with the basic definition of modules as chips wired together inside a package. "There's more to it than that," he says. His definition: several packaged units on a substrate. He points out that anyone can put modules together; "it's almost like stuffing a board," he says. "Those packages don't offer much beyond convenience."

He espouses Integrated Device Technology's approach, one that emphasizes value added by addressing the system issue. "In other words," Kwong says, "the module works like a subsystem. "The result is that the user is really putting together subsystems," he says.

In fact, the company divides its module efforts between two divisions. The Subsystems Division is free to put any CPU in the module; but the RISC System Division is dedicated to the use of RISC central processors.

At Cypress, which industry watchers rank second in the memory module business behind IDT, a spokesman estimates that the packages account for 5% of its business and that growth is fast. Cypress products come from its Multichip Technology Inc. subsidiary in San Jose. The Cypress product line runs the range of standard modules—for example, memories and first-in, first-out devices—as well as custom parts.

One of the major advantages of multichip modules in the eyes of Cypress executives is that with their high performance and high integration they permit the designer to specify Jedec standard packages where one-chip solutions are not yet available.

The nCHIP startup, which swung into action last May with a RISC/Sparc processor that it built for Ross Technology Inc., Cypress's microprocessor subsidiary in Austin, Texas, also has landed a contract from the U.S. government. The company has received a preliminary award—also participating is E-Systems Inc. of Dallas—to build a merchant multichip module foundry that would handle the production of digital devices. E

QUALITY, PRODUCTIVITY SOFTWARE ARE HOT

HERE'S ONE BRIGHT SPOT

BY LELAND TESCHLER

BUSINESS

Everyone says business is bad, but when a 0.1% rise in leading indicators followed news of a 4.4% rise in durable goods orders for December the stock market soared. Why? One reason could be that things still look reasonable for capital equipment this year.

But take a look at what's happening with other long-term propositions, such as quality programs and productivity software. One interpretation: U.S. companies have taken a page from the Japanese strategy book and are spending heavily during a recession to get a leg up on weaker competitors.

Here's the view of recent events from companies trying to sell productivity software to manufacturers:

December was the "best month ever" for sales of Quality Manager, a software package that generates real-time statistics on manufacturing lines. Maker SPSS Inc. of Chicago says sales of its core product, a well-known statistics package of the same name, were a little off in January, but not significantly.

The fastest-growing software company in the industry sees it the same way. Sybase Inc. says that "people are still spending money" and that last year's fourth quarter was strong. "This year, we're aggressive but cautious. So far, so good," says Perry Mizota, marketing manager at the Emeryville, Calif., company. Sybase pioneered the on-line transaction-processing market.

Gensym Corp., maker of a real-time expert system used, among other things, for controlling sputtering lines and in the manufacture of IBM PS/2 boards, says that sales of its package, G2, grew "only" 80% last year, to about $8 million, because of economic conditions. Bob Moore, president of the Cambridge, Mass., firm, is forecasting 50% more sales for G2 this year. E

AP Photo: Toby Talbot

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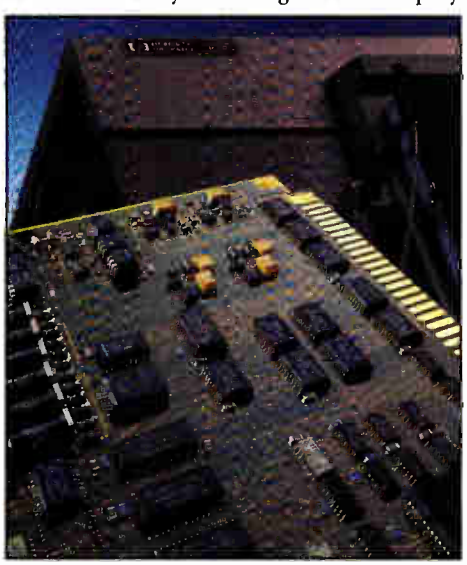

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CIRCLE 172

EAST'S COPYING PAYING OFF

The unauthorized copying of their hardware designs and computer architectures in the former East bloc countries was once a major irritant for U.S. electronics companies. But now the practice is putting those same firms in a good position to penetrate Eastern markets. Take IBM Corp. and Digital Equipment Corp.: many of East Europe's "compatible" mainframes and minicomputers are 10 to 12 years old, so there will soon be a void that IBM and DEC can fill best.

But more immediate business is in the cards for Zilog Inc., whose Z80 microprocessor designs have been copied and sold for many years by VEB Mikroelektronik Erfurt, a state-owned company in what used to be East Germany. VEB is said to have sold more than 10 million such processors annually in recent years. The upshot is that the Z80 processor architecture is currently the most popular in the East, and Zilog is set to cash in by licensing a new incarnation of VEB: Erfurt Microelectronic GmbH, or ERMiC.

First came a September 1990 parts-distribution agreement whereby ERMiC sells Zilog products in Germany, the Soviet Union, Poland, Rumania, Bulgaria, Yugoslavia. And Czechoslovakia, the two firms earlier this year broadened their relationship. ERMic gets a license to manufacture and sell the CMOS Z80 CPU as well as discrete Z80 peripherals throughout Eastern Europe. Zilog gets to use ERMiC as a foundry, a European-based manufacturing alternative that can help Zilog avoid tariffs. E

SIEMENS PARTICIPATES IN JAPANESE VENTURE

Japan's communications authority, NTT Corp., has chosen Siemens AG as the only European company to participate in the development of its so-called Visual, Intelligent, and Personal program, the communications infrastructure for the broadband integrated services digital network of the 21st century.

The technological basis of the Japanese network will be fiber-optic cables as well as the ATM (for asynchronous transfer mode) principle, with which signals of the various services for speech, text, data, and pictures can be switched and transmitted in a simple manner in the form of digital packets. This will enable NTT to offer VI&P subscribers the most sophisticated services over just one socket at low cost.

Germany's Siemens in 1989 supplied an ATM switching system for West Berlin. With its ATM technology, Siemens has also been involved in developing Europe's Integrated Broadband Communications Network, which is part of the RACE (Research in Advanced Communication in Europe) project.

Installation of both the European and Japanese networks is to start in 1995. E

WHAT THE 1990s WILL LOOK LIKE

The Economist Intelligence Unit of London, in a study of strategies of 30 major international companies, has come up with 12 major trends affecting the electronics industry's development in the 1990s. They are:

- Computers and peripherals will continue to account for a third of the output.
- Demand for software and systems engineering skills will grow.
- Demand for telecom equipment will grow steadily.
- World semiconductor markets will increase fourfold. Key areas: memory, ASICs.
- Component sizes will continue to shrink.
- HDTV will arrive by 1995—but with three different standards.
- Optoelectronics will see major advances.
- Government R&D support will move to nonmilitary or dual-purpose areas.
- Governments will become more sensitive to foreign acquisitions of high-tech companies.
- Electronic component counts in autos will double.
- The trend toward strategic allinaces will continue.
- Growing overseas production by Japanese companies will reduce Japan's trade surplus with the U.S. and Western Europe.

EUROPEAN FIRMS TRY TO LOWER LANGUAGE BARRIERS

To some people it's cultural wealth, to others it's a problem, but to a small group of firms and institutes, Europe's multitude of languages—and the resulting speech barriers—is a challenge to their software engineering capabilities. That's why computer-based translation systems are taking on special significance in light of Europe's economic integration as well as the opening of Eastern markets, which is adding about eight new official languages to West Europe's dozen or so.

As part of a $5 million, four-year project called Euro-Triangle (for Translation and Retrieval Oriented Information Base Adapting Data From Native Speaking Grammatical and Lexicographical Form), German, French, and Austrian groups are developing a translation workstation for professionals.

The project involves developing task-specific editors with interfaces for data input and output of various word-processing systems, including spelling aids and rules for separating words, identifying basic word meanings, as well as for assembling dictionaries for English, French, and German words. Aside from basic dictionaries with 20,000 words, the system will have special dictionaries for international business, mechanical engineering, electronics, computer science, and so on.

The translation workstation runs under MS-DOS on IBM personal computers or compatible systems. A second project phase will cover languages such as Italian, Spanish, and Portuguese. E

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CIRCLE 189

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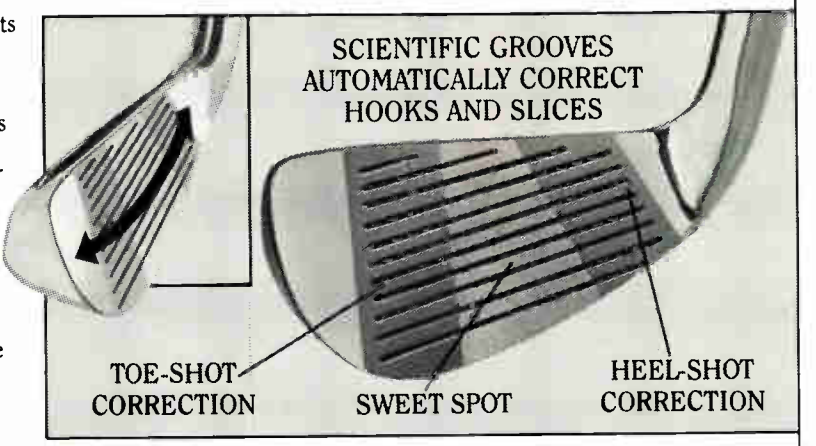
Put your #3, #4 and #5 woods in the cellar. Tests show our new Controller driving iron can outhit all three by 30 to 50 yards.

And that's only half the story. The Controller automatically corrects hooks and slices! The club is so powerful, so accurate, we unconditionally guarantee it will cut 5 to 10 strokes off your score — or you owe us nothing! In fact, to prove it we'll send you one risk-free.

Test it against your #3 wood. If it doesn't give you 30 more yards (if you are a fairly good golfer), send the club back for a refund.

But it will give you 30 more yards! In fact, the Controller is so powerful many golfers use it off the tee, especially on narrow fairways.



Here is the Controller's exact distance advantage as compiled by some low-80's golfers.

CONTROLLER®	220 yards
#3 Wood	190 yards
#4 Wood	180 yards
#5 Wood	170 yards

Now test the Controller's accuracy against your 3-iron. Purposely hit a shot off the *toe* of each club and watch what happens. Your 3-iron will *hook* the ball violently—the Controller will keep it down the middle! The same is true with *heel* shots. Your 3-iron will *slice* the ball violently—the Controller will automatically keep it on course!

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These scientific breakthroughs make the Controller driving iron the most powerful strokecutter in golf. We believe the club will transform the game. First of all, it obsoletes fairway woods! The Controller not only hits 30 to 50 yards farther than fairway woods, it automatically corrects hooks and slices! Here's how it works.

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The Controller has an *invisible curve* across its hitting surface—a curve that's going to revolutionize your game. *No other iron has it!* Hit a shot off the Controller's sweet spot and it will go straight, as it would with an ordinary iron. But even pros hit off the heel and toe.

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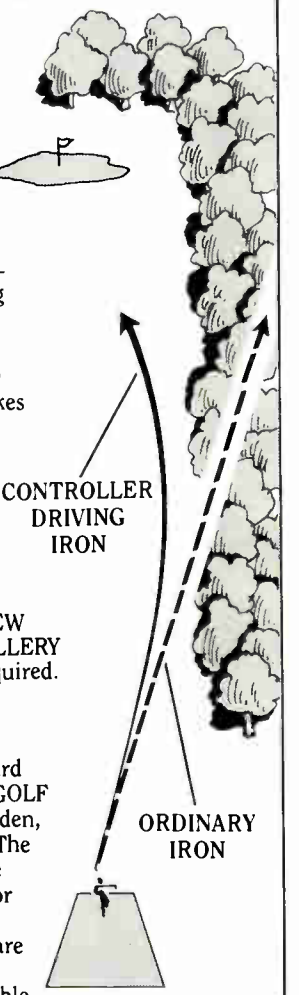

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CD-ROM-BASED INFORMATION DELIVERY MAY REACH THE CONSUMER BY THE MID-'90s

MOVE OVER, HDTV

BY JACK SHANDLE

CD-ROM

The sound and fury expended in launching high-definition TV as a consumer market for the U.S. has obscured the steady evolution toward an electronics-based market in consumer information. This market could be as big as HDTV over the long haul. It also gives small-to-midsize companies a piece of the action.

Microsoft Corp.'s president, Bill Gates, leads the movement, which combines high-end chips, sophisticated software, and content ranging from encyclopedias to Three Stooges films. Calling it multimedia tends to focus attention on hardware, but the real market is information and information delivery.

For the past five years, Gates has refined his vision at Microsoft-sponsored CD-ROM Conferences, and he'll update it again at the renamed Multimedia and CD-ROM Conference in San Jose, Calif., on March 18. "Bill's idea is to change the personal computer from a productivity tool to an information-access device," says Fred Meyer, president of Meridian Data Inc., a Scotts Valley, Calif.-based leader in CD-ROM development tools.

Interestingly, HDTV and electronic information delivery for the home have roughly the same launch date: the mid-1990s. But unlike HDTV, this industry will migrate out of the business market. And since its value lies in content, the market is expected to be both incremental ($50 per package) and vast. Much like the publishing industry today, it targets 25,000 or more consumer subscribers—far fewer in a corporate environment. So it is not surprising that Microsoft followed up its Developers Conference, which drew 700 independent software vendors (ISVs) last fall, with a publishers' conference in New York this month.

The Redmond, Wash., company is not saying much about product plans. But its ISV account managers "are working with well over 100 companies on several hundred applications," says Pamela Goldschmidt, product manager for the Multimedia Systems Group. "When the first machines [PCs with CD-ROM drives] are available, there will be a library of titles." Look for a release date in the next three months.

Gates has had an uphill march since the mid-1980s, and the summit, in some respects, has receded "He hoped the price of CD-ROM drives would have come down a little quicker [than it has]," says Meridian's Meyer. "The relationship between the dollar and the yen has made it difficult for Japanese vendors to lower prices."

The proliferation of operating procedures is another inhibitor. Some applications load from a floppy disk, others from the CD-ROM, and still others use a hard disk. This is particularly cumbersome when video sequences are involved. "People forget that if you don't store video on a hard drive you lose the environment when you swap discs," says Chris Daley, president of Emerson Technologies Inc., North Bergen, N.J. Emerson chose not to follow the lead of Tandy Corp. and Microsoft by integrating a CD-ROM drive in its multimedia PC. "We have a CD-ROM interface on the motherboard," Daley says. "We will offer the drive as an option, but we will not bundle it until the fourth quarter. At $600 retail, it does not buy the end user much now."

Microsoft's Bill Gates

Nevertheless, the trend is clearly in Gates's direction. Computer vendors have almost unanimously made CD-ROM the distribution medium of choice for the documentaion of their high-end systems, and PC-industry leaders such as Compaq Computer Corp. use it to distribute data to resellers.

In the world of large corporate users, the trend is toward publishing CD-ROM titles at the departmental instead of the corporate level. Contrary to widely held opinions, the "real payoffs for CD-ROM are in high-traffic, high-use, volatile information," says Bill Ford, president of Online Computer Systems Inc., Germantown, Md. The advent of writable CD-ROM systems from Sony Corp. of America and others made the economics—$30,000 for hardware and $4,000 for software—of in-house departmental publishing compelling for large companies. The consumer market also looks good to Ford, who predicts 250,000 CD-ROM drives in homes by the end of 1991. IBM Corp.'s PS/1 will offer a CD-ROM drive within a year, Ford predicts. "We will have an installed base, and that will change everything."

A development certain to help is last month's entry of consumer giant Panasonic Industrial Co. into the U.S. market. Panasonic's reputation for high-volume, low-cost manufacturing means drive prices will drop, though just how much is uncertain. "It will be appreciable," says Brian Middleditch, product manager for optical-disc systems, Milpitas, Calif.

Another product that might help is a portable, 1.9-lb drive from Laser Magnetic Storage International Co., Colorado Springs, Colo. It now sells through catalogs, says product manager Rob VanEijk, but he reports "tremendous interest" from laptop resellers and PC makers too.

Meanwhile, Nintendo Corp. of America, based in Redmond, has licensed its GameBoy to traditional publishers. Nintendo has no CD-ROM plans, but Sony is evaluating U.S. market requirements for its Data DiscMan product, now sold in Japan, says Allan Sund, marketing manager for Sony's CD-ROM Division in San Jose, Calif.

HDTV or no HDTV, Microsoft will be waiting.

TWO NEW VERILOG TOOLS FROM CADENCE INVADE SYNOPSYS' SYNTHESIS TURF

CHALLENGING THE LEADER

BY LAWRENCE CURRAN

CAD/CAE

Others are trying, without much success to date, but Cadence Design Systems Inc. has mounted what may be the most credible challenge yet to Synopsys Inc. in the lucrative logic synthesis business. The San Jose, Calif., company is venturing into logic synthesis for the first time with a two-part package that is integrated with Cadence's Verilog hardware-description language and its second-generation design-automation framework, called Design Framework II.

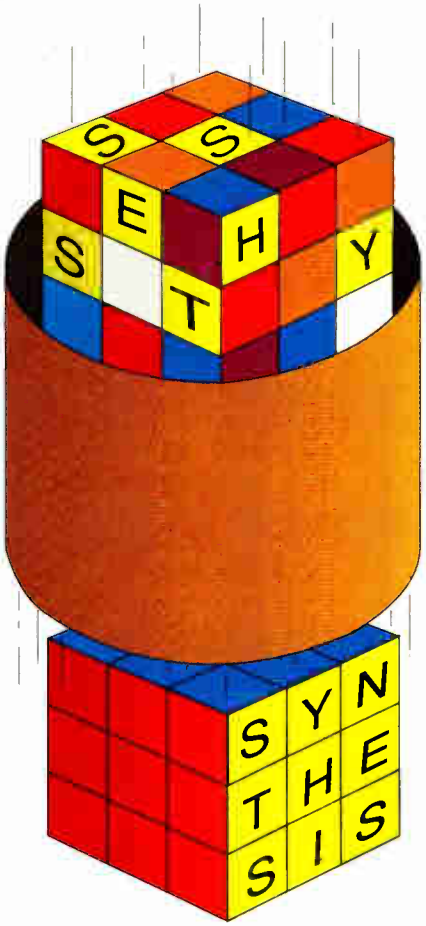
Synopsys dominates logic synthesis, one of the fastest-growing markets in computer-aided design and engineering. Analyst estimates of the Mountain View, Calif., company's share top 90% in a market that was said to be worth about $30 million last year by Dataquest Inc., the San Jose market research firm.

For his part, Synopsys president and chief executive officer Harvey Jones says flatly that his company had $28 million of that, and this month it is introducing a new release of its software in an effort to keep a step ahead of any pretenders to the throne. Dataquest says the synthesis market should hit $61.5 million this year and top $180 million by 1994.

There are other players, too. Mentor Graphics Corp., Beaverton, Ore., and its Silicon Compiler Systems subsidiary are in the fray, as is Racal-Redac via the acquisition of the assets of Silc Technologies Inc., Burlington, Mass. GenRad Inc., Concord, Mass., will jump in this year, after acquiring a logic-synthesis tool from Aptor SA, Grenoble, France.

For its part, Mentor is coming on strong with plans to leapfrog into the market-leadership position by 1993. The firm has dedicated a unit, the Design Synthesis Division, to logic synthesis and is selling the SCS AutoLogic synthesis tool as part of release 7.0 of its EDA environment.

But none of these companies to date has been able to take much of the play away from Synopsys, whose synthesis tool takes an existing logic description



done in the VHSIC Hardware Description Language (VHDL), minimizes the logic required to implement that description, and quickly outputs a net list for a standard-cell or gate-array design. Now Cadence is making a run, after first consolidating its own acquisition of Gateway Design Automation Corp., the developer of the Verilog language.

Verilog, which Cadence placed in the public domain last year, may be the most widely used HDL for VLSI CAD [*Electronics*, June 1990, p. 15]. As of 1990, more than 3,000 Verilog seats had been installed, and another 3,000 or so should follow this year, says Bob Sullivan, vice president for marketing at the Systems Division in Santa Clara, Calif. "And 67% to 75% of those are candidates for an HDL-based synthesis tool," he says. The initial Cadence synthesis software supports Verilog, but future releases will handle VHDL designs too.

The Cadence offering is packaged as two products, Improvisor and Optivisor, which produce "optimized gate-level descriptions based on time and/or area constraints," Sullivan says. The first releases run on standard Unix-based workstations and are intended for the design of complex custom ICs, application-specific ICs, and programmable logic devices greater than 20,000 gates.

Improvisor is a mixed-level synthesis tool that lets users check out various technology alternatives early in the design process by incorporating a "what if" methodology. The tool generates a trade-off curve that simultaneously displays multiple results based on a range of timing or area goals. This means that users don't have to commit to a specific ASIC library—or to an ASIC approach at all—until they have the best logic implementation possible. For example, a user may choose to implement the design in a PLD instead of an ASIC.

Optivisor is the optimizing and mapping tool, which incorporates algorithms that optimize circuit-timing considerations without degrading device performance. It's also the "logic minimizer" element, providing optimal partitioning of designs topping 20,000 gates.

Cadence has about six beta test sites for the new software, including Digital Equipment, Hewlett-Packard's Apollo Systems Division, and Sun Microsystems. Improvisor and Optivisor will run on those companies' workstations initially; first customer shipments are expected this quarter. Improvisor prices begin at $15,000; Optivisor starts at $35,000.

Meanwhile, Synopsys isn't standing by idly. The company acquired the VHDL-compatible Endot simulation software from Zycad Corp. last October. Having Endot in its tool kit means Synopsys can offer customers VHDL, a simulator to debug the high-level description, plus the synthesis tool to convert the debugged design into logic.

This month, Synopsys will unveil version 2.0 of its software, including new tools the company says will usher in the era of what it calls concept-driven engineering. This allows designers to devote 80% of their time to high-level conceptualization and 20% to logic implementation—reversing today's practice. The new tools include HDL optimization, test synthesis, and synthesis for emitter-coupled logic. E

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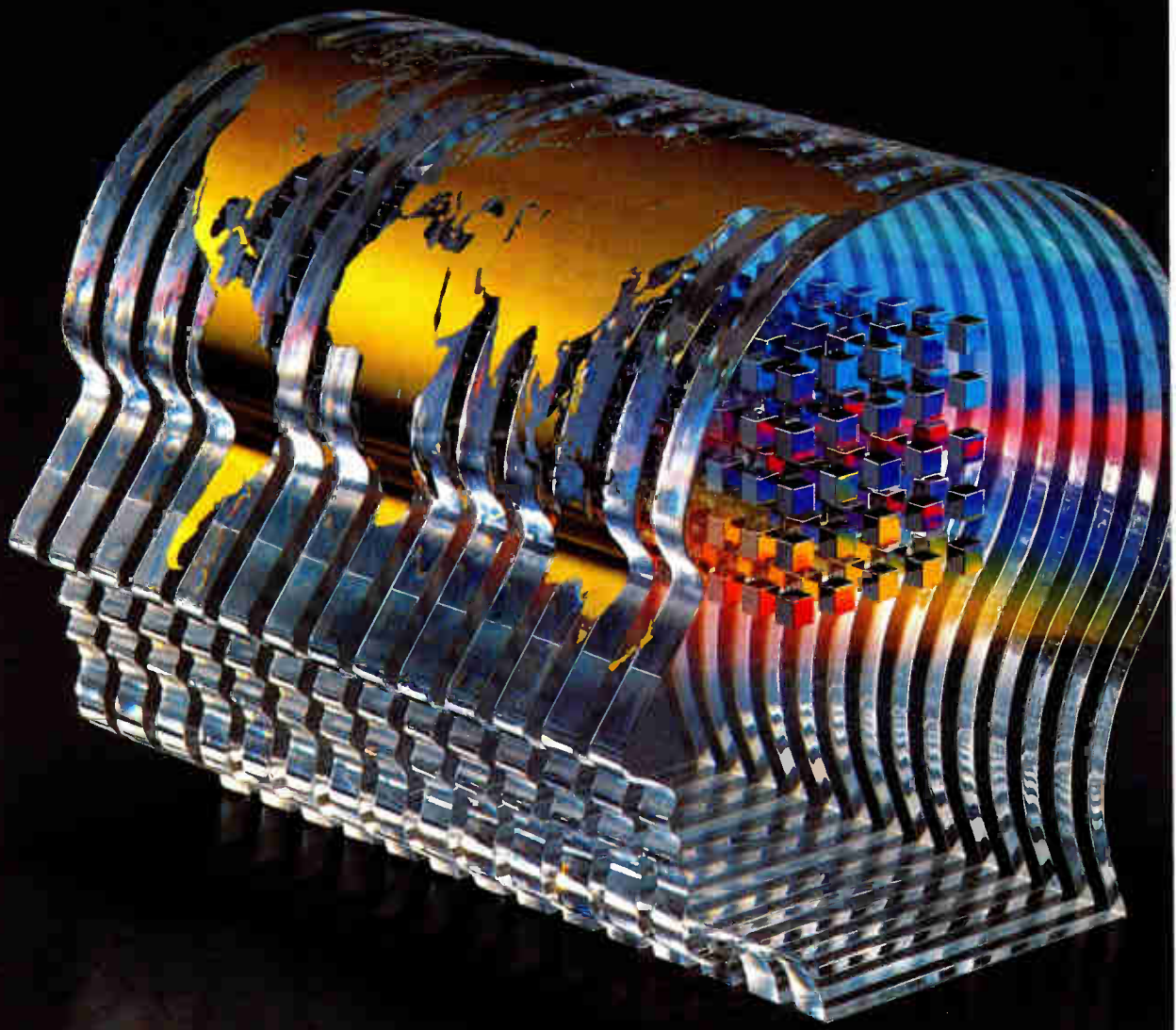

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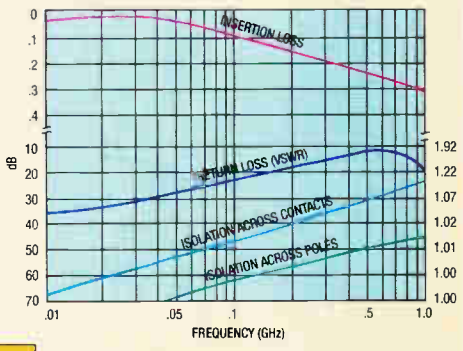

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FREEDOM DOESN'T COME EASY

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BY JACK SHANDLE

Before Mill Ovan and his marketing team hit the road for Motorola, they slip wide-area-networking devices in their shirt pockets. It is not uncommon, says Ovan, for team members to be talking separately on MicroTac cellular phones—perhaps from the same New York taxicab—with the Arlington Heights, Ill.. headquarters, Los Angeles, and Boston.

The MicroTac is a marvel of miniaturization. It is also an enticing sample of the grabbag of wireless personal-communications technologies that will be coming along in the next five years. For now, though, breaking free from the terrestrial phone network will have to wait for regulators and industry giants to get their respective acts together. As for the state of the art today, MicroTac keeps its owner in touch, all right, but only as long as he's within calling distance of a cellular base station that has a channel open.

More than any other company, Motorola Inc. has taken it upon itself to break the wire tethers that bind U.S. business. Ovan's team is doing its part by marketing Motorola's wireless Ethernet (see p. 29). In its most ambitious project, the company in 1994 will start launching a 77-satellite system to deliver personal communications globally.

Other trend-setting companies have a foot in wireless too. For example, Apple Computer Inc. last month petitioned the Federal Communications Commission to allocate 40 MHz of the 1.9-GHz radio-frequency spectrum for computer communications. About 100 companies have overwhelmed the FCC with similar applications. Along with Motorola, BICC Technologies Inc. of Westborough, Mass., and NCR Corp. of Dayton, Ohio, are among a growing number of firms selling wireless local-area networks. In Japan, Nippon Telephone & Telegraph Corp. has developed a portable phone even smaller than the MicroTac and expects to begin marketing mobile services that utilize it early this year. In Europe, especially the UK, plans for personal communications networks (PCNs) are even further along (see p. 48).

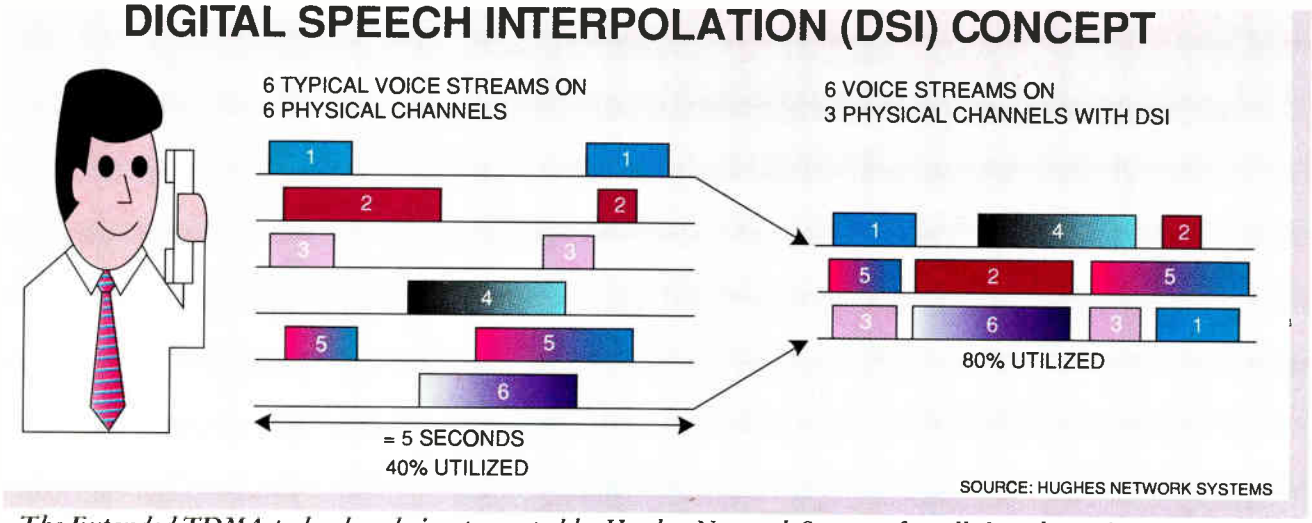
Although most wireless markets exist only in the dreams of product managers, the mobile cellular communications market is robust. In some cities, it is reaching channel saturation. Nevertheless, voice is not enough for some companies. They want to stretch cellular technology to accommodate data. For example, Rockwell International Corp.'s Modem Division in Newport Beach, Calif., last month teamed up with Microcom Inc. of Norwood, Mass., on a handshaking protocol that will make 9.6-Kbit/s PC laptop data communications over the cellular network far more reliable.

The technical problems of sending data over analog cellular links is daunting because of line noise and the unpredictability of base-station handoffs. The prospect of the Microcom/Rockwell technology being pushed aside by digital cellular technologies is real, admits Dwight Decker, Rockwell's business director for modem systems, but in his view that's unlikely for several years.

COMMUNICATIONS

Decker would get an argument from proponents of digital cellular such as George M. Calhoun, senior vice president of International Mobile Machines Corp., King of Prussia, Pa.

"Digital is going to come in a whole lot quicker than most people think," Calhoun says. The number of calls that can be handled by the same cell will increase by a factor of 15, so "the operators will make much more money on digital circuits. They will be giving digital units to their heaviest users." Digital could blow analog away for data communications, he says, adding that data



The Extended TDMA technology being promoted by Hughes Network Systems for cellular phones boosts channel utilization by multiplexing channels during pauses in conversation.

rates of 144 Kbits/s are easily attainable.

One would think that the cellular business, which has been growing at breakneck speed for the past six years, would be a model of stability that other wireless technologies could follow. In fact, it continues to be a rough-and-tumble affair, with service providers creating a crazy quilt of incompatible networks. Efforts to standardize have met limited success, and the industry is now in the middle of a debate over which technology will lead it from the analog world into digital cellular communications.

The fundamental issue is call capacity. With today's analog systems stretched to the limit in some locales, digital cellular is appealing because it can cram more calls into the same bandwidth. And that means more revenue for the cellular carriers. "In the larger cities where you now have the capacity to serve 250,000 subscribers, we are talking in terms of 4 million subscribers," says Jim Mullen, cellular marketing manager at Hughes Network Systems, Germantown, Md.

The technology contenders for digital cellular are time-division multiplexing (TDMA)—such as is used in the terrestrial phone network—and code-division multiplexing (CDMA), a spread-spectrum technology. Qualcomm Inc. of San Diego is championing CDMA and has interested several major carriers, including Nynex, Ameritech, and PacTel. TDMA has gotten the nod from the Cellular Telecommunications Industry Association, but its recommendation is not binding for carriers. TDMA has gone through a couple of generations, with the latest—Extended TDMA—put forth by Hughes Network Systems, International Mobile Machines, and the French telecom giant Alcatel.

"Having used TDMA for many years, we think it is a robust standard," says IMM's Calhoun. But Allen Salmasi, Qualcomm's vice president of development, insists that CDMA will be cost-competitive with TDMA and that its low-power, spread-spectrum approach makes it more easily extendable to PCNs. It seems, then, that cellular communications could be in any of three modes: E-TDMA, CDMA, and conventional analog. (For more on the debate, see Face-Off on p. 20)

The good news for equipment makers is that the semiconductor content of the two technologies is similar. "The algorithms are different, but many of the processing blocks are generically the same," says Nick Kucharewski, general manager of VLSI Technology Inc.'s Communications Products Sector, San Jose, Calif. Most of the contention in the chip business involves the familiar story of general-purpose versus application-specific silicon. VLSI Technology will address cellular with a "half dozen or more" ASIC building blocks and wait for the market to ramp up.

Another approach comes from AT&T Microelectronics. Rick Beal, manager for mobile communications signal processors, says the Berkeley Heights, N.J., chip maker will use programmable digital signal processors and follow where the market leads. "With the standards constantly changing," he says, "programmable processing is very attractive."

Beal is more cautious than Kucharewski about interchangeability among standards and technologies. "The phone set is not a problem," he says, "because it only handles one channel. But the base station has to deal with multiple channels, and that could be a problem." This is especially true for chip companies that want to be global suppliers. Europe's GSM system specifies a different number of channels than the U.S. system, for example, and would require different chip partitioning, Beal says.

Technology issues aside, the wireless revolution is unlikely to begin in earnest until the thorny issue of spectrum allocation is settled. One possible technology fix would be to allow a PCN based on low-power, spread-spectrum technology such as CDMA to coexist in an already allocated band. But since the FCC must approve broadcasting in any already allocated band, the fix by no means settles the regulatory issue.

The FCC can move quickly, but only under ideal circumstances. In order to avoid a regulatory hassle for its wireless LAN technology, for example, Motorola selected "a band nobody gave a damn about," says Len Kolsky, vice president of regulatory affairs in Motorola's Government Affairs Office in Washington. The catch is that Motorola had to develop a state-of-the-art technology—including a so-called Mimic microwave chip—to broadcast at 18 GHz.

"Motorola does not think that spectrum sharing is likely in any widespread way," says Kolsky, because the emergency services that now utilize the 1.9-GHz channel being targeted by Apple

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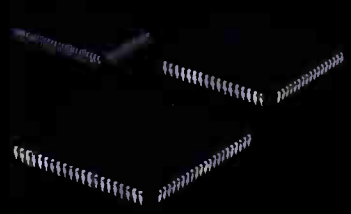

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CIRCLE 218

THE UK WILL BE FIRST TO UNPLUG

Despite recessionary doom and gloom in most electronics sectors, mobile communications companies in the UK remain confident that over the next eight or nine years they will be able to attract between 10 million and 15 million paying customers to services that do not now exist.

That spread of numbers is deliberate. Companies desperately trying not to fool themselves quote the lower figure; other firms use the higher number to impress potential investors. Both camps can produce market research reports that can be interpreted to prove any number in between those limits.

If all of the current players survive, the UK could one day have nine mobile communications companies offering no fewer than 11 services. Of these, personal communications networks (PCNs) from three consortia—Mercury PCN, Unitel, and Microtel—are very much in the limelight as the potential star performers. These services, which will operate at 1.8 GHz and have a 200-meter range between handset and cell, should be ready for commercial implementation by the end of 1992.

To maintain the delicate balance required by Euro-politics, the PCN systems had to line up with the standard for the pan-European digital cellular networks that are scheduled to start service this year. That standard, known as GSM after the Groupe Speciale Mobile working party that defined it, is based on a time-division, multiple-access (TDMA) technique.

For its part, the PCN implementation, known as DCS-1800, was ratified in the last week of January. The prime differences between the two standards lie in the radio-interface frequencies and handset transmitter powers.

Where the GSM specification was designed for use at frequencies in the 890-to-960-MHz band, frequency allocations for PCN were finalized at 1,710 to 1,785 MHz for the telephone-to-network channels; for the reverse direction, the range is 1,805 to 1,880 MHz.

The GSM standard also calls for a means of storing in a telephone a variety of information relating to its user—identity, billing status, home network, and so on. In GSM terminology this is known as a subscriber identity module (SIM).

While the SIM may reside in an electrically erasable programmable read-only memory built into the handset, many vendors and some operators plan to install user-removable SIMs based on any of the technologies currently available. These include conventional magnetic-striped cards of the credit card variety through to solid-state disks that use flash EPROM or battery-backed random-access memory.

The favorite technology, however, is a smart card the same size and shape as a credit card, but with an embedded microprocessor and nonvolatile memory.

The UK PCN operators have seized on this aspect of the standard as a means of allowing them to offer a range of value-added services to their customers. Their philosophy is that a user should be able to take his personal SIM card and slide it into any PCN telephone, no matter who the vendor is.

That way, the operators hope to meet an obligation imposed by the UK government that a user should not be restricted to only the services of the company he first signed up with. The three PCN networks have formed the optimistically titled European Association of PCN Operators to agree upon common service standards.

Individually, the companies are not saying much about implementation strategies as yet. But they are examining tenders from the six or so firms that are able to supply the hardware they need, including the superminicomputers that will be needed to manage their vast networks and keep track of millions of users.—*Peter Fletcher*

and others will not give it up without a fight. "The FCC is faced with its worst nightmare: inflicting pain on somebody," he says. "I think it will be a long, slow process before we see PCNs."

Moreover, if the FCC decides to make existing users share their spectrum, it will have to compensate them with a band somewhere else. About the only unused bands outside the microwave region are the so-called taboo channels of the terrestrial TV broadcast network. When the FCC set up the UHF and VHF channels a half century ago, such guard bands were a way to protect against interference.

Technology advances have made guard bands obsolete for that purpose. But the channels might be needed for transmitting wide-bandwidth high-definition TV signals, and broadcast companies are unlikely to give them up without a fight. Even Motorola's 77-satellite Iridium project is in search of bandwidth. "There just isn't any virgin spectrum lying around," says Kolsky.

With mobile cellular embroiled in controversy and PCNs in search of spectrum allocation, the brightest spot in wireless communications could be LANs. Besides Motorola's announcement of a 10-Mbit/s Ethernet product that operates at 18 GHz, January saw BICC Technologies unveil its InfraLAN network. Based on infrared technology, InfraLAN implements IEEE-802.5 Token Ring protocols at data rates of 16 and 4 Mbits/s. Another new entry is from NCR, which last fall took the wraps off WaveLAN, a 2-Mbit/s product that operates with Novell NetWare and is based on spread-spectrum technolgy.

"I do not expect to see anybody adopt wireless LAN technology across the board," says Jennnifer Pigg, a senior analyst at the Boston-based Yankee Group. MIS managers like it because wireless LANs are easy to move and reconfigure—a major selling point with large corporations. However, "I don't expect to see it impact LAN sales this year," she says.

Although the prospects of making money in wireless communications are well off in the future for most companies, there is another perspective on assessing the market. Technology is moving fast, and there are many options. Major corporations are making room for wireless in their business plans. "Free at last" will still be the rallying cry of communications in the 1990s.

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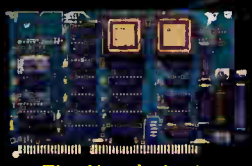

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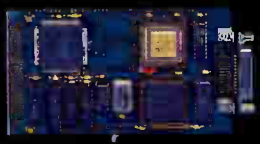

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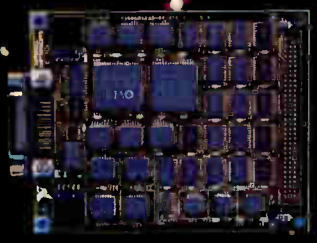

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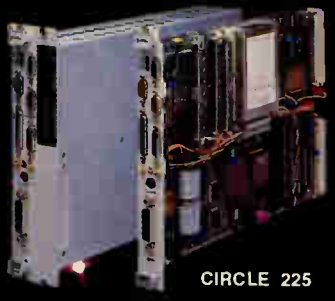

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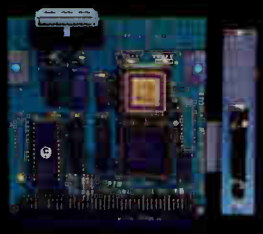

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DIGITAL MEETS ANALOG IN A ROBUST MIXED MARKET

THE PUSH FOR INTEGRATION MEANS ANALOG FUNCTIONS ARE MOVING ON-CHIP—AND BUSINESS IS LOOKING UP

BY SAMUEL WEBER

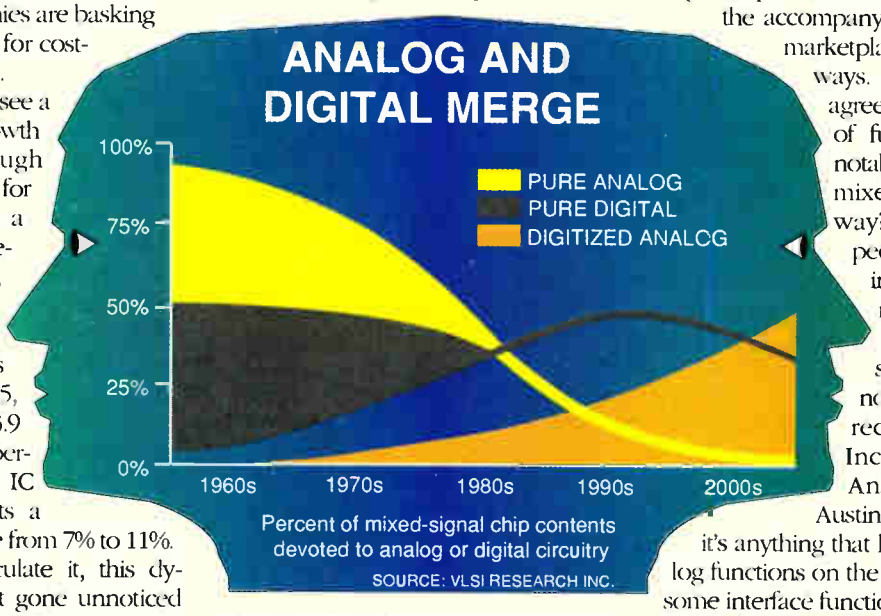
SEMICONDUCTORS

Where's the semiconductor action today? Surprise! Growth in sales of mixed-signal ICs, where both analog and digital functions reside on the same chip, is significantly outpacing that of the semiconductor market overall. As a result, chip vendors are reorganizing, electronic-design houses are scrambling to solve the knotty problems of mixed-signal CAD, and test companies are basking in a growing demand for costly mixed-signal testers.

The market should see a compound annual growth rate of 18.3% through 1995, against 16.9% for semiconductors as a whole, says VLSI Research Inc., a San Jose, Calif., market research firm. In dollar terms, mixed-signal IC sales will hit $9 billion in 1995, the firm says, from $3.9 billion in 1990. As a percentage of the total IC market, this represents a growth in market share from 7% to 11%.

However you calculate it, this dynamic growth has not gone unnoticed by chip makers large and small. More than 50 companies are now in pursuit of this potentially lucrative merchant chip business, with the tool and tester makers marching right along with them. "It's almost the same situation that occurred when ICs grew out of transistors in the early 1960s," says Jerry Hutcheson, chief executive officer of VLSI Research. "The same kind of battle went on then. There were enormous test problems then. There were problems in manufacturing. And everywhere you find similar difficulties in mixed-signal today."

The boom stems from customer calls for more functionality on a chip, calls that are putting heavy demands on semiconductor vendors. Increasingly, customer specs are ratcheting upward in speed and density while calling for reduced power dissipation, lower chip counts, and less cost. In a word, chip design is moving inexorably to system design, with customers looking for complete solutions, not just components. All of this is occurring in an environment where customers want fast turnaround and infinitesimal defect rates.



"What we integrate is changed," says Richard Sessions, director of marketing for mixed analog-digital technology at National Semiconductor Corp. in Sunnyvale, Calif. "It used to be digital integration for density. Now it's functional integration mixing analog and digital." Sessions points to mass storage as a classic example. "Five years ago," he says, "it took more than 100 ICs to build a 20-Mbyte hard disk. Today, for a 2.5-in. drive with twice the capacity it takes only 16. By 1995, that will shrink down to four chips—three mixed analog-digital and one digital memory. By the end of the century, it will be two chips—one mixed-signal and one commodity memory."

But while everyone agrees that this move to systems-on-a-chip is happening, companies are coming to grips with the accompanying changes in the marketplace in a variety of ways. And there is disagreement on a number of fundamentals: most notably, just what is a mixed-signal IC, anyway? "If you ask 10 people what their definition of mixed-signal is, you'll get 10 different answers," says Ron Katchinoski, marketing director for Motorola Inc.'s MOS Digital-Analog Division in Austin, Texas. "We think it's anything that has digital and analog functions on the same chip and has some interface function to the real world on it—be it a pressure sensor, voltage sensor, or digital-to-analog converter."

That fits with only one of the three definitions VLSI Research lists. A second totes up the ratio of analog-to-digital elements on the chip; for example, if a circuit has 10% or more analog cells, then it's a mixed-signal chip. The third definition uses the black-box approach. Here, a device is considered mixed-signal if its input, output, or control terminals contain both digital and analog signals. By at least one of those definitions, mixed-signal has been around for a long time, even though such industry staples as

converters and conditioners have been traditionally classified as linear devices. Indeed, much of the mixed-signal activity in some companies resides at least in part in the linear design groups.

But Hutcheson says none of these definitions is entirely satisfactory. He believes it's a mistake to view mixed-signal as a niche or simply as a bridge between analog and digital—that in fact, a merger is taking place. "Twenty years ago, people chose to define the market by digital versus linear," he says. "So they polarized the market, and the net effect after 20 years of growth is that people still see it that way. But the market doesn't care—it goes where it needs to go, in a direction where neither analog nor digital can go independently."

Hutcheson believes that mixed-signal—which he prefers to call "digitized analog"—is a new, emerging circuit type, a totally fresh approach to digitizing functions that were formerly analog. The result, he says, is new functions that could not have existed alone in either domain—for example, image-compression chips, in which a digital process performs essentially analog functions.

In the more conservative camp is Tom Cate, director of strategic programs for Analog Devices Inc. in Santa Clara, Calif., and chairman of the analog forecast section of World Semiconductor Trade Statistics Inc. (WSTS) in Cupertino, Calif. Hutcheson, says Cate, "is trying to bring in the application aspect. Our philosophy is to look at the function—what it does, rather than its end applications." Cate says the market is not neatly categorized into ADCs and DACs, although everyone agrees these devices should be included in the mixed-signal grabbag, along with things like codecs, modems, and other circuits that process an analog signal digitally. Digital signal processors are another matter. "VLSI Research counts them, [market researcher] Dataquest doesn't, and neither does WSTS," Cate says.

Nevertheless, Cate concedes that Hutcheson has done a good service in pointing out that all real-time systems operate with analog somewhere in their input or output. "In this sense," Cate muses, "all control systems, instrumentation, and display systems are inherently mixed-signal, and as you go higher and higher in integration, more and more chips end up as mixed-signal devices. Ultimately, maybe all chips will be mixed-signal with the exception of high-powered microprocessors and gigabit memories aimed at the mainframe computer market."

MIXED-SIGNAL COMPLEXITY GROWS

Device Type	Number of Components: Analog Elements	Number of Components: Digital Gates	Number of Components: Total	Analog Circuitry: % of Components	Analog Circuitry: % of Chip Area
Op amp	100	0	100	100%	100%
12-bit DAC	275	200	475	58%	70%
12-bit ADC	300	1,050	1,380	24%	33%
8-bit triple subranging ADC	2,800	5,200	8,000	35%	50%
Data-acquisition system	2,600	7,650	10,250	25%	53%
Triple video DAC	3,500	50,500	54,000	6%	20%
Delta Sigma ADC	2,000	8,000	100,000	2%	20%

SOURCE: ANALOG DEVICES INC.

The mixed-signal community covers a wide range of companies, from small, exclusively mixed-signal vendors like Silicon Systems and Sierra Semiconductor to powerhouses like National, Texas Instruments, Motorola, NEC, and Toshiba. Rockwell International, NCR, Harris Semiconductor, Philips Signetics, and SGS-Thomson Microelectronics are heavily involved. Traditional linear companies now widely call themselves mixed-signal outfits—Analog Devices, Burr-Brown, and Microlinear, to name a few.

The bigger firms are plucking engineers from their various analog and digital product areas and regrouping them into mixed-signal units. Many of these groups are set up along application-specific lines, calling themselves automotive or telecom groups, and so on. Since mixed-signal technology is becoming more systems-oriented, many companies are augmenting their mixed-signal design teams with systems engineers.

National Semiconductor is one company that has restructured under the impetus of the new mixed-signal environment, although the mixed-signal effort (National calls it mixed analog plus digital) resides in the company's Analog Division. The thrust is toward application-specific standard products (ASSPs), primarily in traditional linear arenas such as data communications, telecom, and computer peripherals. Whereas in 1989 National's product mix was 56% digital, 24% mixed-signal, and 20% pure analog, by 1995 it will be 52% digital and 28% mixed-signal, says Tom Odell, vice president of the Analog Division. Pure analog will hold steady at 20%.

Texas Instruments Inc. in Dallas also offers mixed-signal ASSPs, including video-interface, telecom, datacom, and computer-peripheral chips. But many of the company's mixed-signal designs are turnkey, made to customer specs. Customers often participate in design, says Paul Koch, manager of what TI calls LinASIC development, many opting to handle the digital end while TI develops the analog portion.

Motorola has two groups working on mixed-signal, one in bipolar and one in CMOS. Both design groups have BiCMOS capability. Motorola divides the mixed-signal market into three categories: partnership products, developed in a joint effort with a customer; ASSPs, which often evolve from partnership products; and semicustom, where Motorola's analog tools and standard-cell library are placed in the hands of customers. As one of those who believes the mixed-signal market must be viewed in terms of applications, Katchinoski sees multimedia as offering a major opportunity in the near future. Right now, he says, telecom is the biggest mixed-signal market.

Yet another definition comes from NCR Corp.'s Microelectronics Division in Fort Collins, Colo. Mixed-signal means all devices "that contain linear components such as comparators or op amps," says Randy Zwetzig, product manager. NCR, which produces mixed-signal ASICs, last year introduced the VS700 cell library, one of the first to utilize submicron CMOS analog cells. With a 0.7-μm effective channel length and

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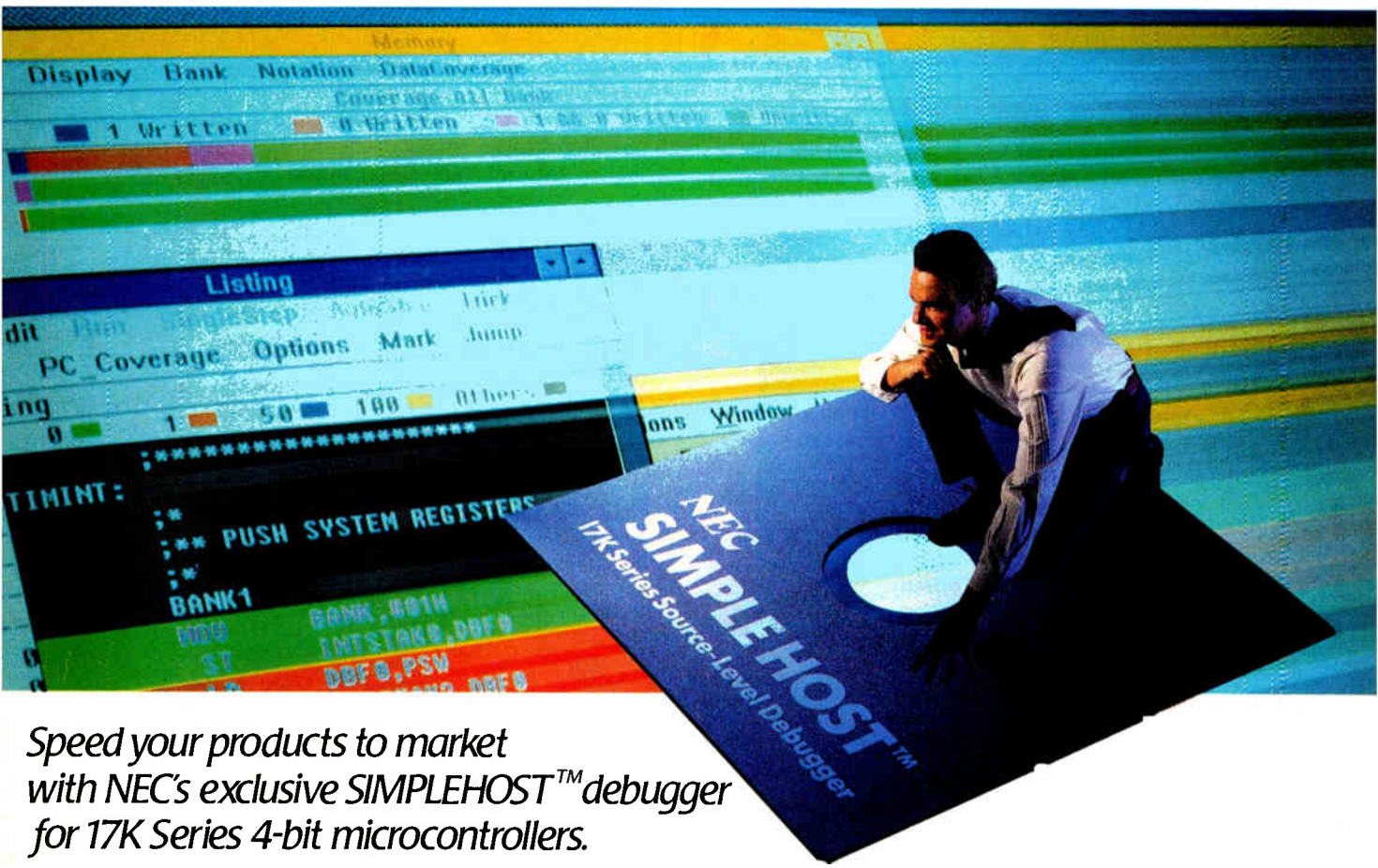

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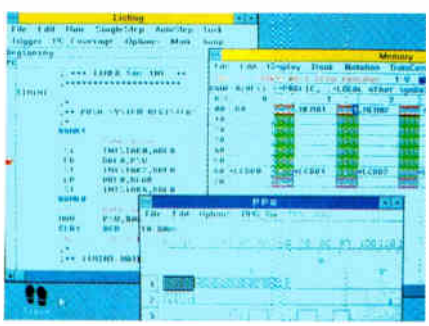

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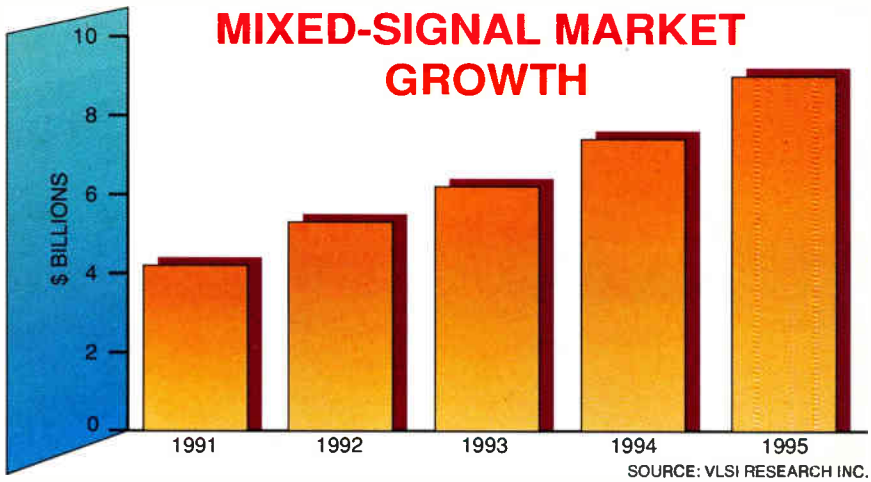
0.95-µm drawn channel length, it doubles the speed and halves the power consumption of its predecessor V1500 1.5-µm library.

Meanwhile, Silicon Systems Inc.'s dedication to application-specific mixed-signal ICs (it calls them MSICs) has vaulted this relatively small Tustin, Calif., company into the top 10 of mixed-signal vendors. Acquired by Japan's TDK Corp. in 1989, the firm earned $140 million in revenues for the fiscal year ending March 1990 and should gain 35% on that this year, says senior vice president and chief technical officer Gary Kelson. The product mix is about evenly divided between custom and standard, with an extensive in-house cell library extending from primitive gates and operational amplifiers to megacells such as disk-drive separators and other high-level blocks.

Harris Semiconductor in Somerville, N.J., which produces custom and semi-custom mixed-signal ASICs, subscribes to the black-box definition. Ken Brizel, director of marketing in the Power and Logic Division, describes mixed-signal as "a box that allows you to come on and off with analog and digital signals. The only thing that matters beyond that is the proportion of analog and digital." That translates into setting up the mixed-signal operation in three categories of processes and their associated libraries: optimized for digital, optimized for analog, and optimized for power. "Depending on the intent of the circuit, that determines how we do the design and the library we use," Brizel says.

As the competition for sockets intensifies, chip makers are demanding better computer-aided design. Effective and useful CAD tools for mixed-signal IC designers have only recently started to appear. That's because while tools for digital design are extremely well developed, analog CAD is still relatively primitive. "There's no question the analog guys were the last to use CAD, and we didn't offer them much of anything," says Jim Solomon, president of the Analog Division of Cadence Design Systems Inc. in San Jose. "But there's a lot of interest in it now. These mixed-signal chips are a different kind of thing than anybody had to deal with before. They're getting really complicated—so bad that nobody knows what to do, and software is one thing that can help."

Mixed-signal companies have a choice of developing their design tools internally; working with a tool vendor, like Cadence or Mentor Graphics Corp.; or lashing together commercially available digital and analog tools with some sort of interface. Most are eschewing the expense and time required to develop their own tools and are working with tool makers—and in some cases with other chip vendors. For example, Cadence has six corporate partners, including Harris, National, and Toshiba, working together in a so-called Analog Alliance creating mixed-signal software.



"If you ask them what their most important problems are," Solomon says, "they say, 'We're having trouble getting good first silicon on big mixed-signal chips. So that's step 1—get good silicon and basic functionality." At step 2, he says, "they start demanding to check the settling time of this ADC or the functionality of this telecom system. You get these escalating levels of need, but the first one is desperation: help me to get first silicon, save me from errors."

Another stumbling block is test. Although capable hardware is available from vendors like Teradyne Inc. and LTX Corp., developing test programs remains a major production hurdle. Companies can opt to buy a mixed-signal tester at great cost; use separate testers for digital and analog; or add mixed-signal capability to an existing digital tester.

"There's no easy way to translate test vectors from a simulation environment to a test environment [as can be done readily in digital-only testing]," says SSI's Kelson. "For the moment it's a problem that can only be solved by having experienced test-development engineers working closely with our design engineers to develop a program."

In fact, says Pat Ham, manager of analog cell library development at NCR, "We've gone through quite an analysis of what's available in the commercial marketplace, and we couldn't come up with a single tester that would allow us to test our ICs to make sure that the digital and analog performance were being measured adequately at the same time to guarantee the customer's specs."

The trade-off NCR made was to marry the Trillium testers it uses for the digital side to Hewlett-Packard Co.'s precision analog test equipment via an IEEE-488 bus and controller. At many other companies, Teradyne's A500 series is the tester family of choice. The Boston vendor has reportedly racked up sales of more than 100 test systems at $500,000 to $2 million per unit. Competitor LTX of Westwood, Mass., also has VLSI testers suitable for mixed-signal work.

"Hardware is not as much of a problem as figuring out how to get it to work," says Charles Gopen, vice president of marketing at Microlinear Corp. in San Jose. "Developing test programs is a long, tedious process. It hasn't been automated. The testers have gotten better, but the basic strategy and test-coverage issue is essentially still a manual process."

Gopen believes design and test are such tough nuts that they may impede mixed-signal growth. Cadence's Solomon agrees they present difficulties, but he thinks solutions are close at hand and the opportunity is here, fueled by the drive toward systems-on-a-chip. "There is just tons of complexity on the digital side, and now it's needed on the analog side," he says. "The guys who figure it out first will capture this lucrative side of the business, where prices are still high and margins are good." E

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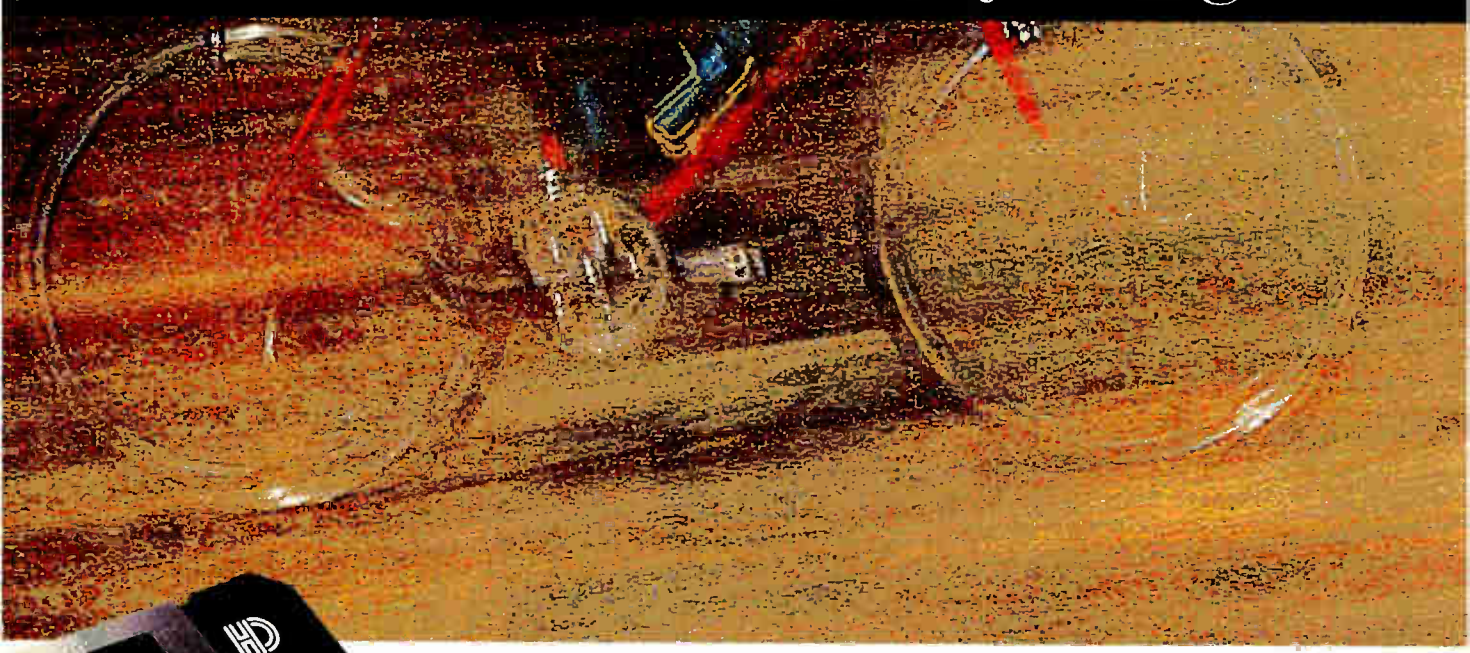

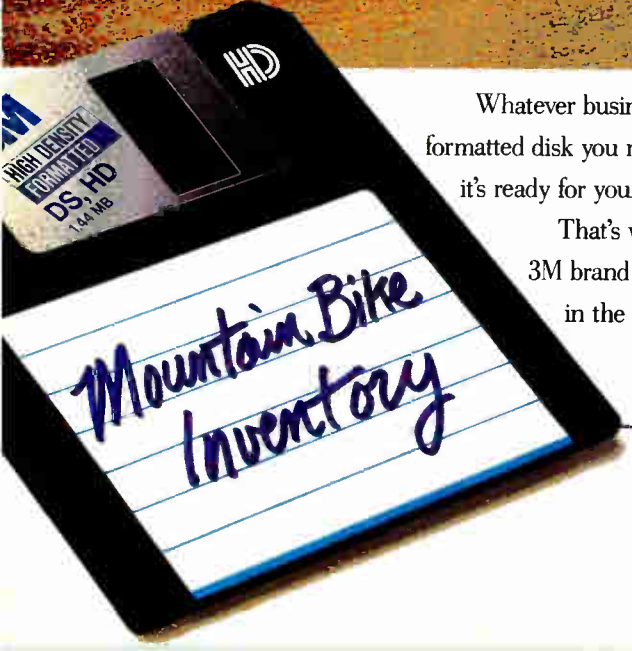

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CHIP MAKERS JOIN THE MULTIMEDIA RUSH

WITH A RICH MARKET BECKONING, VENDORS SCRAMBLE TO ADD VIDEO COMPRESSION AND DECOMPRESSION TO A PC

BY JONAH McLEOD

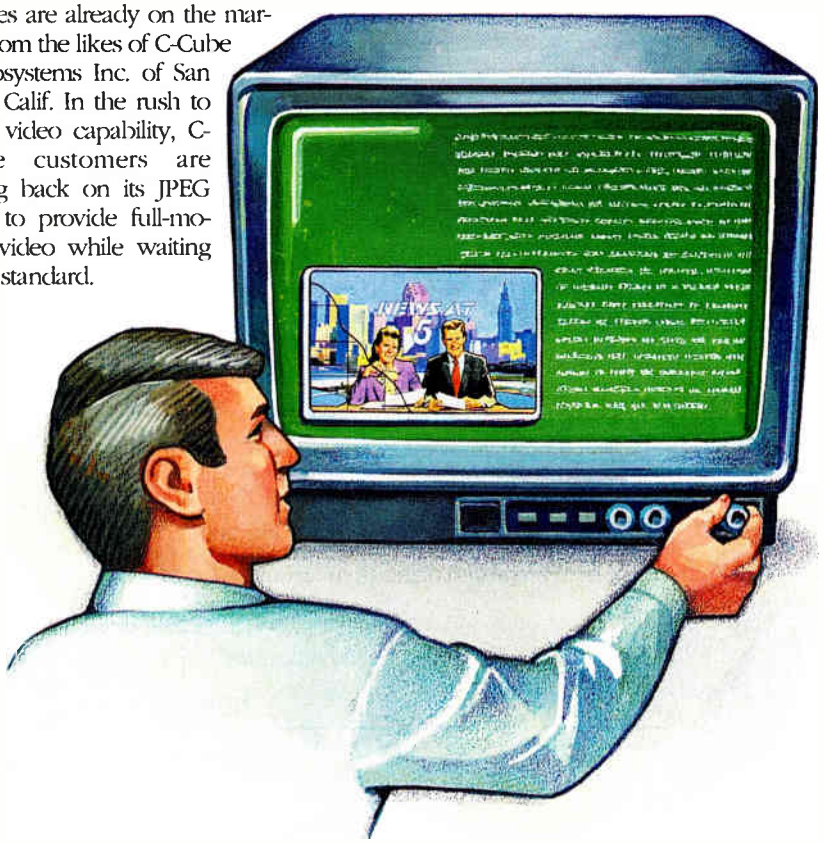
MULTIMEDIA

Anxiety among chip makers is running high as they position themselves to play in the lucrative multimedia chip market. They are racing to offer the first cost-effective chip solution that adds video compression and decompression capability to a personal computer. And there's good reason for some anxiety: the cost of being late is at best a slugfest among Johnny-come-latelies for the leftovers and at worst market exclusion.

With the advent of the International Standards Organization's Joint Photographic Experts Group standard, chips that compress high-resolution still images are already on the market from the likes of C-Cube Microsystems Inc. of San Jose, Calif. In the rush to offer video capability, C-Cube customers are falling back on its JPEG chip to provide full-motion video while waiting for a standard.

C-Cube's offering is part of a crazy quilt of solutions. Others range from the proprietary Digital Video Interactive from Intel Corp. of Santa Clara, Calif., to chips from UVC Corp. in Irvine, Calif., that compress video frame by frame, and from Chips & Technologies Inc. in San Jose that digitize video without compression.

Meanwhile, the ISO's Motion Picture Experts Group, or MPEG, is developing a standard to define compression algorithms for full-motion video. Concurrently the CCITT (International Telephone and Telegraph Consultative Committee) has a standard, Px64, for video compression and decompression for videophones.

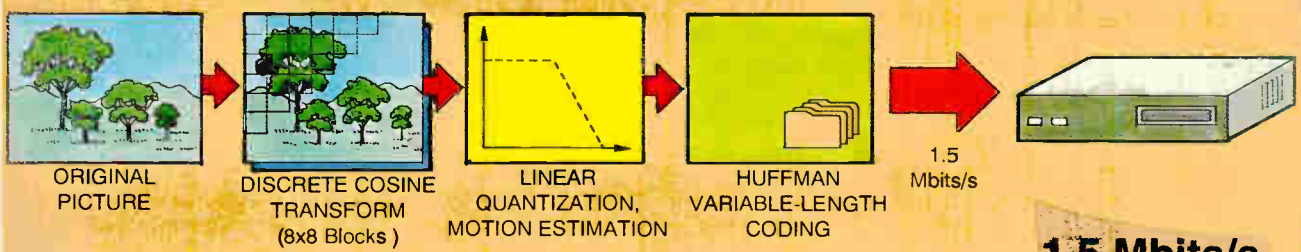


Since no standard exists for compressing and decompressing video for computer-based systems and one is not likely soon, companies such as LSI Logic Corp., SGS-Thomson Microelectronics, and others are creating silicon that executes well-defined compression and decompression algorithms. Others, such as AT&T Microelectronics and Motorola Inc., are waiting to make their final product plans public. Both have extensive research efforts under way.

To understand what's at stake requires a look at the market for multimedia systems. It should hit $10.8 billion in 1993, says William B. Welty, a principal of the investment firm of Volpe, Welty & Co. in San Francisco, from just $217 million in 1990. "Today's systems are managing video and do no compression," says Nick Arnett, president of the market research firm Multimedia Computing Corp. in Santa Clara, Calif. "They control a video-disk player, provide a window on a VGA screen for displaying video, and so on. By 1993, 20% to 25% of all systems will integrate video onboard. These systems will process digitized and compressed video as easily as [they do] ASCII data."

Full-motion video compression and decompression represents a technical hurdle: the task entails a vast amount of processing. In digitizing video, a camera captures an image, which an analog-to-digital converter digitizes and applies to a discrete-cosine-transform function. A DCT function is really a data explosion, says Tom Lavallee, marketing manager for imaging products at SGS-Thomson Microelectronics in Phoenix, Ariz. It divides an image's pixels into 8-by-8 arrays and then performs matrix arithmetic on each in turn. It calculates the

THE CODING AND DECODING LOOP



coefficient value of every pixel value within each array. "The coefficients represent the detail within the image, brightness, contrast, color," he says.

The DCT moves the data to a linear quantization function, which examines the coefficients and eliminates all the redundancies. This step performs part of the actual compression. Next, a Huffman variable-length-coding function eliminates long stretches of 1s and 0s in the bit stream to further compress the image.

Besides compressing the image within a frame, a motion-compensation algorithm performs compression between frames. "In this process, each frame is compared with the previous one, and only the information that has changed is actually collected and stored, or transmitted over a communications link," Lavallee says. Motion compensation is another matrix arithmetic operation. "It compares each 8-by-8 array in the current frame with the surrounding 8-by-8 arrays in the previous frames. By finding a match, the algorithm determines the amount and direction of movement of the image in the current frame."

The resulting compression produces about a 200-times reduction in data, says Peng H. Ang, business and technology director for LSI Logic's DSP Division in Milpitas, Calif. The compressed video is sent over phone lines or banked in computer storage for processing and playback.

"One lucky coincidence for multimedia is that the data-transfer rate of compact-disk read-only memory—1.2 Mbits/s—is about the same as the primary rate for T1 lines—1.544 Mbits/s," says Arnold Englander, marketing manager for multimedia at AT&T Microelectronics, Berkeley Heights, N.J. T1 is the primary means of video conferencing.

One video-compression scheme that has emerged from computer systems is Intel's DVI, which stores up to an hour of full-motion video on a CD-ROM disk. Because it compresses video for storage, not for real-time transmittal, DVI is considered an asymmetrical compression scheme. A mainframe computer compresses the video; an integrated circuit, Intel's i750, decompresses it from the CD-ROM for display on a screen.

"Asymmetrical systems require expensive compression and low-cost decompression," Englander observes. "Real-time interactive video as specified by the Px64 standard and MPEG initiative demands a symmetrical solution—the same hardware performs both compression and decompression in real time."

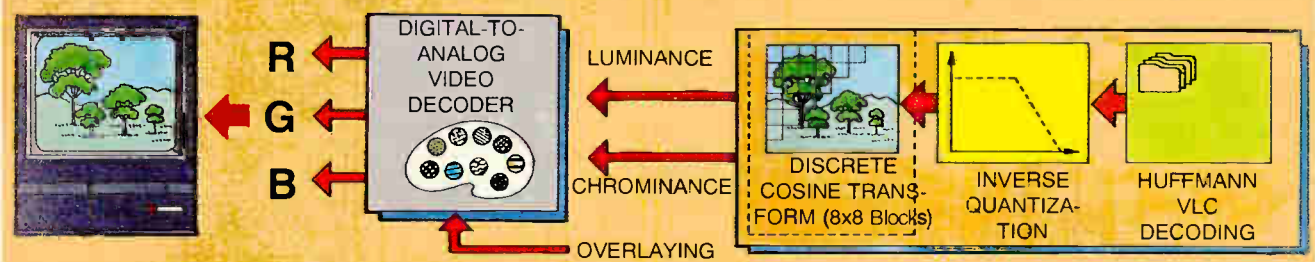
Intel has announced that the i750 will support MPEG when it becomes a standard, says Chuck Korstat, product manager for the chip. "In addition, we rolled out a version of DVI that allows low-resolution video compression on the i750. Developers can create video for their applications on a PC and then publish it on CD-ROM at higher resolution using a more powerful computer system," he says.

1.5 Mbits/s

Intel also says the i750—which is really two chips, the 82750DB display processor and the 82750PB pixel processor—is JPEG-compatible. JPEG's original intent was to compress high-resolution still images, such as full-color photographs, for applications like desktop publishing. Thus, it requires no motion-compensation function.

"A typical 8.5-by-11-in color image digitized at 300 dots/in. takes up 28 Mbytes," says Mauro Bonomi, manager of product marketing at C-Cube. "Even a smaller image can take up to 3 to 4 Mbytes. Compressing an image means far less data is stored on a disk and far less data must be moved within the system as the image is being manipulated." C-Cube has been working with Quark, Aldus, Adobe, and other desktop publishing outfits "to define our image-compression protocol as a common method for calling a compression coprocessor within a system," he says.

A number of suppliers are building one- or two-board solutions that sell in the $2,000 price range, says Steve Chan, vice president of media at Chips & Technologies. The boards digitize video without compression and merge it with graphics and ASCII characters. However, while these boards have their market window, video technology is moving fast. Already, these same board manufacturers are bringing out versions built around the C-Cube chip. Eventually, these first-generation products will be



In the coding phase, a DCT function divides an image's pixels into subunits, performs matrix arithmetic on each, then further analyzes and compresses them for storage or transmission. The process is reversed in decoding.

displaced by new ones that conform to the MPEG and Px64 standards.

C-Cube's chip is actually providing full-motion video compression and decompression on PCs and workstations, although without motion compensation. "Because the chip can perform 10 billion operations/s, we can compress video at a rate of 30 frames/s," Bonomi says. "Videologic, New Media Graphics, and Next Computer have announced video add-in boards for their systems" based on the C-Cube device, he says. Besides saving disk space, another reason for the chip's popularity is its relatively low price: under $1,000.

The success of the C-Cube chip has attracted the attention of other vendors. For example, SGS-Thomson Microelectronics has announced a JPEG chip that will require only a static random-access memory and a microprocessor to become a complete system. It is due out this year. The company has also unveiled a motion-compensation chip, the STi3220 (see below).

Meanwhile, UVC has its own low-cost solution, the Multimedia 1 video and audio processing board. One obvious advantage of the UVC solution is that it does both video and audio compression and decompression on a single board using one chip, the UVC7710. The board will retail for less than $1,000 and will be available in the second quarter. The Multimedia 1 uses a patented algorithm that compresses each line of a frame individually. "It achieves a minimum of 20- and a maximum of 200-times compression without requiring the same compute power as conventional video-compression algorithms," says John Puttre, UVC's Eastern region sales manager. "Using our board, any 286-based PC on up can compress full-motion video and transmit it over any communications link to another PC."

LSI Logic, for its part, offers "a building-block solution to the problem," says Ang. The encoding solution is six chips: an interframe and intraframe processor, two DCT devices, a quantization processor, and a motion-estimation processor. The simpler decompression solution for playback includes a DCT processor, variable-length decoder, and inverse quantizer, along with one interframe and intraframe decision processor that determines how to decompress a received frame. Ang says the chips are being designed into systems, and there should be end products later this year.

Conspicuous by their absence so far are AT&T Microelectronics and Motorola. "Inside of Bell Labs, AT&T has the chips to do full-motion video compression and decompression," says Englander. He notes that all the chip alternatives currently on the market lack a solution for audio. "Our DSP 3210 chip does all the functions—including speech—except video compression and decompression," he says. "In addition, it can be programmed to perform the JPEG standard for image compression and decompression. Full-motion video and full-motion telephony require a separate chip set." Whatever solution AT&T rolls out, it's a good bet it will handle not only MPEG but Px64 as well.

The other dark horse is Motorola. Bryant Wilder, the company's DSP operations manager in Phoenix, agrees that audio is the missing link in all the current solutions. "The chip most commonly found providing sound compression and decompression on computer systems, like the Next Computer, is the Motorola 56000 DSP," he says.

But, as with AT&T, Motorola is eyeing the lucrative motion-video market. Its current solution is its high-performance 96000 DSP. "This chip is being used on a board made by Ariel Corp. in Highland Park, N.J., by the MPEG to define the MPEG standard," he says.

What all of these offerings point to is the complete lack of consensus on a chip-level solution to compression and decompression. However, the mad rush to field products illustrates a market impatient to take off. E

MOTION ESTIMATION AT 14 GOPS

Digital video signals need a large bandwidth for transmission and a huge amount of memory for storage. For example, the bit stream for a digitized 625-line PAL TV signal is 216 Mbits/s (or 166 Mbits/s if only significant bits are considered). Such image data can be processed efficiently only by means of image compression. And all compression algorithms use some form of motion estimation, a technique that trims the amount of data by exploiting the fact that successive images are often similar, consisting of the same elements in slightly different positions.

Motion estimation takes such enormous computing power that a dedicated VLSI processor has long been needed to take it on—no digital signal processor has the clout to handle data at video speeds. Now SGS-Thomson Microelectronics is offering such a device.

The Italian-French semiconductor vendor's STi3220 achieves data-compression ratios of 200:1 by integrating 256 dedicated processors in a single VLSI circuit with a combined throughput of 14 billion operations/s. "At that rate, motion-estimation algorithms can be performed at video speeds," says Philippe Thomas, marketing manager at the Image Processing Business Unit in Grenoble, France.

The device takes aim at an exciting market. Spurred by the need to transmit or store ever greater amounts of video data, the market for video chips will swell from $15 million in 1990 to some $450 million worldwide in 1993, SGS-Thomson predicts. The STi3220, priced at $60 in 10,000-unit lots, should sell "in the hundreds of thousands [of units] in 1993," the year when a mass market should have developed, says Thomas.

To implement motion estimation, the STi3220's 256 processing elements compute distortions and motion vectors at video speed. The single-chip CMOS device handles pixel blocks with up to 16 by 16 pixels in a search window with a maximum displacement of +7/-8 pixels, giving a possible 256 vectors for a given block. In essence, the device performs 256 block comparisons, computing the distortion for each comparison.

It then identifies the smallest of these distortions and calculates the motion vector for the corresponding block. In the simplest schemes, only one motion vector and corresponding distortion are read out, although all distortions are accessible for implementing more complex algorithms such as half-pixel motion estimation.

The STi3220 contains a 256K-by-16-bit RAM where distortions are temporarily stored, a comparator that finds the minimum among those distortions, a bidirectional bus, and data formatters for rearranging the input data before presenting it to the processor. Now available as engineering samples, the device will be out in volume quantities in the third quarter.—*John Gosch*

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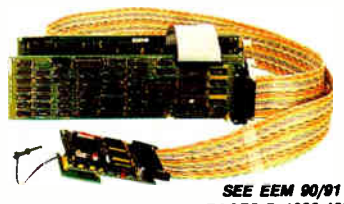

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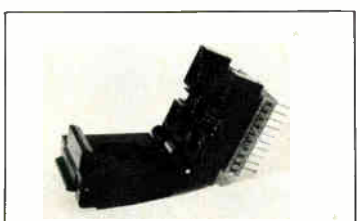

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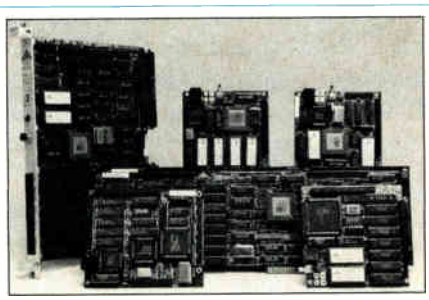

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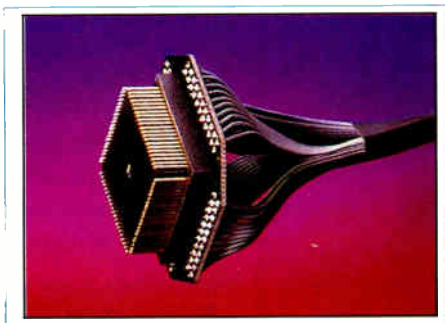

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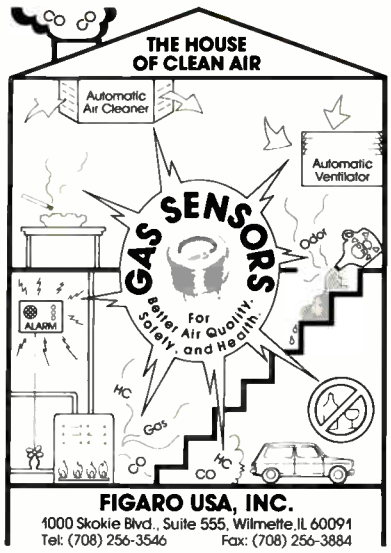

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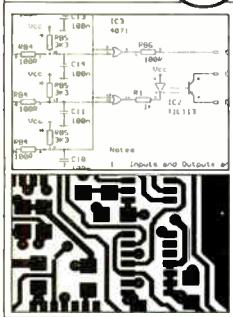

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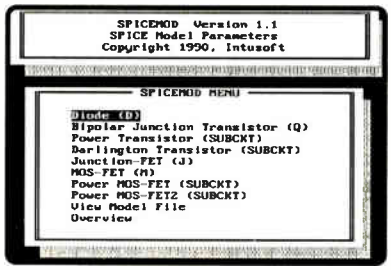

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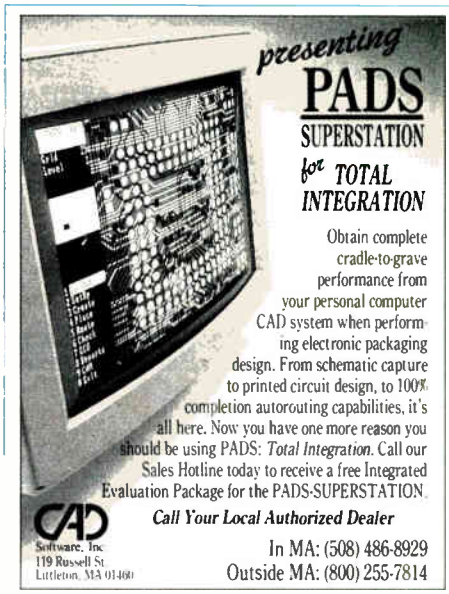

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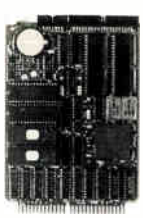

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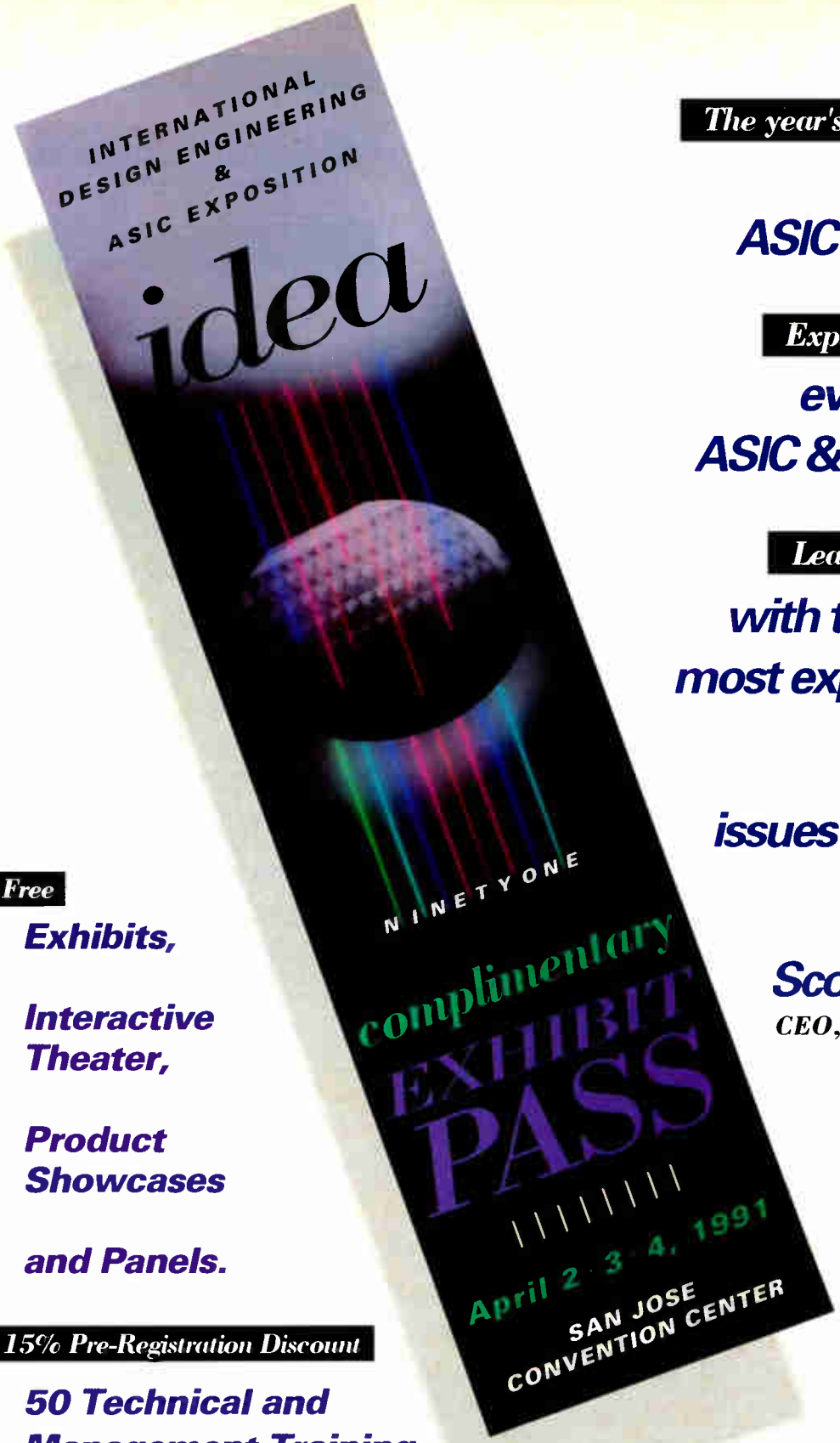

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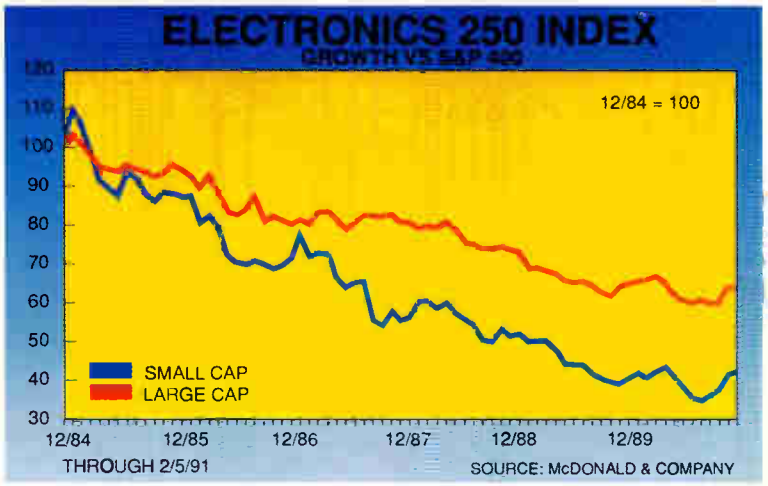
CIRCLE 200

LET'S HEAR IT FOR THOSE CLEVER STRATEGIC PLANS



With widely divergent views on the length and depth of the recession, electronics manufacturers must watch customer needs.

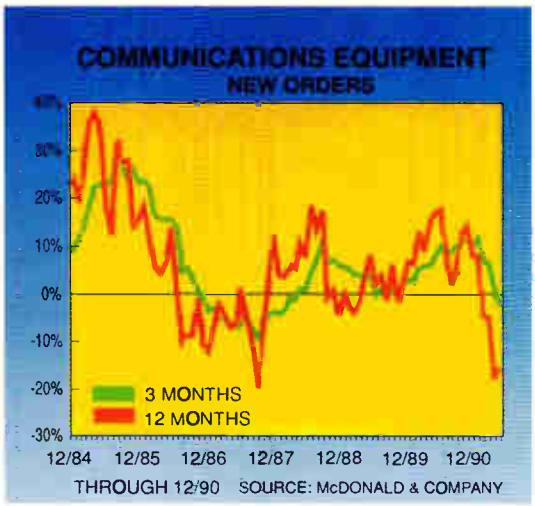
Electronics companies deserve a pat on the back for their response to the recession thus far. In fact, we could probably extend our applause to the entire manufacturing sector. The typical historical pattern of inventory accumulation in the early stages of a recession is nowhere to be found. Instead, inventory reductions have actually accelerated well in advance of deteriorating order patterns.

No one really knows when the recession will end. The Commerce Department predicts a rebound as early as this summer. Industry leaders and mainstream America appear more conservative, while the stock market has become wildly bullish in recent weeks. This strong divergence in opinion is not unusual, but it highlights the need for maximum diligence in tracking and anticipating customer needs.

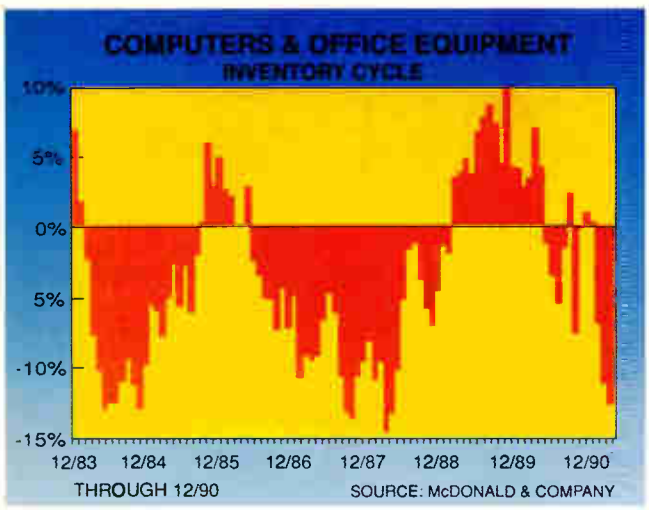
Communications equipment orders have fallen off a cliff the past three months, and weakness in computer orders accelerated markedly in December. Component orders have been gradually weakening, as growth in automotive and aerospace, and the continuing gradual penetration of electronics into capital goods, is helping offset some of the weakness coming from primary end-use markets.

New mainframes and a stronger than usual auto electronics model year are welcome signs on the horizon, as is the increasing talk of restoring the investment tax credit. There are also some disturbing signs of economic weakness in Europe. If the U.S. economy does not recover soon, companies may be doubly glad for tight inventory positions. Many companies reported some order strength in January, but we sense more replenishment of depleted inventories and completion of delayed year-end projects than any real increase in demand. E

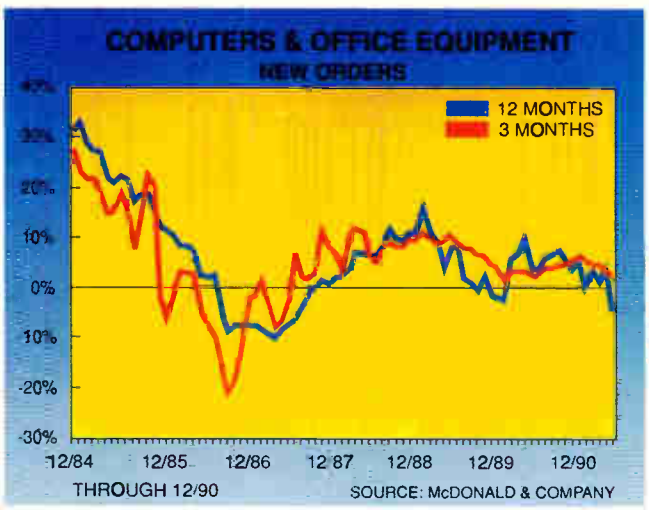
By Mark Parr, McDonald Securities Inc., Cleveland (216-443-2379)



Orders for communications equipment have dropped precipitously the past three months.



Low inventories have preceded recession-induced order reductions, unlike the case in previous recessions.



December saw the decline in orders for computer equipment accelerate considerably.

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AUTO RENTAL

4 - **Hertz**—Never stop at our counter again when you're a member of Hertz #1 Club Gold.

CAE/CAD

102-105 - **Aldec**—Silicon breadboards, OrCAD, Mentor, and VHDL library upgrades.

COMMUNICATIONS

177 - **Fujitsu**—The secret to better Ethernet is NICE, the MB86960 Network Interface Controller with Encoder/Decoder.

CONNECTORS

171 - **AMP**—The AMPMODU System 50 connector is a comprehensive system.
183 - **Elco**—Greater world-class power from our new global connections.
198 - **Fujitsu**—Two new connectors in the half-pitch lineup.

COMPONENTS

178 - **Hirol**—Die-cut components for computers and two-way communication devices.
206 - **Pico**—High-voltage dc-dc converters with 1,000 VDC output.
206 - **Pico**—Plug-in surface-mount axial inductors, toroidal insulated leads.

COMPUTER BOARDS

211 - **Ampro**—Introducing the Erector Set for embedded control applications.
215 - **CEC Capital Equipment**—Control any IEEE-488 device with CEC cards, cables, software for the PC/AT/386, EISA, MicroChannel, and NuBus.
220-227 - **National Instruments**—The software is the instrument.

CONTRACT ASSEMBLY

172 - **Eastern**—Contract PCB assembly is like marriage: you have to pick the right partner.

LOCATIONS

179 - **Utah**—Labor, low costs, lifestyle.

MICROWAVE COMPONENTS

212 - **Murata**—Ready with support for new design requirements.

MANUFACTURING

201 - **Oki**—Better design and production solutions from a global partner with Oki Systems Thinking.

MAGNETIC MEMORY

2 - **3M**—Just about any size, capacity, or factory-formatted disk you need.

MANUFACTURING SYSTEMS

176 - **Chicago Laser Systems**—Now laser trimming is as easy as opening a window.

MANUFACTURING TOOLS

202 - **Brian R. White**—Contact-free soldering and desoldering with the Leister-Labor S hot-air tool.

MEMORY ICs

185 - **Intel**—If you're tired of pouring on SRAM to get 128-Kbyte cache performance, meet the 386 Smart Cache.
228 - **Paradigm**—Paradigm's MIL-STD-883C 1-Mbit SRAMs in LCC packages come through with flying colors.
214 - **Samsung**—A million transistors on a microprocessor is impressive, until you contemplate a SRAM with six times as many.

MICROCOMPUTERS

218 - **NEC**—Five times faster throughput from K-Series microcomputers.

MICROCONTROLLERS

196 - **NEC**—Speed products to market with SIMPLEHOST debugger for 17K Series 4-bit microcontrollers.

MICROWAVE

189 - **Avantek**—How to get a high-frequency product to market before the competition has a chance to develop.

PACKAGING

173 - **Conap**—Use the Conap cure for your encapsulating and potting headaches.

POWER SUPPLIES

219 - **Abbott**—Mil/Pac high-density military power supplies now available in both ac and dc models.
175 - **Vicor**—High-performance power at low cost with the EconoMod family of component-level power converters.

RELAYS

187 - **Teledyne**—A DPDT relay designed for very dense packaging in cost-conscious commercial applications.

SEMICONDUCTORS

186 - **LSI Logic**—Sun uses LSI Logic's RISC and ASIC technology and design methodology to pack more processing power into smaller footprints.

SHOWS

260 - **Far East Electronics Tour**—Visit four major trade shows in Japan, Taiwan, Hong Kong, and Korea, Oct. 3-19.
200 - **IDEA**—International Design Engineering & ASIC Exposition, San Jose, Calif., April 2-4.

SOFTWARE

258 - **T-Cubed Systems**—Reliability-prediction software.

TEST & MEASUREMENT

190 - **Anritsu**—The highest levels of measuring accuracy for all types of communications.
182 - **GenRad**—For edge-placement accuracy in board testing, at 2.5 ns the GR2750 series leads its class.
229 - **Hewlett-Packard**—Dedicated to responsive customer support throughout the world.
180/181 - **Photo Research**—The new SpectraScan SpectraRadiometer brings near real-time testing to the production line.
195 - **Rhode & Schwarz**—The signal generator for digital communications.
174 - **Stanford**—High-performance LCR meters with 0.05% accuracy, 100-KHz frequency.

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16	36	56	76	96	116	136	156	176	196	216	236	256	276	296	316	801	821
17	37	57	77	97	117	137	157	177	197	217	237	257	277	297	317	802	822
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