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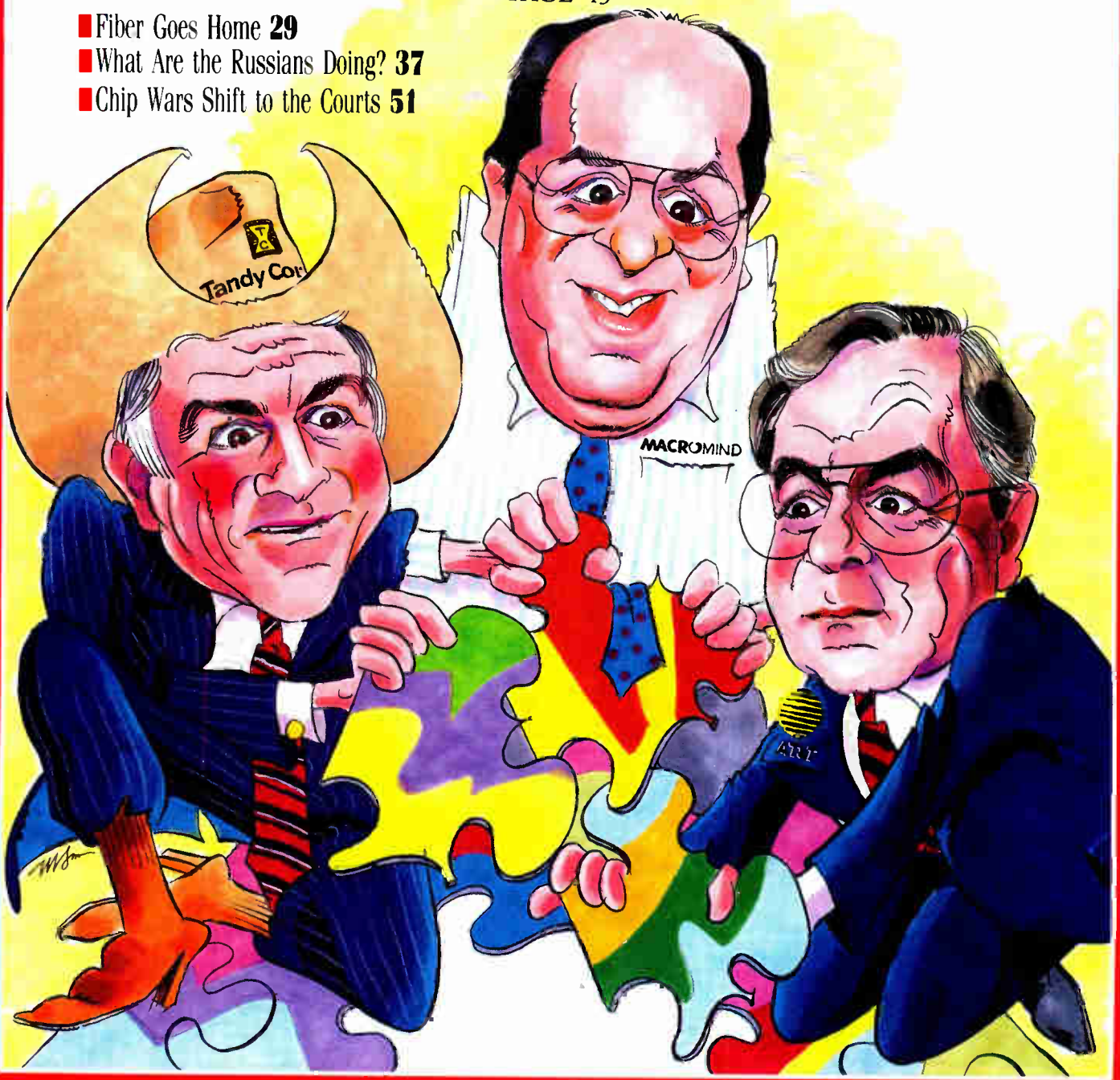
FEBRUARY 1991

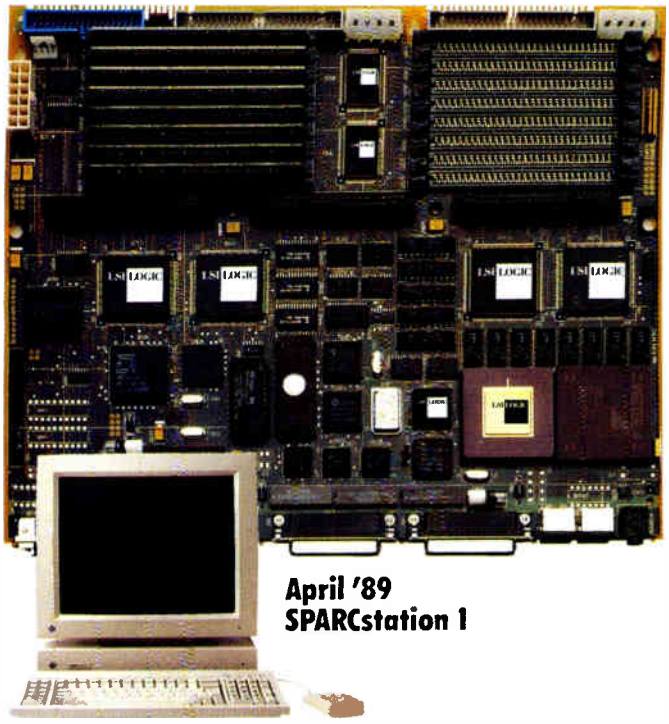
Electronics

FIRST MAGAZINE OF GLOBAL ELECTRONICS MANAGEMENT

MULTIMEDIA: PUTTING THE PIECES TOGETHER

PAGE 43





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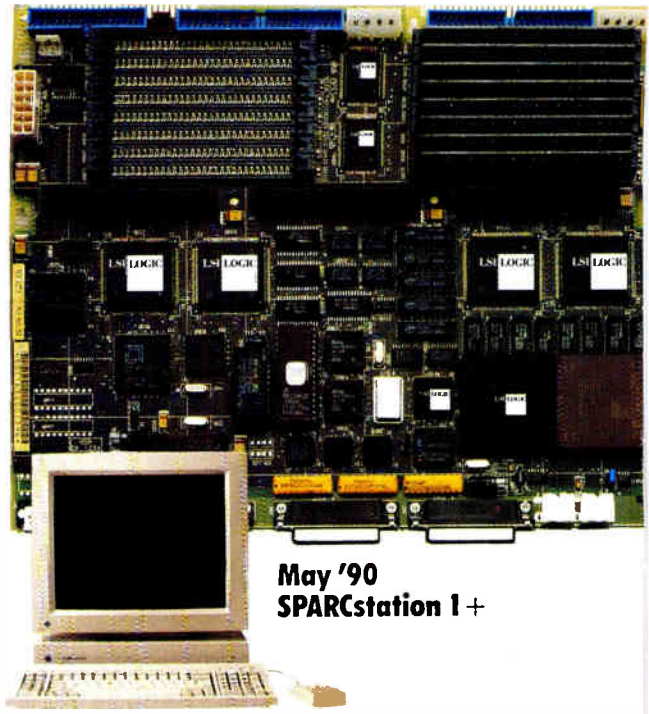

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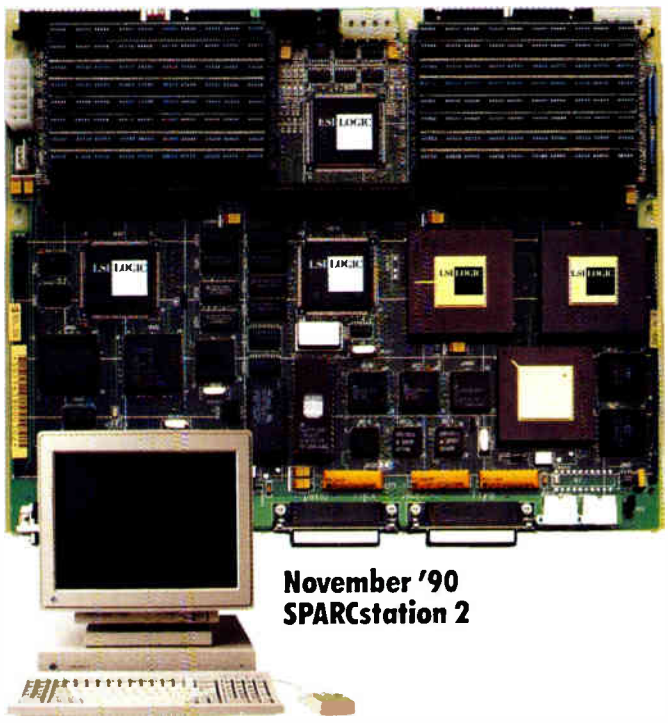

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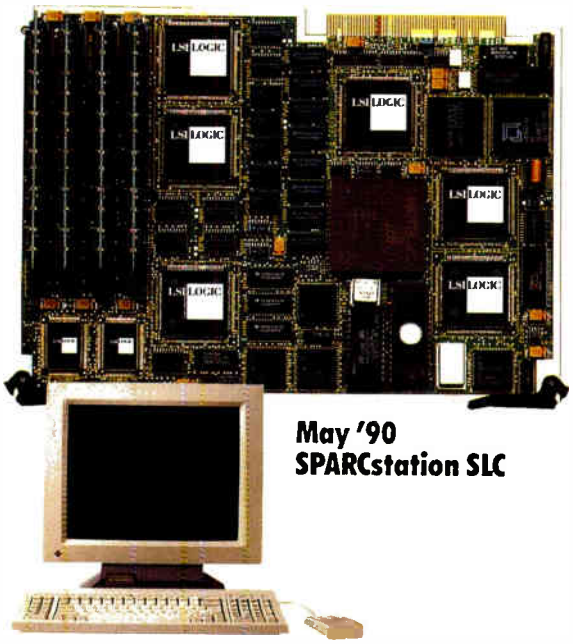

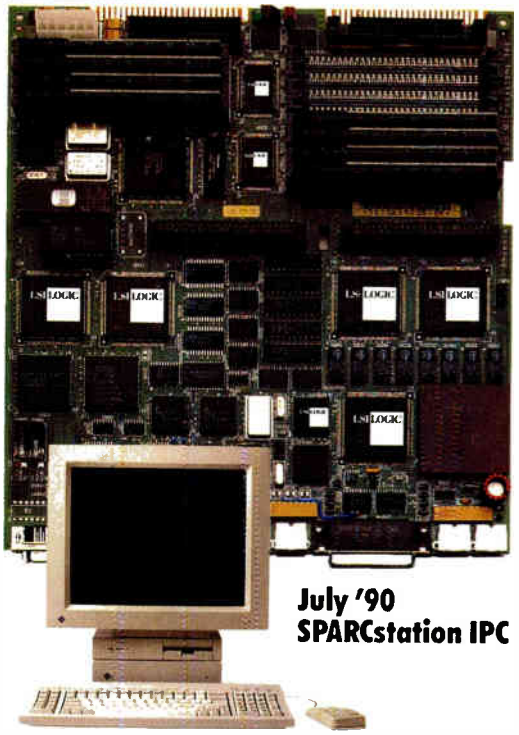

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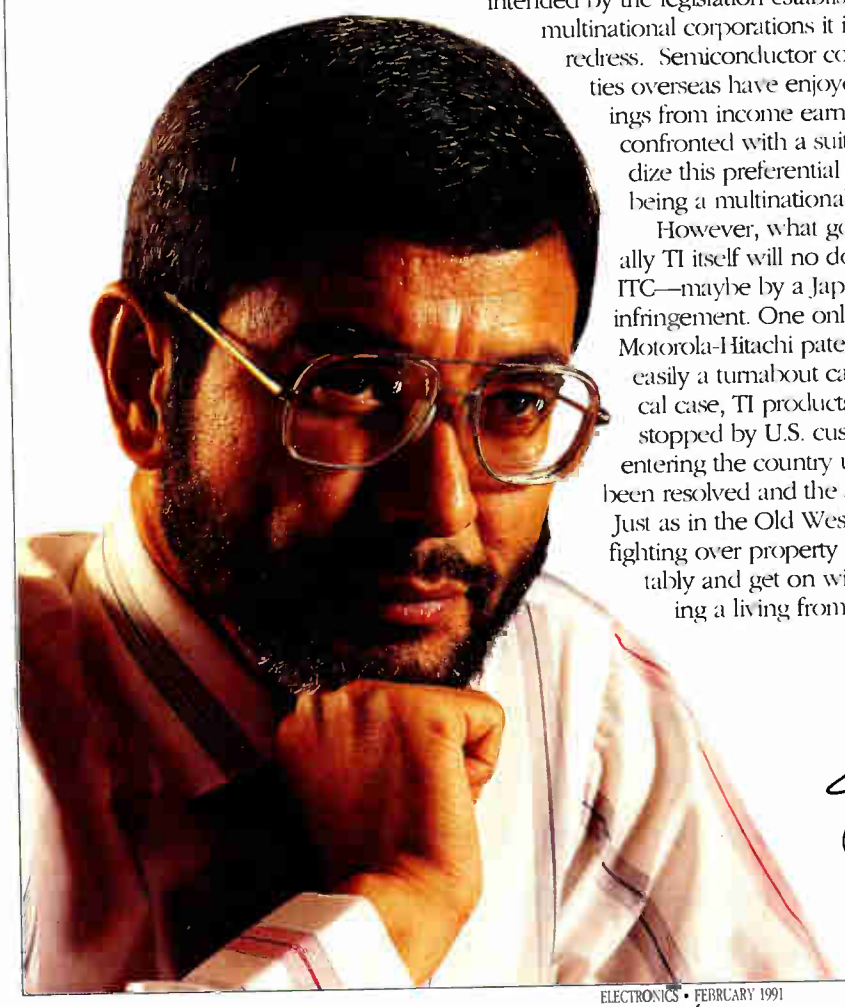
LET'S STOP THIS FAMILY FEUD

In the West of the 1800s, settlers fought deadly, fierce battles over property rights. Today the same fighting goes on, only this time the quarrel is over intangible intellectual property (see p. 16 and 51). One of the more heated brouhahas involves—ironically enough—lone Texas Instruments Inc. against several other chip makers. Who are the good guys and who are the bad guys in this feud? On the one hand, the Dallas-based giant claims other companies are infringing on its patents on packaging, and it wants to be compensated. To persuade offending companies to settle, TI has taken its case to the International Trade Commission. It is asking the ITC to prohibit products made by the offending companies in overseas manufacturing facilities from entering the U.S. On the other hand, the companies being sued are claiming TI should not be taking the extreme measure of involving the ITC in the dispute, which is also the subject of individual lawsuits. The ITC was created to act quickly to prevent dumping of products on the U.S. market by unscrupulous overseas manufacturers. The defendants claim TI is circumventing the due process of civil court in an attempt to force a quick settlement. They use fighting words—such as "extortion," "robbery," and "mugging"—to characterize TI's tactic.

Michael Borrus, codirector of the Berkeley Roundtable on the International Economy (BRIE), observes that he who lives by intellectual property rights must surely abide by them. He says the precedents for involving the ITC in cases of intellectual property disputes among U.S. companies have been established. For example, Apple Computer Inc. prevented U.S.-based Apple II clone makers from bringing their products into the U.S. from overseas manufacturing facilities through an ITC action.

Borrus says TI's use of its intellectual property as a revenue source is prudent business practice, given the competitive nature of the electronics industry and the high cost of capital: the company is using royalties from intellectual property to fund R&D. The way TI is using the ITC may not have been intended by the legislation establishing that body, but in an age of multinational corporations it is a perfectly legal avenue of redress. Semiconductor companies with manufacturing facilities overseas have enjoyed favorable tariff barriers, tax savings from income earned abroad, and other perks. Being confronted with a suit before the ITC that could jeopardize this preferential position is part of the price of being a multinational firm doing business in the U.S.



However, what goes around comes around. Eventually TI itself will no doubt be hauled up in front of the ITC—maybe by a Japanese multinational—for patent infringement. One only has to look at the outcome in the Motorola-Hitachi patent-infringement fight to see how easily a turnabout can happen. Losing such a hypothetical case, TI products made in Japan or Italy would be stopped by U.S. customs agents and prevented from entering the country until intellectual property rights have been resolved and the score settled.

Just as in the Old West, neighbors can kill one another fighting over property rights, or settle their disputes equitably and get on with the more important job of making a living from the land—in this case silicon. E

Jonah McLeod

JONAH McLEOD
EDITOR

CAE Technology Report

February 1991
Vol. 2. No. 9

CAE Tools-Rental

With growing recession, money has become very tight. Leasing or renting CAE tools is suddenly on the rise. One very successful simulation company, ALDEC Inc., is leasing and renting its system level SUSIE ™ logic simulators with payments as little as $75 per month. For example, when equipped with appropriate IC libraries, SUSIE 6.0 is capable of simulating multiple FPGA's, PLD's, etc., at the p.c. board level. Since SUSIE libraries are equivalent to an inventory of IC parts worth tens of thousands of dollars, renting charges for SUSIE simulator seem to many managers as a bargain that's hard to pass. For more information, contact ALDEC, Inc. at 805-499-6868. **CIRCLE 101.**

CAE for the Masses

While the 80's were the years of CAE gurus, the 90's will be years of CAE for the engineering masses. This means that the new CAEs will be easy to use and will require minimum training and technical support. This calls for real-time design environments such as SUSIE™, the system level simulator that exactly emulates hardware breadboarding. You can toggle switches, move jumpers, load JEDEC and hex files, plug in a new IC,, and change layout delays, all within a split second. By emulating hardware breadboarding, SUSIE is so intuitive that learning takes only hours. SUSIE is resold by most CAE vendors like Racal-Redac™, CADAM™, Omation™, etc.

Why Are FPGA Applications Growing So Fast?

Xilinx™ and Actel™ are expected to grow this year by about 50%, despite a recession. Part of their success is attributed to development tools that are easy to use thereby producing complete designs in hours. To assure quick market development, and provide the best tools for the users, both have attracted leading CAE vendors and worked with them very closely to make sure that all parts of the development system work right. This has resulted in reliable and low cost PC-based design development tools.

For more information, call Actel at 1-800-227-1817, ext. 60; Xilinx at 408-879-5199, and Aldec (system level simulation) at 805-499-6868. **CIRCLE 105**

System Level Designs Move To PCs

Many designers are making a common mistake. They size their designs to a particular Xilinx™ or Actel™ part. However, with the newest development tools, there is practically no limit to the system level design using these parts. A design with 20,000 to 40,000 gates can easily be partitioned into several FPGA's and then simulated together as one system under a real-time SUSIE™ logic simulator that runs on PCs. Since SUSIE 6.0 runs under a DOS extender, it can simulate designs in excess of 300,000 gates, moving the practical limits for Actel, Altera™, Plus Logic™ and Xilinx™ implementations into the 200,000 gate area. At last, designers can break large designs into multiple FPGAs and never worry about the system level integration. **CIRCLE 102**

SUSIE 6.0 - Bright, Flexible, *FAST!*

SUSIE 6.0 is a major milestone in system simulation. It's bright because it is fully automated. For example, it checks every pin of every IC during each clock cycle for timing violations and bus conflicts in the entire design. Designer no longer has to be concerned where the problem resides - SUSIE shows it automatically. SUSIE is also very flexible. The designer can change design and test vectors then instantly resimulate past cycles without any compilations,; something no other simulator can do. SUSIE 6.0 is also fast. It's about 3 to 30 times faster than previous versions of SUSIE, and being already considered the fastest simulator on the market. SUSIE 6.0 starts at $1,995 and ships from stock. **CIRCLE 103.**

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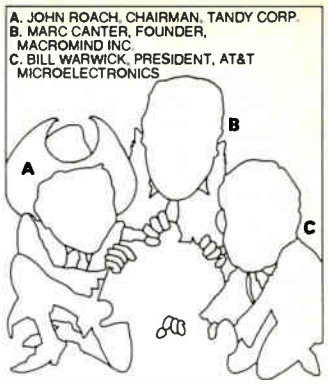
FEBRUARY 1991 VOLUME 64, NO. 2

Electronics

60 YEARS OF GLOBAL LEADERSHIP.



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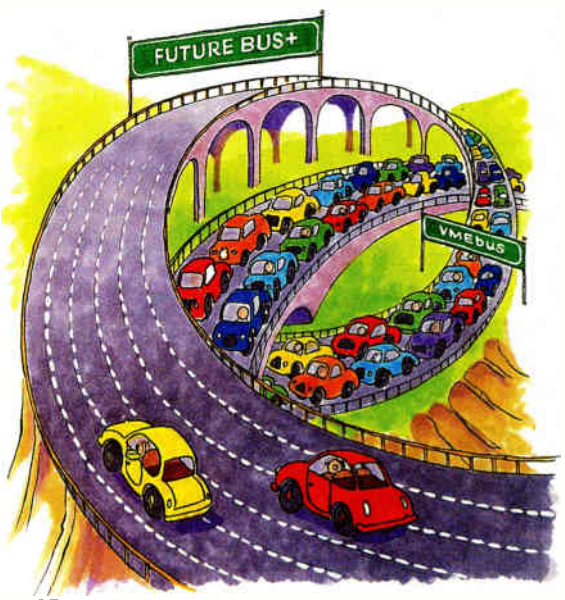

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DEPARTMENTS

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

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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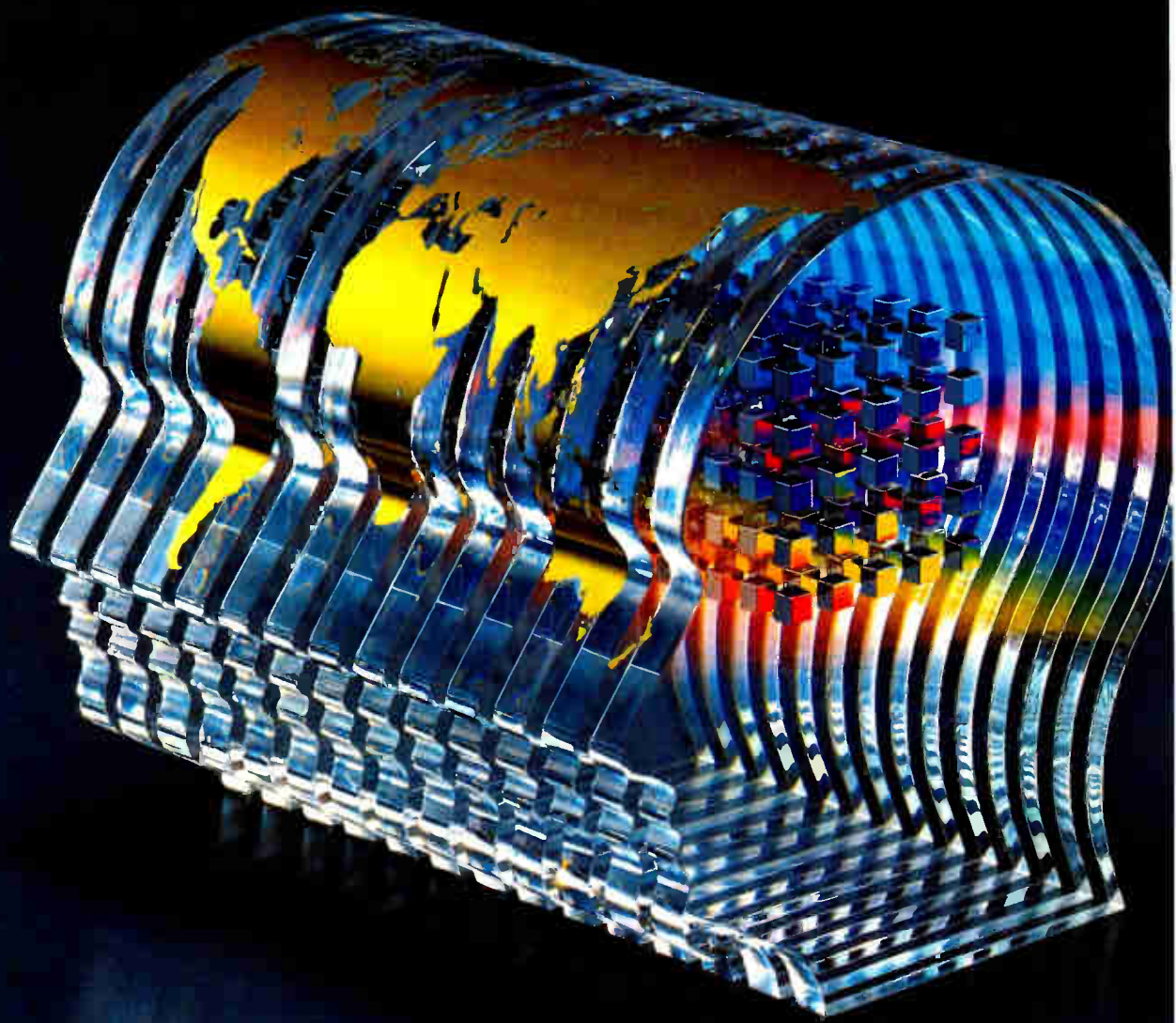

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CIRCLE 201

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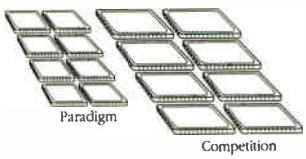

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CIRCLE 228

LETTER FROM

HONG KONG

THE CITY PREPARES FOR ANNEXATION BY CHINA

WHAT WILL 1997 BRING?

BY JACK SHANDLE

Hong Kong knows the secret of eternal life: it keeps reinventing itself. In the past 150 years, the city has metamorphosed from a Chinese fishing village to a jewel in the British crown to a thriving and largely independent manufacturing, financial, and export center. But Hong Kong's next scheduled incarnation is sure to be the greatest test of the city's fabled resiliency.

That is the 1997 annexation of the British crown colony by China. Despite the attending uncertainty, the bustling city of 6 million has an ambitious agenda for the 1990s that is also an insurance policy of sorts. Billions will be spent on infrastructure, including a fivefold expansion of Hong Kong's container port by 2007 and a new airport by 1997 that will handle 80 million passengers a year—far more than Chicago's O'Hare. The new airport, on Lantau Island, will be linked to Hong Kong's business districts by the world's second-longest suspension bridge, after the Golden Gate. Price tag for the package: $17 billion.

Knowing that it will inherit a huge construction bill, China has been doing some deep-throated grumbling about the project's monumental scope. The powers-that-be in Hong Kong view it publicly as a tangible commitment to the future and privately, some say, as insurance. China inherits a world-class port, transportation, and a financial center that it can pay for only by allowing Hong Kong not simply to continue, but to expand as an unfettered, capitalist free port. Now that's resourcefulness.

Hong Kong's leaders must also negotiate a tricky transition from a labor-intensive to a knowledge-based economy. Unemployment is virtually zero, but wages are high for Asia. Success can no longer ride on cheap domestic labor. Another problem is emigration. Despite a British-Chinese agreement defining a special status for Hong Kong through 2047, professionals–including engineers–are leaving. The government estimated the departure rate at 62,000 in 1990.

Hong Kong's entrepreneurs have already solved the cheap-labor problem by setting up factories in the Pearl River delta region of China's nearby Guangdong province, where they employ and manage upwards of 4 million workers.

Training and hanging onto the top layer of talent will be far more tricky. Hong Kong has one of the best-educated work forces on the Pacific Rim. But it has scrupulously followed the tenets of laissez-faire economics: low taxes, minimal government interference, and no special help for infant or struggling industries. Meanwhile, its Asian competitors operate with industrial policies like Japan's, and many in the electronics industry think Hong Kong should loosen up. So when Motorola Semiconductors Hong Kong Ltd. opened its Silicon Harbour Center last December, C.D. Tam, general manager of Asian operations, pointedly observed that if the government could "spend so much money on an airport, it can afford to put better equipment into universities." Hong Kong's universities are not turning out engineers of the quality Motorola desires, he said.

Nevertheless, chip makers such as Motorola, Texas Instruments, and National Semiconductor like the multiplying effect that can result from setting up design centers in Hong Kong, where entrepreneurial companies abound. "In order to have our technology used here, it is essential to have the key engineers know how to use it," says John Stich, managing director of TI Hong Kong Ltd. TI is up to its elbows in programs that support university engineering curriculums.

Unquestionably, cracks are appearing in the government's laissez-faire philosophy. It offers good deals on leasing land in industrial parks, and will open the University of Science and Technology in October. And the government's Vocational Training Council opened a training center last year for the manufacture of application-specific ICs. "This is the first time that the government has helped the electronics industry," says P.F. Tsui, the center's manager. "It is a signal the government recognizes that high tech cannot be run by laissez-faire."

Despite these hurdles, electronics is a growing segment of Hong Kong's economy. It accounted for 25% of total exports in 1989, ranking second behind clothing at 32%. Electronics output has been growing much faster than that of clothing, however, and it could take over first place early in this decade, says C.C. Tse, a senior electronics engineer and analyst with the government's Industry Department.

Why the cost of harnessing lofty technology is much less predatory these days.

Ancient falconers were the first to see the potential of harnessing high-flying technology. By the 1970's, microwave wizards had performed technical feats far beyond what ancient man could imagine. Yet, the most sweeping breakthroughs are emerging now, at Avantek.

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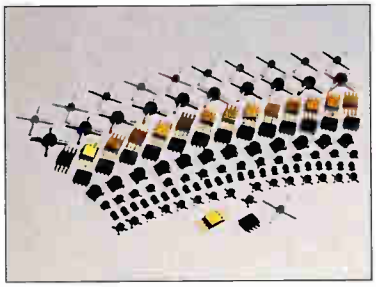
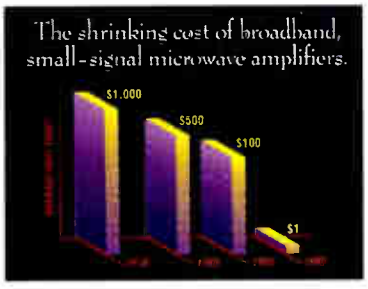


Avantek's broadband microwave amplifiers sell for as little as $1.00 each.



Avantek produces thousands of off-the-shelf products for the cellular telephone, sat com, fiber optics, data com, navigation, and telecom markets. We continue to break price/performance barriers with innovative products—silicon & GaAs semiconductors, LNAs, high power amplifiers, upconverters, downconverters, laser drivers and multiplexer/demultiplexers—for many high volume applications.

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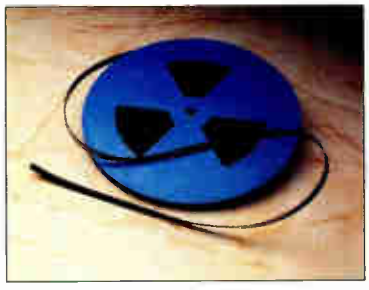
Making microwave history is part of Avantek's 25-year tradition. Today, we have an unsurpassed capability for RF and microwave products. As the world's leading manufacturer of commercial power amplifiers, GaAs & silicon transistors and MMICs for the cellular telephone, VSAT and DBS markets, we know how to meet demanding standards of cost, delivery and quality. Tomorrow this capability will enable us to meet the needs of new markets such as GPS and high frequency automotive electronics.



Avantek supplies microwave components in 7" and 13" tape and reel packaging for high-volume pick and place manufacturing.

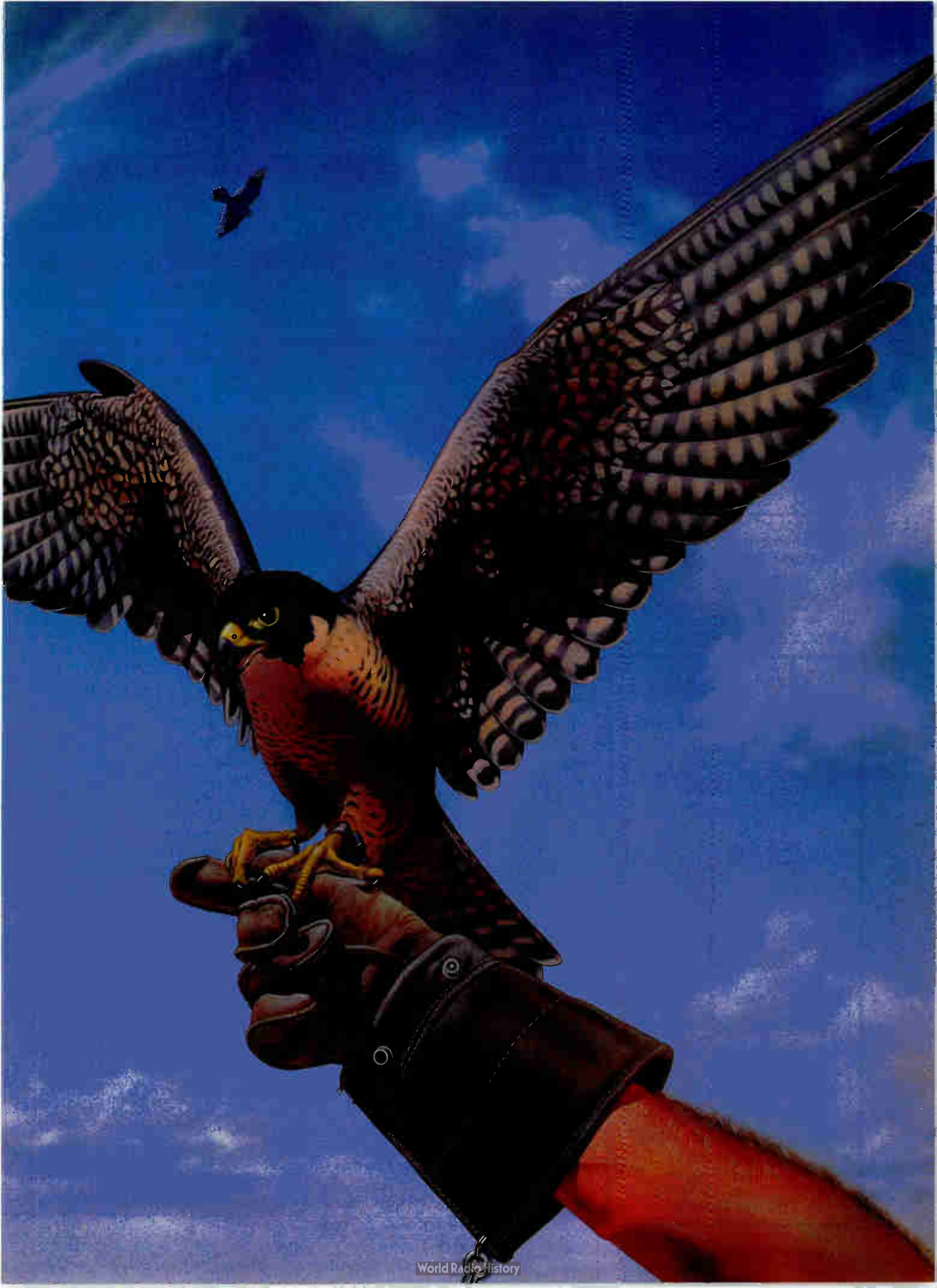
For more information about how Avantek's new technologies can help your business thrive in the most predatory marketplace, call:

1-800-AVANTEK.

AVANTEK

Putting microwave technology to work for you.

CIRCLE 205

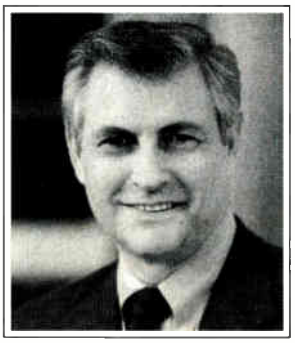


OFF

INTELLECTUAL PROPERTY:

For some, the term "intellectual property" has become synonymous with the litigation in today's electronics industry (see p. 51). A closer look at intellectual property, though, shows it to be a critical issue for the whole of U.S. industry, one that transcends the headlines caused by lawsuits and the perceptions of large company vs. small company. In fact, intellectual-property protection is imperative to the survival of both large and small companies, as well as to the development of next-generation technologies for the semiconductor industry and its customers.

Intellectual-property protection stands as a sentry at the door of technology advancement. Without it, no company would be confident that it could protect its inventions from infringers. With it, companies have the opportunity to achieve fair and adequate returns on expensive investments by either keeping competitors out of the marketplace or by receiving royalties from those who use their patented technology. The key is that returns from both of these approaches generate the dollars that must be reinvested for the R&D of tomorrow. For instance, TI has invested more than $2 billion in R&D over the last five years, resulting in major new products, processes, and more than 2,000 patents.



PAT WEBER

The pharmaceutical, chemical, and consumer industries have long understood this philosophy. For instance, the pharmaceutical industry has an average return on equity of more than 30%, compared with the semiconductor industry's 11%, in part because it takes seriously the protection of intellectual property. These industries understand that intellectual property is an asset, and that patented technology results only from monetary investment that fosters an environment of human ingenuity.

The foundation was set in the 1980s for the same kind of patent protection in the semiconductor industry, thanks to a confluence of stronger patent courts and the aggressive efforts of a handful of companies. Previously, licensing throughout the industry was done almost freely and seldom reflected the value of the technology.

The principles that guide protection of intellectual property should be fairness, recognition of others' patent positions, and expedient settlements. Laws and statutes, such as Section 337 of the Tariff Act of 1930, guard against the importation and sale of products that infringe the patents of others. And these laws do not discriminate against foreign nations by excusing U.S.-based infringers—to do so would raise serious questions under GATT national-treatment provisions.

Over the last several years, electronics companies that have strong patent portfolios have been more aggressive in protecting their investments. Adobe Systems, AT&T, Brooktree, IBM, Intel, and Texas Instruments, to name a few, have fought for their intellectual-property rights against domestic and foreign infringers. As a result, the value of intellectual property is now more widely recognized than it was a decade ago. And the price of access to patented technology more accurately reflects the cost of development.

Ultimately, the result of intellectual-property protection will be stronger individual companies in a stronger industry. Innovation will increase as some of the companies currently without patent portfolios develop them. Those that do not develop technology positions will have the opportunity to license important technology from companies that do. Companies that receive royalties will be able to reinvest these funds in R&D. As a result, we will see an industry that is more innovative and more competitive. And, eventually, intellectual property will be understood as synonymous with technology advancement.—*WILLIAM P. (PAT) WEBER, PRESIDENT, TEXAS INSTRUMENTS INC.'S SEMICONDUCTOR DIVISION*

FAIR RETURN VS. FAIR PLAY

The treatment of intellectual property has undergone a dramatic change in the past four decades. Ever since the 1950s, we have witnessed a remarkable diffusion of technology emanating from Bell Labs. In exchange for truly nominal sums, Bell Labs has licensed virtually any takers on leading-edge technology that contained the Labs' proprietary intellectual property. Companies have used this vast knowledge base to improve upon existing technologies and make breakthroughs that affect our lives daily.

All this is changing now. In the 1990s, intellectual property is being recognized as an asset that should be protected more closely. This makes perfect business sense, since the patent laws were devised to let companies build their business and market share during the 17-year life of a patent. However, companies that use patent protection as a way to cushion profits and build a war chest of cash, rather than compete with products that use the patents, are circumventing the spirit of the law.

WILFRED J. CORRIGAN

Still, it is understandable that reasonable human beings will disagree about intellectual-property issues. To remedy these disputes, U.S. circuit courts specialize in handling these issues. In this forum, the merits of a case can be given a full and fair hearing by a jury.

Recently, a case has emerged that is proving to be a hotbed of controversy regarding how companies protect intellectual property. Texas Instruments Inc. has brought suit against five U.S. semiconductor companies, including LSI Logic, alleging that those firms have violated certain plastic-packaging patents that were originally filed in 1963.

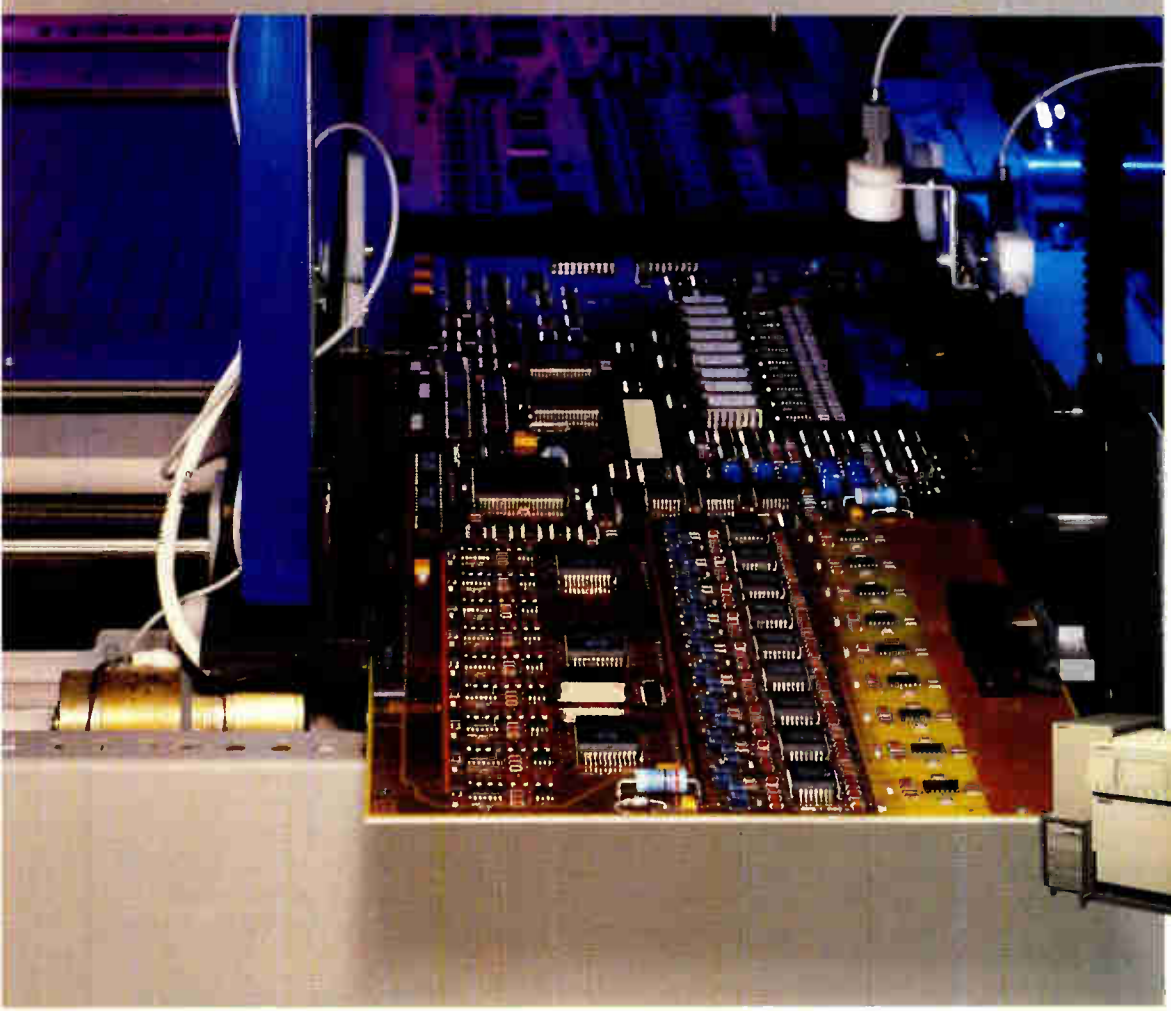
First off, the technology TI got a patent for is now nearly 30 years old. TI has had plenty of time to use it to gain market share and competitive advantages. Also, TI is trying to stretch the intention of Section 337 of U.S. trade law. Section 337 was written in 1930 as a way for U.S. companies to protect themselves from foreign pirates selling counterfeit products. Usually, these foreign firms were fly-by-night operations with no assets in the U.S. They were not liable to show up in a U.S. court and frequently could not be compelled to comply with U.S. court rulings.

The International Trade Commission is the intended forum to deal with these foreign pirates. Even if the offending firms didn't show up, the ITC could prohibit them from exporting the products in question to the U.S. Also, the ITC was intended to offer a speedier remedy than U.S. courts in cases involving products with short life cycles. The speedier remedy was provided at a cost of giving up many of the due-process rights available in a U.S. court—such as a jury trial.

TI decided to use this ITC remedy in filing suit against the five U.S. semiconductor firms. All five are publicly held firms with substantial assets in the U.S. All would show up in court. In fact, TI has filed a second lawsuit against the same five companies on the same patent in a U.S. district court in Texas. The companies are fighting against TI's claims in that forum also.

LSI Logic would like its day in one court—federal court—where disputes among U.S. companies should be resolved. We support strong intellectual-property rights. But an abuse of the system, such as TI is promoting, will have deleterious consequences. TI's intent to divert the income produced by innovative competitors into its own war chest, and its attempt to avoid a full legal challenge by seeking refuge in the ITC, could set an ironic precedent: TI may be setting an example for a foreign firm to ask the ITC to stop certain U.S. companies from importing their own products, on the premise that they violate U.S. patents held by those foreign firms. Let's hope we don't get to that.—*WILFRED J. CORRIGAN, CHAIRMAN AND CEO, LSI LOGIC CORP.*

Complete testing of SMT boards doesn't have to be complex.



Here's your complete answer for hard-to-test SMT boards. The HP 3070 SMT-Series combinational tester.

A totally integrated fixturing system solves the problem of system-level performance at the device under test. Combined with an automatic handling system, it means higher throughputs, too. Testing high performance devices such as ASICs is simplified with advanced system architecture and simulator links. And for faster, easier test development, you get an SMT library for nonstandard pinout devices, plus IPG Test Consultant software.

Call **1-800-752-0900** today. Ask for **Ext. 501E** and we'll send all the details on complete SMT board testing... without the complexity.

There is a better way.

HEWLETT PACKARD

CIRCLE 182

DARPA LOOKING HARD AT NEURAL NETS...

It's getting more and more difficult to ignore neural networks. Just ask the Defense Department, whose Defense Advanced Research Projects Agency is going to spend $33 million through 1992 to see if the networks can help solve signal-processing problems.

The lure of neural nets, which more or less attack problems the way the human brain does, is that they do not need complete data to solve complex problems—like a human, they use context and a kind of intuition. And that, plus massive parallelism and real-time performance, adds up to more accuracy for missiles and increased maneuverability for tanks, ships, and aircraft. What's more, there is evidence that neural nets degrade more gracefully and are easier to program than conventional ones.

Now, Darpa is funding a one-year effort at 50 companies, laboratories, and universities. They are working on neural simulation, theory, and modeling, with more than half the effort devoted to simulating automatic target recognition and speech recognition, and sonar and seismic signal identification. E

DARPA'S NEURAL NETWORK WHO'S WHO

ELECTRONIC HARDWARE

Bellcore, Morristown, N.J.
Hebrew University, Jerusalem
Jet Propulsion Laboratory, Pasadena, Calif.
Lehigh University, Bethlehem, Pa.
MIT Lincoln Laboratory, Lexington, Mass.
Nestor Inc., Providence, R.I.
Science Applications International, San Diego

OPTOELECTRONIC HARDWARE

California Institute of Technology, Pasadena
Carnegie Mellon University, Pittsburgh
Hughes Research Laboratories, Malibu, Calif.
MIT Lincoln Laboratory
University of California, San Diego
University of Southern California, Los Angeles

SOURCE: DEFENSE ADVANCE RESEARCH PROJECTS AGENCY

HARDER TIMES IN MASSACHUSETTS

The widening Massachusetts malaise has finally infected Digital Equipment Corp., the Maynard, Mass., computer giant that had never had involuntary layoffs in its 33-year existence. And analysts believe the layoff of 3,500 that Digital announced last month may not be enough to stem a slump in earnings.

Digital wants to trim its head count by 6,000 by the end of its fiscal year, June 30. A voluntary retirement program fell some 3,500 short.

Digital still employs more than 120,000 worldwide and is the second largest employer in Massachusetts, behind Raytheon Co. But Digital's downsizing will further cut employment in the Bay State, which has lost some 200,000 jobs in the last year, most of them in the once-soaring computer and electronics belt along the Boston area's storied Route 128. E

...AND HERE'S NEURAL COMPUTER THAT DOES 2.3 BILLION OPERATIONS/S

Even as the Pentagon's Defense Advanced Research Projects Agency seeds the neural network pastures, corporate researchers keep working on neural computers—machines, modeled on the human brain, that can handle tasks requiring intuition—though anything like commercial implementation is years away. Now Hitachi Ltd. says it has come up with one whose learning processing unit that can handle 2.3 billion operations/s, 10 times what can be obtained by simulating a neural computer on an Hitachi S-820 supercomputer.

The Hitachi lab model includes 1,152 neurons and is just 12 in. high, 8.3 in. wide, and 9 in. deep. The company has developed stock-price prediction and signature-verification applications that can be run on a workstation that is linked to the neural system. A stock-price prediction takes 10 s, says a Hitachi spokesman, and a signature verification takes 2 s.

The machine goes a long way toward overcoming faults of existing hardware-based neural computers: they either have too few neurons, or they learn too slowly. A practical system needs at least 1,000 interconnected neurons, say researchers at Hitachi.

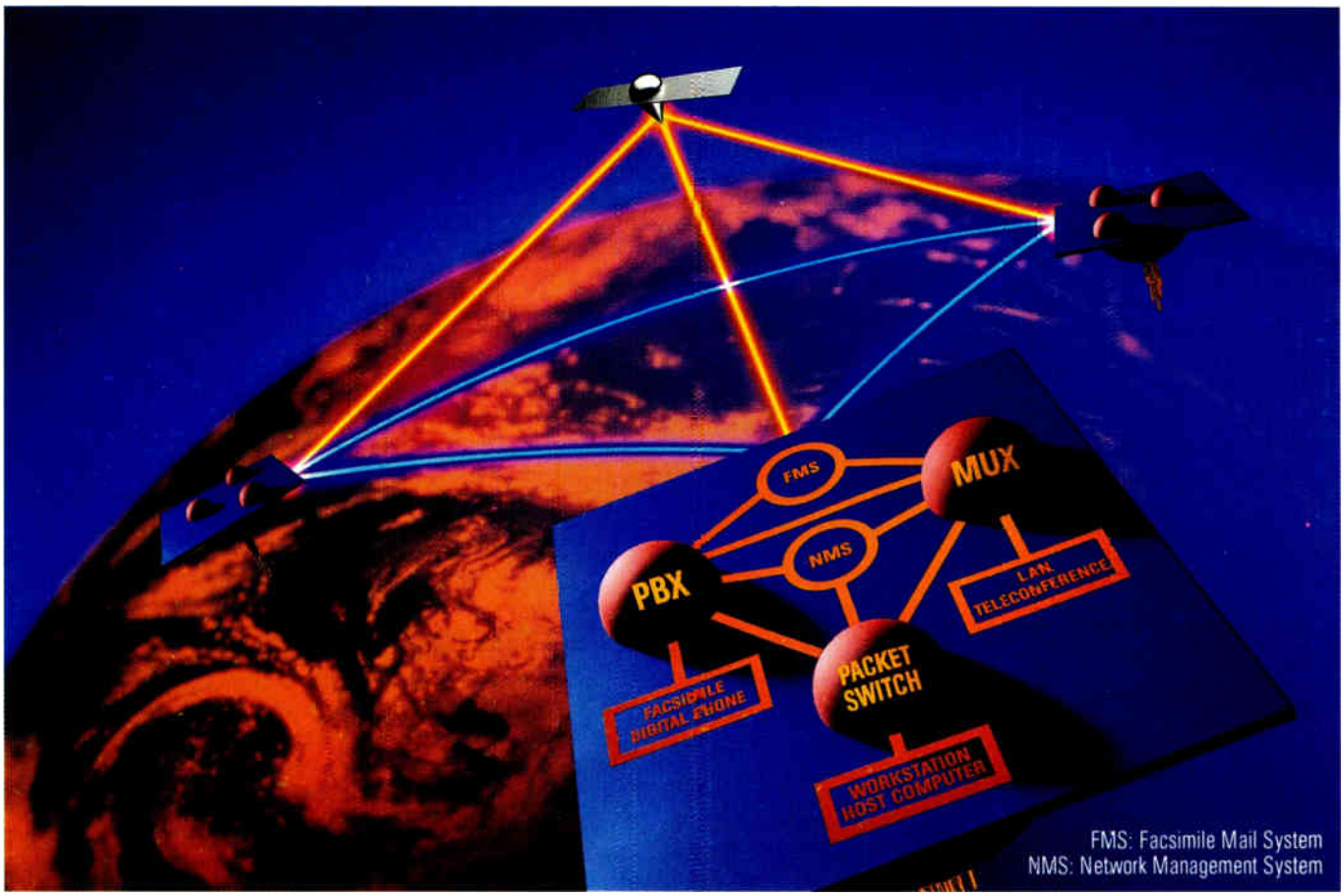
The new computer is based on an LSI circuit announced in 1989 by Hitachi that houses 576 neurons. Eight of them are used in the new computer. E

DATA GENERAL FROSTS 'ASPARAGUS'

Bad news continues to plague Data General Corp., the loss-ridden Westboro, Mass., computer manufacturer. On the heels of the board of directors' firing of founder and chairman Edson de Castro [*Electronics*, January 1991, p. 23] came the disclosure that a once-promising cooperative venture into telecommunications technology has been scuttled.

The firm and Japan's NTT Corp. have plowed under the "Asparagus" project, which might have been worth some $130 million to Data General. The contract—to develop hardware and software for NTT private data networks—was terminated by mutual agreement but at Data General's request, according to a company spokesman.

One reason: delays had reportedly slowed the project. The end came after "a joint evaluation by Data General and NTT of the private data-network environment and the market potential using current technology," the spokesman at Data General says. E



GLOBAL VISION: FOR INTERNATIONAL CORPORATE INFORMATION NETWORKS.

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

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

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

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

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

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

NUMBER 145

READY FOR SDH/SONET DIGITAL NETWORKS.

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

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

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

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

LATEST SHOWCASE OF SKYSCRAPER INTELLIGENCE.

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

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

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

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

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

Super Aladdin: Available only in Japan.

NEW LD MODULE FOR CATV DISTRIBUTION.

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

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

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

NEC

The Microprocessor & License to Create Your Own Industry

Western Design Center backs you with the world's leading installed 8-bit microprocessors and the industry's most workable business arrangements.

The technology that started the personal computer and video game revolution.

The Western Design Center (WDC) W65C microprocessors are the core of some of the world's most popular microcomputers, peripherals and video games...and the heart of some of the health care industry's most important life preserving devices. In fact, with the largest installed microprocessor-based technology, WDC has been the secret to the success of many of the world's most widely used products. Our leading edge technology is only one reason.

You can get a license to succeed.

WDC's unique licensing agreement guarantees you total control over product development, manufacturing and proprietary information – total control over your future. You have Freedom of Manufacturing. That means you can work with any one of several foundries throughout the world. Plus, you have the confidence of knowing your parts are second sourced. With a WDC license, you have the industry's most workable business arrangement because *you drive development.*

- High performance, low cost, low power, low voltage microprocessors
- Core standard product and ASIC product licenses
- Hi-Rel, scaled and worldwide manufacturing
- Freedom of Manufacturing
- Second Sourcing

Investigate the real secrets to success.

Want the technology that can shift your product development into high gear? The license that can put you in the driver's seat? Send for more information about our 8-bit, 16-bit and 32-bit microprocessors and microcomputers. Find out how to qualify for free device samples and a look at our innovative license agreements.

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"Founded in 1978, Licensing since 1981."

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Mesa, Arizona 85213
602.962.4545
FAX 602.835.6442

CIRCLE 208

TO WATCH

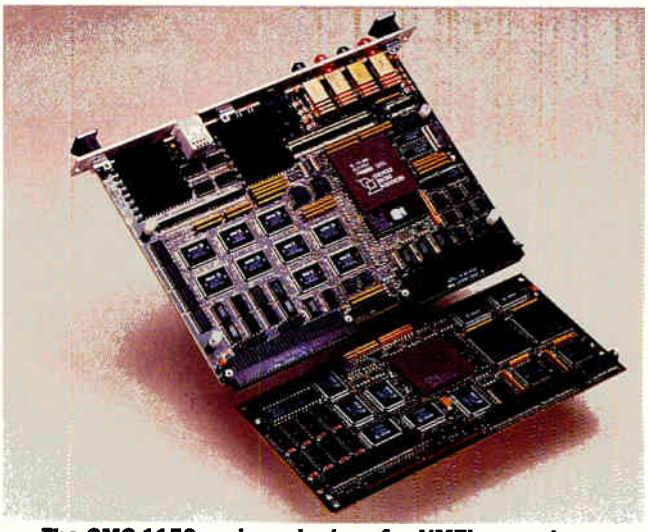
HERE'S FASTER, SMARTER FDDI

CMC is pushing the theoretical throughput limit of the VMEbus-based Unix systems networked on the Fiber Distributed Data Interface with its latest generation of FDDI adapters and link-level drivers.

The Santa Barbara, Calif., subsidiary of Rockwell International Corp. has turbocharged its CMC-1150 series FDDI adapters by replacing several of the Advanced Micro Devices Inc. FDDI chip sets with a custom Link Layer Controller chip that inceases the data path from 16 to 32 bits.

The speed of the direct memory access (DMA) is increased considerably by the addition of 2 Mbytes of VRAM (for video dynamic random-access memory).

CMC's new and improved Link Level Driver for Unix is the first to provide three features–FDDI station management (SMT), the Simple Network Management Protocol (SNMP) agent software, and SunOS 4.1 device driver software–for the 1150-series adapters and the predecessor 1050 series.



The CMC-1150 series adapters for VMEbus systems have a 6U form factor.

And there's more to come. Future software support will include both TCP/IP and GOSIP packages. As for availability, both adapters will be ready for sales in the second quarter, say officials at CMC. E

WEITEK'S MATH CHIPS DELIVER 50-MHz CLOCK RATE

A pair of 64-bit math coprocessors from Weitek Corp., Sunnyvale, Calif., crunches numbers at a 50-MHz clock rate and delivers higher integration, using less power, than the competition.

Fabricated in 0.8-μm CMOS technology, the W4164 and W4364 ease system design by integrating a register file, a multiplier/divider unit, and arithmetic logic unit on-chip. This architecture also enables the chips to perform two independent numeric operations simultaneouly.

The W4164 has one 64-bit input/output port, which suits it to coprocessor applications in desktop systems. The W4364 offers three 64-bit I/O ports, ideal for vector applications in deskside or massively parallel computers. The W4164 will cost $575 when it becomes available in the second quarter of 1991 and the W4364 will cost $625 in the fourth quarter. E

DOCUMENT-PREP SOFTWARE AIMED AT UNIX

An integrated word-processing/graphics software package is intended to simplify document preparation and make it cheaper than full-fledged desktop-publishing systems on Unix-based RISC workstations.

Called Asterix, the $695 package from Applix Inc., Westboro, Mass., combines a Wysiwyg (what you see is what you get) word processor with graphics software that enables users to create, edit, and integrate graphics into text documents.

It offers a simple Unix word processor that lets users get the most from their graphics. The package runs on Sparc-based and Digital Equipment DECstation and DECsystem RISC platforms. It supports OSF/Motif and Open Look user interfaces under X-Windows and is available now. E

LASER MODULE HANDLES ANALOG MICROWAVE

Analog lightwave transmissions at microwave frequencies can exceed 10 km with a laser module from Ortel Corp., Alhambra, Calif.

The model 1540A owes its extended distance to use of distributed feedback laser technology instead of the more common Fabry Perot laser. Applications in which distance becomes important include antenna remoting at rf, L-band, and C-band.

The 1540A laser module operates in the 0.1-to-5-GHz range. Average optical power is 4 mW and the wavelength of the laser is 1,310 nm. E

DOLBY PRO-LOGIC ON ONE CHIP

Extending its push into the consumer IC market, Analog Devices Inc. has come up with what is believed to be the first decoder that combines all the functions of a complete Dolby Pro-Logic surround-sound system on one chip.

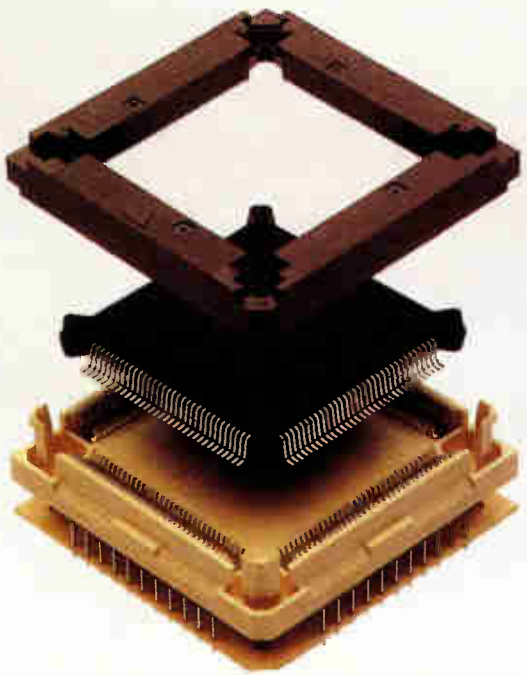
That includes integrated auto-balancing, which competing circuits do not have. It provides dynamic correction of left-right input-signal-level imbalances, eliminating manual user adjustments while improving center-channel dialogue separation from the sound channels.

Designed and fabricated at ADI's Precision Monolithics Division in Santa Clara, Calif., the biCMOS device is for use in "home theater" equipment such as high-quality TV receivers, VCRs, and laser disk units. Prices begin at $15 each in quantities of 100; the chip is available now. E

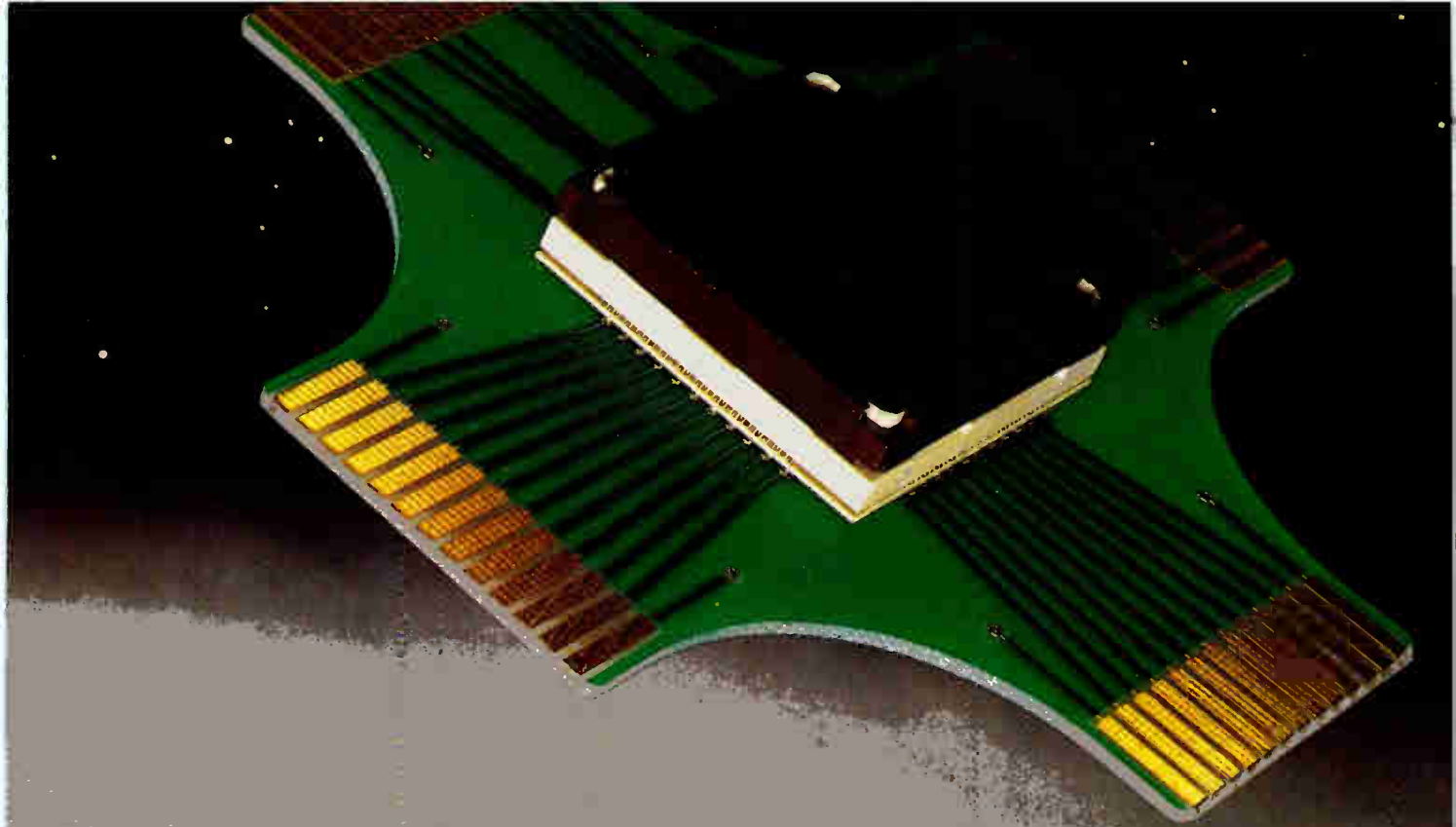
One small step for PQFPs. One giant step for service

Introducing the right technology at the right time—our two-piece Micro-Pitch sockets for JEDEC plastic quad flat pack ICs.

Our patented low-profile (.400″) Micro-Pitch sockets are a remarkably simple, safe way to mount high-speed, high-performance PQFPs. And their simplicity—in engineering, and in the minimum use of material—brings them to you at a remarkably low price.



PQFP as easy as 1-2-3. .025″ centerline Micro-Pitch sockets ease handling, automate readily. High-speed contacts provide oxide cleaning wipe action, 200 grams normal force for positive mating. Footprint on .075″ x .100″ three-row grid.



and manufacturing.

The cover aligns IC leads for easy insertion into the base. It also protects the leads during handling. In fact, your PQFP supplier can insert chips into covers at his site, and send completed units to you. Result: hands-off installation.

Our high-speed tin-plated contacts provide .020″ to .030″ of contact cleaning wipe during insertion, and a normal mating force of 200 grams on each contact. Very positive engagement. And just the kind of quality engineering you can count on from AMP.

Micro-Pitch sockets have been designed with automation in mind, as well. They're fully polarized cover-to-base, and base-to-board, and compatible with vacuum pickup, for fast robotic implementation.

With today's chip costs, and with the high quality and low installed cost AMP is known for, this is one option you'll want to pick up. Fast.

For technical literature and more information, call the AMP Product Information Center at 1-800-522-6752 and ask about Micro-Pitch Sockets. AMP Incorporated, Harrisburg, PA 17105-3608.

AMP Interconnecting ideas

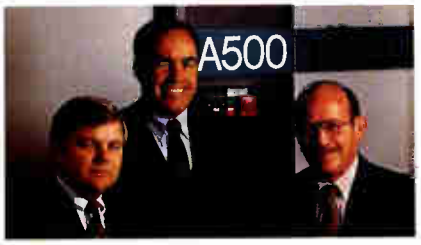
CIRCLE 175

Does it meet Six Sigma

Can it do true mixed-mode testing?

What tools have been developed?

Before the A500 started testing Motorola's mixed-



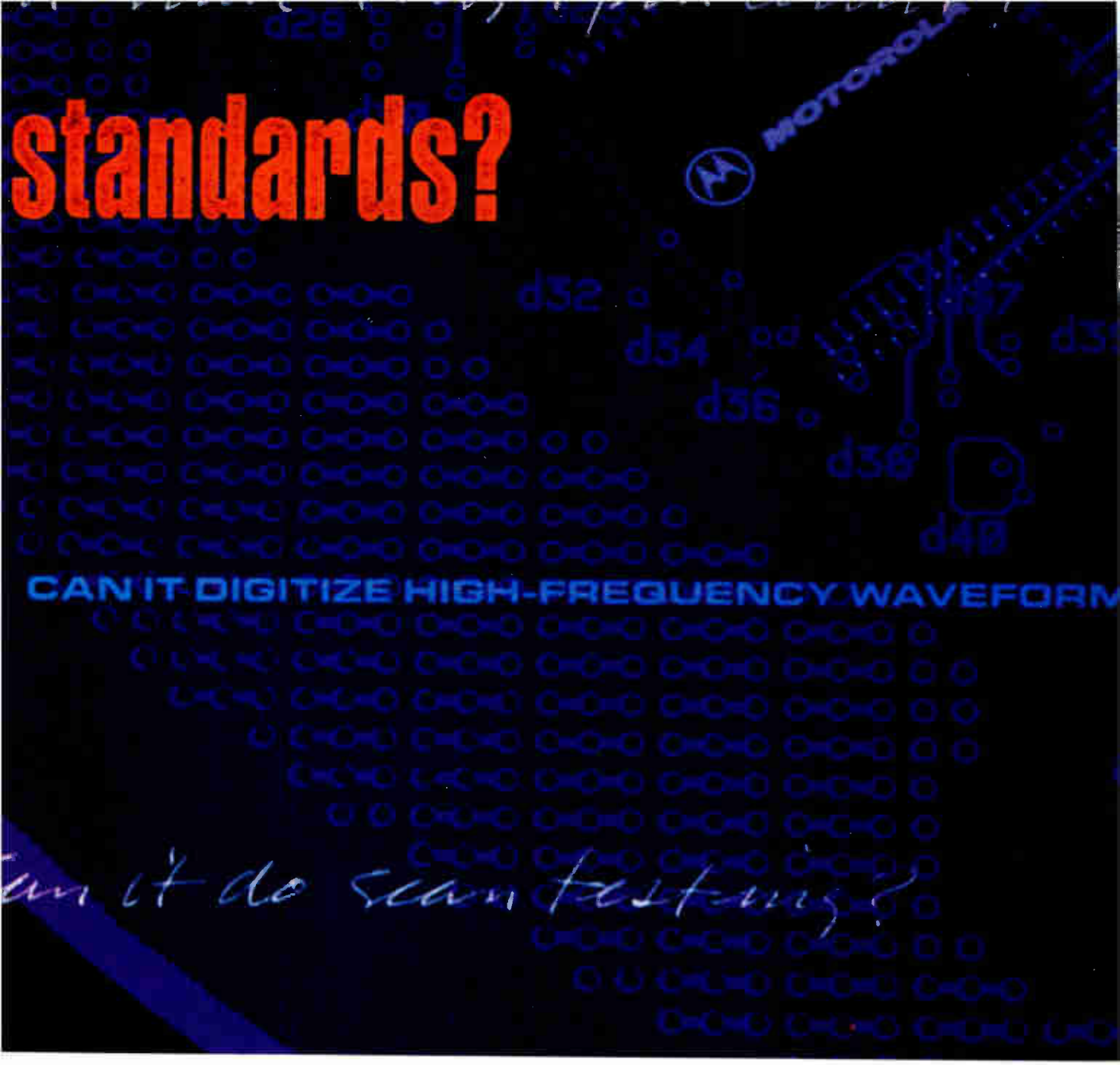
"Motorola has adopted a Six Sigma initiative which focuses attention on approaching zero-defect performance in everything we do, including our test systems. Our purchase of the Teradyne A500 test system supports our Six Sigma initiative and our competitive leadership challenge."

Director of Marketing

Motorola knows you can't have a Six Sigma process unless you can test to Six Sigma standards. That's why Motorola's MOS Digital-Analog Integrated Circuits Division chose the Teradyne A500 Analog VLSI Test System. Because, in addition to proving the A500 could handle the complex technical requirements of Motorola's advanced ISDN interfaces, we also demonstrated that we could perform to Motorola's stringent quality levels.

"Can it do scan testing? Digitize high-frequency waveforms? Do true mixed-mode testing? Does it have a flexible architecture? Can you give us the support for a Six Sigma process? Applications expertise? Complete documentation? The right tools? In each case, Teradyne answered yes."

Manager, Advanced Test Technology



signal technology, Teradyne had to pass a few tests.

With the A500, Motorola had the ability to digitize waveforms at 20 MHz, plus the high pin count necessary to guarantee that their ISDN U-Interface worked the way it was supposed to.

Best of all, the A500's full tester simulation and powerful IMAGE™ software provided the design flexibility and rapid debugging Motorola needed to deliver defect-free parts on time.

"The A500 gave us the resources we needed, in one place, to be able to have a functioning test program very quickly – at least two to three times faster than any other test system. This type of support is just what we need to get our complex circuits, such as the U-Interface transceiver, to the marketplace ahead of the competition."

Operations Manager

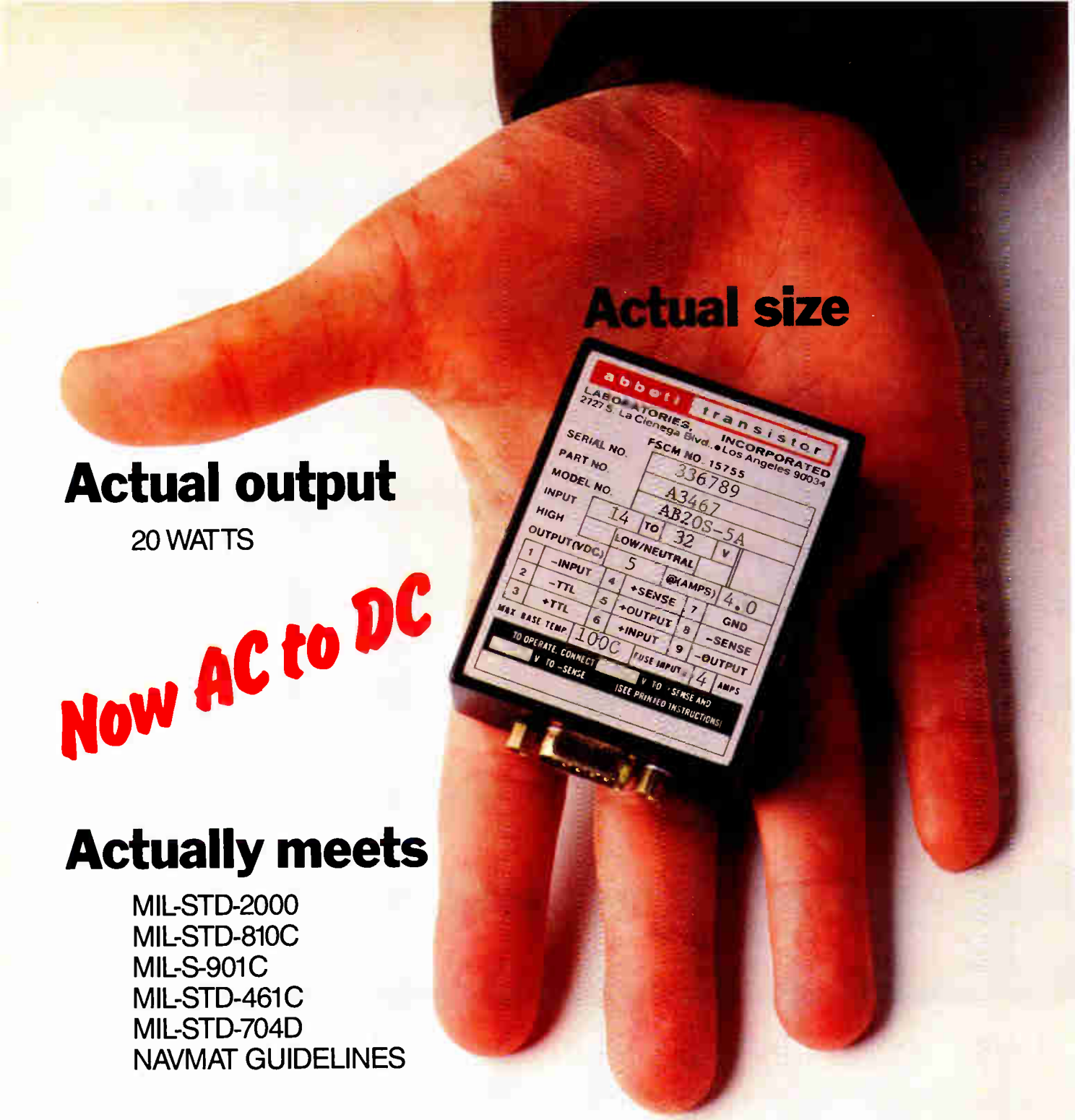
To Motorola, delivering Six Sigma quality is not just a promise. It's a way of doing business. And it's a test that must be passed by suppliers as well.

To see how our A500 family of test systems can help you deliver quality, call Beth Sulak at (617) 482-2700, ext. 2746.

Or call your nearest Teradyne sales office, or write: Teradyne, Inc., 321 Harrison Ave., Boston, MA 02118.

TERADYNE

CIRCLE 188



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CIRCLE 219

MICROSOFT LAUNCHES EXCEL 3.0 RIGHT IN LOTUS'S BACK YARD

DUELING SPREADSHEETS

BY LAWRENCE CURRAN

The ball is in Lotus's court. In the aftermath of Microsoft Corp.'s introduction last month of its most sophisticated spreadsheet to date, the focus of software industry watchers has shifted to Cambridge, Mass., in anticipation of a move by Lotus Development Corp. to protect its Lotus 1-2-3 customer base.

Microsoft, located in Redmond, Wash., chose Boston—just across the Charles River from its Cambridge-based arch-rival—as one of two sites to announce Excel 3.0. Microsoft's primary thrust with the spreadsheet has been to make it faster and easier to use. Significantly, one of the new elements is a help feature to make it easier for 1-2-3 users learn Excel 3.0 for Windows.

The new software is for use with Microsoft's own Windows 3.0 graphical environment, the Macintosh computer, and Microsoft OS/2 Presentation Manager. Users on each of the three platforms will work with similar interfaces and can share worksheets and macros without converting file formats. The version for Windows 3.0 is available now for $495; the other two will carry the same price tag and will appear in the first half of this year, Microsoft says.

Among the most important new features built into Excel 3.0 is a button-oriented Toolbar that speeds oft-used functions, such as formatting spreadsheet cell contents into bold or italic type, or into charts. One click of a button, not several steps, now does it. Another new feature, Autosum, lets users click on a Toolbar button to sum a row or column simply by selecting the cell that will contain the sum.

A helpful analytical tool has been incorporated in the form of an ability to outline information contained in large spreadsheets. The feature collapses or expands large or complex spreadsheets to let users view them at different levels of detail. Data consolidation is another new feature, enabling users to merge data from various spreadsheets, and to link one spreadsheet to another. Such features mean that "Excel 3.0 redefines what it means to be the world's greatest spreadsheet," says Microsoft chairman and chief executive Bill Gates.

Mary Conti Loffredo isn't ready to go that far, but she acknowledges Excel 3.0's strength. Conti Loffredo, a senior software analyst at International Data Corp., Framingham, Mass., says Microsoft "has made some very nice advances. They've picked a few options, such as outlining, that make users see at once why they should pick this spreadsheet." As for using Boston as the eastern introduction site (San Francisco was the other), "It's a plain demonstration that Microsoft intends this to be the No. 1 Windows-based spreadsheet."

For his part, Lotus's Paul Straube sees some worthwhile features in Excel 3.0, but says Microsoft has played catch-up with Lotus in others. "They've put some good sizzle in the product, such as Autosum, but they may have lost sight of performance. The first opinions we've heard are that it's much slower in doing things like recalculations," says Straube, the product marketing manager for 1-2-3 for Windows.

As for playing catch-up, Straube adds that some versions of 1-2-3 have long been able to put graphs and text on one page and to preview a page; both are new features in Excel 3.0. He acknowledges, however, that "there is nothing analagous [to Toolbar] in a Lotus product today." E

With Microsoft's Excel 3.0 spreadsheet, users may create charts from graphical elements

TELEPHONY

AS THE PRICE OF FIBER APPROACHES THAT OF COPPER, RBOCs EMBARK ON SYSTEM TRIALS

FIBER COMES HOME

BY JACK SHANDLE

The time is fast approaching for the aggressive implementation of optical-fiber transmission of telephone services to the home. The reason: the cost-crossover point has been reached between copper and fiber, even for lowly basic telephone service.

Even though the regional Bell holding companies are barred by law from profiting from the wide-bandwidth services made possible by fiber, this month or next will see the in-service deployment of assembly-line fiber-to-the-curb systems. Trials of prototype systems have been under way for several years.

"Our customers [the regional Bells]

companies for commercial TV narrowcasting, or hook up with catalog retailers by distributing video-based buy-at-home services. Under those circumstances, the regionals could count on much more revenue from fiber.

"Phone companies are used to planning 20 or 30 years ahead," says Ballog. "But their strategic direction down the road is in providing broadband services." However, for this to happen, the terms of the 1984 breakup of AT&T Co. must be altered either by Congress or by the judge, in this case Harold Greene, overseeing its implementation. Actively replacing existing copper service could mean that 50% of the homes in the U.S. would be served by fiber by 2000. What remains to be seen is what

source sharing, particularly in the optoelectronic components, which account for 50% of the connection cost. Raynet and BroadBand have resource-sharing architectures based on passive components, such as optical splitters, rather than active electro-optical multiplexing and demultiplexing of the signal. Last July, Bellcore sanctioned passive, resource-sharing architectures for fiber.

Other companies with fiber-to-the-curb technologies currently being field-tested in the the U.S. include Northern Telecom, which offers a system compatible with the synchronous optical network (Sonet); Alcatel, which also has a Sonet-based product; American Lightwave Systems; and R-Tec, a subsidiary of Reliance Electric.

Both Raynet and BroadBand have U.S. trials too. Also, Raynet has a trial with Telefonica, the Spanish phone company, and a cable TV trial in Germany, where phone companies may supply TV service. Raynet's Passive Optical Network uses an optical splitter to distribute signals to the pedestal outside each home, with copper in the last 100 feet. BroadBand also uses such splitters to distribute signals to the pedestal. Its architecture has built-in upgradability to video-signal capability, which it says will cost about $400 per subscriber.

BroadBand's system also provides for all-digital—and therefore ISDN, switchable—TV. And its digital video dovetails nicely with the all-digital version of high-definition TV that AT&T Microelectronics and Zenith Electronics Corp. plan to develop jointly.

want to start testing as soon as we have our commercial system ready, and that will be some time this quarter," says George Ballog, communications director of Raynet Corp., Menlo Park, Calif., one of a handful of fiber-to-the-curb competitors. Approval to actually use it in the network will follow in six to nine months, he says. But it could take longer since the regional Bells and Bellcore, their research and planning arm, have had to write new test procedures, he adds.

Fiber in the subscriber loop is just one of the many disparate pieces that are falling into place for the telecom companies' multimedia scenario (see p. 43). "Right now, we are talking about entertainment-type video," says Salim Bhatia, president of BroadBand Technologies Inc., Research Triangle Park, N.C., another company with an attractive fiber-to-home technology. "But down the road, we are thinking in terms of being able to provide hospital-type services, such as X-rays."

The regionals generally see the cost of installing fiber to the curb converging with copper at between $1,000 and $1,500 per line, says Bhatia. This break-even point should be reached this year in many areas, which means fiber can be used for new construction. But fiber in new construction alone would be only 10% of the entire U.S. network by 2000.

The cost picture would change radically if the regionals were allowed to offer more than what they call POTS—plain old telephone service. For example, they could compete with cable TV

mix of technolgies will be involved.

AT&T has been testing fiber-to-the-curb technology for almost a decade and has 20 active field trials. Its architecture approximates the star wiring used for conventional copper service, and requires optoelectronic components at every pedestal outside each home or service node. Copper can be used for the last segment from the pedestal into the home. This scheme can support the 1.5-Mbit/s signaling of primary-rate integrated services digital networks if VLSI technology is used for line equalization and echo canceling in the copper segment.

But costs can be pushed down if the architecture makes greater use of re-

PREPARING FOR THE '92 GAMES, SPAIN INSTALLS THE WORLD'S HIGHEST-CAPACITY TELECOM LINK

OLYMPIAN ACHIEVEMENT

BY JOHN GOSCH

Imagine this: a town of 60,000 where each person has a telephone and half the population can talk with the other half simultaneously over just one pair of glass fibers. Is that the promise of some future communication system? No, it's the present-day capacity of a digital system installed in Spain.

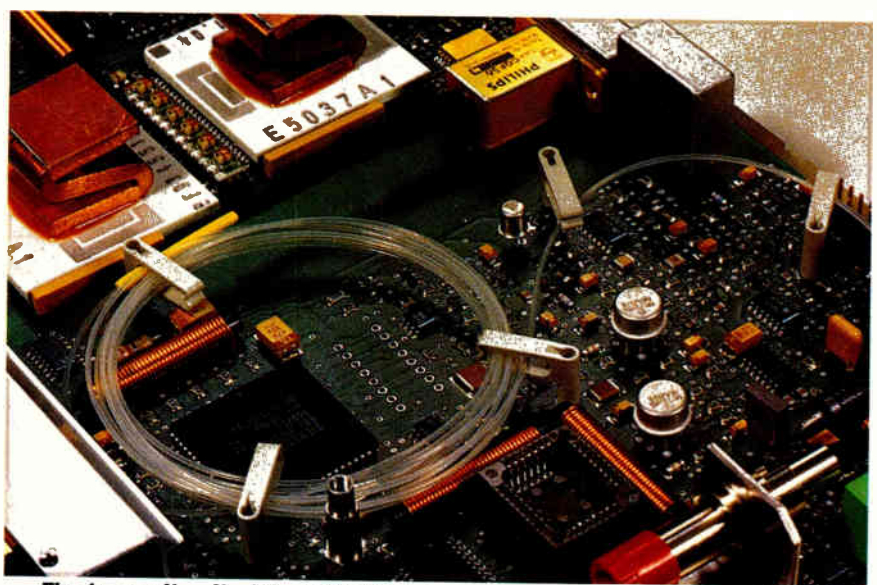
Operating at 2.5 Gbits/s, which is four times the rate of the speediest links in use today, the system has room for 30,720 64-Kbit/s voice channels or sixteen 140-Mbit/s TV channels. That makes it the world's highest-capacity communications link in place so far.

Based on the new Synchronous Digital Hierarchy (SDH) standard, the system was developed at Germany's Philips Kommunikations Industrie AG. Competing against a number of U.S., Japanese, and other European firms, PKI came out the winner in the "international race to develop and install superfast, extreme-capacity SDH communication links," says Eltjo Haselhoff, sales director for southern Europe at the Nuremberg company. The firm is part of the Dutch giant Philips International NV.

The SDH standard is based on the Sonet (for synchrnous optical network) standard from the U.S. SDH technology overcomes many of the limitations resulting from different national and application-specific standards.

That Spain is first to have a gigabit SDH link is no accident. The country is preparing for the 1992 Summer Olympics in Barcelona, and just as some previous Olympic Games have spurred advances in electronics—for example, in scoreboard display technology, high-precision timing equipment, and sports-related data banks—the 1992 Games are behind Spain's efforts to improve its telecommunications infrastructure so that results can be relayed more efficiently at home and around the world.

The 2.5-Gbit/s link runs from Valencia on Spain's Mediterranean coast to Cuenca, which is halfway to Madrid. There are seven repeater stations along the 150-mile stretch. Last November PKI turned over the system to the state-run telephone operating company, Telefónica de España, for field tests under actual operating conditions in the pub-



The transmit unit of the 2.5-Gbit/s transmission system is compact, and houses multiplex and transmit functional units.

lic phone network. The link will be extended to Madrid by midyear.

With the installation in Spain, Philips got a leg up on the competition in gigabit SDH transmission technology. "We hope we can win the contract to complete Telefonica's planned 2.5-Gbit/s network," says Sokrates Apostolides, manager in PKI's international sales and marketing department. In addition to the Valencia to Madrid line, Telefonica wants links from Barcelona to Madrid and to Valencia, so that the completed network forms a triangle. It's these two additional legs that PKI hopes to equip.

PKI first got involved in 2.5-Gbit/s technology three years ago, and in June 1989 Telefonica picked the Philips company to submit a proposal. Winning the delivery contract, it supplied two synchronous multiplexer and transmission systems as well as the repeaters last October. It's this speedy delivery that's buoying PKI's hopes to beat out its competitors on completing the net.

Meanwhile, PKI has won other gigabit system contracts. This spring it will set up a synchronous multiplexing and line-transmission system, working in conjunction with a network-management system, in Australia. It's to become operational in April. In France and the Netherlands the company is supplying laboratory systems, and New Zealand has asked for proposals.

Digital signal transmission systems in use today are based on three different concepts and thus have three different hierarchies. These are defined by recommendations of the International Telegraph and Telephone Consultative Committee, the CCITT. The North American and Japanese hierarchies are based on a 24-channel system transmitting at 1.544 Mbits/s, while the European hierarchy is based on a 30-channel system at 2.048 Mbits/s.

The SDH was born in February 1988, when the CCITT agreed on a worldwide standard optical transmission network. In November that year the SDH proposal was accepted and recommended for worldwide introduction. SDH can work with plesiochronous networks (in which each source has its own clock), "thus allowing further development of present systems," says Rainer Wiechers, product manager for synchronous transmission systems at PKI.

In SDH, synchronous transport modules are used for infomation transmission. The basic element is the STM-1 signal with a bit rate of 155.520 Mbits/s. All higher-order transmission signals are multiples of this first stage. A total of 16 STM signals results in 2.5 Gbits/s.

The new CCITT standard for multiplexing and transmitting digital signals at gigabit rates, Wiechers says, makes a worldwide, standardized transmission network possible with modifiable network topologies for the optimum use of available transmission capacities.

A major feature of this standard is that individual digital signals—for example 2-Mbit/s signals—can be added to or dropped from an SDH multiplex signal of a higher hierarchy level without having to demultiplex the entire signal. This means that a complicated and expensive process, which has thus far limited the use of optical fibers to point-to-point connections between main network nodes, is not necessary. E

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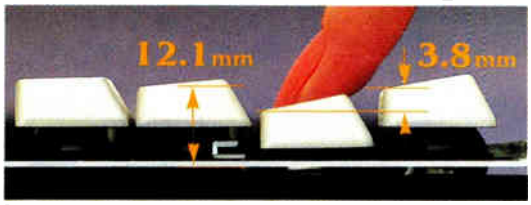

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CIRCLE 171

MATERIALS

INDIUM TIN OXIDE IS AN ALTERNATIVE IN LIGHT-TRANSMITTING ELECTRODES

A SUB FOR POLYSILICON

BY JOHN GOSCH

The preferred material for the light-transmitting electrodes in image-sensor chips—the devices that convert images into electric signals—is polycrystalline silicon. This material can be readily processed and its deposition on oxidized silicon wafers can be easily controlled. A major drawback, though, is that polysilicon absorbs light, and that reduces the chip's sensitivity.

Now a scientist in the Microcircuits department at the Philips Research Laboratories in Eindhoven, the Netherlands, has shown that indium tin oxide—ITO, for short—can be successfully used as an alternative material. In a study partly carried out within the framework of Esprit, the European Strategic Program for Research in Information Technology, Christ Weijtens has demonstrated that ITO is one of the few other materials usable for electrodes in solid-state image sensors.

ITO is both conductive and transparent. In order to use it, however, technological skills and theoretical know-how must be developed. That's what Weijtens has done.

Basically, the technology involves putting narrow electrode tracks in dense rows on the chip's ITO layer. One problem encountered is that the use of ITO results in troublesome crystal faults in silicon oxide, requiring corrective measures. What's more, for volume production, the processes must be stable and compatible with chip-fabrication methods.

Weijtens's technology calls for applying ITO electrodes in a number of process steps. First, in a magnetron sputter-deposition arrangement, indium and tin atoms are forced out of an indium-tin cathode by ion bombardment at low pressure in a plasma composed of argon and oxygen.

The indium and tin atoms combine with the oxygen to form ITO, which is deposited on an oxidized silicon wafer. Next, just as in the fabrication of other chips, the ITO layer is locally etched away using photoresist and exposure via masks. This way, the required track pattern is made.

The track width Weijtens achieved is 2.0 μm, with the distance between tracks also measuring 2.0 μm. Furthermore, the Philips researcher obtained excellent electrode contacts. For this purpose, he developed a double layer of aluminum on titanium tungsten. The specific contact resistance to ITO is more than 40 times lower than previously realized.

The resulting device is made up of a 100-nm silicon-oxide layer deposited on the silicon substrate. Then come a 20-nm film of polycrystalline silicon, a 6-nm film of silicon oxidized by ITO, and finally the ITO layer, which is 130-nm thick.

Unfortunately, the silicon-oxide layer is damaged when the ITO tracks are applied—it causes defects in the crystal lattice. So when electrons are transported along these defects, some electrons stay behind. The result is a weaker output signal than corresponds to the amount of light hitting the sensor. The electrons left behind may come with the next charge package, and that again gives rise to an incorrect signal. Until now these problems were a major obstacle to ITO's use in image sensors.

One of the causes of crystal lattice damage is the charging of the nonconducting silicon layer by the plasma before a conducting ITO layer is present. However, by applying a very thin, practically transparent conductive layer of polycrystalline silicon prior to ITO deposition, Weijtens's technique prevents charging of the silicon-oxide layer. Another advantage the polysilicon layer brings is that the surface of the silicon-oxide layer is clean and well defined.

Moreover, Weijtens was able to reduce any defects that still occurred by using a brief heat treatment—about half a minute long—at 950°C, as well as another heat treatment at a lower temperature taking place in a hydrogen environment. This technique further improves the ITO layer's properties, such as light absorption and the electric resistance. E

MARKETS

WORLD MARKET WILL GROW 8.8% A YEAR, FROM $20.5 BILLION TO $48 BILLION, BY 2000

GOOD DAYS FOR SENSORS

BY JOHN GOSCH

The electronics industry has the jitters as markets contract in many sectors, but for makers of sensors, life is good. The global market for such devices should rise rapidly, with average annual growth—about 8.8% a year from 1990 to 2000—almost matching that of integrated circuits.

That, in a nutshell, is the result of an analysis by Intechno Consulting AG, a market research organization in Basel, Switzerland. Considering sensors only for civilian applications and for the open market (that is, disregarding those made for in-house use), Intechno figures that the world sensor market will expand from a base of $20.5 billion in 1990 to $48 billion in the year 2000.

Demand for sensors is currently the strongest in the U.S., accounting for a share of 38.7% of the global market in 1990. Next in line are Japan, with 23%, West Germany (without the former East Germany) with 13%, and France, Italy, and the UK with 7.2%, 6.7%, and 5.6%, respectively.

Presenting these findings at the recent Eurosensors Conference in Karlsruhe, Germany, Norbert Schröder, Intechno's general manager, says the

leading demand sector for sensors is currently the process engineering field, which consumed $5.8 billion worth of such devices in 1990. Following were the automobile sector with $4.3 billion and the machinery and plant construction sector with $3.8 billion. The highest annual growth rates are 12.5% for the auto sector, 10.9% in the field of buildings and safety technology, and 9.3% for environment control.

Looking at West Europe, Intechno finds that the plant construction and process-technology industry is the leading sensor consumer, accounting for $3.1 billion in 1990. West Europe's machine sector used about $1.27 billion worth of sensors that year, with machine tools gobbling up $133 million, robotics $47 million, and mechanical conveyors $207 million worth.

West Europe's automotive sector will register the most dramatic increase in sensor demand in the decade ahead, Schröder says. Its consumption will expand from $1.13 billion in 1990 to $3.66 billion in 2000.

Schröder not only trots out figures on current and future markets but also points up trends in sensor technology. Decisive for the innovative strength of West Europe's sensor makers will be cooperation with R&D institutes, as well as customer orientation.

"In contrast to scientific institutions where there is a continuous search for new sensor materials and for ever higher degrees of precision and resolution, in the industry the factor that counts is absolute reliability of series-produced sensors," Schröder says. This is true especially for advanced silicon-based microsensors, integrated optical sensors, and optical fiber sensors. "Industrial applications of these types often fail due to lack of reliability, robustness, and reproducibility of measured results," he adds.

Schröder sees the most important sensor innovations coming from the overlapping of sensor physics with other technologies and sciences. For example, a mix of sensor engineering with biotechnology will bring new biosensors. Likewise, sensor techniques and chemistry will result in novel chemosensors. Also, sensors on the one hand and electronics, optics, and optoelectronics on the other will make for smart sensors, integrated optical sensors, and optoelectronic IC sensors. Finally, overlapping sensor, communications, and information technology will make possible new remote sensing devices and sensor bus systems.

Addressing German sensor makers, Schröder points to their current dominant position, especially in devices for the machinery sector. But he cautions that their position must be secured by quickly transferring their know-how to miniaturized sensors. "It's particularly with silicon-based micro devices functioning as bio- and chemosensors that U.S. and Japanese manufacturers rate as the leaders," he says.

One aspect becoming more and more important for West Europe's sensor industry is standards. "Unified European standards and regulations would considerably improve the chances of innovation for European sensor manufacturers," he says. E

DATA COMMUNICATIONS

EUROPEAN RAILWAYS ARE GETTING TOGETHER TO FORM A DATA-COMMUNICATIONS NETWORK

HERE COME THE TRAINS

BY PETER FLETCHER

European railway companies, all of them state owned, are preparing to roar into the pan-European telecommunications business. While awaiting regulatory changes to allow their move, 11 of them have formed a jointly owned subsidiary known as HIT Rail BV, which is already investigating setting up a pan-European data-communications network.

HIT Rail will act as a holding company to coordinate and manage information-technology projects for the members of the Union International Chemins de Fer—the UK, France, Belgium, the Netherlands, Germany, Switzerland, Denmark, Sweden, Switzerland, Italy, and Austria. In the longer term, it will be responsible for the specification and development of hardware and software projects and products that will be used by the railway companies, but which could be offered for general sale.

Even though executives have yet to be recruited and a permanent headquarters established—probably in the Netherlands—HIT Rail has already made its first acquisition, taking a stake in PSG NV, a small Dutch software house. PSG specializes in industrial software designed to support manufacturing operations. However, under its new ownership, the company is soon to apply its expertise in transaction-based applications to producing software for electronic data interchange that would control financial transactions among the 11 railroads, says Otto Benz, director of information systems and technology for British Rail.

HIT Rail's first major task is to oversee the upgrading of the railways' continent-wide X.25 data-communications network, known as Hermes. Hermes was installed in the late 1970s, Benz says, and was the first pan-European network of its type. "Apart from the link across the English Channel, which uses British Telecom-supplied lines, the system uses private cables installed alongside railway tracks," Benz says. While it uses X.25-type protocols, it is not fully compliant with the latest standards and chugs along at just 9.4 Kbits/s.

When completed, the new Hermes will allow the railway companies to handle EDI and international documentation transactions as well as reservations, ticketing, freight consignment, and scheduling information, tasks for which it was originally conceived. According to the outline proposals, the network may be extended to carry value-added services and data for third parties "when the regulatory environment allows." In fact, Benz says that it was this proposal that won the approval of the members of the Union International des Chemins de Fer and led to the formation of HIT Rail.

Benz says that the project has reached the stage where partners have been chosen, and that HIT Rail is negotiating with a four-company consortium comprising Racal Data Networks of the

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CIRCLE 197

UK, Daimler Benz of Germany, Banque Suez of France, and Nynex of the U.S. for the supply, installation, and management of the new network. Benz says that the upgraded Hermes network will be run at 64 Kbits/s and link 13 mainframe computers in the HIT Rail member countries. "We want it to be completed by the end of 1991," he says.

Details of the Hermes network and its possible cost have yet to be negotiated. However, it seems likely that it will be operated and owned by a new company whose shareholders would be HIT Rail and the four consortium members. Benz says that this approach represents "a totally new concept in railway-information technology projects." He adds that HIT Rail will also be looking to form or acquire other subsidiaries in the future.

Hermes is concerned only with data communications, Benz says: "Voice-communications networks within the railways are being studied by other groups." So far, however, discussion is centered around the adoption of common specifications and standards for voice-network equipment, rather than plans for an interconnected network.

WITH EUROPE'S TELECOM IN A STATE OF FLUX, THE TIME IS RIPE FOR SUCH A DATA AND VOICE NETWORK FOR THE CONTINENT

The timing of the move appears fortunate. European telecommunications are in a state of political and technical flux. Already the European Commission is studying a report that recommends the establishment of a pan-European long-lines telecom operator, independent of the existing national phone companies. And that is a role that the railway companies believe they could fulfill, because all have extensive cable, fiber, and microwave networks already in position.

Furthest along is the UK, where a far-reaching review of telecom policies will introduce more direct competition into a market dominated by a duopoly of British Telecom plc and Mercury Communications Ltd. This is expected to result in the licensing of at least one—and possibly more—new national carriers. In anticipation, British Rail has formed a subsidiary, BR Telecom, with its own impressive infrastructure. E

TELECOMMUNICATIONS

SELLING TELECOM EQUIPMENT WILL BE EASIER WITH SINGLE COMMUNITY-WIDE STANDARDS

MAKING IT EASIER

BY ANDREW ROSENBAUM

Selling telecommunications equipment in Europe has never been easy, because each state-owned communications authority sets its own standards. But things are about to change, and manufacturers and network managers are eagerly waiting for the change to become official.

In April, the European Community is to pass a directive that will make it possible to sell equipment throughout Europe after it has been approved in any of the 12 EC member states, according to a spokesman for the commission.

There already has been some relaxation of rules, but nothing as far-reaching as the pending deregulation. In fact, under the current EC directive 86/361 (called the Council Directive on the Initial Stage of the Mutual Recognition of Telecommunications Terminal Equipment) a terminal or a modem has to be tested for conformity in just one of the member nations. But it must be approved by a standards agency in each individual nation in which it is to be sold. That means 12 separate approvals—according to differing standards—for every piece of equipment.

The approval procedures take time and cost money. But ignoring them can be perilous. "The [German telecom authority] Bundespost checks lines," says a network manager with a large European organization. "It doesn't happen often, but people get caught and pay heavy fines."

The new directive will also institute a regulatory commission that will determine obligatory technical standards. These standards, which the EC spokesman says will be broad technical and safety requirements, will become obligatory throughout the EC. E

EMPLOYMENT

ELECTRONICS IMPROVES

JOB OUTLOOK GOOD IN UK

BY PETER FLETCHER

Job prospects in the British electronics industry have improved for the first quarter, making it one of only a few UK industries not showing a decline. That's the conclusion of a quarterly survey from employment services company Manpower (UK) Ltd.

"Electronics companies seem to be bucking the national trend because nearly every other sector in the country has shown a decline in employment prospects from last year. Here, employers don't seem to have changed their outlook at all. That's very encouraging when everyone else is talking about recession," comments Lilian Bennett of Manpower.

The survey questioned more than 1,500 companies. The national findings are yet another indication of deepening recession in the UK, with employment prospects overall the worst they have been since 1983. E

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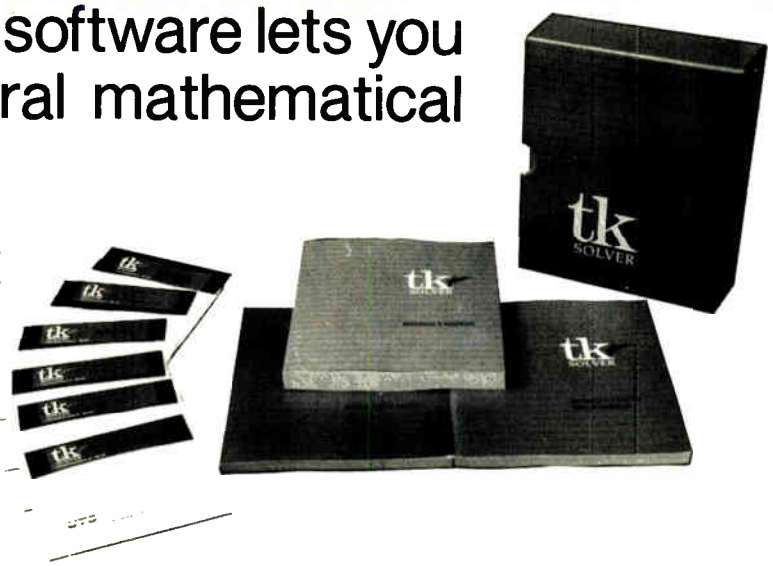

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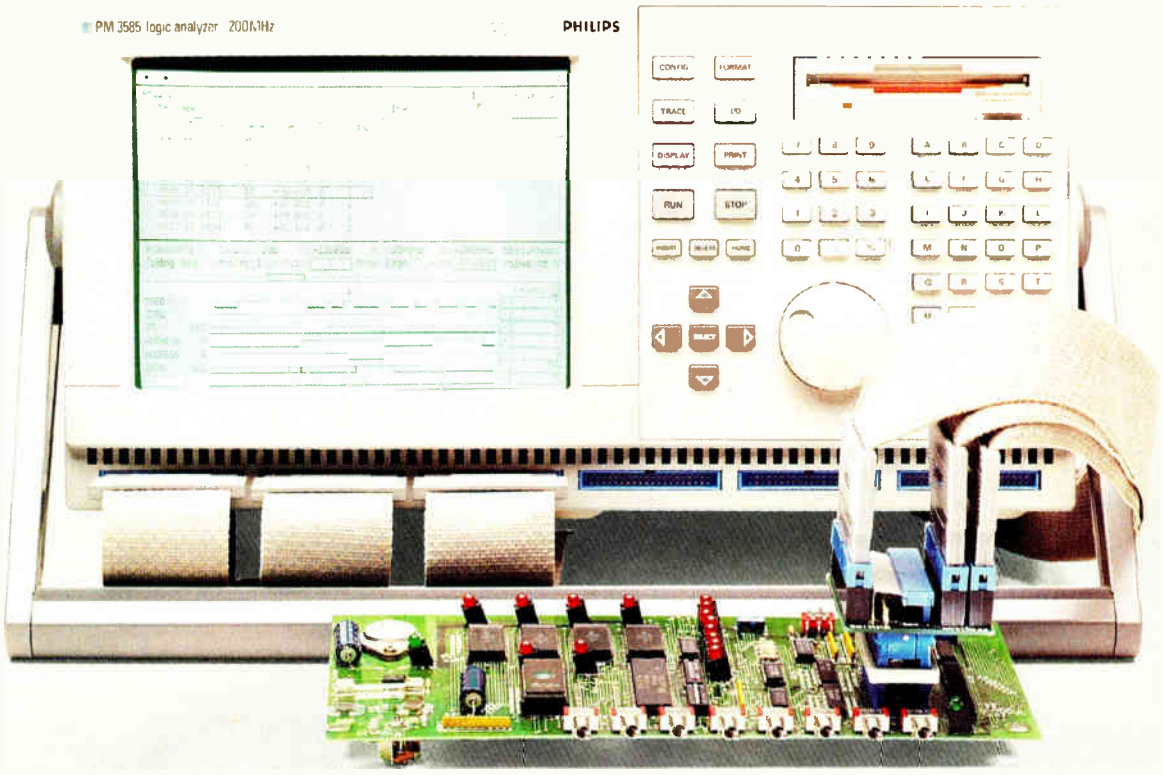

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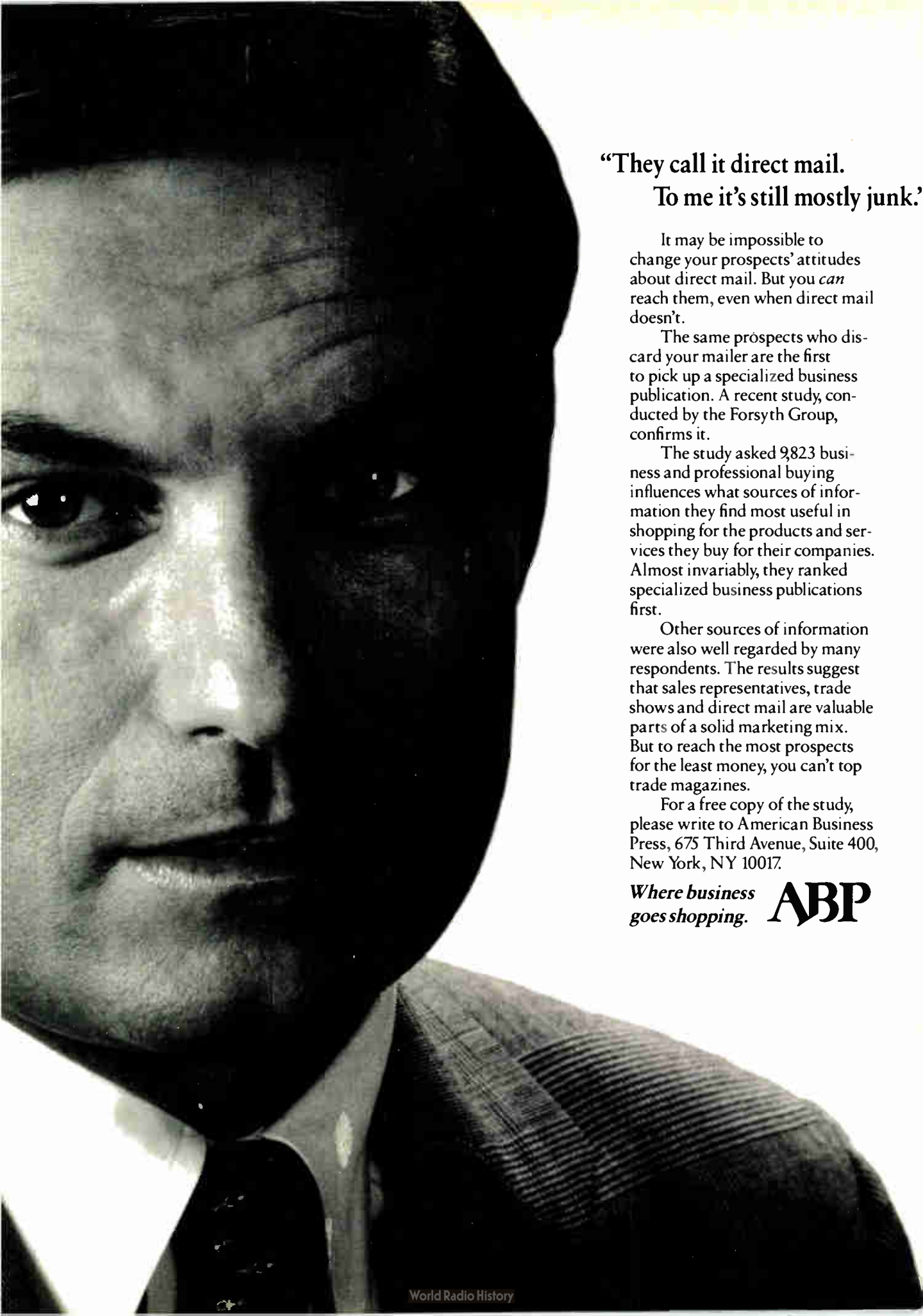

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For a free copy of the study, please write to American Business Press, 675 Third Avenue, Suite 400, New York, NY 10017.

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OBSERVER

OPTICAL FIBERS TO LINK EAST, WEST

In an effort to spur the economic development of the newly opened nations in East Europe by improving the telecommunications infrastructure between east and west, four countries—Germany, Poland, Hungary, and Czechoslovakia—are banding together to install a common glass-fiber cable system.

Starting at Frankfurt, Germany, the Trans Europe Line (TEL) will run through the south of ex-East Germany to Görlitz. From there one branch will cross the border to Warsaw, Poland, and the other to Budapest, Hungary, via Prague and Bratislava in Czechoslovakia. After that, there are plans to extend the line from Warsaw to Moscow.

Transmitting several thousand voice channels or a correspondingly high number of data streams, the TEL will span 3,200 km, or about 2,000 miles, when it hits Moscow. To cost about $130 million, the line is scheduled for completion by the end of 1993.

EUROPE'S BURGEONING FIBER MARKET SPURS CAPACITY EXPANSION...

The planned Trans Europe Line points up one thing: Europeans use an awful lot of optical fiber—and they're going to be using considerably more in the next four years. In fact, demand for the material from the continent's communications authorities will climb to 2.4 million km during the next three years, about the size of today's North American market. Worldwide, the demand has swelled from 1.5 million km worth in 1985 to more than 5 million km in 1990. About half of that was consumed in North America and over one-third in Europe.

So Siecor GmbH, a joint venture of Munich-based Siemens AG and Corning Inc. of the U.S., is gearing up production to keep up with the heavy demand. Since putting out 1 million km, or 620,000 miles, worth of fibers at its Neustadt, Germany, facilities during the past four and a half years, Siecor is now investing $40 million to produce that much in just one year. Behind this move is the unexpectedly high demand. Siecor does about 90% of its business in Europe and roughly half of that in Germany. However, the German share is expected to decline as sales in other European countries climb more rapidly.

But there is a dark side. Because of drastic price reductions, many companies expanded their capacity to recoup the high initial investment in production equipment. That has led to stiff competition over market share which, in turn, caused prices to fall. The result of the price squeeze has been a shakeout among optical fiber producers.

...AS A CHINESE VENTURE FINALLY CRANKS UP

Some things just take time. A case in point is a technology-transfer agreement that Germany's Standard Elektrik Lorenz AG (SEL) made with China's Tianjin Optical and Electrical Communication Corp. three years ago.

The Chinese company has finally started production of optical-transmission systems in Tianjin, after SEL transferred the technology and equipped a production facility there. SEL, a subsidiary of France's Alcatel NV communications group, also trained local personnel. It will market the products jointly with its partner.

For SEL, China is a strategically important market for digital technology, which the Beijing government plans to use to expand its network. By the end of this decade, the number of subscriber lines in China will total around 34 million, up from 14 million today.

SEL'S AMPLIFIER BOOSTS CATV OUTPUT 10 TIMES

Using an erbium-doped fiber-optic amplifier, engineers at the research center of Standard Elektrik Lorenz AG (SEL) in Stuttgart, Germany, a subsidiary of France's Alcatel NV communications group, have boosted the output of an analog cable-TV transmitter tenfold, to 20 mW (or +13 dBm) from the 2 mW that is typical for transmitters built around conventional fiber-optic amplifiers.

The high optical output power will have the advantage of enabling a cable-TV user to share the costly optical CATV transmitter built around many subscribers or remote terminals. The CATV signal the SEL engineers used in their experiments encompassed 35 AM TV channels and 30 FM stereo broadcast channels in the 47-MHz band.

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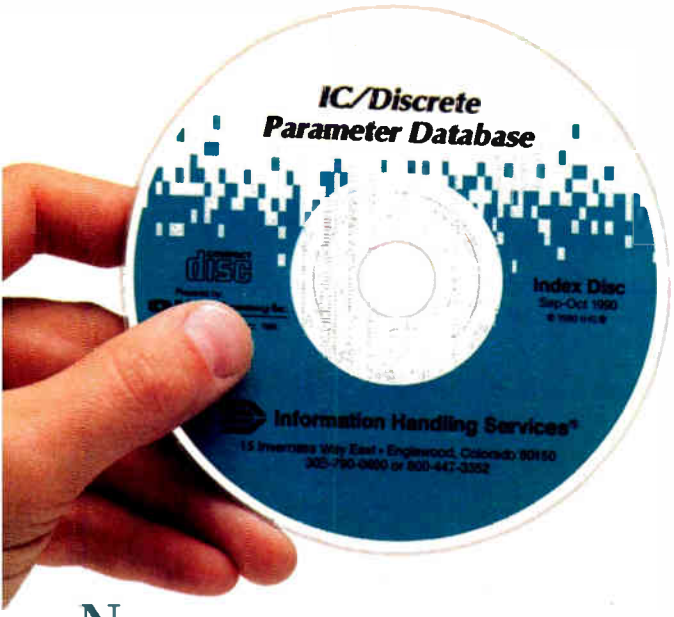

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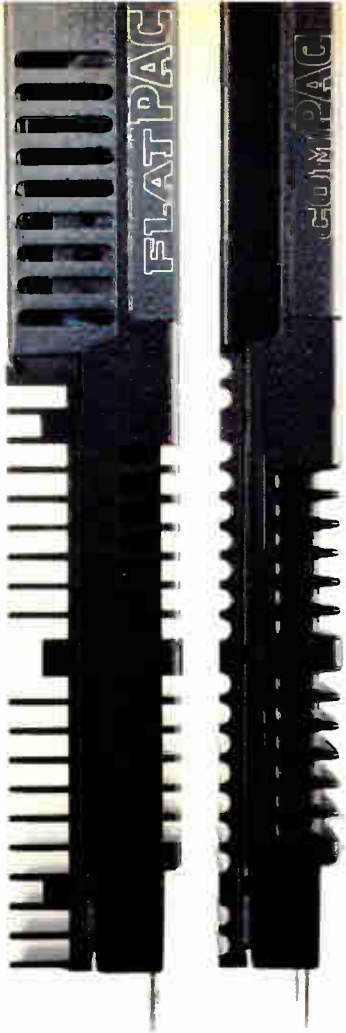

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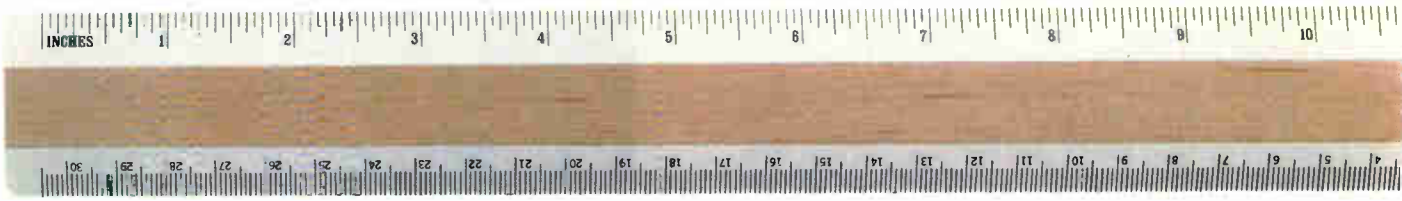

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CIRCLE 204

SOLID STATE

THE ISSCC LIVES UP TO ITS GLOBAL MONIKER BY SPOTLIGHTING SOVIET SCIENTISTS

WHAT'S DOING IN RUSSIA

BY HOWARD WOLFF

At first glance, it would seem to be impossible for the International Solid State Circuits Conference to become any more global in its approach. Even its critics—if indeed there are any—must concede that the show has been faithful to the first word in its title, reflecting the flow of innovation away from the U.S. But this year the ISSCC has managed to come up with an attraction that further polishes its reputation as the must-go show for the movers and shakers of the worldwide solid-state fraternity.

Not only will the 38th ISSCC, taking place Feb. 13 through 15 in San Francisco, repeat last year's special session on circuit technologies of the future, but it will be the first actually to serve as host to researchers from the Soviet Union. Four of them, selected from among 50 USSR technologists seeking to present their papers, will take part in a special session on the state of technology in the Soviet Union.

The four technical papers, bearing the names of seven researchers, are broad and touch on subjects not usually heard at the conference. After an overview on microelectronics in the USSR from Richard Jaeger, head of the Alabama Microelectronics Center at Auburn University, there will be a description of the use of space-charge waves in gallium arsenide thin films for microwave signal processing. The technique could be used for amplification, filtering, correlation, and other signal-processing functions.

Another paper will describe a nonvolatile static random-access memory organized as a 4-Kbit main nonvolatile memory that copies into any of four pages of 4 Kbits each. The chip measures 3.6 by 6.9 mm and uses 2.5-μm design rules. The third paper covers a

family of n-channel 256-Kbit and 1-Mbit flash electrically erasable programmable read-only memories. Built around one-transistor memory cells measuring 27 mm square, they use 2.0-μm design rules. Read and page-write times are 700 ns for the 256-Kbit parts and 10 ms for the 1-Mbit EEPROMs.

The final Soviet paper describes a modular minifab for low-volume, fast-turnaround application-specific integrated circuits. Featured are Class-1 miniature reactors in each module that perform several process steps.

The rest of the papers at the ISSCC are the customary top of the line, with 225 submitted and 87 selected. Of those, 22 cover analog developments, 21 signal processing and communications, 18 memories, 13 digital, and another 13 discuss general topics. In addition, there are seven papers on emerging technologies plus the four from the Soviet Union. Geographically, adding up the plenary speakers, panelists, and papers, 43 are from the Far East, 42 hail from the U.S., and 17 are from Europe.

On the digital side, there is an eye-opening collection of systems on a chip, a good sampling of memories, and an interesting renewal of the RISC-vs.-CISC battle. "The emphasis is on microprocessors, large-area gate arrays, and very large, very fast memories," says John Tmka, a member of the senior technical staff at IBM Corp. in Rochester, Minn., and the ISSCC's program chairman.

Whole systems have been packed on single chips for years. But anyone who thought that the days of major progress are over will be surprised by the systems being previewed at the ISSCC: the new offerings aren't just more of the same.

There will be the first description of a 100-MHz 80486 microprocessor from Intel Corp.'s Aloha, Ore., operation—a complex-instruction-set device in what is becoming the era of reduced instruction-set computing—as well as one from Mitsubishi Electric Corp. and Itami University in Osaka that is rated at 50 million floating-point operations/s. A third gem is a RISC 64-bit superscalar device with digital-signal-processing enhancements from National Semiconductor Corp.'s facility in Herzlia, Israel.

In memories, there will be a large number of 64-Mbit dynamic RAMs, including the disclosure by Fujitsu Ltd. of a GaAs model. There will also be fast 4-Mbit static RAMs built with CMOS and biCMOS technology. And if the ISSCC is any indication, there are signs that the 16-Mbit level is around the corner for EPROMs and EEPROMs.

The analog and mixed-signal community will be dazzled by a veritable potpourri of sampling: over and under, ac and dc, prequantization, and for nonvolatile analog on-chip storage. In pure analog, there will be a collection of chips ranging from 10-GHz GaAs to 6-GHz silicon Gilbert-cell multipliers. One

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of the more dazzling analog developments comes from Information Storage Devices Inc. in Santa Clara, Calif. It will be presented as part of the session on emerging circuit technologies. The company is a new one, and its technique is equally fresh. It employs an extended EEPROM technology and can record 16 s of audio that is better than telephone quality on a chip that measures 200 mm per side.

Those looking for trends in communications devices also will hit pay dirt at this year's conference. "Mixers, modulators, and multipliers are fundamental building blocks," says John Steininger of Comlinear in Colorado Springs, Colo. So on display will be improvements in speed, precision, sensitivity, and circuit-integration levels in those basic devices. It all means smaller, less expensive, and easier-to-use technology.

Among the other communications devices will be a double-balanced active Gilbert mixer from Hughes Aircraft Co. in Manhattan Beach, Calif., and its research laboratory in Malibu that can achieve 6-dB conversion gain. Then there's a 200-MHz digital modulator from the University of California, Los Angeles, and a wideband multiplier that hits 8 Gbits/s, from Ruhr University in Bochum, Germany.

One of the more perplexing problems associated with the advances described at the ISSCC is testing: how does design testability enter into ever more complex and crowded chips?

With some digital logic devices operating at clock speeds faster than 1 GHz, the challenge is significant. So one of the evening discussion sessions will attempt to provide some answers while examining such issues as built-in test techniques, radio-frequency tests at wafer probe, the capability of commercial test equipment, mixing analog and digital testing, power dissipation on wafer test, cooling problems, design for testability, and limits to testing.

Judging from the discussion of emerging circuit technologies, the buzz word is "neural." Three of the seven papers are devoted to imparting the reasoning qualities of the human brain to solid-state circuits. There's a neural net execution engine, a self-learning chip, and an analog neural-net processor.

The five members of the panels will come from Japan's NTT, Bipolar Integrated Technology, AT&T Bell Labs, Stanford University, and IBM. E

Tiny Glitches Lead to Giant Wobbles

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

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Hipparchus

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CIRCLE 190

Like environmental air and water pollution which are the unwanted by-products of rapid industrial growth, "noise pollution" has resulted from high technology electronics.
Minor problems such as glitches on a TV screen can be annoying. Severe cases of "noise" interference can result in traffic jams due to malfunctioning control systems on automatic car and railway signals, flight accidents, and the malfunctioning of computerized on-line banking systems.
Furthermore, noise analysis can re-generate the original signal. In other words, the regeneration of signal noise can mean sharing your important information with anyone interested in analyzing it. Noise pollution is already a severe problem for safeguarding sensitive information, as well as your own privacy.
In the above cases, electronic equipment generates conducted noise in cables or radiated noise in the air. To eliminate interference from conducted noise, filters and transient suppressors are added to the cables. Radiated noise is eliminated with protect computers, various shields which screens, etc. Complete noise protection requires that all cables and equipment be safeguarded, and since noise pollution has steadily increased due to the increased power and performance of electronics, conventional countermeasures are becoming inadequate.
Murata has responded to the challenge with two new products. The "Compact, High-Performance EMI" protects systems against instrument noise, while the "Chip EMI Filter" provides excellent protection against conducted interference while reducing the space required for a filter.
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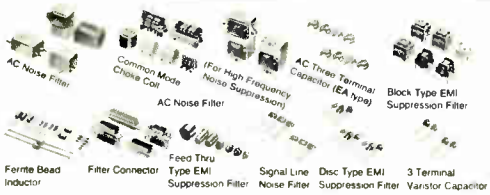

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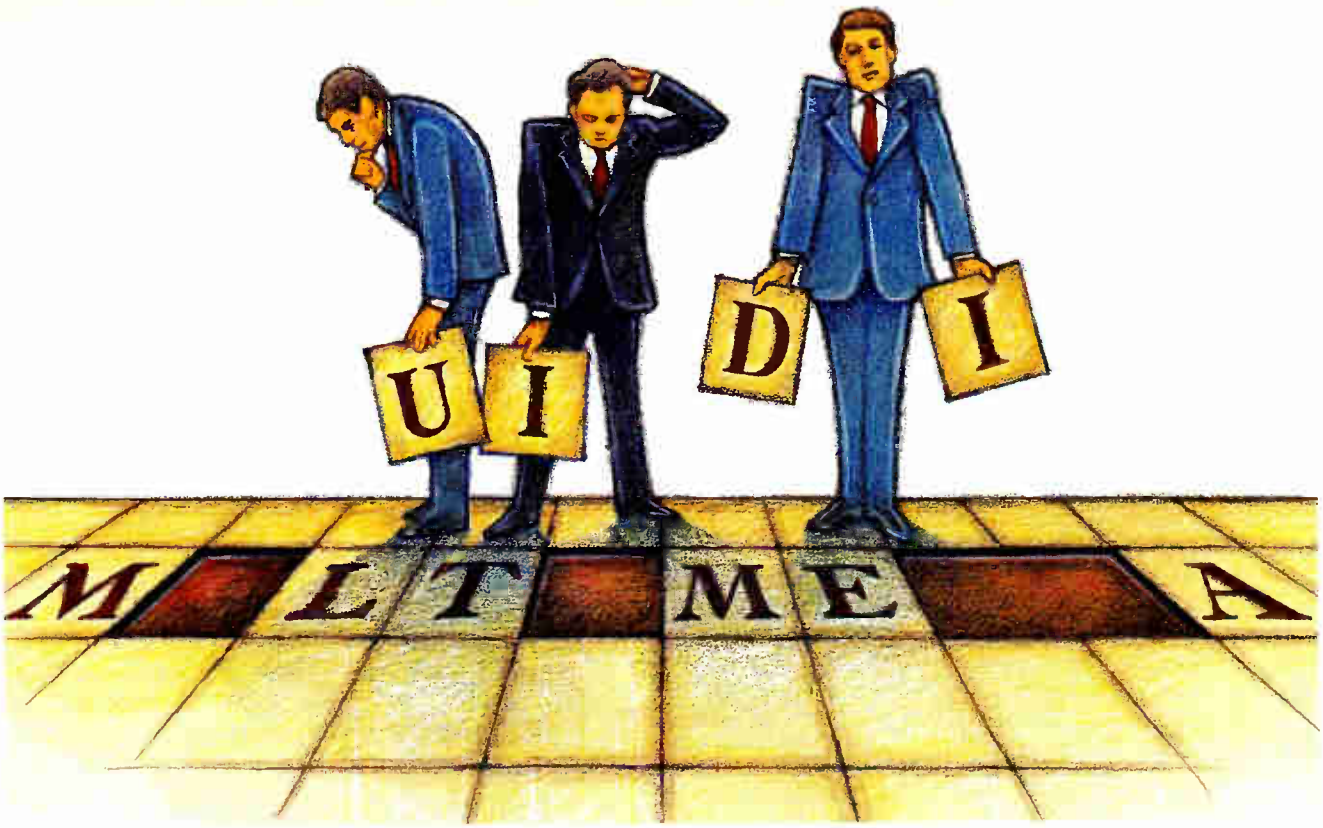

MULTIMEDIA: MAKING ALL THE PIECES PLAY TOGETHER

CD-ROM FINALLY FITS AND DSP COPROCESSING IS LOOKING GOOD, BUT LANS WILL FIND A COMPETITOR IN ISDN

BY JACK SHANDLE

In the annals of electronics, 1991 is likely to be remembered as the year when some serious glue started to be applied to multimedia. It remains to be seen when the vertical markets bolstered by this year's application of technology will be bridged by one or more software applications into a real multimedia market.

Common specifications are a wonderful thing for an emerging technology, and they became a reality for multimedia running on IBM-compatible personal computers last year. Beginning this month, several major PC makers will start rolling out machines that conform to—or exceed—the minimum platform specs hammered out in November at the Microsoft Multimedia Developers Conference in San Jose, Calif. But bringing powerful multimedia computing to the desktop will require more than the first cut of the Microsoft platform specification. For starters, it needs a digital-signal-coprocessor architecture, a control architecture for video and another for audio, first-rate software-writing tools, a reliable means of distributing multimedia documents, and a sophisticated reseller channel. Movement is being seen on all these fronts.

MULTIMEDIA

Signal-processing capability is important because the heart of multimedia—algorithms that transform analog into digital data and compress it—run on DSPs. Although this is being done with DSP coprocessors hardwired for specific algorithms, general-purpose DSPs—and their programming—remain a mystery to C-language applications programmers.

But the glue to bond a familiar development environment such as Microsoft Windows with a DSP coprocessor board is about to land on the programmer's workbench. This year will see the appearance of DSP systems and subsystems that support the Open Signal Processing Architecture developed by Spectron Microsystems Corp., Santa Barbara, Calif., and Texas Instruments Inc., Houston. "Some sort of universal signal-processing architecture is

essential," says Marc Canter, founder of San Francisco-based MacroMind Inc., a leading multimedia software house. "The last thing that we want to do is microcode a DSP."

For his part, Canter will add another major piece to the multimedia jigsaw puzzle with MacroMind's animation package for Windows. Since the company's remarkable authoring system, MacroMind Director, runs on Apple Computer Inc.'s Macintosh, Canter's defection to the IBM platform, however limited, has special significance. "My future is in Windows," he says.

Spectron's OSPA has been endorsed by three of the four major DSP makers: TI, Motorola Inc., and Analog Devices Inc. Along with AT&T Microelectronics, which has withheld its endorsement, they account for 90% of the market. By supporting OSPA and Spectron's SPOX operating system for DSPs, the three chip makers provide a path for interoperable DSP-based products. Common algorithms can be disseminated by software vendors, and executing DSP functions becomes almost as simple as a procedure call from Windows. Spectron has already prototyped a multimedia platform that encodes and decodes audio sampled at 15 KHz, encodes and decodes color pictures using the CCITT's JPEG (Joint Photographic Experts Group) algorithm, and transmits and receives data over 9,600-baud phone lines using the CCITT's V.29 fax/modem protocol.

A somewhat similar concept—with the addition of video—has been announced by Fluent Machines Inc., Framingham, Mass. (see p. 49). Fluent's platform leapfrogs the Microsoft Windows-oriented spec by using OS/2 Presentation Manager and Intel Corp.'s Digital Video Interactive technology.

Although widespread use of video is somewhere off in the future for most corporate users, video output to tape is already the most common way of storing a multimedia document. On Jan. 10, Sony Corp. of America took an important first step in providing a standard for computer-to-video glue. Its video-interface box (VBOX) allows PCs to control Sony consumer-video peripherals such as video decks and 8-mm camcorders. In the past, outputting a multimedia document to video meant manually cueing all the video devices. "Anything Sony does is important," says MacroMind's Canter. "Right now, it supports just four speeds—stop, play, rewind, and fast-forward, but we think they will be adding variable-speed control."

VBOX is the first hardware implementation of Sony's Video System Control Architecture (Visca), a standard set of platform-independent command codes for synchronized computer control of video peripherals. The Visca command set is platform-independent and has been endorsed by Apple, MacroMind, and Farallon Computing Corp., Emeryville, Calif. Now that the VBOX hardware is available, software vendors can incorporate the video-write capability in their products.

IMAGE MANAGEMENT

The full implementation of sophisticated document management will be multimedia's growth path.

On the audio side, firms that make their mark in music synthesis—such as Voyetra Technology Corp., Pelham, N.Y.—are filling a similar void. In a strategy similar in concept to Spectron's OSPA, Voyetra has created an audio architecture for DOS-based PCs that reduces the application programmer's role to making simple C-language calls in the program. Voyetra's Multimedia Player application programmer's interface provides high-level function calls such as play, pause, and record. It sits between the application program and Voyetra's low-level drivers controlling music synthesizers, FM sound, and digital audio record/playback hardware.

With the DOS bases covered, Voyetra will soon roll out Multimedia Lite, a follow-on product for the Windows environment. "It is a slimmed-down version of Microsoft's Multimedia Windows 3.0," says president Carmine Bonanno. "Multimedia Windows is a very heavy-duty environment that will probably be issued on CD-ROM. Multimedia Lite will be for someone who only wants to add voice and music."

With its DOS drivers, Voyetra is addressing the low-end spec announced last November at the Microsoft Multimedia Developers' Conference. That document's chief architects were Microsoft and Tandy Corp., Fort Worth, Texas, for hardware, and Microsoft and IBM Corp. for software. But many other companies contributed as well. "These standards provide the necessary focus for software development," says John Roach, chairman of Tandy, "and still allow for innovation and product differentiation on the part of PC makers."

CD-ROM capability and Microsoft's Windows with multimedia extensions form the basis for the first generation of IBM-compatible multimedia systems. Otherwise, the minimum spec addresses a large installed base: a platform powered by an Intel 10-MHz 80286 with VGA graphics, 2 Mbytes of system memory, and a 30-Mbyte hard disk. The spec will become the bible of PC-clone manufacturers that include Tandy, AT&T Computer Systems, CompuAdd, Fujitsu America, NEC Technologies, and Zenith Data Systems.

Tandy's contribution to the multimedia jigsaw will be a low-cost CD-ROM drive that delivers a sustained data rate of 150 Kbytes/s, says Howard Elias, vice president of computer merchandising for Tandy's Radio Shack Division. The sustained data rate is needed to prevent audio from stuttering and moving images from blinking. Along with the new drive, Tandy will offer high-quality, high-fidelity sound, partially based on Voyetra's products.

In a business development of no less significance than all these technology glues, companies such as Autodesk Inc., Sausalito, Calif., have been fashioning solutions to the formidable systems-

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A New Way of Thinking

CIRCLE 173

integration problem that multimedia poses. Autodesk operates at the high end of the IBM-PC spectrum with professional tools such as Autodesk Animator and 3-D Studio. "You can't find a single store where you can buy [high-end] computer, audio, and video equipment," says Barry Dickman, general manager of Autodesk's Multimedia Division. "So there is a major problem of who is going to integrate it."

Autodesk is following the same strategy it used for AutoCAD, its PC-based computer-aided design software, by developing a sophisticated reseller channel. Sony, Apple, MacroMind, and Ingram/MicroD, the world's largest software distributor, are jointly looking at similar solutions in the Mac world, says MacroMind's Canter. At the market's low end, Radio Shack is well positioned because it handled audio and video components before ever getting into the computer business, says Elias.

MULTIMEDIA SOLUTIONS

* **T**andy's high-performance, low-cost CD-ROM drive delivers massive storage to computing for the common man.

* **M**acroMind looks to its future in Windows as a delivery platform.

* **AT&T** readies its network to handle the media blitz.

While many pieces of the multimedia puzzle seem to be falling into place, at least one element still has a ragged edge: disseminating the multimedia documents created at the desktop. The spotlight has fallen mostly on the platform and the problems inherent in modifying and upgrading it to handle multiple data types. But this perspective ignores a megatrend of the last half of the 1980s: networking.

Conventional local-area networks—even the high-speed Fiber Distributed Data Interface—may not be able to handle the media blitz. "LANs won't provide guaranteed bandwidth, satisfying response times, or wide enough connectivity," says Bill Warwick, president of AT&T Microelectronics, Berkeley Heights, N.J. "The telephone network is needed for the rich human interaction promised by multimedia."

Conventional LAN techniques such as collision detection/retransmission or token passing will ultimately cause noticeable data dropout in audio and video transmission, adds Arnold Englander, manager of multimedia market development for AT&T. The basic design criteria for a multimedia server—wide bandwidth along with uninterrupted connections—are already being addressed in the integrated services digital network. The synergy between ISDN and multimedia begins with the coherence between the 1.2-Mbit/s CD-ROM data rate and ISDN's 1.5-Mbit/s primary-rate interface. In AT&T's scenario, the multimedia server of the future should be a private branch exchange or even the telephone company's central-office switch. AT&T chip offerings will concentrate on signal processing, compression, and switching, says Englander.

Back in the world of the desktop, multimedia software development has fallen behind the pace of hardware advances. IBM, Apple, Tandy, Next Computer Inc., and most others with platforms are spending heavily to help software developers bring new applications on line. "We have discouraged simply augmenting existing programs with multimedia capability," says Tandy's Elias, "because they were created under very limited design criteria. Augmenting them gives a result that is usually not very compelling."

Meanwhile, chip makers are gearing up to deliver whatever performance software houses demand. C-Cube Microsystems Inc. in San Jose is at the epicenter of present-generation multimedia. Its hardwired DSPs that execute the JPEG algorithm for color-image compression support both still- and moving-image applications.

There is a trade-off at the system level between storage technology and image quality, notes Mauro Bonomi, C-Cube's product marketing manager. CD-ROM's relatively slow data rate requires high compression ratios, which mean relatively poor quality. "Today there is no programmable [DSP] solution that can deliver NTSC-quality at video rates," he says. "But in the future, programmability is very interesting."

Speaking of programmability, last year's joint-development agreement between Intel and PictureTel Corp., Peabody, Mass., a video-conferencing company, is a case in point. The team will create a chip that is as comfortable in a videophone as it is in a PC running DVI, says Pat Hayes, PictureTel's chief chip architect. Set for delivery in 1992, the full-custom chip will feature Intel's 80586 technology, a 32-bit architecture that executes 1 billion operations/s, and a $100 price tag. It will be a "system on a chip" that can execute the CCITT's Motion Picture Experts Group (MPEG) full-motion video standard in real time.

Meanwhile, TI, with more than 50% of the DSP market, has some ambitious plans of its own. "In the next 18 months, we will see multitasking systems that do audio, speech, video, and telephony simultaneously," says Rick Rinehart, manager of TI's floating-point DSP program. "But none of this technology is going to be used if it costs a lot." TI is aiming at under $30 a chip.

Its contribution to the puzzle—in conjunction with Spectron's DSP operating environment—will be to add telephony to Windows. TI also owns a big chunk of the graphics-chip market and Karl Guttag, a TI Fellow specializing in graphics, sees near-term, broad-market opportunities not so much in MacroMind-style animation as in document processing. The long-awaited paperless office will have a multimedia component, because it will include compound documents—text and bit-mapped images at the very least.

No systems house has a better grasp of the image market than Xerox Corp., and Jim Bair, manager of its Advanced Solutions Group in San Jose, has concluded that "image management is not a viable product standalone. Document management is the correct course."

The difference begins with the definition of document as a collection of information rather than a stand-alone image. It is also something that is constantly updated, not just stored and retrieved. This concept quickly escalates into the requirements of groupware, and the ability to browse through and query the document base. "All this requires a very friendly user interface," says Bair. Xerox is already implementing sophisticated document management at the high end. Augmenting that model with richer data types and putting it on a platform for the common man would be a worthy goal for multimedia.

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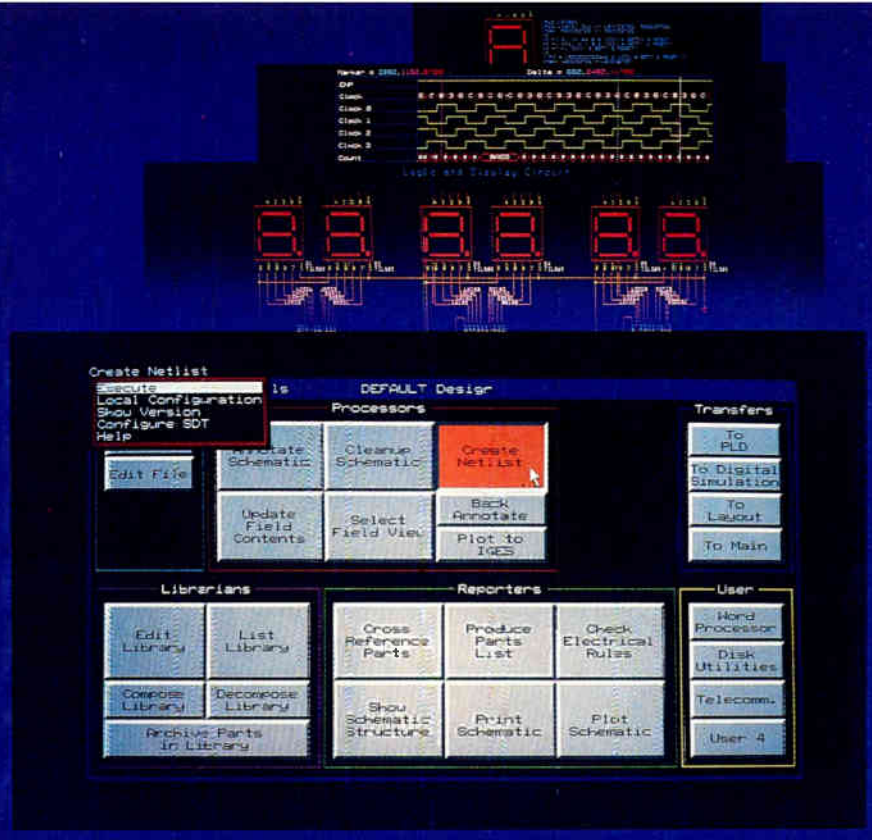

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CIRCLE 189

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CIRCLE 177

HERE'S AN INTEGRATED APPROACH TO MULTIMEDIA

FLUENT UNVEILS A PC SYSTEM THAT CAN DISTRIBUTE VIDEO AND SOUND OVER A NETWORK

BY LAWRENCE CURRAN

Until now, most approaches to bringing full-motion video and sound to desktop personal computers have involved parts of a total solution—an add-in board to enable the real-time display of video, or perhaps software to develop multimedia applications. Now comes Fluent Machines Inc., which is offering a whole lot more. The Framingham, Mass., start-up company is introducing what it calls a video system architecture, which for the first time brings full-motion digital video and sound to networked PCs as standard data types. The result is a PC that can process, display, and distribute video over a network as easily as it does text, numbers, and graphics.

MULTIMEDIA

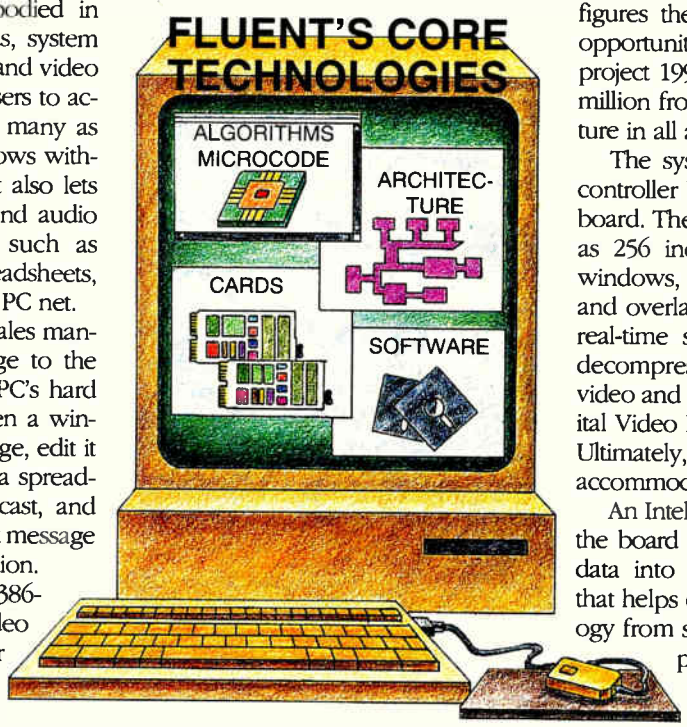
Fluent's architecture—embodied in two PC/AT-compatible boards, system software, development tools, and video application utilities—allows users to accept, process, and display as many as 256 simultaneous video windows without burdening the host PC. It also lets users integrate digital video and audio with standard applications, such as desktop publishing and spreadsheets, and distribute all of it across a PC net.

For example, a company sales manager can videotape a message to the sales force and store it on a PC's hard disk. He or she can then open a window and play back the message, edit it using a mouse, blend it with a spreadsheet detailing the sales forecast, and send the linked files with a text message to a worldwide sales organization.

The system runs on a 386-based PC that displays the video in OS/2 Presentation Manager windows. Users can install Fluent's system on their own PCs at a cost of $5,000 to $6,000 or buy a Fluent-preconfigured PC for around $20,000.

That's much more than the $700 to $2,000 commanded by video add-in boards today, but Fluent founder and president David Nelson stresses that "we won't be a board house. We intend to provide enabling technology for a range of customers from PC vendors to telecommunications and media companies." Fluent has already delivered systems to American Express Travel Related Services, Nynex, and FCB/Leber Katz Partners, among others.

The last is the New York office of the Foote, Cone and Belding advertising agency, which is developing a marketing workstation that integrates the agency's creative and analytical functions. Jeff Woll, senior vice president for strategic marketing systems at FCB/Leber Katz, explains that in a single session, a workstation user can analyze sales data in one window while viewing relevant commercials or focus-group discussions running simultaneously in others. "Fluent is helping us redefine how an ad agency can do its job," he says.



Fluent's architecture is embodied in two boards, software, development tools, and application utilities.

Fluent is aiming for applications in desktop video conferencing, video mail, and computer-based training, says Larry Pape, Fluent's vice president for marketing. He says the 1990 market for desktop video conferencing alone was some $330 million, a figure that will zoom to $1 billion in four years. Pape points out that the cost for a workstation to do that task is about $50,000; at less than $20,000 for Fluent's system on a PC, he figures the company has an excellent opportunity for growth. He and Nelson project 1991 revenues of more than $3 million from the video system architecture in all applications.

The system hardware consists of a controller board and a video-processor board. The controller supports as many as 256 independent full-motion color windows, which can be sized, clipped, and overlayed. The processor provides real-time symmetric compression and decompression of full-motion digital video and audio using Intel Corp.'s Digital Video Interactive (DVI) technology. Ultimately, says Nelson, the system will accommodate multiple standards.

An Intel i960 RISC microprocessor on the board multiplexes video and audio data into multiple streams, an ability that helps differentiate Fluent's technology from single-stream multimedia approaches, Pape says. The software includes tools that allow a user to record and play back video from a camera, VCR, or analog source. E

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CIRCLE 210

THE PATENT BATTLE TAKES AN UGLY TURN

THE CHIP INDUSTRY IS UP IN ARMS OVER TI'S PURSUIT OF INTELLECTUAL-PROPERTY RIGHTS AT THE ITC

BY SAMUEL WEBER

BUSINESS

Just as the battle of Waterloo was won on the playing fields of Eton, so may the future of the semiconductor industry be decided far from the ostensible battlefield of labs and fabs. U.S. chip makers, led by an aggressive Texas Instruments Inc., are nudging the arena of combat from the marketplace to the courtroom. Recent moves by TI to reap huge profits from its patents portfolio spotlight the growing contentiousness over intellectual property, resulting in ever more rancorous court fights over patent infringement.

Although many competitors denounce the TI offensive—"Irresponsible!" "An outrage!" and "Tantamount to extortion!" are among the epithets being hurled—others are haunting the courtroom corridors themselves. For example, Motorola Inc. recently grappled with Hitachi Ltd. over alleged patent infringement of a microprocessor design, and a clash between Intel Corp. and NEC Corp. resulted in a landmark ruling on the copyrightability of microcode.

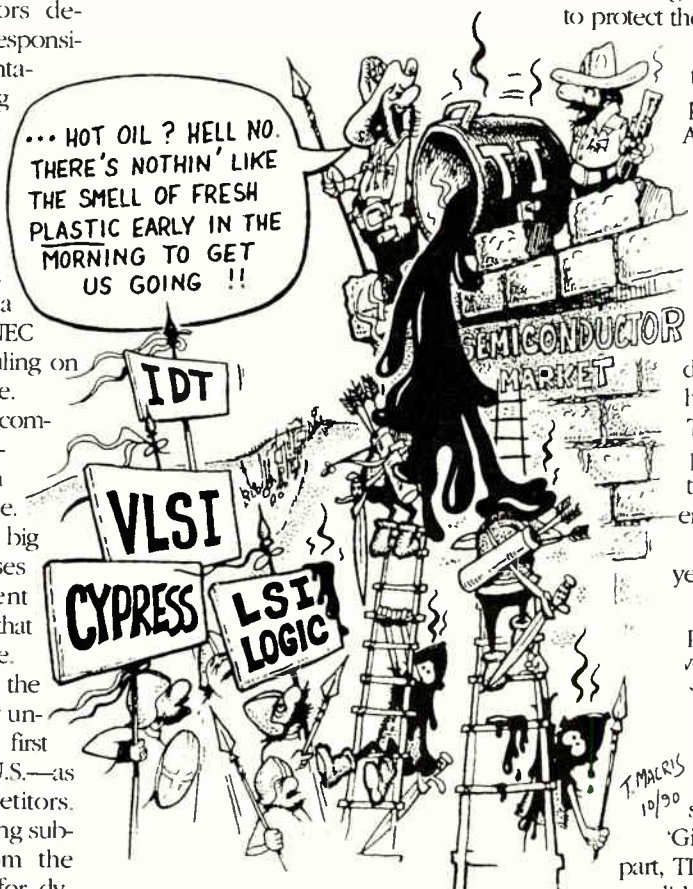
Now Intel is locked in bitter combat with Advanced Micro Devices Inc. and with Cyrix Corp. in separate suits over a related issue. And there are rumblings that the big Japanese semiconductor houses may be contemplating patent moves of their own, in the belief that the best defense is a good offense.

TI stands at the center of the storm, a position it gained not by unleashing its legal arsenal in the first place, but by unleashing it on U.S.—as opposed to Japanese—competitors. Flushed with success after winning substantial royalty payments from the Japanese for licensing patents for dynamic random-access memories, the company is now aiming its guns at U.S. chip makers, much to their dismay. TI's most deeply resented tactic is its pursuit of intellectual-property rights at the International Trade Commission in addition to the normal courtroom venue.

In yet another controversial move, the Dallas-based company is suing systems houses over the way microprocessors interact with computer systems. If its claim is upheld, it could mean that any manufacturer of a system using a microprocessor—it doesn't matter whose—would owe TI a royalty. The chip attack centers around TI's request to the ITC to impose restrictions on U.S. companies' importing of plastic-encapsulated integrated circuits under Section 337 of the U.S. Trade Act of 1930. Many U.S. firms ship their American-made wafers overseas for assembly and packaging, and then "import" them back again. And almost all vendors use the encapsulation method, which is apparently covered by TI-owned U.S. patent 4,043,027.

The original intent of Section 337 was to protect the U.S. industry from foreign competition by preventing the export to the U.S. of products that infringe on American patents. By applying it against U.S. firms, competitors say, TI is violating the spirit, if not the letter, of the law. The ITC gambit, they hold, is an attempt to strong-arm them into negotiating royalty deals or risk being put out of business by an import ban. TI is reportedly asking for a percentage—said to be between 2% and 3%—of revenues on chip sales.

"TI has a bunch of lawyers out of control," says T.J. Rodgers, the outspoken president and chief executive officer of Cypress Semiconductor Corp. of San Jose, Calif., one of the chip houses TI is attacking. "They have a gun in your stomach and are saying, 'Give me your wallet.'" For its part, TI justifies the ITC approach as a valid way to get a fast decision. There's no question that TI's mili-



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tant stance on intellectual property has paid off handsomely so far—so handsomely, in fact, that one source says royalties alone are keeping the $6.3 billion company profitable. "If not for the patent royalties, TI would be showing a huge loss, since profits from its regular operations have taken a nosedive," says the industry newsletter *TekBriefs*.

And some members of the financial community applaud the firm. "You're in business to maximize your value and you go with the flow," says Rick Whittington, a semiconductor analyst for Kidder, Peabody in New York. "This is a company that investors have loved to hate, because their management was seen in the past as not being very intelligent about maximizing returns. Now here they are maximizing returns and people are criticizing them. I think they are doing what they are supposed to do—create value for shareholders."

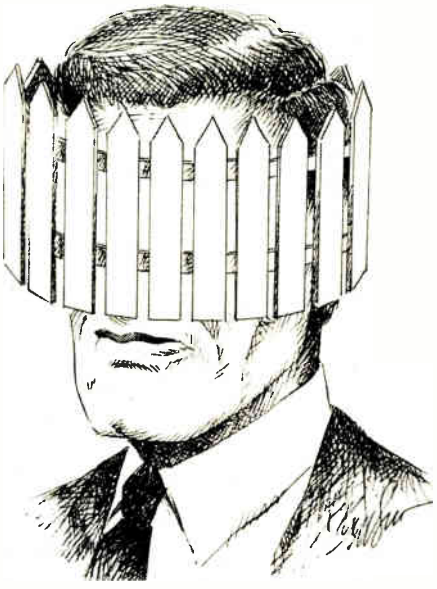
Claiming infringement by a host of companies of the more than 5,000 patents TI has accumulated over many years, the company has used a combination of litigation or the threat of it, and/or negotiation, to take in more than $600 million in royalties in the past five years. The figure could soon swell to $1 billion or more, in part because the DRAM licenses granted to Japanese companies—among them Fujitsu, Matsushita, Mitsubishi, Oki, Samsung, and Toshiba—must be renewed after 1990.

But the company is reaching far beyond DRAMs. The Japanese patent office recently upheld TI's basic "Kilby" patent, named for IC coinventor Jack Kilby, which covers fabrication technology for almost every step of semiconductor manufacturing. As a result, it's likely that TI will be collecting royalties on every IC made in Japan for the next 12 years, says Ken McKenzie, executive vice president of Teklicon, a Mountain View, Calif., consulting firm specializing in high-technology litigation matters and the publisher of *TekBriefs*.

Recently, TI and Toshiba Corp. concluded a broad-based, 10-year cross-license agreement by which Toshiba will pay TI royalties on worldwide sales of its semiconductors. Although the terms are confidential, the annual payments are expected to greatly exceed those TI received under the old agreement. Accords with the other Japanese manufacturers are still to come.

On the home front, in 1989 TI won a $38 million judgment against Micron Technology Inc., Boise, Idaho, after protracted litigation on the DRAM issue. Now it's broadening its sweep and going after five small, niche suppliers—Analog Devices, Cypress, Integrated Device Technology, LSI Logic, and VLSI Technology—on the plastic-packaging issue. TI is suing all five and simultaneously pursuing the ITC action.

On another front, TI's move against the systems houses could have even more profound ramifications. Claiming infringement of a group of eight patents relating to the interaction of microprocessors in computer systems and the di-



agnostic self-test procedure a system goes through when it boots up, TI has filed suit against Dell Computer, Zenith Data Systems, Samsung, and Daewoo, all makers of personal computers.

TI has successfully arranged cross-licensing agreements with IBM Corp. and Compaq Computer Corp., which "takes care of the broad majority of the IBM-compatible marketplace," says Stan Victor, a TI spokesman. "We've gone out to the other microcomputer systems companies and put them on notice they are using our patents. We have concluded agreements with Tandy Corp. and a Japanese firm that prefers not to be named." Oddly enough, Fort Worth, Texas-based Tandy, which earlier agreed to pay royalties based on these patents, has filed a suit against TI challenging the signed agreement.

There are a number of reasons why TI and other companies are now using their high-tech patent portfolios not only as a competitive weapon but also as a profit center. Perhaps nothing points so graphically to the dramatic changes in the semiconductor business in the last decade as the changed attitude toward intellectual property.

"If you go back to the late 1970s and early '80s," says Thomas Dunlap, general counsel for Intel in Santa Clara, Calif., "a new design then cost about $1 million. You could not get a patent held as infringed here in California at that time—for all practical purposes, the Ninth Circuit Court read patent protection out of the Constitution. So you had relatively low investment required for chip development and relatively weak intellectual-property protection."

But the tables have turned. "Now a design costs not $1 million but $100 million," Dunlap says. "Second, the copyright law was amended in 1980 to clearly cover computer programs, and the *Intel vs. NEC* case established that microcode can be protected under copyright law." Also, he says, "In 1984, Congress passed the Semiconductor Protection Act, which says you can't copy masks, and in 1985, a special Federal court for patents was established that has generally been much more favorable toward patent holders."

Intel, for its part, is embroiled with AMD in a bitter suit over microcode based on a 1976 license agreement between the two firms. AMD claims the contract grants it the use of Intel microcode; Intel concedes the point but says the microcode may be used only for internal purposes, not in products.

In specific contention is AMD's use of Intel microcode in its version of the 80287 math coprocessor, which it is second-sourcing. But there's more at stake: if AMD's claim is upheld, it will have carte blanche to use Intel microcode in its new Am386 microprocessor, a product that could threaten Intel's virtual monopoly on its extremely lucrative 80386 chip. Trial is set for April 15. In another twist, Intel recently filed a patent-infringement suit against Cyrix, based in Dallas, over its 80387 math coprocessor. Cyrix, for its part, is suing Intel for antitrust violations on the device.

Meanwhile, the howls of protest against the demands of Texas Instruments are gaining in decibels if not in immediate relief. The loudest and bitterest protests come from Cypress presi-

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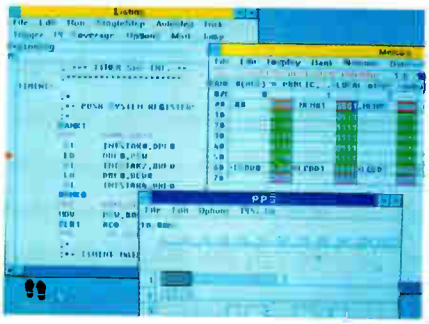

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CIRCLE 172

dent Rodgers. "Their [TI's encapsulation] patent, which was granted in 1963 on a transistor package, talks about where to put the hole to squirt plastic in a package," Rodgers says. "And the concept that that would allow them to take 2.5% of our revenue, and therefore have us forfeit a substantial portion of our profit, is a joke." He finds the ITC action especially galling. To Rodgers, the tactic smacks of punitive efforts to cut off a competitor's product flow, since the ITC cannot award monetary damages but may only recommend an exclusion order that the President must sign.

Rodgers maintains that the TI encapsulation patent is relatively easy to get around, and that Cypress and other companies fighting TI in court and at the ITC are changing their tooling at a cost of "only about $260,000. When we win this plastic thing," he says, "we'll make public for everybody's use the way to get around [the patent]."

Also outraged is Bruce Entin, vice president for investor relations at LSI Logic Corp., who calls TI's demands "tantamount to extortion." Says Entin, "It's a pity we're at the point where TI is litigating instead of innovating. We agree that intellectual property should be protected. We don't agree that you should lose perspective on it and use it as an extortion tactic to get excessive amounts of money. They are trying to railroad the industry with royalty demands that are far in excess of the value of the patents themselves."

OWN A PATENT? SUE!

- In the battle over intellectual property, the bone of contention is TI's moving the arena of combat from the courtroom to the ITC: it has brought action against five smaller vendors for allegedly infringing a packaging patent.

- The new wave of suits may have opened a Pandora's box; insiders say the Japanese multinationals are looking over their own patent portfolios.

Entin points out that "there are hundreds of steps for making semiconductors, and each step along the way has alternatives. They [TI] say the way you inject epoxy is something they can hold you up on, but that's only one small step out of a hundred, and the value of that is only a small amount. But," he says, "what they are demanding is a percentage of the overall selling price of the device."

Meanwhile, TI argues that the ITC is a proper venue for an intellectual-property dispute. According to TI's Victor, the ITC's time frame calls for resolving issues within a year. "So from the point of view of getting off the dime and getting something settled quickly, the ITC provides us with a forum to bring this issue to a head." In the courts, Victor points out, "after 12 months you're still in the process of discovery."

Victor also denies that TI is singling out any company or group of companies. "We expect all companies to abide by intellectual-property standards, and we're not going to apply it only to foreign companies but also domestic, large and small. Otherwise, we will be putting people at different cost advantages, and we have an ethical and moral responsibility to have an even-handed approach." As to the charge that the royalties TI is demanding are exorbitant, Victor says simply, "One of the principles you apply in negotiation for the value of a patent is, what does it cost to design around it. That is the basis of negotiations around the world in patent rights."

Meanwhile, there are murmurs that the Japanese may be considering a counteroffensive. "I think TI will rue the day that it woke the sleeping tiger," says Rodgers of Cypress. "Toshiba and Hitachi have thousands of patents, and if they decide to go to New York and hire some cantankerous lawyers, it will be a pretty sad day for everybody."

There are signs that the tiger is already on the prowl. Gary Summers, president of Teklicon, says his firm is signing up a lot of international clients. "The big conglomerates from Europe and Asia have been hiring us to protect them by doing what we call prelitigation research when confronted with a threat of a suit by U.S. corporations," he says. "They've asked us to evaluate the intellectual properties and see if we can invalidate them in some way."

They're also moving offensively, says Summers. "They are asking us to review

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their portfolio of U.S. patents. In the last five years, there has been a tremendous rush by the Asian companies to file for U.S. patents. We have just done a search here for some of the big ones like Hitachi, Mitsubishi, Toshiba, and Sony, and it would stagger you to know how many patents they have been granted in the last five years. We've been asked to look at their portfolios and select 20 or 50 of the most probable 'hits' and see by reverse-engineering of U.S. products if they can find infringement." If so, he says, "they'll then use this as a lever to negotiate favorable license settlements. They're not saying they're going out to sue somebody, they just want to be ready when they get sued or when someone strong-arms them."

Hitachi wielded just such a weapon last year in a case that proved embarrassing to Motorola. The brouhaha began when Motorola filed a suit claiming patent infringement and unfair competition, charging that Hitachi's H8 microprocessor infringed on four Motorola patents related to its own processor family. Hitachi then searched its own patent portfolio and found that Motorola was using a Hitachi invention—a content-addressable memory—in its 68030. Hitachi filed a counterclaim. Last March, a Federal judge ruled that both firms had infringed on each other's patents, urged the parties to settle the dispute between themselves, and—to the dismay of Motorola and some of its customers—enjoined both from selling their respective processors.

If allowed to stand, the injunction would have been disastrous for Motorola, which anticipated annual revenue of $600 million for the 68030, and for its customers, whom Teklicon says sold $3.5 billion worth of products containing the chip. The two companies announced a moratorium on their court battle and the dispute was settled out of court at undisclosed terms last October.

On a more positive note, Motorola recently received a handsome undisclosed settlement from Mitsubishi, in cash up front and royalties over the next five years, for use of Motorola microcontroller patents.

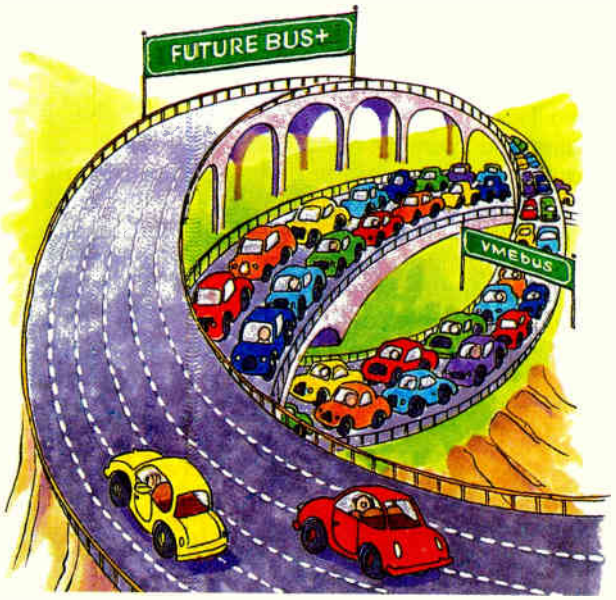
All this jostling and juggling of intellectual-property rights may ultimately cause trouble in ways not yet foreseen. "There's a smell to this," says Teklicon's Summers, "a smell of unfair competition or antitrust." To illustrate, he hypothesizes: "Suppose you're a semiconductor company and you make a microprocessor. And let's say it's the only place a systems house can go to get a processor. If all the semiconductor companies cross-license one another and have all these deals, then it's like a monopoly and the system guy will have to pay royalties no matter who he buys from."

Dunlap of Intel acknowledges what he calls a tension between intellectual-property and antitrust laws, but thinks there is an appropriate balance on the books. "On the one hand," he says, "intellectual-property rights give you protection for innovation, and on the other, they give you a limited monopoly. I believe Congress has balanced that appropriately and there is proper protection for these $100 million and $200 million chips. It really is up to the courts now to interpret these laws with respect to the current technology." E

NATIONAL CHIP SET UNCLOGS THE DATA HIGHWAY

THE FUTUREBUS+ OFFERING BROADENS THE BANDWIDTH OF ADVANCED COMPUTERS TO 3.2 GBYTES/S

BY LAWRENCE CURRAN



SEMICONDUCTORS

As microprocessor speeds soar ever higher, a mismatch has developed between computer central processors and their internal buses—the pipelines that move data around inside the system. Much of the CPU speed is dissipated at the backplane because bus bandwidths restrict data flow. But a standard called Futurebus+ greatly expands the pipelines, and now National Semiconductor Corp. is implementing the standard with a five-chip set.

Futurebus+ and the silicon that realizes it combine to break the throughput bottleneck in high-performance computers caused by the failure of such buses as Multibus and VMEbus to keep pace with microprocessor clock rates. Futurebus+ overcomes the problem—which involves driving a densely populated computer backplane—by specifying backplane-transistor logic (BTL) as part of the standard. BTL eliminates the transmission-line obstacles that have limited the speed of buses based on TTL.

Although the Futurebus+ standard probably won't be finalized by the Institute of Electrical and Electronics Engineers until late this year, the silicon specifications are all but set. A number of companies are expected to go after the Futurebus+ integrated circuit business, which is projected to grow from just $5 million this year to more than $200 million by 1994 as the silicon finds sockets in fast workstations, image processing, and multimedia systems. That's the estimate of National and Insight Onsite, a San Jose, Calif., research firm.

National's isn't the only Futurebus+ chip set that's reached the sampling stage. Texas Instruments Inc. and Philips Components-Signetics have chip sets designed as part of a joint-development and alternate-source agreement. Philips-Signetics has samples of first-silicon transceivers and expects second-silicon versions this quarter; controller parts are to debut in the second quarter. TI is aiming for midyear availability on its ICs.

But National, which announced its chip set late last month at the Buscon/West show, is believed to be further along than the others. The Santa Clara, Calif., company has samples of a fully functioning chip set, and has bagged at least 10 beta test sites and a dozen or more actual design wins, says Brian Gillings, director of marketing for the Interface and Peripherals Group. National will be in "full-blown production" by March, he adds.

National's Futurebus+ roots run deep. The company invented BTL and introduced it in 1985 in response to an IEEE requirement for higher-speed backplane-driving devices. National has been a major contributor to the evolution of the standard going back to the original P896 Futurebus Working Group established by the IEEE in 1979. And the company isn't stopping after these five chips. Gillings promises additional devices later this year.

BTL overcomes the substantial output capacitance typical of TTL transceivers used in a dense computer backplane. A Futurebus+ transceiver presents less than 5 pF of capacitance to the bus. That compares with 20 to 25 pF in a similar TTL-based system, and results in faster data transfers. Further, BTL uses a 1-V logic swing, against 2 to 3 V required for TTL. BTL reduces the drive current needed for switching, and also eliminates the settling-time delays typical of TTL-driven buses.

That all adds up to huge boosts in throughput to meet what the Futurebus+ standard specifies: an open multiprocessor bus architecture that can accommodate data words of 32 to 256 bits, addressing as much as 64 bits. It provides a system bus-to-backplane bandwidth ranging from 25 to 100 megatransfers/s. At 256 bits, 100 megatransfers/s means a bus bandwidth of 3.2 Gbytes/s. By contrast, VMEbus systems top out at 30 Mbytes/s.

The set consists of a bipolar 9-bit data transceiver, a CMOS arbitration device, and three biCMOS parts: a 9-bit latched data transceiver, a handshake transceiver, and a distributed arbitration transceiver. All but the CMOS device have BTL-compatible outputs, Gillings says. He adds that the chip set "provides a complete Futurebus+ solution when used with a protocol controller that's tailored to a specific host processor." E

THE 82532: A CHIP FOR ALL SEASONS

SIEMENS'S ENHANCED SERIAL COMMUNICATIONS CONTROLLER SET TO CONQUER DATA COMMUNICATIONS AND TELECOM

BY JOHN GOSCH

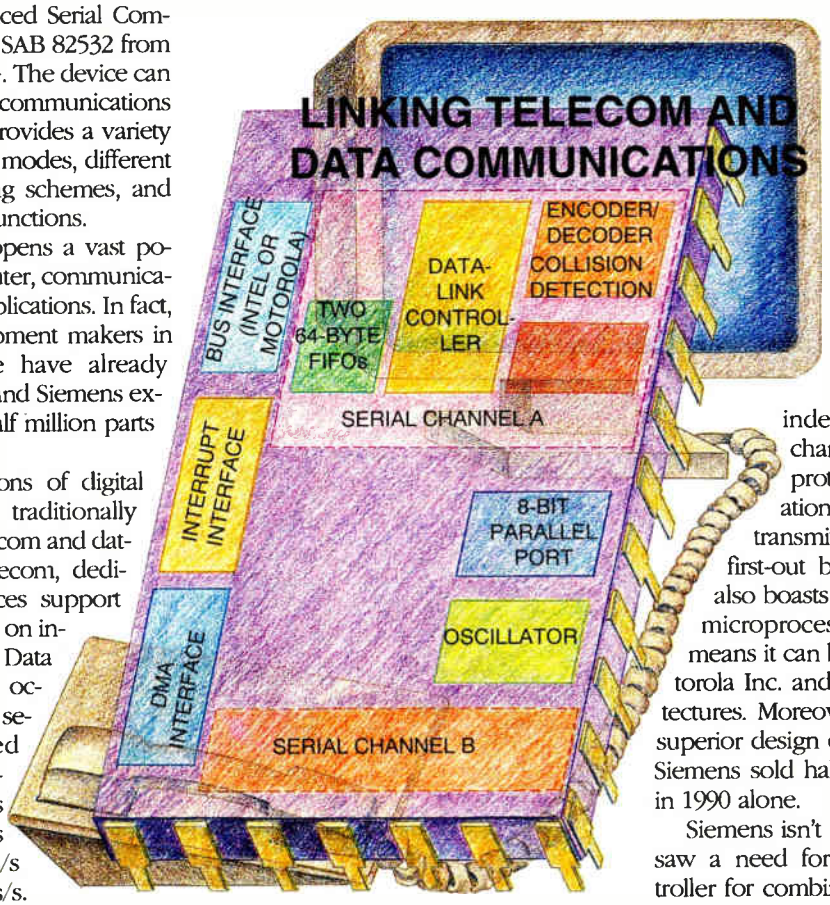
It's hard to draw the line these days between telecommunications and data communications. In today's mix-and-match world, a wide-area network might incorporate both standardized, telecom-specific devices transferring data at 64 Kbits/s and diverse, nonstandard serial communications lines and networks with different data rates and protocols.

This means there's a need for a versatile controller that can implement serial channels in any application. Satisfying this need is the Enhanced Serial Communications Controller SAB 82532 from Germany's Siemens AG. The device can be used for both data communications and telecom, since it provides a variety of operating and clock modes, different encoding and decoding schemes, and important supporting functions.

That combination opens a vast potential market in computer, communications, and industrial applications. In fact, a number of big equipment makers in the U.S. and Europe have already placed sizable orders, and Siemens expects to be selling a half million parts annually by 1992.

In serial transmissions of digital data, a distinction is traditionally made between the telecom and datacom domains. In telecom, dedicated peripheral devices support protocols mostly based on international standards. Data transfer at 64 Kbits/s occurs in time slots on a serial time-multiplexed link. Data communications, by contrast, uses a variety of data rates ranging from 300 bits/s to more than 10 Mbits/s. Protocols are often nonstandard or proprietary.

But with the merging of the two realms, more flexible communications controllers, like the 82532, become mandatory. The device marries the telecom features of Siemens's high-level HSCX serial communications controller for the integrated services digital network to the datacommunications features of the 8530 from Advanced Micro Devices Inc. That device has become the world standard for implementing serial channels for data transmission. The Siemens controller significantly improves on the 8530. Where that chip handles rates up to 19.2 Kbits/s using asynchronous protocols and 2 Mbits/s with synchronous protocols, the 82532 tackles data rates up to 2 Mbits/s in the asynchronous mode and 10 Mbits/s synchronous. Because of this, the Siemens chip "has prospects of becoming the successor of the ubiquitous 8530," says Pavel Karmazin, senior product marketing manager for datacommunications chips at the company's Semiconductor Group in Munich.



The 82532 marries ISDN features to the datacom capabilities of the industry-standard 8530.

Another attraction is the controller's aggressive pricing: $13 for the 2-Mbit/s version and $19.50 for the 10-Mbit/s type by 1992. Engineering samples are available now, and full production quantities will be out by summer.

The 82532 has two independent, full-duplex channels, provides multiprotocol, multimode operation, and features 64-byte transmit and receive first-in, first-out buffers per channel. It also boasts an adaptable 8-/16-bit microprocessor interface, which means it can be used with both Motorola Inc. and Intel Corp. bus architectures. Moreover, it draws upon the superior design of the HSCX, of which Siemens sold half a million worldwide in 1990 alone.

Siemens isn't the only company that saw a need for a multiprotocol controller for combined telecom and datacommunications applications. Similar products are being marketed by two

U.S. firms–Motorola Inc. with its 68302, which is designed mainly for telecom applications, and Zilog Inc. with its new 16C30, aimed mainly at datacom applications. But the Siemens controller outperforms both of them, Karmazin says.

For example, where the 82532 implements two serial channels, the Motorola 68302 implements three, Karmazin says. This means that the number of controllers required cannot be optimized for applications needing channel configurations of two or multiples of two. The Motorola device is also less suited for data tasks than the Siemens entry, Karmazin says, since it handles transfer rates only up to 500 Kbits/s. Furthermore, its system-bus interface is compatible only with the Motorola architecture, not with that of Intel.

Also, says Karmazin, neither of the two competing devices has on-chip logic for time-slot assignment or collision detection. Finally, one of the most serious drawbacks is in the FIFO buffer–the Motorola device has none, and the Zilog part has a 32-byte FIFO (per channel and per direction), against 64 bytes for the Siemens controller. This reduces controller performance on both the system-bus side and the serial interface, Siemens says.

A number of big U.S. computer and communications firms will use the 82532 in their equipment and have already placed orders, leading to Karmazin's prediction of 500,000-unit sales in 1992. Among the American customers are some that are now setting up manufacturing plants in Europe in order to be within the Single European Market that is to become a reality by the end of 1992. "They want a European firm that can deliver controllers meeting not only American but also European requirements," he says.

The systems houses will be using the device for a wide range of jobs. Datacom applications are in office computers, workstations with the X.25 interface, asynchronous terminal clusters, and in large systems, where the controller can be used for internal communication between subsystems. The device is also suited for multiprotocol communication cards for general networking, primary-rate interface cards, bridges and gateways, telemetry systems, terminal multiplexers and servers, and various multimaster configurations.

No less versatile is the 82532 in telecom applications. It not only performs functions such as data-packet assembly/disassembly or central signaling in public switched networks, but also handles many tasks in private networks using time-slotted packet transfer. In primary-rate interfaces, the controller can transfer signaling data or implement serial data channels. Furthermore, it can be used in ISDN terminals. High-volume applications are also in base stations for digital mobile radio.

FAST COMMUNICATIONS

- **S**iemens's SAB 82532 controller chip is a milestone in high-speed communications.
- **I**t offers a large profile of protocol options at transfer rates up to 10 Mbits/s for each of its two independent channels.
- **W**ith its flexible 8-/16-bit bus interface, the 82532 adapts to either Intel or Motorola processors.

The 82532's two full-duplex serial channels are entirely independent of each other, which facilitates software design. Either channel supports various data communication protocols such as asynchronous data transfer, synchronous character- or byte-oriented transfer, and diverse bit-oriented high-level data-link control (HDLC) transfers. The device performs special functions such as back-to-back, or shared-flag, transmission, which is necessary for high-speed data communications.

The controller can be programmed for four different operating modes: auto and nonauto, transparent, and extended transparent. In each case the extent of the protocol support depends on the operating mode selected. It also supports all common data-encoding and decoding schemes: nonreturn-to-zero, NRZ-I (inverted), biphase space and biphase mark, and Manchester.

Either channel has a fast digital phase-locked loop (DPLL) to recover the synchronous bit clock from the incoming data stream up to 2 Mbits/s without the need for separate synchronous information on auxiliary lines. Siemens is now developing controllers with a DPLL for 4 Mbits/s. Such fast clock recovery allows the 82532 to be used in optical-data transmission applications. For synchronization purposes, the controller sends a programmable preamble with a selectable number of repetitions (up to eight).

The 82532 performs a number of functions that till now could be implemented only with complementary glue logic. What's more, the flexible and fast microprocessor interface means the device can be attached to 8- or 16-bit multiplexed or demultiplexed buses.

Data exchange is possible in the interrupt mode, but the direct memory access (DMA) mode considerably increases the throughput. A four-channel DMA interface with one request line for each transmitter and receiver on both serial channels supports fast transfers from and to the 82532. The DMA mode, together with the large 64-byte FIFO buffer for each channel and each transfer direction, decouples the 82532 from the central processing unit. The latter is thus relieved from critical reaction times and from any considerable loading at the serial interface side.

When used in point-to-multipoint configurations, the 82532 supports both the master/slave and multimaster architecture by way of collision detection and resolution. Collision resolution is of a deterministic type (carrier-sense multiple-access/collision detection) and allows the parallel connection of any number of stations on a common serial bus.

To facilitate system integration, Siemens offers an inexpensive evaluation kit, the EASY532. It consists of a PC-AT add-on card as well as the appropriate software and technical manuals.

The device uses Siemens's ACMOS5 advanced CMOS 1.0-µm technology and is housed in a compact 68-pin plastic-leaded chip carrier for surface mounting. The power consumption is a mere 50 mW at 2 Mbits/s. Engineering samples are available now and production quantities will be on the market by early this summer, Karmazin says

As a companion device to the two-channel 82532, Siemens is now designing the software-compatible eight-channel version SAB 82538. It integrates four SAB 82532s on a single chip. Cutting board space and minimizing power consumption—to only 120 mW for eight channels—this device will be housed in a QFP-160 (quad-flat pack with 160 pins) package. Engineering samples will be offered in the fall.

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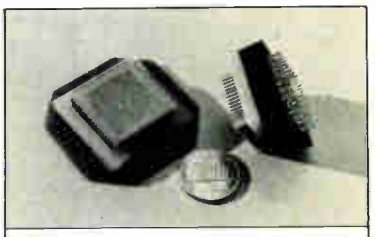

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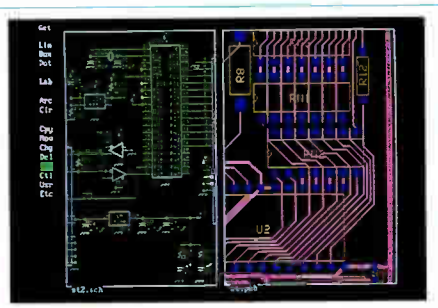

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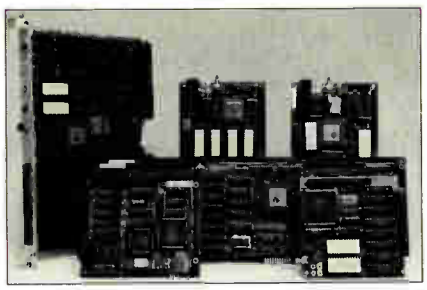

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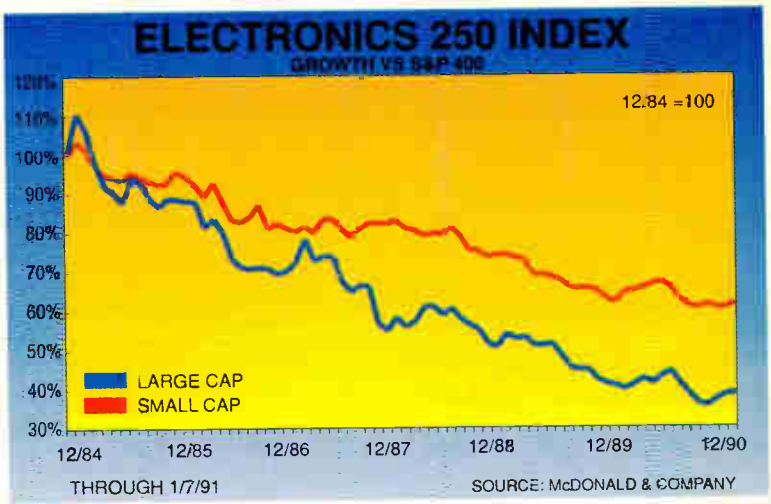
SLUMP, WAR: UNCERTAINTY IS THE WORD



Growth for companies capitalized at $500 million or more as well as for smaller ones registered a slight gain in December.

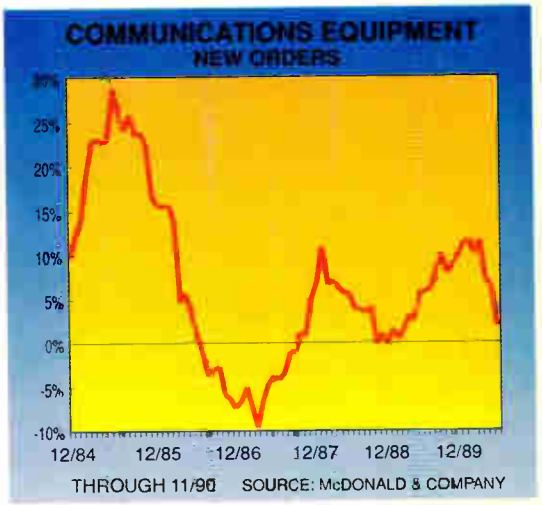
It's likely that the recession will be extended, and the upswing, when it comes, will be weak. As of Jan. 16, the day the Persian Gulf crisis became the Persian Gulf war, belts were being tightened everywhere. The results: real GNP for 1990's fourth quarter could decline as much as 3%, leading indicators continue to slide, and unemployment is increasing.

The electronics industry has not been immune. Order momentum has turned down decisively for computers, components, communications equipment, and instrumentation. As inventories rapidly fall, companies are betting that things are going to get worse before they get better. On the flip side of the cycle, though the economy in general could see a shallow rebound, lower electronics inventories now presage a stronger than average industry recovery for sales, earnings, and stock prices.

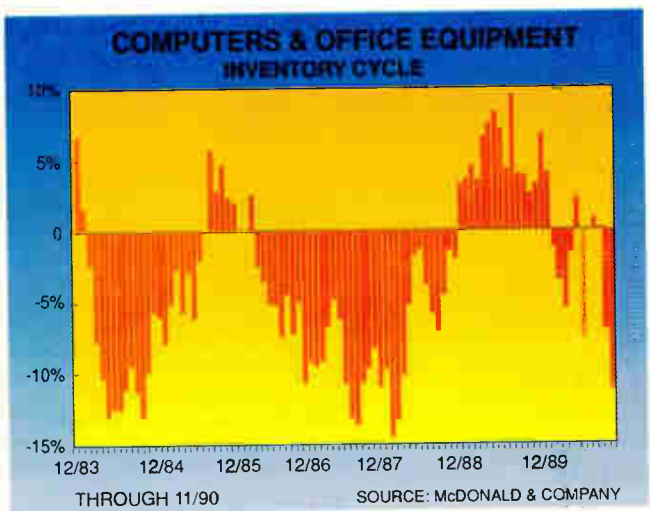
At the same time, the government has lost much of the flexibility needed to help stimulate the economy out of a recession. Foreign governments have been net sellers of U.S. securities, making it difficult to reduce interest rates. The budget deficit could exceed $300 billion this year—and that's not including the estimated $500 billion needed to bail out the savings and loan industry or the billions of dollars that must be expended for Operation Desert Storm.

Connector makers don't anticipate anything close to the first-quarter seasonal surge, but changes in the Middle East scenario could release a lot of pent-up demand in fairly short order. For mainframes, new cycles and a weak dollar will help this year. And pent-up auto demand has been building for at least six months, which further enhances growth potential over the next 12 to 18 months for this key electronics market. E

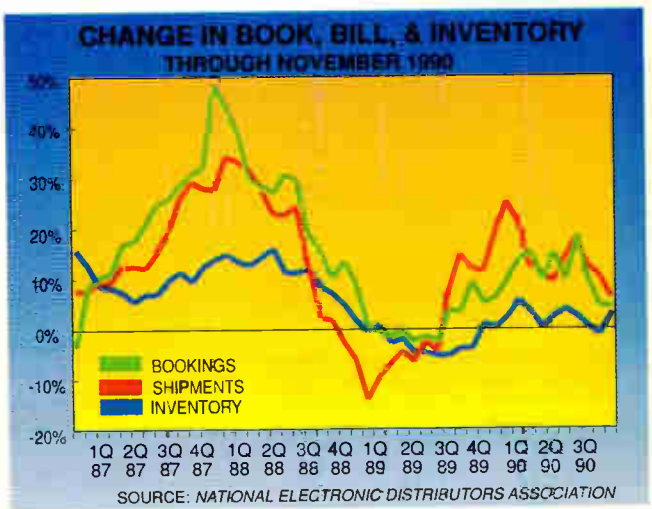
By Mark Parr, McDonald Securities Inc., Cleveland (216-443-2379)



Orders for communications equipment continued to slide as the new year began.



Inventories for computers and office equipment continued to show negative growth as the recession hardens.



Book, bill, and inventory figures are slouching toward parity as users tighten their belts.

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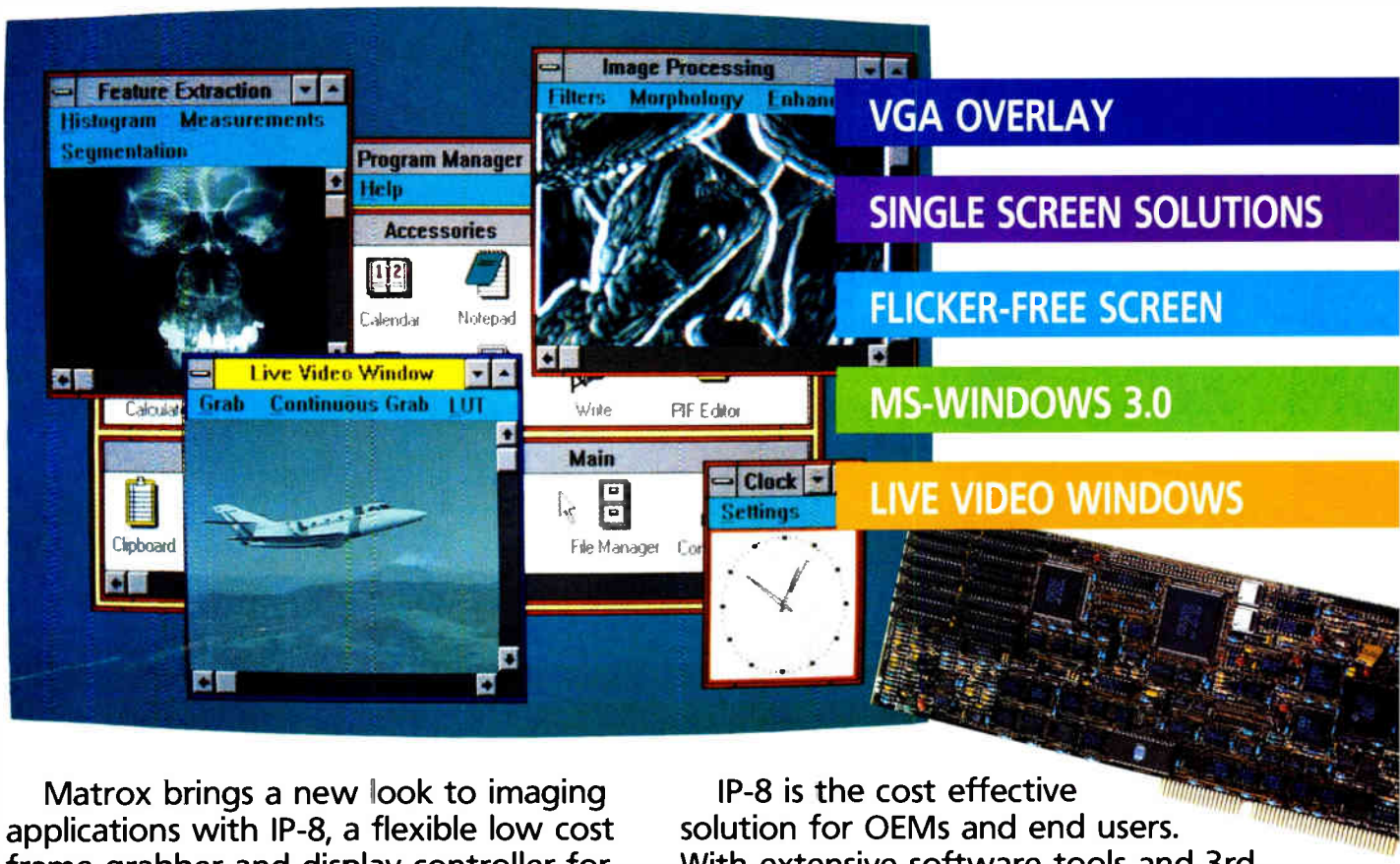

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