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MICRO-
ELECTRONICS
MONITOR

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Distributed free to a targeted audience in developing countries

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I. NEWS AND EVENTS

Computers sold with "stolen" software

People who sell second-hand computers should make sure they know what is stored in memory, or face possible prosecution.

Sales of second-hand computers are booming, as companies go bankrupt or buy newer models. Often the computer has a hard disc already loaded with software.

A recent court action began when Surrey (UK) trading standards officers went to an auction and found computers illegally preloaded with a range of business software and seized them. The liquidators, based in London, pleaded guilty under the Trade Descriptions Act 1968 and Copyright, Designs and Patents Act 1988, and were fined £4,314.

A few companies prohibit any resale of their software. Most software companies, however, allow resale if their programs are sold complete with the original printed manuals and original floppy discs. Many computers now reaching the second-hand market have no discs or manuals to accompany the software. Often the first owner or reseller retains the originals.

"Anyone buying a second-hand computer must insist on getting all the software manuals as well. Without a manual the software is of little use," says the chief executive of FAST, Bob Hay. FAST, the Federation Against Software Theft is now spreading its net wider, from auctions and shops specializing in second-hand computers, to car boot sales. Although the Federation needs a court order to seize goods from business premises, under the 1988 Act, FAST can go to a street market or car boot sale with an agent of the copyright owner and seize infringing goods. The police usually go along too, to prevent what FAST describes as "any breach of the peace". (This first appeared in New Scientist, London, 25 July 1992, the weekly review of science and technology.)

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To access UNESBIB on ECHO, to obtain documentation and a free password, please contact: ECHO, BP 2373, L-1023 Luxembourg GD. Fax: +352 488040. (Source: UNISIST Newsletter, No. 4, 1992)

New department focuses on economic and social statistics

The Secretary-General of the United Nations has decided to establish a new department at the Organization's New York Headquarters, the Department of Economic and Social Information and Policy Analysis.

The new department will focus on the compilation and dissemination of economic and social statistics; the analysis of long-term trends, including population trends; the elaboration of projections; the monitoring and assessment, from a global perspective, of economic and social policies; and the identification of new and emerging issues requiring attention by the international community.

The department will serve as the lead unit for economic and social information within the United Nations, and will provide statistical support to all parts of the Organization. Mr. Jean-Claude Milleron of France has been appointed as the Under-Secretary-General to head the new department. (Source: United Nations document SG/A/516, 4 December 1992)

Optical cable venture to link Asian countries

In collaboration with 10 other countries, Taiwan will become the core of an optical cable network spanning 26,000 kilometres around the Asia-Pacific area by the end of the century.

The 10 countries to be connected with Taiwan through this network are Japan, the Republic of Korea, Singapore, Hong Kong, Malaysia, Indonesia, Thailand, Brunei, the Philippines and Guam.

In addition to facilitating telecommunications among the 11 countries, the network will serve as their joint conduit for telecommunications linkage with other parts of the world. Construction is expected to start in 1993 and finish around 1997. (Source: Electronics, 14 December 1992)

EC's programme to end telephone monopolies given a boost

European Commission attempts to end national telephone monopolies by obliging Governments to accept competition from private operators has won the backing of the European Court of Justice.

In November 1992, the Court threw out a challenge by the Governments of France, Italy, Spain and Belgium, which claimed that the Commission was acting illegally.

In 1990, the Commission ordered the national administrations in these countries to allow private firms to compete for services such as databases and electronic mail.

The countries complained that the Commission had bypassed normal EC procedures by ordering the break-up of national monopolies without consulting the EC Council of Ministers. But the Court ruled that the Commission was entitled to act directly under the EC's founding Treaty. However, the Commission was not justified in ordering Governments to cancel or renegotiate long-term contracts concluded by their State-owned telephone companies before 1990. Most of these contracts are for dedicated data lines for large corporations. (Source: *Electronics*, 14 December 1992)

Radio filters combat overcrowded airwaves

Overcrowding of the radio frequency spectrum coupled with the introduction in Europe of strict legislation on electromagnetic susceptibility and spurious emission has highlighted a need for simple, stable and economic filtering components.

To meet that need, Racal MESL of Edinburgh has set up a custom design team that can design to order multipole ceramic radio frequency filters that can be manufactured in production volumes for less than £1 a pole. The company can produce band-pass and band-stop filters for application at frequencies between 300MHz and 4GHz whose characteristics can be precisely matched for temperature stability, centre frequency and pass or stop band notch width.

Low-cost physically small filters will be needed for use in mobile communications handsets, wireless LANs, cable TV networks and consumer equipment such as satellite decoders.

The company has recently designed a filter that will be used with domestic video recorders to prevent interference from terrestrial TV broadcasts in channels 35 and 37 that are scheduled to start in the UK in 1993. (Extracted from *Electronics Weekly*, 11 November 1992)

Next phase in automotive electronics discussed

Leaders from the automotive industry world-wide, along with their semiconductor suppliers, gathered in Dearborn (Mich.) in October 1992 to accelerate the next phase in automotive electronics. Meeting at the biennial International Congress on Transportation Electronics, known as Convergence '92, industry officials sat down to tackle the following issues:

Pushing function-specific controllers such as those for engines and transmissions into another level of semiconductor integration to reap new cost benefits from integrated-circuit technology.

Increasing the use of bus architectures to replace conventional wiring harnesses and the large number of connectors throughout an automobile to improve reliability.

Incorporating silicon-based sensors throughout the car on a broad basis. There is a growing interest on the part of the automotive industry in acceleration sensors, also known as accelerometers, for use in the air-bag system.

Making gallium-arsenide-based global-positioning-system receivers for use in mobile navigational systems a low-cost reality.

Eliminating the roadblocks now impeding the proliferation of electric vehicles.

However, concern about costs in the lingering recession and the need to keep a close eye on reliability contribute to a reluctance from the automotive industry to incorporate unproven electronics technologies into their products. (Extracted from *Electronic Engineering Times*, 26 October 1992)

US firms develop digital transmission

US satellite broadcast and video compression specialists Oak Technology, C-Cube and Leitch are working on a new transmission technology that will allow a 270MBit s digital television channel to be carried over a 24Mbit s satellite channel.

While Europe wrestles with the hybrid analog D2MAC satellite broadcast format, US development is aiming for full digital transmission.

The work will ensure that the development of digital compression protocols within the ISO's MPEG standards group are fully compatible with satellite transmission systems.

Without compression a 270Mbit s video signal would require as many as six transponders. With compression it is reduced to a 3.5Mbit s standard

transmission quality video signal. (Source: *Electronics Weekly*, 28 October 1992)

Duo cut lead poisoning threat

Two companies have introduced products aimed at reducing the potential threat of lead poisoning among electronics industry workers, in response to EC health and safety at work directives due to come into force in 1993.

Lead-based dust can be released by de-drossing operations during wave soldering. It settles on machine surfaces and adjacent work spaces, creating a toxic coating. Exposure to even small amounts of lead over a prolonged period can constitute a health hazard.

Specially prepared swabs, called LeadChek swabs from the Solder Connection in Lydney, Gloucester, (UK) can detect lead contamination. They are actuated by squeezing a cartridge at two marked points. They are then shaken to mix the contents, and the test area is rubbed for 30 seconds.

If lead is present, the swab's cotton tip turns pink. This test can detect as little as 2 microgrammes of lead on a variety of materials and surfaces.

Alternatively, a "lead-safe" wire solder has been produced by AIM Products. This reduces the hazard for operators using hand soldering irons. It is sold in the UK by Dage, of Aylesbury, Bucks.

The pure tin cored wire is filled with a paste, containing a tin-lead alloy, which results in a 63/37 alloy in the solder fillet when it is melted. The external coating of pure tin prevents contact with lead during the soldering process.

The wire solder can be used in all manual uses or automated soldering machines, which are cored wire solder, without any changes to operating procedures. It meets US Federal OO571 and Mil 2000 soldering specifications. (Source: *Electronics Weekly*, 28 October 1992)

Health hazard

Women who were exposed to two chemicals used in semiconductor manufacturing had a higher risk of miscarriage, according to a study by John Hopkins University that was commissioned by IBM. The chemicals are diethylene glycol dimethyl ether and ethylene glycol monoethyl ether acetate. They are used as solvents during the wafer etching process. The study examined the case histories of 30 women who worked with the chemicals at two IBM plants and became pregnant. Ten of the women, or 33.3 per cent, miscarried. Even though the number of women studied was small, the researchers concluded that there is a significant link between the women's miscarriages and their exposure to the chemicals.

Several other technology companies have issued warnings about the chemicals recently, although none have ceased using them. However, several chip manufacturers have offered alternative positions to workers who are worried about the chemicals. Thousands of workers may have been exposed to the chemicals, which are also used in other industries, such as printing and aerospace. (Extracted from *New York Times*, 12 October 1992)

Metacenter to link supercomputers

At a supercomputing meeting in Minneapolis, in November 1992, a group of collaborating computer scientists from each of the US National Science Foundation (NSF)-funded supercomputing centres announced a new concept in linking computers, the Metacenter, which will be a disembodied system of procedures and protocols that will enable researchers with computational problems to tap into virtually any of the many machines already available at the supercomputing centres.

Hooking the machines into the Metacenter should enable users to get more thorough answers faster than in the past, because of "heterogeneous computing", a scheme in which multiple computers work on a single problem, each solving the part for which its architecture is best suited.

Of course, there is plenty to do before the Metacenter will be all it can be. (Extracted with permission from *Science*, Vol. 258, 4 December 1992)

Europe takes parallel lead

Europe is ahead of the rest of the world in fast parallel computing for commercial applications. A cabinet-sized system will be on the market by the mid-nineties.

The computer has been developed as an EC ESPRIT project (European Declarative Systems - EDS), and the consortium involved includes ICL, Bull, Siemens, and the European Computer Industry Research Centre.

Europe's efforts in supercomputing have already come in for criticism in a report published by an EC advisory committee on High Performance Computing and Networking.

EDS uses up to 256 processors based on the Sparc microprocessor, each one running at 60 million instructions per second. The relational database server can handle complex commercial queries, which have only been processed using slower mainframe computers to date.

Warwick University has been chosen to be the leading academic partner in an ESPRIT project to determine future benchmarks for European parallel computers. (Source: *Electronics Weekly*, 2 December 1992)

GaAs gives CMOS run for money

Gallium arsenide (GaAs) will soon be cost competitive with CMOS for making standard products such as PC glue logic and field programmable gate arrays (FPGAs), according to US GaAs specialist Vitesse Semiconductor.

Vitesse reckons GaAs technology will increasingly be used to make standard high-density digital chips rather than its traditional role as a high-cost process for rf and microwave components.

The company's first GaAs xx86 micro-peripheral - a cache controller - will be sampled in early 1993 and will be manufactured in production volumes in Q2. (Extracted from *Electronics Weekly*, 18 November 1992)

Environmental emphasis at Semicon/Southwest

One of the surprising successes at the recent Semicon/Southwest Show was the Environmental Green Exhibit, sponsored by SEMI and SEMATECH.

Gas treatment

Processing and treating gas to prevent the exhaust of materials into the atmosphere was highlighted in the exhibits of seven different companies. These efforts included the development of gas cabinet effluent treatment systems, gas systems for exhaust gas management that use dry resins to convert exhaust into waste that can be disposed of safely, the development of gas reactor columns to convert plasma etching exhaust into a solid mass and the plant wide use of scrubbers, gas handling, monitoring and disposal systems.

Acid reprocessing

Sulphuric and hydrofluoric acid waste disposal is a major concern by many manufacturers. Therefore it is significant that several exhibitors identified that through acid reprocessing, over 90 per cent of the acid waste and disposal problem can be eliminated. Another approach exhibited was the reduction of the use of conventional "piranha" strippers and cleaners by the use of substitute materials such as Caro's acid that consists of a stabilized solution of sulphric acid and hydrogen peroxide.

Seals

It was also demonstrated that gas leaks can be minimized or halted by using magnetic liquid seals that not only prevent gas leaks into the atmosphere, but do not degrade and thus contaminate process chemicals.

Research, standards and public communications

Developing an industry-wide environmental agenda involves not only considerable research into new chemicals, processing techniques and equipment, but requires the development of various types of standards, databases and environmental models. Such efforts were exhibited by SEMATECH, SEMI and MCC. Also maintaining a positive image is very important, particularly because of the many hazardous materials that are inherent in the production of semiconductors. Therefore public communications programmes, such as conducted by the Chemical Manufacturers Associations' Responsible Care programme and described in the Airco Gas exhibit, are essential.

CFC and TCA elimination

The reduction in the use of ozone depleting trichloroethane and chlorofluorocarbons was also highlighted by several exhibitors and was the reason for the development of such products as Olin Hunt's ESC-96 and Schumacher/Intel's Trans-LC. ESC-96 degrades completely in the lower atmosphere to safe compound. Similarly Trans-LC is an alternate to TCA that has a half lifetime of less than four days. Also changing hardware and procedural changes make possible the use of non-CFC solvents. Changing of manufacturing processes can have a significant effect on stopping ozone depletion as identified by 3M who changed its manufacturing methods and between its two exhibiting divisions has eliminated the generation of over 1,000,000 pounds of emissions and hazardous waste.

Safe chemicals, materials

Although the ozone depleting chemicals get most of the headlines other materials are equally important. For example two alternate solvents for use in positive photoresists were developed in response to concerns over the effects on human respiration and genetics of EG-MEA (UCB-JSR).

Miscellaneous

Other environmentally oriented displays included: Cybeq's special adhesive tapes that eliminate the need for solvents and hazardous chemicals in the backgrinding process; EKC technology's photoresist recycling programme; FAS Technologies' fluid dispensing systems that reduce chemical waste; Memtek's cross flow microfiltration products that produce less wastewater and reduce solid wastes by 75 per cent; NOW Technologies' reusable chemical container that reduces solid waste; and Santa Clara Plastics' vapour jet dryer that reduces IPA fab emissions dramatically. (Reprinted with permission from *Semiconductor International Magazine*,

CHC emissions curtailment

AT&T has gone back to nature in a move to curtail chlorohydrocarbon (CHC) emissions in its multichip module fabrication. CHCs, like chloro-fluorocarbons, are said to deplete the earth's ozone layer.

Instead, the company has developed a manufacturing process using a solvent found in cantaloups and other fruits to replace 1,1,1-trichloroethane, a CHC. Known as n-butyl butyrate, a chemical frequently used to flavour gum, the solvent is recyclable via distillation.

AT&T began using n-butyl butyrate at the end of 1991 for making its Polyhic polymer substrates.

Use of the solvent was tested over the past two years at AT&T's Merimack Valley Works and Bell Laboratories. AT&T is buying the chemical in synthetic form, a spokesman said.

The process, which uses the new solvent, works like this: wafers, coated with a patented AT&T material, are imaged using a photomask. The n-butyl butyrate is then sprayed onto the wafer to dissolve the unexposed photoresist, revealing a sharply defined pattern.

AT&T earlier developed a cleaning solvent named BIOACT EC-7, derived from orange peels and a water-soluble flux for PC boards. (Reprinted with permission from *Semiconductor International Magazine*, February 1993. Copyright 1993 by Cahners Publishing Co., Des Plaines, Ill., USA)

UNDP debates Tumen River telecom project

In a meeting held in Seoul at the end of January, UNDP proposed the plan to develop telecommunications in the Tumen River district, where telecommunications facilities are underdeveloped. The district follows the river through the Democratic People's Republic of Korea, China and Russia.

The plan includes the establishment of a direct Seoul-P'yongyang link with 30 channel capacity. UNDP says the line, if established, will be linked to Vladivostok in Russia's Tumen River district, and later, to the Trans-Siberian Line (TSL), which is now under construction.

The Democratic People's Republic of Korea's delegates also say their country and China are discussing the establishment of a microwave communication network linking both countries, for which the Democratic People's Republic of Korea is suggesting 30-channel capacity, while China is offering 45 channels.

The UNDP's plan also includes the installation of a 30,000-circuit line digital exchange in Najin and Songong, the Democratic People's Republic of Korea, and a 20,000-line exchange in Hunchun, China and Slavank, Russia.

Sixteen representatives from the two Koreas, Mongolia, China, Russia and UNDP agreed upon the basic direction of the plan. (Source: *Electronics*, 8 February 1993)

II. NEW DEVELOPMENTS

Hitachi succeeds in superconducting device operation test

Hitachi Ltd. has succeeded for the first time in the world in a test of superconducting device operation. Consisting of a combination of a superconductor and a semiconductor, the device utilizes electron quantum effects to implement functions, which have required several dozen to several hundred conventional silicon devices.

The experimental device has a 0.08 μm wide needle-shaped electrode and a 0.8 μm wide niobium opposing electrode on a silicon substrate, separated by a 0.1 μm. There is a poly-Si gate electrode between them. The electrons emitted by the needle electrode are reflected from the interface between the opposing electrode and the Si substrate, and converge on the needle electrode again through the same paths. The opposing electrode has a stepped structure, so that when the electrons converge on the needle electrode a phase difference is generated between those reflected by the convex portions and the concave portions. This phase difference causes an interference between converging electron waves, the intensity of which can be detected by the current flowing between the superconducting electrodes. The voltage of the gate electrode can be used to vary the phase difference, and thereby control the interference. This principle of the device was verified by interference control at -271° C.

The device is provided with a function to control input of electron waves and thereby current output, making it possible for the device itself to execute sum operations. Hitachi claims the device will be able to execute sum, weighted addition and other complex operations. (Reprinted with permission from *Semiconductor International Magazine*, October 1992. Copyright 1992 by Cahners Publishing Co., Des Plaines, Ill., USA)

Microprocessors

Eager to pack extra power into their processors, chip makers are stuffing them with more and more transistors. Two decades ago firms making

microprocessors, the calculating engines within computers, were lucky to fit 5,000 transistors on a chip. Now the Intel 486DX, found in the most powerful PCs, has 1.2 m of them huddled on its 78 square millimetres of surface. Its successor, the Pentium, will accommodate 3.2 m.

Putting ever more, ever smaller transistors on a chip brings two advantages: speed and speed. The smaller the transistor, the shorter the distance electrons within it have to travel, hence the faster it can switch from one state to another and by crowding transistors together, the distance that signals must travel between them is cut, increasing speed still further.

These advantages come at a cost. The more tightly transistors are packed, the greater the microprocessor's "current density" - the amount of electricity rushing around its circuits. As it flows, some of this current leaks out. In small doses this has little effect, but a lot of stray current damages the silicon and kills the chip - a sort of micro-shortcircuit called "electromigration".

Also, electrons travelling along adjacent paths less than 500 nanometres apart (a nanometre is a millionth of a millimetre) tend to interfere with each other. Such "crosstalk" can confuse a microprocessor, again causing it to fail. Designing a chip that is free of crosstalk and electromigration is easy with 1 m transistors on board; with 10 m vying for space it becomes extremely difficult.

And then there is the heat. Intel's Pentium microprocessor puts out around 15 watts, three times the amount produced by a 486 chip running at the same speed. It may not seem much; but, since a chip is very small, it can make things unpleasantly hot.

Overheating is a nuisance because it changes the characteristics of silicon-based transistors, increasing their resistance and cutting the microprocessor's speed. One esoteric way to solve this problem is to build chips out of a material like gallium arsenide, which allows electrons to flow more freely the hotter it gets. But gallium arsenide is costly and brittle, and hard to make into wafers. At present the technology for manufacturing civilian gallium-arsenide chips is about ten years behind that for silicon.

Intel has another answer. In 1993 it will change both the size of its transistors (from squares 800 nanometres on a side to squares 600 nanometres on a side) and also cut the voltage they run on (from 5 volts to 3.3 volts). The changes will cut Pentium's heat generation by more than half. The low-voltage design of the "Mark II" Pentium will also make it less susceptible to crosstalk.

Despite the technical problems, the need for speed continues to stimulate research on ever smaller transistors, packed in ever greater density on their chips. In December 1992 a team led by Ping Ko, an electrical engineer at the University of California at Berkeley, claimed to have developed the world's fastest transistor, a device designed to switch on or off 74 billion times a second during routine operation.

Dr. Ping's transistors are similar to those found in conventional integrated circuits, but much smaller, only 80 nanometres across, and are built using silicon-on-insulator (SOI) technology. SOI wafers are made up of a thin layer of oxide insulator sandwiched between two layers of silicon. This structure allows the 100-atom-thick silicon layer on top to carry a high current with much less interference between neighbouring transistors.

SOI transistors produce more heat for a given task than run-of-the-mill silicon devices, but their improved isolation from each other makes that less of a problem. The transistors' tiny dimensions also allow them to run at low voltages; Berkeley's world record was achieved at 1.5 volts. Crank up to 6.5 volts, however, and the device really stops dithering. At that voltage the Berkeley team got it to switch in 7.6 trillionths of a second - the time light takes to travel just two millimetres. (Source: *The Economist*, 19 December 1992)

Getting a charge from nanobatteries

Reginald Penner and co-workers at the University of California, Irvine, have constructed the world's smallest battery: at 70 nanometers across, the silver-copper device is about the size of a common cold virus. Penner's nanobattery generates about 20 thousandths of a volt for 45 minutes before dying out, but improved versions might one day power molecule-sized motors. While waiting, even the crude version the researchers now can make "will allow you to look at very early stages of a corrosion process" and study how molecules polymerize when they are aligned in the battery's potential gradient. (Extracted with permission from *Science*, Vol. 257, 28 August 1992)

German bonds

German firm Heraeus has developed a new type of ultrasonic bonding wire, which it claims requires a particularly low bonding force, reducing chip loading during the bonding process. The wire is made from a high-purity aluminium/silicon alloy, with the silicon distributed finely through the aluminium matrix. The alloy is produced in a special manufacturing process, which improves the flow and hardening properties of the wire during bonding compared to other AlSi alloys. As a result the wire needs less ultrasonic energy for bonding, and produces a bond with greater stability in

the heel-wedge area. (Source: *Electronics Weekly*, 2 December 1992)

Monster chip built by VTI

A monster five million transistor processor chip, with 428 pins, based on three-level metal 0.6-micron CMOS technology has been built for French computer maker Bull by US chip maker VLSI Technology Inc. (VTI).

Containing the equivalent of one million logic gates, measuring 15 mm on a side, the full-custom chip is designed as a test-vehicle processor to help with the development of future computers. (Source: *Electronics Weekly*, 2 December 1992)

GEC optical techniques in millimetre wave radars

Optical techniques are being employed in millimetre wave radio frequency designs by engineers within GEC's new missile business - GEC Marconi Dynamics.

Millimetre wave radars are being developed by the firm for applications such as bad-weather landing systems for commercial aircraft.

One advantage of millimetre wave systems is that the "optics" are easier and cheaper to make than for analogous visible wavelength systems, while the precise alignments and assembly needed for optical systems is unnecessary at millimetric wavelengths.

Millimetric "lenses" are opaque coin-size plastic discs with concentric grooves moulded into them to mimic a blooming layer. The choice of plastics for lenses and reflectors is determined by the radio frequency equivalent of refractive index - the dielectric constant of the material.

One example of the difference between light and millimetre waves is that millimetre waves do not come to a sharp focus; the beam is pinched in, like the waist of a Coke bottle - a phenomenon known as "beam-waisting".

Subtle differences like this mean that the standard equations of optics have to be modifed before they can be applied to the design of millimetre wave systems. By using a Cassegrain reflector system, of the kind used in astronomical telescopes, the designers effectively exploited the optical properties to double the beam scan angle. Also, the millimetric wave detectors, the antennae, are much smaller than conventional radar receivers and cheaper than charge coupled device-optical detectors. They can be built essentially as printed circuits laid down on a substrate.

Millimetre wave systems are small enough, cheap enough, and easy enough to make that they may find their way into high volume applications such as cruise control radars for cars or automated security systems. (Source: *Electronics Weekly*, 2 December 1992)

Light-emitting silicon chips make a splash

When certain chemicals are applied to optical chips, they emit less light. Because alcohol is one of the chemicals that causes this reaction, sensors could be developed for testing suspected drunken drivers, among other uses including measuring air quality and determining the level of sugar in a diabetic persons's blood.

Light-emitting silicon chips could eventually lead to computers that "think" with light, rather than electric impulses.

In the short term, it may be possible to develop "hybrid" computers, which would "think", using traditional electronic signals, but would contain porous silicon chips that communicate with each other and with devices by using flashes of light and optical fibres instead of electric impulses and metallic wires.

Light travels through fibre optic cables ten times faster than electric signals travel through wires, so the new chips should increase computer speeds.

Many light signals could be sent concurrently through a single optical fibre, whereas only a single electronic signal can be sent through present computer components.

A computer using light-emitting chips would increase the speed and volume of information it is able to support.

Another possibility for high-efficiency cells for solar energy could be possible if the band gap was made larger in inversely the same way as when attempting to have the chips emit less light. If this happened, the cells could absorb more light and produce more solar energy.

"Optoelectronic" or "photonic" integrated circuits have been developed by Texas Instruments and AT&T's Bell Laboratories, but they use semiconductors that are more expensive and complicated to manufacture than light-emitting porous silicon chips. (Source: *Electronics Weekly* 2 December 1992)

Tamarack blueprints hologram memory

Tamarack Storage Devices has plans on the drawing board to develop products to replace floppy discs, tapes and CD-ROMs with holographic memory in certain applications.

Storage technology from the Microelectronics and Computer Technology Corporation (MCC) would allow data to be preserved in a low-cost film or crystal

medium as a three-dimensional hologram. This technology is aimed at applications which require storage and interchange of large amounts of data.

Holographic storage gives hard disk-like access speeds and transfer rates with the large storage capacity of a tape drive at a cost that is comparable to today's high end 8 mm tape drives.

Light beams are steered instead of actually moving heads over the medium, allowing access times in tens of microseconds, compared to tens of milliseconds for hard disk drives.

Since information is stored as two-dimensional images or pages, and each page contains a large block of data, the natural parallelism of imaging optics results in very large transfer rates.

Tamarack, based in Austin, Texas, is aiming for holographic storage to be available for commercial use "within the next couple of years", according to a company spokesperson. (Source: *Electronics Weekly*, 2 December 1992)

Molecular battery makes charges stick

A sandwich-like material that mimics the way plants capture the energy in sunlight through photosynthesis could form the basis for a new generation of solar cells which generate electricity or split water into oxygen and hydrogen fuel.

Chemists have been experimenting with such materials for many years but retaining the energy has been one of the main stumbling blocks. Now researchers in the US have constructed a structure that traps solar energy and holds onto it indefinitely.

Such structures - often referred to as solar-powered "molecular batteries" - use the energy of light to create a positive charge in one part of a material and a negative charge in another part, and to keep the charges separate so that they do not lose their stored energy by recombining.

The energy stored in the battery can do useful work provided that the displaced charges can be siphoned off into an electrical circuit, but attempts so far to build molecular batteries have met with limited success because the devices retain their charge only for milliseconds.

Lori Vermeulen and Mark Thompson of the chemistry department at Princeton University in New Jersey report that they have found a material that holds onto the trapped charge almost indefinitely. They constructed a sandwich-like structure composed of successive layers of zirconium phosphonate and a compound called viologen. Energy from light striking the material displaces electrons from chloride ions that

form part of the structure. The electrons bounce into the viologen molecules which straddle the gap between successive layers of zirconium phosphonate.

Two problems remain before the material can be of any use. The first is that the energy stored in the viologen is inaccessible, and so cannot be siphoned off to do useful work. Vermeulen is hoping to make new versions that are more porous and perhaps transfer the electrons to some other molecule in solution.

The other problem is that only a fraction of visible light activates the material. Vermeulen hopes to overcome this by replacing the chloride ions with ions of other halogens, such as iodine. (This first appeared in *New Scientist*, London, 5 September 1992, the weekly review of science and technology.)

Laser teams in hot pursuit of blue light

The race is on to develop semiconductor lasers that produce beams of blue light, following Sony's announcement. Infrared semiconductor lasers are already widely used in CD players to read the digital data off the disc, but the shorter wavelengths of blue light would let the CDs record data as smaller dots, and so hold much more information.

At least three university groups have made devices similar to Sony's, but none have produced as short a wavelength as the Japanese claim: a continuous beam of 447 nanometres if the laser is operated at -196° C, the temperature of liquid nitrogen. However, at least one of the university groups has produced blue light at room temperature, which is essential for use in commercial devices.

At Heriot-Watt University in Edinburgh, Brian Cavenett's group has come closest to Sony in wavelength, with a laser that produces pulses of light with a peak output near 460 nanometres operated at -269° C, the temperature of liquid helium.

Bob Gunshor of Purdue University in Indiana claims the record for the shortest wavelength for a laser operating at room temperature. His laser contains six thin layers of zinc cadmium selenide and produces light at 490 nanometres.

A team at North Carolina State University in Raleigh also claims to have made blue semiconductor lasers which operate at a temperature of -196° C. (Extracted from *New Scientist*, London, 22 August 1992, the weekly review of science and technology)

Compact thermal plasma system for CFC decomposition

Professor A. Kanzawa and his research team of the Faculty of Engineering, Tokyo Institute of Technology, have succeeded in decomposing

chlorofluorocarbons (CFC), the principal causes of destruction of the earth's ozone layer, by using a thermal plasma generated by a DC arc discharge with a simple system.

CFC decomposition with the thermal plasma method has the advantage of rapid large-scale treatment. Research on the technique previously used a massive facility based on the radio frequency plasma technique. The new system has demonstrated that a compact system with an input of a few kilowatts enables adequate CFC decomposition. Further information is available from Tokyo Institute of Technology, Faculty of Engineering, 2-12-1, Ookayama, Meguro-ku, Tokyo 152. Tel.: +81-3-3726-1111 (ext. 2110). Fax: +81-3-3729-0425. (Extracted from *JETRO*, August 1992)

UV gets a new lease of life

Recent advances in optical lithography are pushing back the day when chip maker will have to turn to esoteric technologies such as X-rays.

It looks as though conventional optical technology using ultraviolet (UV) light can be used to make chips with feature sizes as small as 0.25-microns, saving the semiconductor industry the massive costs of moving to a new technology to make 256 Mbit DRAM memory chips.

Optical lithographic techniques for 256 Mbit DRAM technology are already being explored by several firms including Japan's Toshiba, which is collaborating with Siemens of Germany and IBM of the US in this technology.

Matsushita has already used one of these, excimer laser lithography, to produce silicon features small enough for 256 Mbit DRAMs as well as a prototype 64 Mbit DRAM and the inconvience of using excimer lasers may be overcome following a UV laser breakthrough made by researchers at IBM in Japan.

European researchers working on another approach - phase-shifted i-line steppers - for the JESSI European chip research programme said that optical techiques are sufficient to make advanced logic chips with both 0.35-micron and 0.25-micron technology.

All this spells bad news for those backing X-ray techniques for chip making, such as Britain's Oxford Instruments, which has already built a large electron synchrotron X-ray source, called Helios, for IBM in the US. (Source: *Electronics Weekly*, 25 November 1992)

Polished performance

A breakthrough in laser mirror technology has been reported by British optics firm Laser Beam Products of Sandy, Bedfordshire. The firm claims that clever polishing techniques make its new series of laser

reflective mirror surfaces, called Maxflat, the flattest and most reflective laser mirrors commercially available. They have tolerances more than 20 times better than other commercially available laser mirrors, making the mirror flat to better than one-tenth of a wavelength of light, providing a reflectivity of 99.9 per cent, which is particularly important in high energy laser systems. The mirrors are designed for use with carbon dioxide industrial lasers. (Source: *Electronics Weekly*, 25 November 1992)

Wave replacement

A continuous wave laser that could replace pulsed excimer laser systems in chip processing applications has been developed by US computer firm IBM's Japanese subsidiary. IBM Japan has developed an ultraviolet (UV) laser beam capable of boring, cutting and fine processing of semiconductor substrates with a 0.26-micron wavelength continuous beam UV laser with a 6 W power output. The basis of the system is a large-scale argon laser which generates a maximum output of 10 W at 514 nm, thereby producing UV rays with a continuous 257 nm wavelength thanks to frequency doubling technology. The engineers replaced the resonator optical elements with optical parts that sustain strong output while keeping power loss to a minimum. The key was an output mirror specially coated with a mirroring layer that does not deteriorate under continuous high power laser light. (Source: *Electronics Weekly*, 25 November 1992)

Prototypes at the press of a button

VME board designers can now reconfigure prototype systems at the press of a button with the launch of the world's first VME bus field programmable circuit board (FPCB) from US startup Aptix. Aptix's FPCB-VME 6U4 board contains four of the company's patented field programmable interconnect chips (FPICs), launched earlier this year. These 1,024-pin devices can be programmed to connect up to 1,000 of the pins in any desired combination. On the VME board this enables the designer to program connections between any combination of the board's 3,400 device pin holes. The reprogrammable SRAM-based chips are removable and come in two versions, one of which has a 64-channel diagnostic port with logic analyser interfaces for rapid debugging. Development software to program the boards accepts netlists from standard schematic capture packages. (Source: *Electronics Weekly*, 25 November 1992)

Revolutionary laser research to hit electronics

US and European scientists are taking a "radical" new approach to measure directly and analyse the way electrons react with interfaces.

A team of Swiss and US researchers working with the free-electron laser at Vanderbilt University in

Nashville, Tennessee, is using free-electron laser internal photoemission (FELIPE) to measure conduction band discontinuities claiming dramatically improved accuracy.

Researchers say the technique could have implications for the thousands of items that use transistor devices, including cars, computers and home electronics.

"The free-electron laser at Vanderbilt University is the most powerful laser of its kind in existence, and this is the only place in the world these measurements can be done with this unprecedented degree of accuracy", said Norman Tolk, director of Vanderbilt's Center for Molecular and Atomic Studies at Surfaces.

The research hopes to resolve longstanding disagreements between competing semiconductor band lineup theories, Tolk said.

At this point, the FELIPE research is focused on injecting a photon of light into common transistor combinations of materials gallium arsenide and gallium aluminium arsenide; indium phosphide and gallium indium arsenide; and germanium and gallium arsenide. By increasing the energy of the photon, current begins to flow and the electron jumps to the next energy level. (Extracted from *Electronics Weekly*, 25 November 1992)

486 PC control on a single chip

United Microelectronics Corporation has released the first single chip controller for 486 PC applications, the UM82C491.

The UM82C491 contains all the control circuits like memory controller, cache controller, local bus, peripheral controller, keyboard clock and a real-time clock oscillator in a single 208-pin flatpack.

With the UM82C491 and 12 pcs TTL circuits, one can maintain a compact and low-cost solution with a maximum flexibility.

The UM82C491 device supports 486DX, 486SX and 386DX systems in single and 2x clock applications and a range of co-processors.

The UM82C491 can operate with four banks of 64 Mbyte memory size and it supports also 16 Mbyte DRAM chips. (Source: *Electronics Weekly*, 18 November 1992)

Lithium manganese dioxide gives power to batteries

Lithium manganese dioxide is looking like the battery technology, which is attractive to everyone from mobile telephone makers to environmentalists.

Development work at the University of St. Andrews and Dowty Batteries has created rechargeable lithium manganese dioxide cells with 50 per cent the storage capacity of equivalent nickel cadmium cells. But the new technology could have a broader application as a non-toxic high power density battery for industry and the military.

Traditionally, lithium sulphur dioxide and lithium thionyl chloride have been used as high discharge rate batteries, but they have severe safety and toxicity problems.

Dowty claims that it has developed a solid cathode lithium manganese dioxide (LiMnO$_2$) cell, which can match the high discharge rates of these liquid cathode systems without adding voltage delay and safety problems. The solid cathode systems also offer instant start-up important for emergency equipment.

In straight performance comparison LiMnO$_2$ cells offer all the benefits of lithium cells over conventional batteries but with a much higher energy density of 300 watt hours kg.

The new LiMnO$_2$ cell has a solid cathode, which is not in solution and so passivating films are not formed on the lithium electrode. This reduces voltage delay. But perhaps the system's most important feature is that it does not form the unstable compounds associated with some liquid cathode systems.

To ensure low internal resistance and high discharge rates the Dowty cell uses spirally wound electrodes of manganese dioxide and carbon pressed onto an aluminium current collector. This maximizes surface area and so minimizes resistivities within the cell.

The venting pressure within the LiMnO$_2$ cell is between 200 psi and 250 psi permitting C rate operation. It also vents safely at well below the melting point of lithium under short circuit conditions.

Dowty claims that 3V LiMnO$_2$ batteries are becoming the preferred choice for critical aerospace and emergency applications.

Its work with St. Andrews University also promises a new type of rechargeable cell, which can outlast the consumer favourite nickel cadmium. (Source: *Electronics Weekly*, 18 November 1992)

Commercial SOI moves closer

Researchers at the University of California at Berkeley say they have improved silicon-on-insulator (SOI) technology to the point where it may be used in commercial applications.

SOI offers a way around structural problems such as electron punch-through and latchup that occur when silicon junctions are too close to each other. These are becoming increasingly common as chips become ever more highly integrated.

SOI involves growing a silicon layer in which the transistors will be placed on top of an oxide insulator layer on a silicon substrate. This allows for closer spacing of transistors without causing interference between them.

An added benefit is that transistor speeds are as much as five times faster, and capacitance is lower.

The University researchers say that they have discovered a better method of manufacturing SOI devices that produces the essential high quality oxide layer that is necessary for such devices. They also claim to have solved the problem of edge transistor behaviour, which will keep SOI chips much smaller. The University has produced CMOS field-effect transistors fabricated in SOI with 0.25-micron channel widths.

They are now hoping that a local Silicon Valley chip company will use their process to develop commercial chips using SOI fabrication. (Source: *Electronics Weekly*, 11 November 1992)

Polysilicon-based LCD technology

Researchers at GEC's Hirst Research Centre have developed an active matrix liquid crystal display (LCD) with driver circuits integrated on the glass substrate.

The display is built using a low-temperature glass-compatible polysilicon process, and the company claims that it is much cheaper than similar technologies that use quartz substrates for the integrated driver circuitry.

Researchers describe a 2.8 in. diagonal display comprising 200 x 200 pixels, each of which is driven by a dual gate NMOS transistor. An RCT architecture is used whereby the row and column drivers are on opposite plates of the display. This maximizes the yield of the matrix because there are no row-column crossovers.

Column drivers have a dynamic shift register, a line memory latch and an output driver. Row drivers have a static shift register and a logic and output buffer to produce the required waveforms.

Redundancy is built into both types of driver to allow faulty stages to be cut out with a laser and backup circuits to be connected by welding metal through the passivation layer.

The transistors' polysilicon active layer was built using a Rytrak low-power chemical vapour deposition machine to deposit silicon onto a glass substrate.

GEC has already built 6.2 in. 240 x 960 pixel LCDs using external drivers. The company also claims that displays of this size are possible using the integrated

driver technology. (Source: *Electronics Weekly*, 11 November 1992)

Superconductors

US Government researchers say they are close to developing a way of forming high-temperature superconductor materials into usable wires.

Researchers at the Ames Laboratory of the US Department of Energy say that the technique could allow the use of superconductor materials into everyday applications. So far, researchers have faced a serious problem in trying to use superconductors in practical applications. The materials are very fragile and wires formed from them are brittle and cannot handle large current loads.

Ames researchers say that by teaming up with researchers from Babcock & Wilcox (B&W), a firm specializing in the manufacture of furnace insulation fibres, they have adapted a B&W technique that has successfully produced superconductor wires that are five times more flexible than previously manufactured wires.

The wire is formed by forcing molten superconductor material through a supersonic nozzle. When it emerges, it quickly cools and solidifies into long fibres. (Source: *Electronics Weekly*, 11 November 1992)

Fujitsu makes show of 0.5-micron gate arrays in GaAs and CMOS

Half-micron gate arrays in both CMOS and gallium arsenide are now available from the world's largest gate array vendor Fujitsu.

The CMOS arrays, called CG51, have an effective drawn gate length of 0.45-micron, can work off 3.3 V, range from 34,000 to 820,000 gates in complexity, and are available now. Gate delays are a typical 260 ps.

The gallium arsenide arrays, called CG11, range from 25,000 to 250,000 gates and operating voltage is from 1.2 V to 3.3 V depending on the I/O options which are GaAs, GTL, ECL, CMOS and TTL. Internally the arrays work off 1.2 V. (Extracted from *Electronics Weekly*, 11 November 1992)

Phones go for GaAs

Motorola has introduced a new range of low-cost gallium arsenide RF power modules for use in cellular telephones.

The surface-mountable packages (MHW9002) series occupy a cubic space of 1.1 cm, and they are fixed by soldering four "feet" to a suitable heatsink. The devices offer a minimum gain of 26.5 or 27 dB,

requiring an RF input signal of only 5 mW (7 dBm) to obtain a minimum 1.4 W of output power.

The modules provide a 60 per cent typical efficiency for four frquency bands that cover the AMPS, JTACS, ETACS and NMT900 cellular standards. (Source: *Electronics Weekly*, 18 November 1992)

Record high

Two Japanese researchers have developed a material they say becomes superconducting at around -103° C, surpassing the previous highest-temperature superconductor by about 45° C.

Professors Tomoji Kawai and Shichio Kawai of Osaka University's Institute of Scientific and Industrial Research developed the new material by arranging copper oxide, strontium and calcium in layers. The sheet of material, about 5 millimetres square, exhibits all the properties of a superconductor. However, Tomoji Kawai says more tests are needed to confirm their findings.

Japanese physicists hailed the discovery as a breakthrough, saying that the relatively simple structure of the material could help explain the nature of superconductivity. (This first appeared in *New Scientist*, London, 26 September 1992, the weekly review of science and technology)

Japan claims supercomputer lead

By linking together chips with the power of more than 200 supercomputers, Fujitsu claims to have made the most powerful computer ever. The VPP500, the company's first supercomputer, is about 10 times more powerful than today's top models and will be available in a year's time for heavy duty computing tasks such as weather forecasting and drug design.

Until now, supercomputers have fallen into one of two categories: vector computers, which tend to have between one and 16 extremeley fast calculating chips, and parallel computers, which farm out the calculations to thousands of slower, cheaper chips. The VPP500 has an intermediate number of fast processors - up to 222 - each of which is a vector supercomputer in its own right. Each runs at up to 1.6 billions of calculations a second, or gigaflops, so in concert they could manage 355 gigaflops. (Extracted from *New Scientist*, London, 19 September 1992, the weekly review of science and technology)

Low-end parallel processing computer

Thinking Machines has unveiled a low-end parallel processing computer aimed at new types of commercial database applications. Its traditional scientific and technical users will also be addressed but with the new computer Thinking Machines is putting more effort into commercial sites. The new computer is being set up as a back-end processor to mainframes. Ultimately, according to James Bailey, Thinking Machines' director of marketing, the parallel computer will supplant the mainframe altogether. The computing power in an organization will then comprise desktop workstations plus a series of scalable, parallel processors.

Featured at the low end of the company's new line is the new CM-5 Scale 3 machine, based on Sun Microsystems' Scalable Processor Architecture processor, which features disks and processing nodes in a single computer. The combination of 3.5-inch disks and processors can be customized. Currently, on the market, the new machine runs a version of the SunOS Unix-based operating system. Information, regardless of where it originates, can be stored in one format, Thinking Machines points out, noting the system's file server possibilities. A system with 384-disk-storage nodes has a capacity of 3 Tbytes and a transfer rate of 4 Gbytes per second, in contrast to traditional disk storage systems with transfer rates of about 90 Mbytes per second. (Extracted from *Computerworld*, 19 October 1992)

Swirling cylinders spin power beneath the waves

Tennis players, golfers and bowlers in cricket all know how to make a ball curve in the air by adding a little spin. The forces they exploit when creating this swing have now been harnessed to generate electricity from waves.

Chris Retzler of the Ocean Engineering Research Centre at City University in London has built a prototype of a machine called the wave rotor. He expects to hear early in 1993 whether the Science and Engineering Research Council is prepared to fund its development.

The wave rotor consists of two parallel, horizontal cylinders that spin about their own axes, and are joined at their ends by plates. The whole device rotates about a central axis parallel to the cylinders and the wavefronts. The cylinders are driven mechanically in opposite directions and, as they turn, are subject to the same force as a spinning ball - the Magnus effect.

Water streaming past each cylinder is pulled over or under it, depending on which way the cylinder is spinning. The water accelerated by the rotating cylinder exerts less pressure on it than that from the slower-moving water on the other side. In much the same way as an aircraft wing experiences lift as it speeds through the air, the cylinder is also lifted.

This lift pushes the spinning cylinders of the wave rotor so that they rotate around the central axis. If the flow of water was in a straight line across the two cylinders, the rotor would turn through 90° C and stop when the water flowed symmetrically between the

rotors. But water in a wave turns in vertical circles. As a result, the rotor turns at the same frequency as the water and will orient itself so that the current always flows across the two cylinders, generating a steady rotating force. This motion can be used to drive a generator, says Retzler.

Retzler's device is unusual in relying on circular currents that are set up beneath waves. Most other wave power devices are designed to exploit the vertical or horizontal oscillations of the seas, he says.

For a rotor that would work in the North Atlantic, Retzler estimates that the cylinders would have to be about 2 metres in diameter. The machine would be tethered to the seabed but would be buoyant to keep it in its optimal position beneath the waves.

In the sea, such a device would produce about 70 kilowatts of raw power for every metre's length of the cylinders. How much of this can be converted into electrical power is not yet clear, says Retzler. In addition, spinning the cylinders faster increases the lift, so the size of the machine could be reduced. This could make the device more compact than other wave power devices.

In practice, any advantages the rotor has over other wave power machines will not be known until Retzler can find the funding for more research. (This first appeared in *New Scientist*, London, 12 December 1992, the weekly review of science and technology.)

GPS sets goal for BiCMOS process

Britain's leading chip maker GEC Plessey Semiconductors (GPS) aims to have a commercial 0.5-micron BiCMOS process by early 1994.

The company is pulling together a research team, comprising engineers from the former Ferranti site at Oldham, where bipolar devices are made, and the former Plessey plant at Roborough in Devon to develop the process.

This will be the first move by GPS into BiCMOS technology, and if the schedule is met, it would give the company a process comparable with leading international manufacturers.

Leading Japanese manufacturers such as NEC, Hitachi, Mitsubishi and Toshiba use BiCMOS processes to make fast static RAMs (random access memories) and logic devices. These are all using 0.8-micron lines at the moment, as are American chip makers like Texas Instruments and Cypress Semiconductor.

Mitsubishi has just started shipping 1 Mbit SRAMs made on a 0.6-micron process. Toshiba makes similar products on a 0.7-micron line, and Hitachi is planning to have a 0.5-micron line available early next year.

A spokesman for GPS said that the company currently uses bipolar technology at its Oldham plant to make mixed-signal devices containing analog and digital elements, and that some of these would be made on the new BiCMOS processes.

BiCMOS manufacturing processes combine the speed and drive capabilities of bipolar transistors on the same chip as low-power high-density field effect transistors made of metal-oxide semi-conductors (MOS). (Source: *Electronics Weekly*, 21 October 1992)

Synthetic diamonds

AT&T is claiming to have won the race to offer the first commercial application of synthetic diamond films in electronic heatsinks.

AT&T has developed a synthetic diamond film, which can be electrically bonded and has a thermal conductivity greater than 10 W per degree Kelvin.cm. In some cases it can even better the 22 W per degree kelvin.cm conductivity of natural diamond.

The new synthetic diamond submounts will be in production before the end of the year under licence from AT&T by chemically vapour-deposited diamond specialists including GE in the US, Sumitomo Electric of Japan and Drukker in Holland.

The heatsinks initially developed for cooling semi-conductor laser devices may also find an important application with the latest generation of power hungry microprocessors, gallium arsenide components and interconnection devices. (Source: *Electronics Weekly*, 21 October 1992)

Flash moves closer to ousting discs

Chips are getting closer to challenging discs as the storage mechanism in portable computers with the announcement by flash inventors Toshiba of the world's first 16 Mbit NAND flash memory chip.

First production is scheduled for March 1993 at a cost of $125. That is still a hefty $2,500 for 40 Mbytes of storage but, whereas memory chip prices typically erode by 50 per cent a year and tend to go down to $2 a piece, discs have revolving machinery, which means they are unlikely to drop below $100.

Flash memory prices should erode quicker than traditional memory prices because they are made on production lines debugged, and partly depreciated, by being used for production of DRAMs.

Toshiba has pencilled in 1994 for the introduction of 32 Mbit flash memory. (Source: *Electronics Weekly*, 28 October 1992)

Xilinx claims speed lead in FPGA arena

Xilinx claims that its SRAM-based FPGAs are the fastest in the world.

The firm says that internal modifications and a migration to a 0.8-micron process have doubled the speeds of members of its 1,000 to 5,000 gate FPGA family - the XC3000.

Xilinx has implemented the new technology in four members of the 3000 family and calls them the "XC3100" family. They have clock speeds of between 50 MHz and 80 MHz and some simple logic functions can reach 100 MHz.

That puts SRAM-based FPGA well into the speed band of anti-fuse. Xilinx claims its 3100 parts are generally faster than equivalent density anti-fuse devices. It intends to extend the new techniques to its 5,000 to 10,000 gate family, the XC4000 series, to provide similar improvements in performance. (Source: *Electronics Weekly*, 28 October 1992)

First European 0.25 μm CMOS silicon

The first European 0.25 μm CMOS devices, containing about 100 transistors, have been built at the Philips Research Laboratories in Eindhoven, The Netherlands. These ring oscillator devices have been constructed as part of the 0.25 μm JESSI programme in work over the past two years that has concentrated mainly on isolation materials, wells, and transistor design. Philips Laboratories is working towards larger circuits containing a few thousand transistors. (Reprinted with permission from *Semiconductor International Magazine*, December 1992. Copyright 1992 by Cahners Publishing Co., Des Plaines, Ill., USA)

Ultrathin SOI CMOS

Hitachi plans to propose a new ultrathin silicon-on-insulator CMOS technology that employs selective tungsten CVD, rather than a silicide, for the source drain contacts. The announcement was made at the International Electron Devices Meeting in San Franciso in December 1992.

According to Hitachi, ultrathin SOI is a promising material because it enables ultra-shallow junctions to be formed. The problem, however, is that there is a high parasitic resistance between the thin SOI-Si layer and the first level metal. Silicidation is not an answer, Hitachi says, because even minor material inhomogeneities present during the silicide-reaction may lead to fatal defects, such as cavities in the Si layer.

By using a selective CVD W contact process instead of a silicide, Hitachi says it has eliminated interface problems, while reducing parasitic resistances. Also, the elevated thick W layers offer low resistance and easily provide good contact with the interconnection layer. (Reprinted with permission from *Semiconductor International Magazine*, December 1992. Copyright 1992 by Cahners Publishing Co., Des Plaines, Ill., USA)

E-beam processing emerges from E-beam lithography research

Thin film head manufacturer Read-Rite Corp. (Milpitas, Calif.) is now using electron-beam curing on its production line; it uses an electron-beam system from Electron Vision (San Diego, Calif.) to harden and stabilize resist and cure inner layer dielectrics without heat.

Reportedly, this process allows thin-film head manufacturers to make higher density and higher performance heads. In hardening resist, Electron Vision's Electron Cure system accomplishes in a few minutes what it would take 10 or more hours to do in a thermal process. In addition, because the process does not use heat, it preserves resist geometries by immediately cross-linking the full thickness of the resist at the very start of curing. Electron beam curing can turn resist into scratch resistant coatings, preserving the original image geometries while raising the glass transition temperatures to above 400°C. Other applications for this method include curing interlayer dielectrics for multichip modules, LCD panel fabrication, resist stabilization for IC manufacture and conformal coating for magnetic discs. (Reprinted with permission from *Semiconductor International Magazine*, December 1992. Copyright 1992 by Cahners Publishing Co., Des Plaines, Ill., USA)

Metalization manufacturability improved

With some relatively simple modifications, process engineers at VLSI Technology Inc. (San Jose, California) have been able to make significant improvements in reliability performance and yield of 1.0 and 1.5 μm CMOS metalization processes. Their standard double level layered TiW AlCu TiW metalization process consisted of dry via etching with a bottom TiW thickness of 2200 Å, deposited in the same pumpdown as the Al film. In the modified process, the via etching is wet dry and the bottom TiW thickness is reduced to 1700 Å and exposed to air before deposition of Al-1 per cent Cu.

As reported by researchers Vijay Chowdury, Guy Harper, Steven Song and Hunter Brugge at the 3rd Annual Advanced Semiconductor Manufacturing Conference and Workshop in October, exposure of bottom TiW to air for five minutes in an otherwise standard process brought about a significant improvement in electromigration lifetime of Al-one per

cent Cu films compared to the standard process. Why this is so is not exactly clear, possibly having something to do with the intra-grain roughness, which is decreased in air-exposed TiW, or the oxygen that is introduced during the air exposure, which may suppress the interdiffusion of barrier layers to aluminium. A significant improvement in n- leakage current was also seen with the air-exposed TiW.

By tapering the via walls through the modified wet dry etch, the researchers found that metal step coverage was significantly improved, with a corresponding drop in via resistance.

It was also found that TiW barrier films thinner than 2200 Å have better barrier performance than the standard thickness when exposed to air before deposition of subsequent layers, even down to film thicknesses of 1625 Å. This is thought to be due to plugging of the TiW grain boundaries with oxygen during the air exposure step. Another benefit of reducing the TiW thickness is that particles are reduced, since the amount of TiW particles that wind up on the wafer surface is often a function of the total deposition time. (Reprinted with permission from *Semiconductor International Magazine*, December 1992. Copyright 1992 by Cahners Publishing Co., Des Plaines, Ill., USA)

Analog design system raises wafer yields

A group at the SGS-Thomson Micro-electronics (STM) facility at Agrate, Italy, claims that an analytical design system it has developed will achieve improvements of up to 50 per cent in the yields of analog ICs from wafers. The STM group formulated equations that express certain design objectives, for example gain-bandwidth and total harmonic distortion, in terms of such design and statistical production parameters as channel width and dopant levels. These analytical equations were then employed to build models of the behaviour of the fabrication processes in terms of design objectives and parameters.

The model has been incorporated into a CAD package, known as PLUTO, which has been constructed around databases holding the design and statistical production parameters. In the designer's hands, PLUTO can define any characteristic of the circuit as a specification or a design objective.

STM presented this design system at the European Solid State Circuit Conference in Copenhagen. The paper described the building of analog operational amplifiers using models containing 12 independent process parameters with four offset voltages using a 1.5 µm process.

Workers ran the PLUTO model with nine different values for each of the transistor channel widths. It showed estimated device yields ranging from zero when the channel width was too small to over

96.6 per cent. These operational amplifiers were built from the models and a yield of 99.97 per cent was obtained. The total harmonic noise was 7 dB below the previous value. Although the 20 dB band-width fell from 1.2 MHz to 1.1 MHz, it still exceeded design specifications. (Reprinted with permission from *Semiconductor International Magazine*, December 1992. Copyright 1992 by Cahners Publishing Co., Des Plaines, Ill., USA)

A kinder, gentler chip inspection

Chip factories are strewn with corpses - of expensive silicon wafers deliberately cracked to pieces. Electron microscopists are the murderers: they do it to check the quality of all sides of the microcircuitry components at each point of the manufacturing process. Now, the wafer carnage may be about to become a thing of the past, says manufacturing researcher Kumar Wickramasinghe of IBM Thomas J. Watson Research Center in Yorktown, New York. He and IBM colleagues described a new atomic force microscope (AFM) that images all parts of a chip's microcomponents - side-walls included - non-invasively. In a trial run of the new tool, the researchers imaged the deep contact lines on the 16-megabit memory chip.

To pull off the feat, the workers had to modify a standard AFM. AFMs work by dragging a superfine stylus over a surface. A force sensor monitors its ups and downs and a computer then assembles an image of the surface from this data. But for inspecting chip quality, these tools fall short of the task: their tips plough into soft surfaces such as the polymeric photoresists used during chip making, thereby distorting the images. The tips also cannot probe into deep clefts in the surface, notes Calvin Quate of Stanford University, who helped develop the original AFM in 1985 and is now developing ways of using arrays of AFM tips for ultraprecise manufacturing.

In their variation on the AFM theme, the IBM researchers circumvent the ploughing problem by relying on "noncontact" imaging. As the tip hovers slightly above the surface, it taps into subtle attractive forces between molecules - known as van der Waals forces - to assemble the image. The novel "double spike" shape of the tip also allows it to get into nooks and crannies that standard AFM tips have been blind to, Wickramasinghe says. That, he predicts, should mean a dramatic drop in the wafer death rate. (Source: *Science*, Vol. 258, 4 December 1992)

Chipmaking's future may be riding on a beam of light

Building computer chips is fraught with trade-offs. To make faster chips, engineers cram transistors closer together but they are approaching the point where circuits will be so tightly packed that signals will interfere with each other. So scientists want to develop optoelectronic chips. These will use light pulses to carry

signals - an advantage because light beams pass through each other with no interference.

Researchers first tried combining silicon switches with tiny laser diodes made of gallium arsenide, but the combination is extremely difficult to manufacture. Now they are making startling breakthroughs using a better choice: silicon and germanium, a duo pioneered by IBM. Last summer, Princeton University Professor James C. Sturm made a silicon-germanium device that produced a faint beam of light at room temperature. A University of Tokyo scientist Yasuhiro Shiraki recently built a silicon-germanium chip that emits a strong beam of light at room temperature. Shiraki says it will take at least five years to commercialize chips with integrated electronic and optical functions. But the rewards could be fantastic. He envisions chips that are much faster than any on the drawing boards today. (Source: *Business Week*, 14 December 1992)

Tiny electromagnetic motor

Toshiba has produced an electromagnetic motor 0.8 mm in diameter, which uses a 1.7 V power supply. The motor weighs only 4 mg. Each of the three electromagnetic coils in the motor is 0.25 mm in diameter. The wire is 0.03 mm thick. Toshiba has developed automatic winding machines to make the tiny coils. Toshiba hopes to develop a motor tiny enough to be used to clean the inside of arteries or to inspect tiny pipes in manufacturing plants. The speed of the motor needs to be reduced from the current 10,000 rpm to increase torque, perhaps through gears. (Extracted from *New Scientist*, 10 October 1992)

Superconducting magnet

A superconducting magnet that generates a magnetic field of 4.6 Tesla at temperatures of 11° Kelvin (-262° C) without requiring liquefied helium has been developed jointly by Kazuo Watanabe, a professor at the Institute for Materials Research of Tohoku University, and researchers from Sumitomo Heavy Industries Ltd.

Watanabe said the new magnet was made possible by combining a niobium 3-tin superconducting coil and Sumitomo's high-temperature oxide superconductor for the current leads.

The superconducting leads are high-temperature oxides consisting of bismuth, strontium, calcium and copper that remain superconductive at temperatures of 110° K (-163° C).

Sumitomo's superconductor leads eliminated the need for liquefied helium, Watanabe said, adding that the oxides have a critical current characteristic of 1,000 amperes or more in zero magnetic field at liquefied nitrogen temperatures of 77 K (196 degrees below zero C).

This superconductor is a ceramic that conducts little heat, a Sumitomo spokesman said, adding the ceramic's thermal conductivity is several hundred times less than copper now in wide use.

The system is capable of conducting electric currents of 500 amperes in temperatures of 10 to 30 K. It measures 32 centimetres (12.6 inches) in outer diameter and 92 centimetres (36 inches) in height.

The system, priced at 15 million to 20 million yen ($125,000 to $167,000), will initially be sold to laboratories and research institutes, Sumitomo said. (Extracted from *American Materials Market*, 4 November 1992)

Research to improve silicon properties

Japan's Science and Technology Agency, part of MITI, is carrying out a new research programme aimed at discovering a replacement material for silicon in semiconductors. The programme is based not on the fear that silicon could become scarce, but on a desire to improve the electrical, thermal and mechanical properties of silicon. There is thought to be potential in the use of monocrystalline diamond layers and in cubic boron nitride crystals. The research programme is expected to last five years initially, and is being funded by MITI. (Extracted from *Funkschau*, 2 October 1992)

Functional blue SC laser race

Sony and 3M are both racing to develop the first functional blue semiconductor laser, to increase CD storage and improve surgery products. With the ability to focus on tiny spots, blue semiconductor lasers could triple the amount of music stored on audio compact discs and increase the storage capacity of CD ROMs. Sony has already demonstrated a blue laser. 3M developed the first experimental device and is working on another version. (Extracted from *Design News*, 26 October 1992)

Optical fibre technology research

A research project is aiming to exploit advances in optical fibre technology to allow remote sensing of potentially explosive gas and pollutants in water.

Work will concentrate on the detection of chemicals using fibres that can carry laser beams with wavelengths of 5-12 microns. Although such fibres are being used in very sophisticated medical devices, it is only recently that they have made an impact on industry at large.

The remote sensing system will use carbon dioxide and lead salt diode lasers as sources.

The project is led by Leatherhead-based contract R&D firm ERA Technology, which says water,

electronics and processing firms are interested in collaboration.

In a recent project to demonstrate the potential of optical sensing, ERA detected ethylene gas to an accuracy of 3 ppm. The use of more sophisticated signal processing techniques will improve on this, it says.

The 5-12 micron wavelength region is often referred to as the fingerprint region because of its ability to force molecules to absorb energy at very precise wavelengths. The system can therefore be tuned to interact with specific chemicals.

During operation, the source beam is transmitted through a waveguide into a gas cell containing the sample. The gas absorbs some of the energy and the modified beam is sent to an infra-red detector. This gives a measure of the level of contaminant in the sample.

More sophisticated methods involving the dissipation and recollection of laser beam energy will have to be developed for liquids, says ERA. (Extracted from *Engineering*, 15 October 1992)

Acousto-optic switch

Bellcore has developed an experimental acousto-optic switch that will dramatically improve the functionality and capacity of fibre optic networks. The switch uses the physical properties of sound and light to sort and distribute signal wavelengths, processes incoming and outgoing wavelengths about 100 times faster than present technologies electronically. The switch works in microseconds rather than milliseconds. The device selectively extracts 1+ wavelength channels, independently and simultaneously, from one optical fibre and diverts all or part of each signal to a second fibre. According to Dave Smith, technical staff member, the switch is not expected to be available commercially for about five years. (Extracted from *Telephony*, 5 October 1993)

Use of DNA in ICs

DNA might be used to help make integrated circuits smaller than is now possible, according to researchers at Heinrich Heiner University (Dusseldorf, Germany) and La Sapienza University (Rome, Italy). The DNA itself would not be in the chip; instead, it would be grown in precise patterns to form a pattern for chip production. The technique was patented in 1990, but the patent has just recently been published. The technique could be licensed to a Japanese firm for production to begin in a few years. The DNA strands are assembled with a DNA synthesizer in any shaped network. Some 3,000 constituent bases can be placed in a width of 1 micron, creating "wires" 1-2 nm across. Existing chip-making techniques make wires 1 micron thick, or 1,000 times thicker than is possible with the

new technique. The DNA network is used as a template to make a mask for photolithography. (Extracted from *New Scientist*, 17 October 1992)

New high-temperature superconductor

A bismuth-based high-temperature superconducting tape for magnetic coils that achieves a critical current density of 66,000 amperes per square centimetre at a temperature of 77° Kelvin, or -196° C, has been developed by Toshiba Corporation, jointly with Showa Electric Wire and Cable Company.

A Toshiba spokesman said the new superconductor, which surpasses in value the former record of 53,700 amperes per square centimetre by more than 20 per cent, is to be used for superconducting magnetic coils for magnetically-levitated transport systems and magnetic resonance imaging (MRI) systems.

The new superconductor's capability to generate higher electric current and a strong magnetic field is also expected to contribute to the practical application of high-temperature superconductors, replacing metal superconductors cooled with costly liquid helium.

The new tape conductor, Toshiba explained, is fabricated by the power-in-tube method. Silver tubes packed with the oxide powder are subjected to drawing, rolling and heat treatment and then pressed, causing them to lengthen and form a tape.

The tape's superconducting characteristics were improved by increasing the density of the oxide, improving the orientation of superconducting grains, and reducing the volume of non-superconducting phase, it was explained.

Toshiba said the company's researchers are engaged in extensive research and development activities in superconductivity ranging from materials to application systems, including MRI and magnetically-levitated transport systems, with emphasis on high-temperature superconductivity in liquid nitrogen.

The new superconductor was reported at the 5th International Symposium on Superconductivity held in Kobe in late 1992. (Extracted from *American Materials Market*, 2 December 1992)

Washing boards in water

ICI has discovered that washing printed circuit boards in water rather than CFCs allows for more components per board, while costing less. CFC solvents are inert and are used to remove dirt from printed circuit boards without affecting the performance of the boards. CFC-cleaned boards also do not need to be heated to dry them off. By contrast, water can oxidize copper circuits. But ICI has now developed soldering systems and fluxes that wash off in water. These new

components actually produce better circuit boards than are made with conventional processes. And water washing actually gets the boards cleaner than CFCs. An additive in water keeps the copper from oxidizing. Although water washing machines cost ICL £1 million, the cost of solvents has been slashed drastically. Of course, the firm's water bill has gone up. (Extracted from *New Scientist*, 7 November 1992)

Light pulses for semiconductor chips

Optoelectronic semiconductor chips would use light pulses to transmit signals, operating much faster than standard chips that incorporate closely-packed transistors. When the transistors are too close together, the signals get in each other's way. This does not happen with optoelectronic chips, since light beams going through one another causes no interference. One scientist said that no less than five years will pass before chips having integrated electronic and optical functions are commercialized. (Extracted from *Business Week*, 14 December 1992)

New liquid crystal display

GEC (UK) has made a liquid crystal display with the electronics printed onto the display's glass. Many companies have developed displays with the control electronics in the glass, but ordinary glass has not been able to withstand the high temperatures to purify silicon. Such displays have used expensive quartz. GEC makes a display with the imprinted silicon electronics on glass at a lower temperature. The silicon is not as pure, but the electronic structure tolerates faults. Currently, displays make electrical connections between the control electronics and the many picture elements at the displays' edge. (Extracted from *New Scientist*, 5 December 1992)

New silicon carbide

A new silicon carbide said to be of the same grade as high-purity silica glass has been commercially developed by Toshiba Ceramics Company for the semiconductor market.

The new silicon carbide features much lower levels of iron, aluminium and vanadium than comparable current materials, a Toshiba Ceramics spokesman said. Its nickel content, however, is 0.03 parts per million compared with 0.01 ppm for silica glass. All of the trace elements cause defects in semiconductors during processing, Toshiba noted.

Previously, silica glass was widely used as material for semiconductor processing equipment such as diffusion, oxidation and chemical vapour deposition (CVD). Elements contained in the component material of the processing system affect quality as well as yield of semiconductors produced.

As wafers have become larger in diameter and require higher processing temperature, silicon carbide, which excels in strength and heat resistance, has received increasing attention. But the problem with silicon carbide has been its inferior purity compared with silica glass.

Iron is a chief cause of lower yield for semiconductors processed in high temperatures. But the newly developed silica carbide has an iron content of only 0.19 ppm, less than half the 0.40 ppm in silica or quartz glass, Toshiba said.

Aluminium content in the new material is 0.48 ppm compared with 8 ppm in silica glass and its vanadium content is 0.07 ppm against 1.06 ppm, Toshiba said. (Extracted from *American Material Market*, 25 November 1992)

New soldering process

Researchers at Sandia National Laboratories, working in collaboration with Motorola's Government Electronics group and Los Alamos National Laboratory, have demonstrated a no-clean soldering process that eliminates ozone-depleting solvents from electronics manufacturing. The laboratory said the technique is at least as reliable as conventional, rosin-flux, solvent-based soldering.

The new process - developed under a programme funded by the Department of Energy's Industrial Waste Reduction Program - uses adipic acid, an ingredient used by the food industry to give tartness to gelatin, rather than rosin flux as a board preparation fluid. Unlike rosin flux, adipic acid does not leave behind a sticky, moisture-grabbing residue susceptible to corrosion. Soldering is performed in a sealed chamber containing nitrogen gas and formic acid, which breaks down into carbon dioxide and water. The nitrogen/ formic acid mix prevents oxidation during the soldering process.

Ron Iman, project manager for Sandia's manufacturing systems reliability modelling department, said the process is environmentally sound and eliminates the need for a cleaning machine.

In a separate development at Sandia's centre for solder science and technology, the laboratory is working on chlorofluorocarbon-free, "fluxless" soldering methods. That work is also sponsored by the US Department of Energy's Office of Technology Development. Studies at the centre involve development of soldering techniques using controlled atmospheres, thermomechanical surface activation and protective coatings. (Extracted from *Electronics News*, 30 November 1992)

Semiconductor material using fullerene C_{60}

Mitsubishi Electric (Japan) claims to have developed the first semiconductor based on the carbon material called C_{60}. Carbon 60, or fullerene, is made up of pure carbon atoms arranged in a spherical, lattice-like structure. The material will allow for the manufacture of semiconductor substrates that possess increased resistance to heat and radiation, greater transparency and a higher degree of integration than conventional silicon-based materials. The new semiconductor will be able to receive and emit light radiation over a wider range of wave lengths more efficiently. (Extracted from *Asian Wall Street Journal*, 5 October 1992)

Photorefractive material stores holograms

A photorefractive material that can store holograms internally as a pattern of electrical charges has been developed by researchers at Purdue University (Lafayette, Indiana). The new material operates with ten times less light than previous photorefractive materials. These could be used to control light in optical computers. The new material's high light sensitivity makes it possible for the low-power, low-cost laser diodes in optical computers. In photorefractive materials, ultrathin semiconductor layers confine photons to enhance optical qualities of the material. When the material is placed at the intersection of two laser beams, the beams interfere with each other to produce a pattern of bright and dark. Light entering the material changes the properties of the material, thus altering the second beam. (Extracted from *Science News*, 3 October 1992)

New identification method

Personnel Identification and Entry Access Control (Yellow Springs, Ohio) has developed an identification system based on measurements of the human hand, leading to a new generation of identity-checking machines. According to President Charles Colbert, a medical physicist, "the shape of the hand is as unique as a fingerprint". While large banks and producers of automated teller machines have yet to buy the system, orders are pending for several smaller applications, such as checking the identification of workers with access to computer rooms or other high-security areas.

The system records information about the shape of a person's hand, and encodes the data onto the magnetic stripe of a plastic card. Each time the card is used, the holder places a hand on the screen, which compares measurements with those on the magnetic stripe. The system can overlook minor injuries and temporary swelling, while still identifying the distinct characteristics of the user's hand. Advanced versions can take three measurements of each finger and detect a pulse (so that an unmanned station cannot be fooled by a fake hand). (Extracted from *New York Times News*, 21 October 1992)

Fastest silicon bipolar transistor yet

Using transistors based on new technology, researchers at the company's Central Laboratories in Munich have built ring oscillators that achieve a gate delay of 18 picoseconds at 1.6 milliwatts of power per gate.

The short switching time results from an excellent high-current performance. At collector current densities up to around 1.6 mA μm^2 (milliampere per micron squared), the cut-off frequency never drops below 44 GHz. A non-optimized static frequency divider achieves a best-ever performance for silicon transistors of 23 GHz. (Source: *Electronics*, 14 December 1992)

MODD features 35 ms access time

Samsung Advanced Institute of Technology (SAIT) (Kiheung, Republic of Korea), announced it has succeeded in developing a 5.25-inch magneto-optical disc drive (MODD) with 35 millisecond access time - one of the fastest 5.25-inch MODD in the world.

The 650-Mbyte MODD, dubbed SMD-506S, features voice coil motor (VCM), 2400 RPM, 22 gram separated head and direct-access servo method. It also includes an SCSI interface for wider compatibility.

A spokesman for the institute said it will mass produce the MODD in early 1993. SAIT expects the world MODD market to grow an average of 37.5 per cent until 1996. (Source: *Electronics*, 14 December 1992)

Device measures pH inside single cells

Chemists at the University of Michigan have developed a new type of fibre-optic pH sensor that is a thousandth the size and can analyse a millionth the sample size of previous optical fibre-sensors, and that responds 100 times faster than previous ones.

The sensor is the first capable of physically poking inside single living cells and cellular organelles and measuring substances there using fluorescence indicators. Although the new sensor measures only pH, its principle of operation is a general one that is likely applicable to determining other substances besides hydrogen ions.

The sensor was developed by a team led by chemistry professor Raoul Kopelman, and including chemistry doctoral and postdoctoral students Weihong Tan, Zhong You Shi, Steve Smith, and Duane Birnbaum.

The sensor is the first based on a "near-field" light source - a source that can be focused down to a spot that is smaller than the wavelength of light. Such subwavelength resolution was long thought to be

physically impossible, because light waves undergo diffraction when passing through a small aperture, spreading out the beam. However, physicist Aaron Lewis and co-workers at Hebrew University, Jerusalem, working with Kopelman, recently found that light can squeeze through a tiny aperture to form a subwavelength point in the "near field" - an area very close to the aperture.

Kopelman and co-workers have now used near-field optics to develop sensors as small as 0.1 μm in diameter that can detect pH in samples of a few femtolitres with millisecond-range response times. The smallest optical-fibre sensor previously reported had a diameter of about 100 μm, required a nanolitre-range sample, and had a response time of several seconds. (Extracted from *Chemical and Engineering News*, 2 November 1992)

New optical material

New non-linear optical materials have been developed by Dr. Seth R. Marder of the California Institute of Technology and colleagues at NASA's Jet Propulsion Laboratory. The organic salt DAST, first produced in 1989, has now been shown to work 20 times better than lithium niobate as an electro-optic switch. DAST requires only 1/350th as much electric charge to change the index of refraction. DAST is also stable, and can be formed into large crystals. It would cost only about 10 cents/gram. DAST is asymmetrically polar. (Extracted from *Science News*, 21 November 1992)

New hall sensors

Hall sensors, conventionally manufactured using bipolar or hybrid integrated circuit technology, can now be implemented using CMOS technology. ITT Semiconductors of Freiburg, Germany, has developed a family of these new hall sensors which, using CMOS, produce smaller, less expensive components while creating much closer tolerances with switching thresholds. Designed particularly for the automotive sector, the sensors are superior to their optical counterparts due to insensitivity to dirt. (Source: *Electronics*, 9 November 1992)

III. MARKET TRENDS AND COMPANY NEWS

Market trends

High tech, high anxiety

For America's computer firms, 1992 has been a year of upheaval. The Standard & Poor (S&P) index of computer makers (which, like the S&P 500 from which it is derived, includes only companies quoted on the New York Stock Exchange) is dominated by firms that make minicomputers, mainframes and supercomputers -

IBM, Digital Equipment, Amdahl, Data General, UNISYS and Cray. Fewer people are buying those products these days. IBM, which accounts for a hefty 62 per cent of the index, took a charge of $6 billion against pre-tax profits in the fourth quarter of 1992, announced another round of job cuts and said its previously sacrosanct dividend might be cut. Since January the firm's shares have fallen by 45 per cent, to a ten-year low.

PC makers have fared better. The growing trend towards replacing cumbersome mainframe computers with nimble networks of personal computers has helped global sales of PCs rise by 12 per cent in 1992, with a similar increase forecast for the coming year. That has boosted the sales revenues of Apple, Compaq, Dell, a host of other American PC makers and even IBM's PC unit. Higher sales have not helped profits, however. Manufacturers have waged the fiercest-ever price war in the PC business. The cost of a typical PC has fallen by half since January 1992.

With another round of price cuts likely in the spring, investors should put their money only on those PC makers with rock-bottom operating costs.

Falling PC prices have started to make software prices look high. Software-price skirmishes are on the increase: Microsoft, for instance, is launching its new Access database software at an 86 per cent discount to its "list" price. Many analysts expect a software price war in 1993.

A second factor is that software firms' operating costs are rising as programs become more difficult to write. Companies are struggling to adapt their DOS-based applications programs to Microsoft's newish Windows operating-system software, which now dominates the PC market. All this is squeezing margins hard.

Fears of rising costs and falling prices have undermined shares in those firms that sell mainly applications software.

Given the turmoil that hardware and software companies have been through, why have shares in chip makers risen so much over the past year? Under fire from Japanese rivals, American semiconductor firms did a lot of restructuring in the mid-1980s. As a result, most now concentrate on making the highly profitable microprocessors that are the "brains" of a computer, rather than low-margin memory chips.

Should investors bank on more good times for America's chip makers in 1993? A combination of economic recovery and the increasing number of firms swapping their mainframe computers for PC networks means that personal-computer sales should rise even more quickly. Though the PC price war will put pressure on microprocessor prices, firms like Intel and

Motorola have fat enough margins to prosper. And chip shares still look cheap, despite gains in 1992. S&P's chip-maker index sells on a price earnings ratio of just 14.3, compared with a p e of 24.8 for the S&P 500. (Extracted from *The Economist*, 26 December 1992 - 8 January 1993)

Market for computer-based banking sluggish

Retailers, still convinced a large untapped market awaits, are trying to find a new blend of hardware and network services that will save them money and make it easier for consumers to shop and bank at home.

To date, such efforts have largely been unsuccessful. Computer-based shopping and banking services are too complicated to attract the mass market, and few consumers have bought or leased the specialized phones needed to use the more advanced home banking and shopping services.

While 16.7 per cent of US homes use the phone to retrieve bank account information, only 1.6 per cent use an electronic bill-paying service, according to a survey by the Yankee Group Inc., the Boston-based consulting firm. However, 19.6 per cent say they are very interested in using such a service.

Michigan Bell Telephone Co. has responded with ScanFone, which was developed by US Order, of Herndon, Va. ScanFone is a "smart" telephone with a display screen, a barcode scanner, and a credit card magnetic-strip reader that Michigan Bell leases for $12 a month to permit Detroit-area customers to pay bills, order groceries, and shop by catalogue from home. Calls are routed through the telco's public packet-switched data network via long-haul carriers to US Order's data centre in Herndon. (Extracted from *Information Week*, 9 November 1992)

Power protection devices

The future trend for power protection devices includes miniaturization, faster processing speeds, and lower logic voltages. By the twenty-first century, the average personal computer will be very sensitive to power quality, in addition to being very small and fast. Delicate, tightly-packed micro-chip traces and DC bus voltages will need adequate protection from over voltages and electronic noise. The future will include an overtaxed electrical distribution infrastructure, as supply may lag behind peak demand by as much as 50,000 MW Surge suppressors will not be enough. Users will need uninterruptible power supply systems (UPSs) that boost voltage and provide backup power when power is cut. In the future, power protection will be bundled with PC's much like a printer, monitor and mouse are today. (Extracted from *Computing Canada*, 9 November 1992)

Prospects of VR technologies

Virtual reality (VR) technologies will revolutionize human-computer interaction, changing how people search, assimilate, and display database information. The 3-D nature of VR systems can help eliminate the 2-D translation of ideas to paper that must take place before these ideas take a physical form, back in 3-D. The information industry stands to gain from this technology in that with so much information available, actually using it is becoming overwhelming. In the future, VR interaction with a database will eliminate the keyboards, monitors, commands and menu options altogether in favour of the human body and senses interfacing with the database. Physical immersion in the data could take advantage of all the senses.

VR technology could be used in a business sense by portraying the stock market as a wheat field. Each stalk would represent a different stock and grow or shrink according to price fluctuations or other factors. A stockbroker or other user would literally walk through the market, recording a virtual field of real-time stock information. (Extracted from *Online*, November 1992)

Graphics chips step on the gas

Graphics accelerator chips are suddenly one of the hottest technologies in town.

As Windows software opens out into ever more applications and the graphical user interface has become flavour of the month, enter the silicon companies offering a route to faster, higher resolution graphics.

The market has attracted a mix of seasoned industry campaigners and specialist start-ups.

The three-year-old S3 Inc., which is distributed in the UK by Manhattan Skyline, claimed to be the first company to ship a single chip graphics user interface accelerator in August last year.

It brought together on one chip such functions as bit block transfer, line drawing and clipping colour expansion for fast text and filling. These features, together with sharper resolutions and up to 24-bit colour images, are forcing VGA chips out of the PC graphics market place. But competition has not been far behind S3.

The idea is clearly to get better graphics on screen faster. Many of the chips use different techniques to achieve this function.

Some of these devices are VRAM-based, others use DRAM. VRAM parts offer higher performance. (Extracted from *Electronics Weekly*, 11 November 1992)

PC's to proceed in a homely direction

Manufacturers want to make the PC a more widely usable domestic tool. PC software - and its recent "ease of use" ideas are being looked at for use in everything from automated bank teller machines to hand-held "personal data assistants" television, video-tape recorders and microwave ovens. Within the next five years people will have a few wall-mounted colour flat screens at home that will be used for TV, video games, information management and the control for all systems including central heating, video recording, etc. It will be a single hand-held controller with picture-based software screen. There are many technological issues to be settled before this happens, however. (Source: *The Times*, 16 October 1992)

Evolving technology changes the focus for telecoms designers

More digital signal processing ICs are used in telecommunications than in any other application. From mobile telephones to video compression somewhere there will be digital signal processing (DSP).

New chip technology and computer-aided design tools are changing the way that telecommunications designers are looking at DSP.

VHDL tool-kits from specialists are putting more of the DSP design responsibility in the hands of the systems engineer.

DSP chip suppliers still retain control of their basic DSP cores but suppliers recognize that designers now have the tools to differentiate the product with their own peripherals.

Industry standard tool-sets such as VHDL enable the customer to carry out full modelling, can generate complete logic synthesis and even create test patterns.

All the chip company does is produce the silicon. There may be more to it than that but the design authority is moving the right way: towards the customer.

In the areas of mobile communications this is driving down costs and offering product differentiation, but in broadband networking it is opening up whole new markets for DSP, which did not exist two years ago.

New high-speed switching and networking protocols such as asynchronous transfer mode (ATM) are compelling systems builders to do more processing in fast and dedicated DSP silicon. What in the past was software development on standard microprocessors needs dedicated hardware.

A group of engineers at BT have gone further and demonstrated how DSP will in future play a role in network analysis. New software has allowed the network designer to look through the microscope and monitor how the network is working on a sample-by-sample basis.

These tools make both DSP simulation and network modelling a less daunting task and more compatible. Those used by BT group were Comdisco's BONes a synchronous event driven network modeller and the synchronous DSP Framework model.

Graphical environments allow simulation programmes to be written from pre-defined libraries or from user-written blocks.

The most important tool allows close integration of high-level network modelling with low-level DSP simulation. This was achieved by using a C cross-compiler to produce DSP code.

The demonstration of mixed-modelling techniques could have important applications in other areas of telecommunications network design, for example marrying the model of a cellular communications network to the specific time dependent behaviour of radio channels.

The development of new digital processing technologies like speech encoders and video compression are transforming telecommunications. But it is important that they do not develop in a way which will make networks less efficient to run.

There is no unwritten law which says that an optimal network design is fully compatible with optimal speech coder.

No longer can the two elements be designed in isolation and new CAE tool-sets are putting DSP simulation right at the heart of telephone network design. (Source: *Electronics Weekly*, 20 January 1993)

Company news

Motorola and ASM working on silicon carbide films

Motorola Semiconductor Core Technologies, Phoenix, Arizona, and ASM America, Phoenix Arizona, have signed an agreement to co-develop plasma enhanced chemical vapour deposition (PECVD) silicon carbide films.

The companies will work to combine the benefits of thermal and PECVD processing to produce films for use in advanced bipolar and other devices. The films will be based on PECVD silicon carbide processes jointly developed in ASM's advanced Plasma IV dual frequency batch reactor.

Previous research at ASM has proven that silicon carbide can be successfully deposited in a PECVD reactor resulting in low stress amorphous films applicable for use in a wide variety of technologies. (Reprinted with permission from *Semiconductor International Magazine*, October 1992. Copyright 1992 by Cahners Publishing Co., Des Plaines, Ill., USA)

European consortium to attack active matrix LCD market

Philips Electronics NV of Eindhoven, the Netherlands, Thomson Consumer Electronics SA and Sagem, both of Paris, have decided to join forces in the field of active matrix liquid crystal displays.

The new company will start operations on 1 January 1993 and will market, develop, produce and sell LCDs. They expect the first products to be delivered in the course of 1993

Philips will contribute its Flat Panel Displays business group to the new company.

Meanwhile, the European Commission has made ECU 22 million available to the new consortium to challenge Japan's lead in flat-panel displays. (Extracted from *Electronics*, 14 December 1992)

Intel micros turn green

Intel says it will include power saving features in all of its future microprocessors as part of a US Government programme to reduce electricity use by PCs and help cut down on pollution from electric power stations.

Intel says it will include its Intel System Management Mode (SSM) and other energy-saving technologies in its future microprocessors. The SSM technology is currently used in Intel's microprocessors designed for portable computers. Intel predicts that its chips could reduce desktop system power consumption to as little as 50 watts instead of 200 to 300 watts.

The Environmental Protection Agency estimates that if PC companies use chips such as those proposed by Intel, it could lead to saving as much as 20 million tons of coal a year from being burned by power stations. (Source: *Electronics Weekly*, 21 October 1992)

Chip duo merge to take third place

Two of Taiwan's leading semiconductor companies, Vitelic and Mosel, have merged to form the island's third largest chip firm after UMC (United Microelectronics Corp.) and TSMC (Taiwan Semiconductor Manufacturing Company).

Vitelic is a specialist high speed DRAM company and Mosel is an SRAM company.

As well as DRAM and SRAM, the company specializes in "Voice ROMs" and has a 4Mbit ROM that can deliver between one and two minutes of speech.

The company was developing EPROM, E2PROM, and flash for voice applications but a main constraint was developing a chip that can be sold for one dollar - the market rate for voice ROM. (Source: *Electronics Weekly*, 21 October 1992)

Battery agreement

Philips Matsushita Battery Corporation (PMBC), the joint venture between the Dutch and Japanese consumer electronics giants, is to make nickel cadmium and nickel metal batteries following an agreement between its two parents. Belgium-based PMBC will establish a portable rechargeable battery division and will start production of nickel cadmium batteries in July 1993. About 25 million pieces will be produced per annum and will meet the need for small rechargeable batteries in cordless telephones and office automation equipment. (Source: *Electronics Weekly*, 18 November 1992)

Discrete power for a purpose

SGS-Thomson is to offer an application specific service in discrete power semiconductors, capable of integrating up to 150-power semiconductors (Schottky diodes, Zener or Transil, thyristors, triacs, resistors and capacitors) on one chip.

Initially, the first multi-discrete devices from the Applications Specific Discrete (ASD) group based in Tours, France, will be used for circuit protection applications.

Other applications include the control of fluorescent lamps. (Source: *Electronics Weekly*, 18 November 1992)

Franco-Italian cash for STM

Chipmaker SGS-Thomson Microelectronics (STM) is to get £1.2 billion in cash aid from the French and Italian Governments.

The two Governments are investing Fr5 billion (£617 million) of new capital into the indebted chip maker, which analysts predict will make it more attractive to potential partners.

They have also agreed to jointly provide Fr4.5 billion (£560 million) over five years to help pay for STM's ambitious research and development programme.

The research funding will amount to Fr900 million (£112 million) each year over five years starting from 1993.

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STM is Europe's third largest indigenous chip maker, ranked 13 in the world and has annual sales of around $1.5 billion (£870 million), reporting a loss of Fr581 million (£72 million) last year. (Source: *Electronics Weekly*, 11 November 1992)

SGS-Thomson signs with Exar

French-Italian chip maker SGS-Thomson Microelectronics and Californian hard disc specialist Exar have signed a technology development agreement. The two companies intend to collaborate on the development of chips for small disc drives - those below 3.5 inch diameters. The project is aimed at developing a family of highly integrated 1.2-micron BiCMOS read channel devices for drives that are capable of handling data rates of 12-33Mbyte/s. Such devices incorporate mixed signal circuit systems including pulse detection, data separation, active filtering and frequency synthesis. The aim is for a total power consumption of less than half a Watt from a 5V supply, although the two firms are working on 3V chipsets for portable computers as well. (Source: *Electronics Weekly*, 25 November 1992)

Hyundai in 64M push

Hyundai intends to be one of the first companies in the world to market the 64Mbit DRAM, bucking the global trend among major chip companies of forming alliances to fund future generations of memories.

This has been made possible by virtue of a new technique for dealing with the capacitors called "cavity cell", according to one of the chip's four designers, Seung Han Ahn.

Ahn pointed out that while US and Japanese companies were entering R&D and manufacturing alliances for next-generation DRAM, the top Korean companies would go it alone.

Hyundai is also building a 30,000 wafer-a-month wafer fab in Korea, which will be used to make the chip. First silicon from the fab - initially of 4Mbit and 16Mbit DRAMs - is expected in early 1994.

Ahn said that the difficulty of shrinking capacitors without impairing their capacitance had been solved by burying them in tunnels. The chip is made on 0.35/0.4-micron process technology and fits into the JEDEC standard package.

Hyundai is currently moving its standard manufacturing process from 0.8-micron to 0.65-micron, which will speed up its 4M DRAM to 50 ns. The company's 16M generation device made on a 0.55/0.6-micron process will be introduced in the second quarter of 1993. (Source: *Electronics Weekly*, 25 November 1992)

IBM tries to win back users to APPN cause

IBM has been forced to make concessions in its strategy for opening up mainframe-centred networks after a rival approach threatened to steal its user base. Now it is trying to stop users defecting with a new package designed to make the technology more attractive.

IBM unveiled Advanced Peer to Peer Networking (APPN) early in 1992, claiming the announcement was a watershed that would eventually transform mainframe networks from one-protocol systems into multi-protocol networks that were easy to manage and maintain.

But a recently formed rival, the Advanced Peer to Peer Internetworking Forum (APPI), has said that APPN was not as open as IBM claimed and that it could do the job better.

In six weeks the APPI Forum has signed up 22 members, many times the number of companies that have bought APPN licences. Now IBM has retaliated by offering routing vendors and resellers improved terms. (Extracted from *Computer Weekly*, 19 November 1992)

Laser chips go home

Laser chip-based modules to link future optical communications systems with multimedia computers and other applications in the home are to be developed jointly by US telecoms giant AT&T and Japanese electronic equipment maker Mitsubishi Electric, following an agreement announced late in 1992.

Both firms think such optical devices will be key to the development of broadband digital communications networks that go into homes - since laser chip-based systems do not require cooling, unlike the conventional laser-based systems used in telephone networks. (Source: *Electronics Weekly*, 2 December 1992)

Microsoft switches on to electronics

In December 1992 the PC software giant became the latest in a growing number of IT companies to combine PC technology and consumer electronics with the announcement of its Modular Windows product.

Modular Windows is an extension to the company's Windows operating system family, based on version 3.1 of the graphical user interface.

It is initially designed for CD-ROM players and a new breed of digital devices, which will provide consumers with new ways to access data transmitted by telephone, cable or wireless systems.

Microsoft's announcement comes almost a year after Apple announced its entry into the consumer

electronics market and nearly two months after IBM made its opening gambit.

Microsoft will ship customized versions of Modular Windows for the various digital devices. Versions for Personal Digital Assistants will come later.

The term PDA was coined by Apple when it announced its consumer electronics strategy in January 1992.

John Sculley, Apple chairman, believes the convergence of PC technology and consumer electronics will become a $3.5 trillion (£2 trillion) industry by the year 2000.

Apple will ship its first consumer electronics product in 1993. IBM is also working on PDA-type products. (Extracted from *Computing*, 10 December 1992)

Microsoft angers PC makers

Microsoft has come under fire from PC manufacturers after introducing a new licensing scheme for its MSDOS operating system.

The company is encouraging smaller customers who buy MSDOS in multiple packs to join its Easy Distribution original equipment manufacturing plan. But the scheme means they will have to pay a royalty fee on all PCs they ship, regardless of which operating system is pre-installed. Manufacturers claim if they do not sign up for the optional scheme, Microsoft will charge them up to 40 per cent more for their orders. Smaller manufacturers buy the MSDOS program in packs of 20, 50 or 100. (Extracted from *Computing*, 10 December 1992)

X-ray lithography to use GEM, used for GaAs

SEMATECH (Austin, Texas) has given an equipment improvement contract to Hampshire Instruments (Marlborough, Mass.) to supply a 0.35 μm X-ray stepper with a Generic Equipment Model (GEM). This partnership will allow Hampshire to complete GEM compliancy a year ahead of schedule; collaborating with software engineers at GW Associates (Sunnyvale, Calif.), who have a software package for GEM specifications, Hampshire plans to demonstrate GEM to SEMATECH by year end.

SEMI's GEM interface defines the behaviour of semiconductor equipment as viewed through a host computer link; it enables "lithocell clustering", hence potential users anticipate increases in productivity and reductions in tool and factory costs of ownership.

SEMATECH views the ability to integrate equipment into a manufacturing environment through a well-defined communications interface as an important

requisite for purchase consideration. The SEMATECH equipment interface development programme requires that all 200 mm wafer compatible equipment at SEMATECH support a GEM interface.

In another contract from Lockheed Sanders (Nashua, N.H.), Hampshire will provide an X-ray stepper and technical services for manufacturing 0.25 μm gallium arsenide (GaAs) monolithic microwave integrated circuits (MMICs); services from Hampshire will include mix-and-match processing. X-ray reticle fabrication, resist development and plate-up process development.

Sanders and Hampshire expect to show that they can achieve improved yield, lower chip cost and smaller critical dimensions. (Reprinted with permission from *Semiconductor International Magazine*, December 1992. Copyright 1992 by Cahners Publishing Co., Des Plaines, Ill. USA)

Sharp Laboratories to develop LCD research in Europe

The Japanese owned Sharp Laboratories of Europe has formed a fourth research division to concentrate on liquid crystal displays including a special interest in ferroelectric displays. This division has opened a new laboratory at Oxford, England, and will be under its new chief scientist Peter Raynes who helped to develop ferroelectric LCDs at the British Government's Defence Research Agency site at Malvern (formerly the Royal Signals and Radar Establishment). The LCD group will work alongside the three existing research groups in optoelectronics, information technology and imaging systems. (Reprinted with permission from *Semiconductor International Magazine*, December 1992. Copyright 1992 by Cahners Publishing Co., Des Plaines, Ill. USA)

IV. APPLICATIONS

Transponders for RF-based systems

Texas Instruments is preparing to start high-volume production of small user-programmable, low-frequency transponders for an emerging business in RF-based identification systems. TI's goal is to drive down the cost of EEpROM-based passive transponders from about $4-$10 each to the $1 range, ostensibly making them suitable for a wide range of ID applications, such as factory automation, inventory management, livestock tracking and security.

The battery-less transponders can be embedded in ID tags or attached to products and even animals for inventory and tracking purposes. Activated by a half-duplex RF link from a hand-held or stationary reading unit, TI's transponders can transmit ID data at 8-kilobits

per second up to 2-metre distances. TI's patented half-duplex, low-frequency transmission technique is among about 96 patents filed to cover the system, called TI Registration and Identification System (TIRIS).

TI believes its technology could replace bar-code readers used today in inventory control. The production ramp-up, scheduled to start in Malaysia, is part of a three-year business plan aiming to double annual revenues and launch new products in low-frequency passive transponder technology for what TI feels is a possible 18-month to 24-month lead over would-be rivals.

Specifically, TIRIS managers are waiting for several large Japanese companies to enter the RF ID market, which is estimated to be $300 million to $500 million world-wide. The RF ID market has already attracted one other manufacturing giant: the Hughes Aircraft subsidiary of General Motors, while the rest of the field is made up of about 65 small ventures.

TI has earmarked about $100 million in investments for the business unit; about $50 million will have been spent by year end. Part of the investment includes a new high-volume assembly line at TI's plant in Kuala Lumpur, Malaysia. The line will be able to produce 5 million transponders a year, but can be quickly doubled. (Extracted from *Electronic News*, 21 September 1992)

Data salvage

Computer data is usually made totally useless if it is dropped in water, but for the computer engineers at BASF Magnetics in Mannheim, who specialize in software, this no longer applies. They succeeded in recovering millions of damaged bytes in a unique data rescue operation. After spending months investigating the geological prospects for the existence of oil and gas reserves off the coast of Nigeria, an oil company had 3,750 megabytes of data stored on magnetic tapes on board its research ship. However, during unloading a mishap occurred: the cassettes fell into the murky water of the harbour. They were fished out of the harbour basin and then sent to Mannheim by air. There the BASF technicians first cleaned the approximately 200 metres of magnetic tape with isopropyl alcohol. Then they copied the valuable test results onto undamaged tape, and using software they had developed themselves, they eventually succeeded in recovering the data. More than 90 per cent of the bits were rescued. The lost data did not affect the overall usefulness of the survey results. (Source: *Scala* 6/1992, December 1992)

Cray computer to use MPP

Leading supercomputer maker Cray Research has announced details of its first computer to make use of massively parallel processing (MPP), as opposed to the vector-scalar processing approach that the company has used until now.

Instead of building a pure MPP machine the company will develop a heterogeneous architecture that combines parallel processing with its existing Y-MP C90 and M90 machines.

A similar approach has been followed by Fujitsu, the world's second largest computer maker, who recently announced a machine that contains several hundred processing elements each containing both vector and scalar processing units.

In the Fujitsu machine, each processing element is a 1.6 Gflop machine in its own right and can have up to 256 Mbyte of its own memory and transfer data at 800 Mbyte s to other elements.

The point is that MPP techniques are not applicable for all tasks and so the retention of some form of vector processing is required.

Cray's heterogeneous architecture will follow a slightly different approach to that of Fujitsu. The company will use the Alpha Risc microprocessor, designed by Digital Equipment, to build a parallel processing section, comprising 1,024 processors, that will be linked via a HIPPI interface to an existing Y-MP supercomputer.

The Alphas will be linked in a three-dimensional cube-like arrangement and each will have some local memory associated with it. However, although this is physically distributed it will be globally accessible.

To communicate with each other, and the distributed memory, the Alphas will be surrounded with Cray's own 150 MHz interprocessor communications chips.

The first 1024 processor Cray MPP system will be ready in 1993 and will produce 150 Gflops peak performance. (Source: *Electronics Weekly*, 11 November 1992)

Videos help root out tooth decay

Dentists drilling your teeth may in future look at a video monitor rather than into your mouth. A radiologist in the US has developed a system that scans a tooth with a laser beam. The light passes through the tooth, is picked up by a detector and digitized and an image is then displayed instantly on screen.

Abund Wist, assistant professor of radiology at the Medical College of Virginia in Richmond, says the laser system would allow dentists to make adjustments to the treatment without having to wait for an X-ray film to develop. The light, unlike X-rays, is a non-ionizing radiation, so it can be used continually during treatment.

With specialized software, the system can also provide three-dimensional images, which can be rotated on the screen so that the tooth can be viewed from all angles.

In experiments, the prototype laser system was able to detect tooth decay as effectively as current dental X-rays, according to Wist. Areas of decayed tooth scatter light more than healthy areas, so they appear as darkened regions on the laser image.

The system can also distinguish between living and dead teeth by first using a wavelength of light that is sensitive to blood, then the normal wavelength, and comparing the results to identify blood circulation within the tooth. Dead teeth have no blood circulation and it is not possible to pick this up with conventional dental X-rays.

The laser system works because a tooth is porous and during development the dentine and enamel grow as a series of tubular formations.

However, Wist says he sees the laser system as complementing rather than replacing traditional X-rays, which are good at showing metal material, such as fillings, in the middle of the tooth.

International Sensor Corporation, based in Pittsburgh, is now developing a commercial version of the system for use in dentists' surgeries. It uses a cap-shaped device that fits over the tooth itself and is open at the top so the dentist can drill the tooth. The cap contains a semiconductor laser at the front of the tooth and a sensitive photodiode detector at the back which converts the light to an electrical signal. A thin cable carries the signal from the mouth to a computer. Clinical trials of the system are planned to start in a year's time. (This first appeared in *New Scientist*, London, 26 December 1992, the weekly review of science and technology.)

Video buffs take home the reel thing

Home video enthusiasts with £2,000 to spare will now be able to turn their personal computers into a video editing suite that mimics expensive professional systems. The system can also add special effects, making pictures tumble, fly in and out of the frame, shrink, zoom, spin and dissolve.

The German electronics company Fast Electronic of Munich has launched the Video Machine, a circuit board that fits into slots in the back of one of the more powerful IBM-compatible PCs or an Apple Macintosh. Three conventional video recorders are connected to the board, two for playing tapes and one to record the output.

The board converts each frame of the video signal from its normal analog form into digital code. The digital standard maintains the full picture quality and gives a range of 16.7 million colours. The signals are then reconverted into analog form to be recorded on the output tape. Picture quality is limited only by the quality of the original tape.

The computer screen displays windows depicting the content of each input video sequence. These are displayed in the form of "time lines" running across the screen and indicating the length of each sequence. The operator can break and join the time lines to create an edited sequence.

The timing of TV pictures is kept in step with invisible synchronization pulses that accompany the picture signal. But the mechanics of video recorders often spoil the timing of the pulses, which can make the picture appear unsteady on screen. The Video Machine automatically restructures the pulses from signals taken from tape, as do all professional systems.

Cuts and mixes can be rehearsed and stored as control decisions in the computer memory. The sequence can then be viewed before copying onto tape.

The board has three megabytes of extra memory, enough to store at least two video frames. This lets the system add special effects: control software manipulates each image as it moves through the computer and subtly changes the shape of each image from the previous one.

The system comes with a library of more than 100 pre-programmed effects. Editors can also modify the library effects or can make their own completely new ones.

The control software is also compatible with word-processing programs so that an editor can add titles, direct from a text file, and is compatible with any font the word-processor uses. (This first appeared in *New Scientist*, London, 3 October 1992, the weekly review of science and technology.)

R4000 interfaces with EISA chipset

Chip maker Opti, a spin-off from Chips & Technologies, has collaborated with Integrated Device Technology and workstation maker Deskstation Technology to produce an EISA (Extended Industry Standard Architecture) chipset based around the Mips R4000 Risc microprocessor.

Deskstation Technology has designed an interface between the R4000 processor and the Opti chipset, which was originally developed for use with an Intel 486.

That interface is currently implemented in a number of GAL programmable logic devices. The spokesman added that IDT will convert the GAL implementation into a single-chip ASIC and that volume

shipments of computers based on the devices will occur in the first half of next year.

This will allow easy upgrades of existing PC designs based on the EISA bus to more powerful Risc based machines. Crucial to the new machines will be the appearance of Windows NT, the forthcoming operating system from Microsoft, which should also be ready by the second quarter of 1993. (Source: *Electronics Weekly*, 2 December 1992)

Inspecting ICs without damage

IBM's Thomas J. Watson Research Centre has developed a non-destructive method of inspecting integrated circuits, and says that it will license it to other semiconductor manufacturers.

The technique uses a variation of scanning force microscopy to scan small parts of a chip in great detail without damaging it.

Scanning force microscopy relies on the use of a very fine tip moved across the surface of a material.

Sensors measure the attractive force between the tip and the surface of the material, producing detailed images of the surface to a resolution of 1 nm.

IBM's adaptation uses a different shaped tip and analyses the attractive forces in different ways to generate detailed images not only of the surface of the chip, but also the depth of a chip's features.

This technique will allow semiconductor manufacturers to improve production processes and determine where faults lie in complex chips. (Source: *Electronics Weekly*, 18 November 1992)

LAM etches a name in memory chips

California-based LAM Research has built a commercial machine that can etch silicon wafers to the degree of accuracy needed to produce 64 and 256 Mbit memory chips.

The machine uses the company's transformer coupled plasma (TCP) technology to carry out precise sub-half micron etching on polysilicon substrates. This is also achieved at relatively low pressures compared with other plasma etching or reactive ion etching machines.

These systems often operate at pressures greater than 50 mTorr, which cause ions to collide frequently and scatter over a wide angle range. This in turn causes lateral etching of the side wall in the channel, which can affect the function of a circuit.

To prevent this lateral etching, complex and expensive chemistry or high bias power are necessary, which can in themselves cause damage and affect yields.

TCP technology, operating at lower pressure and at lower bias power, produces less scatter among ions and therefore allows vertical profiles to be etched in the substrate. The low pressure operation also reduces the incidence of localized etching effects, or microloading.

The LAM Research machine uses a patented planar coil, located above the chamber in a parallel plane to the wafer being etched, to produce a uniform plasma directly over the wafer.

It operates at pressures between 1.5 and 5mTorr and allows a simple transfer of power to the plasma. Ion densities possible using the machine average between 10^{11} and 10^{12} ions cm^3. This is achieved with ionization efficiencies, i.e., the ratio of ions to neutral charges, claimed to be two orders of magnitude higher than other etching machines. (Source: *Electronics Weekly*, 18 November 1992)

Smartcards are getting smarter

Smartcards are finding their way into many more applications than was originally envisaged, and today there are hundreds of trials taking place world-wide for applications including parking meters, betting cards, ID cards, access control - the list is almost endless.

Looking more closely at the volume areas for growth in smartcards, market research shows GSM, pay TV and banking as being the three major user areas of smartcards.

Another progression in smartcard chip technology is in the field of security via data encryption. Today, all encryption is implemented using private key algorithms, which are stored in the ROM or EEPROM of the chip.

In particular, there is a need for smartcard chips with very small amounts of memory, incorporating the newer EEPROM and HCMOS technologies. These would be used in applications currently using memory cards, but which now require the extra security offered by an MPU-based smartcard. The overall effect is polarization of device portfolios - large memory and increased complexity devices at one end, with small low cost solutions at the other.

For increased security, there is growing interest in public key algorithms. These involve many more computations, and when implemented in software, take an unacceptable length of time to compute.

However, using a dedicated hardware block on the chip, public key algorithms can be executed in an acceptable time frame. Although there are no applications currently using such hardware blocks, future encryption is sure to be implemented by this method. It is likely therefore that there will be an increasing number of devices on the market with hardware encryption blocks on board.

As the demand for smartcards increases, and with the resulting advances in technology, there is a major opportunity waiting for smartcard chip makers. They will have to work very closely with system suppliers to define and design the necessary devices for the application, and position themselves to ramp up production to meet volume orders.

For example, Motorola, currently one of the dominant world-wide smartcard chip makers, has invested in excess of $50 million in the company's East Kilbride facility. The company says that it is responding to an increased forecast smartcard demand of 25 million units. (Source: *Electronics Weekly*, 18 November 1992)

Memory cards take hold

IC memory cards are small, rigid cards, the size of a credit card, and they contain DRAMs, SRAMs, OTPROMs, EPROMs, etc. They are capable of reading or being read through a small edge connector at one end.

Portability means that they can be used to collect or hold data, or specific programs, which can then be taken elsewhere and run computers or test equipment.

They are still expensive in comparison with magnetic storage medium, such as diskettes, but they are light to carry, simple to use and are robust.

Where limited memory capacities are called for, such as small lap-top PCs, memory cards will increasingly replace hard disc drives.

In the future, two types of memory cards will come into common use. One as an extension of central memory and the other type will have a more frequent and portable use, to complement and replace diskettes.

Compatibility of cards made by one manufacturer to operate with another maker's computer has been a problem to date. For this reason, the Personal Computer Memory Card International Association (PMCIA) in the US and the Japan Electronic Industry Association (JEIDA) are attempting to standardize card dimensions, as well as the interface and connectors used. (Source: *Electronics Weekly*, 18 November 1992)

LCD screen has wider viewing angle

Fujitsu Laboratory says it has developed a colour liquid crystal display (LCD) screen that offers users a clear view at nearly any angle.

Fujitsu says that unlike conventional LCD screens, which offer the best views only within a narrow range of angles, its new screen offers a six times wider view. The improved clarity is achieved through the use of spherical-type liquid crystal cells instead of the common rectangular cells used in most LCDs.

Fujitsu has produced a prototype of its display and says it is based on thin-film transistor and Polymer Disperse technology. Fujitsu says that this technological breakthrough will allow it to manufacture larger and better computer display screens, and also large, flat TV screens that can be viewed from almost anywhere in the room. (Source: *Electronics Weekly*, 11 November 1992)

Chipset supports ATM

TriQuint Semiconductor, the US gallium arsenide specialist, has introduced a $120 data communications chipset, which supports the asynchronous transfer mode (ATM) network architecture. The three-chip FC-265 chipset operates at serial data rates up to 265.625 Mbit/s. The GaAs transmitter converts an encoded 10-bit TTL-compatible word into a differential ECL signal, which will drive optoelectronic transmitters. (Source: *Electronics Weekly*, 18 November 1992)

First Hobbit products

The first products built around the Hobbit microprocessor from AT&T are the Personal Communicator models 440 and 880 from EO. These are pen-driven computers with built-in communications facilities like a modem and a connector for a cellular telephone. The Pen Point operating system and nine application programs are preloaded in ROM. These include software for word processing, electronic mail, fax, diary and calculation. Other software such as database management and spreadsheet applications are under development. The EO machines also have a fast serial port that allows data to be downloaded to IBM-compatible PCs. The 440 weighs only 2.2 lb. and will be available in March 1993. (Source: *Electronics Weekly*, 11 November 1992)

Revolutionary mouse offers computability to the disabled

Disabled users can now control a PC via a sensor system that reacts to human movements and talks to a computer using its mouse port.

Gwent-based Penny and Giles Biometrics originally developed the sensor as a working tool for physiotherapists, but the firm has now developed software and an interface box that allows the mouse to control a standard PC or a BBC Archimedes computer. (Source: *Computer Weekly*, 12 November 1992)

Computer responds to the tender touch

Conventional computer screens can now be quickly and easily adapted to respond to the touch of a finger, thanks to an American device which requires changes to be made to the screen itself.

Touch-sensitive computer screens have been available for some years, but they are expensive, always need to be installed professionally and are permanently fixed to the screen. However, Touchmate, developed by Visage of Boston, is a slim box, roughly 35 centimetres square and just over 4 centimetres thick, which sits under a normal computer monitor. The monitor stands on a top plate which is separated from the main part of the device by springs.

When the monitor is touched, eight sensors in the device detect the force the finger is applying to the screen. By analysing the rotating, tilting and horizontal forces on the screen, the TouchMate calculates where it is being touched and with how much pressure. Three accelerometers attached to the base of the device detect any inadvertent motion of the table or desk underneath so that this movement can be discounted.

To calibrate the device, the user simply pokes the side of the monitor in various places and wobbles the table on which it stands. Visage claims it is accurate to the nearest 0.6 of a millimetre and can detect 256 pressure levels.

The device can be used with software packages that rely on graphic "icons", such as Microsoft Windows. The average finger may be a little too blunt to select very small icons on screen, but with larger touch-screen targets, such as those used in automated banking machines and information systems, the system works faultlessly.

At £650, the Touchmate costs about the same as converting a 35-centimetre monitor to touch-screen working. But it can handle screens up to 48 centimetres, at which size a normal touch-sensitive screen would cost around £1,000. Also, it only takes about five minutes to set up. The British company Ellinor is selling the devices in Britain and will soon manufacture them under licence.

Grid, which pioneered a range of portable computers controlled with a pen, last week launched what it claims is the world's first "convertible" computer that can be controlled by a pen or a keyboard.

When the computer is closed, a pressure-sensitive screen faces upwards and responds to commands written with a stylus. Beneath the screen lies a full-sized notebook computer keyboard. When the screen is up, it is possible to type in information and use the pen system simultaneously.

Although the technology for the pen system and the notebook are both tried and tested, Grid's innovation has been to bring the parts together. The Grid Convertible will cost £2,700 and goes on sale early in 1993. (This first appeared in *New Scientist*, London, 28 November 1992, the weekly review of science and technology.)

Power PC architecture goes into action

Motorola and IBM have described the first implementation of the Power PC architecture, for which silicon has already been produced.

The 601 is binary compatible with IBM's RS 6000 processor chipsets, although it has a smaller instruction set. Trap and emulate software takes care of missing instructions.

It is a superscalar design allowing three instructions per clock cycle. Also the RS 6000 architecture has been extended to allow 64-bit operation. There are new instructions for shift compare and divide. Applications written for 32 bits can run with a 64-bit operating system kernel, and 64 bit applications can call 32-bit libraries. Users can switch between 32 and 64 bit modes.

To increase speed, the 601 has instruction fetching and branch processing units. An instruction queue and dispatch unit has an 8-entry instruction queue and an 8-word bus to fetch instructions from a 32 kbyte cache.

Branch processing is improved by an 8-entry sequential prefetch from cache to the instruction queue.

A fixed-point 32 bit instruction unit has 32 general purpose registers and all multiply and divide instructions are supported in hardware.

A floating point unit also has 32 registers and supports all data types in both single and double precision.

Made in 0.65 micron CMOS, the device typically dissipates 9 W in operation. (Source: *Electronics Weekly*, 21 October 1992)

Mitsubishi memory cards contain SRAM and Flash

Mitsubishi has started sampling memory cards that contain both SRAM and Flash memory chips. The first companies in the UK to receive samples are

software houses working on the development of applications for hand-held computers.

The cards have up to 1 Mbyte each of SRAM and Flash and meet the PCMCIA 2.0 card format. They will be particularly useful for small computers that have only one card slot. These typically have small on-board memories and rely on PCMCIA cards to boost their user RAM capacity.

Supplying application programs for such machines on cards packed with non-volatile ROM deprives them of this extra RAM space. Cards with only Flash memory would give them the combination of application code and extra user memory space. However, Flash is still significantly slower than SRAM and also consumes more power which is a big disadvantage in portable equipment.

The new Flash SRAM combination cards offer the compromise of supplying a program in non-volatile Flash, without sacrificing all of the extra RAM that a PCMCIA card can supply.

Another possible use is in cases where the PCMCIA card acts as a non-volatile backup disk. Again portable computer users can have this advantage without losing all their extra user RAM. However, in both cases issues such as disk partitioning need to be addressed at the system design stage and so software companies are working to ensure that their programs will be fully compatible with computers making use of the new facilities. (Source: *Electronics Weekly*, 21 October 1992)

Africa's sunlight aids the deaf

The sun will soon be helping deaf people in developing countries to hear. The Botswana Technology Centre has developed a tough, low-cost hearing aid which uses solar power to recharge its battery.

Conventional hearing aids are not really appropriate in developing countries, says Steve Jump, head of electronics at the Centre.

The hearing aid consists of a standard earpiece attached by a cable to a clip-on box measuring 5 cm by 7.5 cm by 2 cm and weighing 60 grams. This contains the electronics plus a tiny nickel-cadmium battery that was designed originally for use in radio pagers. A solar panel is built into the casing. Exposing the panel to five hours of direct sunlight will recharge the battery fully and give between 50 and 80 hours of use, depending on volume.

For maximum toughness, the casing is injection-moulded in polycarbonate, a material which is also used for motorcycle crash helmets. Jump says that the casing was designed to withstand being dropped from a height of 1 metre onto a concrete floor. None of the parts of

the hearing aid are replaceable; it is simply intended to last about five years.

After encouraging results from field trials, the hearing aid will go into production. It will be assembled locally at Camphill, a workshop for disabled people which recently received 7,800 pulas (about £2,300) for tools from the British High Commission. (This first appeared in *New Scientist*, London, 19/26 December 1992, the weekly review of science and technology.)

Multimedia in future PCs

The move to add multimedia functions to personal computers has DSP-chip vendors scrambling to grab a corner of the PC motherboard. Armed with multimedia software systems - real-time kernels designed to encapsulate a DSP subsystem within a personal computer - two camps are readying DSP solutions that will emerge at upcoming conferences.

Analog Devices (Norwood, Mass.) and the IBM/Texas Instruments/Intermetrics Mwave project will both introduce kernels in an attempt to make DSP hardware a standard part of next-generation personal computers. The goal is to simplify integration of DSP technology for hardware designers and software developers - a move that could trigger a real explosion in DSP silicon production.

At the heart of the Analog Devices approach - dubbed Signal Computing - is a series of chips, tool kits and development tools coupled with "reference designs" from several partners aimed at easing DSP design-in for software vendors.

The TI/IBM approach, meanwhile, includes a new DSP chip, designed by IBM and sold by Texas Instruments, intended to accelerate the design-in of DSP-based multimedia capability in PCs. (Extracted from *Electronics Engineering Times*, 12 October 1992)

Workstation with VR

Sun Microsystems (Mountain View, Calif.) has developed a holography workstation enabling almost physical interaction with a virtual reality environment. The workstation is based upon the Sun SPARCstation 2GT or 10GT. It uses the Stereographics stereo display system and Logitech's ultrasonic tracking technology. Stereographics uses liquid-crystal shutter glasses that alternate fields from eye to eye. Logitech provides a 3-D mouse for direct interaction with the models and also a feedback loop that tracks the movement of the user's head relative to the 3-D images. Deering has provided software that enables the user to view the display from different perspectives. The innovation of this device lies in the integration of the head-tracking device, which creates predictive images based on where the user's head will be when the display changes.

With this workstation, users can lathe a 3-D model of a spinning cylinder of metal and extrude virtual material from it as simply as squeezing toothpaste from a tube. Other interaction with models can be carried out just as easily. (Extracted from *Computer World*, October 1992)

Discs at the heart of a revolution

Compact disc technology lies at the heart of a revolution in the world of personal computing. Since CD technology is digital it can be used to distribute different types of information including text, photos, motion video, software and of course digital sound. Also this is based on the CD audio technology ensuring economies of scale, which keeps costs down. Drive performance and compression technology also have drastically improved as well as rapid transfer of data from disc to PC. A further innovation is the extended capability of CD extended architecture (CD-ROM XA) and a storage for digital images with full photographic quality, which can be edited and combined with standard computer applications. (Source: *The Independent*, 13 October 1992)

Convertible computers on duty for a double shift

Apple Computers have produced portables that convert into desk-top machines. The system, called Duo, consists of a notebook computer that can be removed from a desk-top chassis and used outside the office and replaced again. Weighing about 4 lb and about 1½ inch thick and including a hard disc, it slips into the docking base just as a video tape slots into a video player. Its popularity is fuelled by the fact that companies do not like having to buy two machines for one employee, one for the office and one to carry around. The "docking stations", as they are called, need to be improved in design. It requires sophisticated software that automatically sets up the notebook and a security locking device so that people do not walk away with your notebook. (Source: *Times*, 23 October 1992)

New solid oxide fuel cell

Ceramatec (Salt Lake City, Utah) has developed a solid oxide fuel cell that could ultimately generate more efficient household power and reduce pollution. Ordinary solid oxide fuel cells (SOFC) are built as tubular devices. This design is difficult to scale up to commercial size without major cost and larger power units, according to Brian Hatt, vice president of development. Ceramatec researchers have developed a flat SOFC that can be scaled up economically. The planar unit can provide the basis for a 25-kilowatt commercial unit the size of a refrigerator to power an average household, as well as for larger units to provide utilities with electricity. Inputs are natural gas, water and air. (Extracted from *Mechanical Engineering*, November 1992)

Bulbsaver

The chandeliers at Chatsworth House and the light bulbs in the Goat Inn public house near Peterborough both exploit a British design for increasing the life of the ordinary light bulb.

The Bulbsaver, developed by Microcel, of Peterborough, is a tiny device installed behind the wall switch. The chip-on-a-circuit reduces the electrical surge that occurs when the light is switched on, which weakens the filaments in the bulb. The designers say the life of bulbs should be increased tenfold.

At £4 per unit, the Bulbsaver will be most widely used where it is difficult to replace bulbs - in Belisha beacons or railways signals - or where one switch controls a large number of bulbs. Further information from Microcel (UK), Tel. 0778-347214. (Extracted from *Financial Times*, 27 November 1992)

Disc formats promise to develop photography

Photo CD started as a way to store holiday snaps but now offers much greater potential. A 5-inch disc can hold up to 100 pictures and when put into a photo CD or CD-I player (both of which will play audio CDs), the picture will appear on the TV screen. Kodak has announced special formats that will take 6,000 thumbnail pictures. If a designer, magazine editor or advertising agency wants to use a particular image they will contact the owner for a negative or transparency. A museum could store images of every item in their collection, which could be searched by a key word. There are also medical applications to which this could be put. (Source: *The Independent*, 13 October 1992)

Taming an unfriendly beast

For years, printers have been the most complex and frustrating aspect of personal computing with lack of standardization. The new HP LaserJets will feature automatic language and interface switching for mixed computing environments. The printer will automatically sort out the queuing of the documents, switching between page control languages and interfaces. For users with networks, there will be cost and performance benefits. Compaq, Canon and Apple are also entering the fray as formidable competitors. (Source: *Financial Times*, 20 October 1992)

Two heads are better than one

With the introduction of powerful, low-cost "servers", PCs are now competing with the mini-computers and mainframe computers, the traditional workhorses of corporate computing. The performance of these multi-brained PC servers is enhanced by the addition of extra multiprocessor PC chips. Minicomputer manufacturers feel that since PCs were not designed to

run large-scale applications and high volumes of information processing, they can never replace minicomputers. PC makers now claim that the multiprocessor PC will eliminate the information bottleneck by carrying out several tasks simultaneously in its multiple brains. The benefits of multiprocessing will be felt only when users have access to applications optimized for use with multiprocessor operating systems. (Source: *Financial Times*, 6 October 1992)

Canon camera focuses by eye

Camera-maker Canon is developing a 35 mm camera that uses a photo-detection chip to automatically focus the lens by detecting what the photographer's eye is looking at.

Most autofocus 35 mm cameras today focus the lens by bouncing a sonar signal or infrared beam off the subject being photographed.

The Canon A2e, due for release in the second quarter of 1993, is claimed to be the first camera to reverse the auto-focusing process.

The "Eye-Controlled Focus" is built using infrared beams, a beam splitter, a condensing lens, and a CCD (Charged Coupled Device) sensor.

The Eye Controlled Focus works by detecting the rotation angle of the photographer's eye.

A pair of miniature infrared-emitting diodes (IREDs) are mounted on the eyepiece which illuminates the eye for a fraction of a second when the shutter button is pressed.

The infrared light is reflected from the eye into the camera's viewfinder and refracted by a beamsplitter through the condensing lens to a CC sensor where it forms an image of the eyeball as well as a pair of reflections from the IREDs.

The Eye-Control system then calculates the photographer's line of sight by comparing the position of the pupil to the IRED reflection images.

Once users calibrate the A2e, provisionally priced at $750, to their specific eye characteristics, they simply look at a subject through the viewfinder and press the shutter button halfway.

The lens then focuses automatically, and a green indicator in the viewfinder information panel confirms the focus completion. (Source: *Electronics Weekly*, 28 October 1992)

Colour printers

Colour has become an integral part of desktop computing and much software now relies on it as a way of communicating information. Yet, while colour photocopiers are appearing in offices and colour publishing has become the norm, nearly all computer output has remained monochrome. Presentations may be in colour, but the speaker's notes are distributed in black and white. Reports contain bright charts and subtle scanned images, but only if you view them on-screen.

Slowly this is changing. Colour printers now account for 6.6 per cent of the printer market, according to Romtec, compared with 3.4 per cent a year ago. Most of these machines (about 70 per cent) use ink-jet technology, which provides the best balance between cost and quality for everyday printing tasks. The market is dominated by Hewlett Packard with nearly 90 per cent, mostly its cheap DeskJet 500C series; Canon has 7 per cent and Integrex nearly 3 per cent.

Ink-jet printers work by squirting tiny drops of ink through nozzles thinner than a human hair. Most have four colours: cyan, magenta, yellow and black. Cyan, magenta and yellow can be combined to give three further colours, red, green and violet, giving seven in all. Apply these side by side in a process called "dithering" and they create the impression of a full range of colours.

The higher the resolution, the better the blend and the sharper the image. Printers like the Canon BJC, HP DeskJet and PaintJet, and Tektronix Phaser III have a resolution of about 300 dots per inch (like a standard mono laser printer). Others, like the Sharp JX-735 or Tektronix ColourQuick, are around 180-200 dpi. Integrex boosts the 160 dpi resolution of its ColourCel by varying the size and position of the dots and the intensity of the colours to give near-photographic quality.

Most ink-jet printers use liquid ink. An alternative is solid ink or "phase change" printing. This uses a wax-like ink, which is solid at room temperature and is melted before being squirted onto the paper, where it cools and solidifies. The paper is then passed between two rollers for the ink drops to be flattened or "cold-fused" to improve the image quality.

Liquid ink is a simple, well-established technology and prices start as low as £500 for HP's now rather outdated DeskJet 500C, whereas the solid ink Phaser III costs £9,000, but liquid link is less reliable, since ink left in the nozzles can dry up and block them; manufacturers are improving on this, with self-cleaning mechanisms, but admit that it remains a problem. For best results, liquid-ink machines also require special paper, which can cost up to 30 pence a sheet. Solid ink, by contrast, will print on anything, even coarse paper or fabric. Both will print on overhead projector film.

Solid ink comes in individual sticks like Lego bricks. Bubble-jet printers have a disposable cartridge, which contains the ink and print heads, while piezo models have permanent heads. It is usual to have two

cartridges, one for black and one for the three colours. Some cheaper models, like the HP DeskJet 500C and Integrex ColourJet, only take one cartridge at a time, so in colour mode they have to create black by overlaying the three colours, which is less sharp than true black. A new cartridge costs about £20, and should print about 250 pages of graphics or 1,000 pages of text, so running costs are reasonably low. The greatest running expenses are special paper for liquid-ink models (30 pence a sheet) and overhead projector film (up to £1 a sheet).

Few manufacturers quote a lifespan for their printers. Ink-jet printers are less robust than some computer equipment, and their life can be prolonged by reading the instructions. Put the wrong medium, such as fabric, into a piezo printer, and you could ruin the print heads. Ship any liquid ink printer with the dye cartridge in place and it may leak. Another problem is matching on-screen colour with printed output. Colour matching is generally done by the software drivers supplied by the manufacturer. Some are pretty rudimentary, assuming the printer will be used only for rough proofing or for simple business graphics, others allow sophisticated tinkering, changing hue, brightness and saturation.

The main drawback of colour ink-jets, however, is their speed. While laser printers measure print speed in pages per minute, colour ink-jets are measured in minutes per page - usually about 4-7 minutes for A4 graphics, depending on the quality and resolution required. Page printers with their own processor are quicker, but even this has a top speed of only 1.5 minutes per page.

The quality of ink-jet output is disappointing compared with professional colour printing. Most ink-jets are therefore used for rough proofing of documents, which will be professionally printed, or for preparing documents for in-house circulation. For better output, more expensive technologies are necessary. Dye sublimation, a Polaroid-like process, produces excellent photographic quality. But graphics and text quality is poor. Thermal wax, the oldest desktop colour technology, melts coloured wax from a rotating drum, giving bright, rich colours ideal for overhead projector films. However, photographic quality is poor, the output is easily damaged and the hardware cost is £4,000 - £6,000, with pages more than £1 each. The best all-round colour technology is laser printing, with fast speeds and cheap page costs. But currently it is unreliable and capital costs are £20,000-£100,000. The cheapest colour technology is dot matrix, but this is noisy and output quality is poor.

A good colour ink-jet printer costs almost double the price of a monochrome model. By the mid-1990s, however, manufacturers are promising speeds and prices equivalent to a monochrome laser printer, with plain-paper printing and portable models. Colour desktop monitors are the norm and colour displays on portable PCs are becoming common. A colour printer on every desk is likely to be next. The question is whether it will be provided by faster ink-jets or cheaper lasers. (Source: Computing, 12 November 1992)

Energy-efficient computers

Computers are quick thinkers but much of the time they wait for users to tap in the next task. Apple Computer estimates that most PCs spend 60-70 per cent of their time doing little more than make flying toasters flap across their screens; a sample of PCs surveyed by the National Research Council of Canada was found to be idle 90 per cent of the time. Up to 40 per cent of computers are left switched on all night and during weekends, wasting even more power.

According to E. Source, a consultancy based in Boulder, Colorado, the typical desktop PC uses 150 watts of power. Left on 24 hours a day, it will consume 1,314 kilowatt-hours of electricity a year, at a cost of just over $100; for a high-power desktop machine, that rises to around $200. At the other end of the scale, a Cray YMP2E supercomputer eats as much as 440 megawatt-hours each year, and needs an air-conditioning system able to waft away at least 10 kilowatts of waste heat. All that produces an annual electricity bill of about $35,000.

According to America's Environmental Protection Agency (EPA), computers account for 5 per cent of the country's commercial electricity consumption. By the year 2000, says the EPA, the proportion could double. Computers are the fastest-growing consumers of electricity. Turning them off when they are not in use would probably be the biggest help. Meanwhile manufacturers are looking at ways to make the machines inherently energy-efficient.

Cathode-ray display screens and electro-mechanical devices like disk drives and fans are the most power-hungry parts of a desktop. In time, each will give way to less energy-intensive technology. High-definition liquid-crystal displays, for instance, use a fraction of the power consumed by cathode-ray tubes, but at present cost more to make. Hard disk drives may well be ousted by memory cards based on "flash" EPROM (erasable-programmable read-only memory) chips. These have no energy-draining moving parts and - unlike dynamic random access memory (DRAM) chips - do not lose their memory when the power is switched off. At present a 20-megabyte flash card costs $500-$600, at least twice the price of an equivalent disk drive, but the cost of flash chips is falling fast.

The fan can be replaced by cunningly designed heat-sinks, which channel away waste heat through a computer's chassis without using any electricity.

Intel, which makes the microprocessors that drive 80 per cent of today's PCs, reckons it can achieve energy savings by incorporating System Management Mode

(SMM) circuitry into its chips. Accounting for about 10 per cent of the 3.2m transistors on Intel's new Pentium chip, SMM switches idle bits of the computer in and out of "sleep" mode at great speed. SMM will even turn off different parts of the microprocessor between keystrokes.

Sleeping computers are usually troublesome in networks, where machines constantly give each other electronic "handshakes" to reassure themselves that their fellow network members are still up and running. Intel's SMM, however, will shake hands in its sleep, coming wide awake only when a key is touched or when prompted by other computers in the network.

IBM's prototype Energy Desktop PC incorporates one of Intel's energy-saving chips. It does away with a fan and takes a variety of solid-state memory cards. At full blast it uses 50 watts; when sleeping, just 16 watts. Run continuously, says IBM, it will use $15 of electricity a year. The machine even has a recyclable case. IBM says its green PC could go into production in 1993; many of its features will be incorporated into IBM's other PCs over the next two years. (Source: *The Economist*, 5 December 1992)

Olive oil scam caught in the net

Unscrupulous olive oil dealers often try to sell virgin oil diluted with cheaper olive oil or other oils, claiming it is the pure article. But a neural network computer will soon be on their trail.

Douglas Kell and Royston Goodacre from the University of Wales in Aberystwyth, and Giorgio Bianchi from the Olive Oil Research Institute in Pescara, Italy, have developed a system based on a chemical analyser called a Curie-point pyrolysis mass spectrometer.

The spectrometer heats and breaks up the oil molecules in a vaccum, and analyses the atomic masses of the resulting particles. The masses give an overall "fingerprint" graph for the particular oil, but to the naked eye the graphs appear to be virtually identical.

The researchers gave a neural network the finger-prints for 24 samples to learn from. The network was told which oils were which and altered its structure to optimize its ability to distinguish between them. In a double-blind test it identified another 24 samples correctly.

Kell says that another technique, gas chromato-graphy, can identify the oils, but takes about 90 minutes for each sample. The new method takes 90 seconds. (This first appeared in *New Scientist*, London, 12 December 1992, the weekly review of science and technology.)

V. COMPUTER EDUCATION

Scots schools put chips on the menu

Scots schools could soon lead the world in teaching children about integrated circuits, thanks to a project undertaken by a consortium of education and business organizations in Scotland, which has developed what it claims are the world's first teaching micro-chips.

Motorola, Edinburgh University, Compugraphics and Scottish Enterprise have invested a total of more than £100,000 in the scheme, which has produced four different chips in special packaging with a glass window that allows students to see the microscopic electronic elements.

The four chips are: a semiconductor materials resistor chip, for investigation of basic semiconductor and resistor properties; a CMOS transistor chip, to study logic and memory circuits; an optoelectronics chip, with a collection of diodes and photo diodes; and a ring oscillator chip, enabling students to investigate the propagation delay of logic gates.

The chips in the package were designed jointly by staff at Edinburgh University and Motorola and produced using Motorola's CMOS process in the firm's MOS 1 wafer fab at East Kilbride. Compugraphics provided mask sets.

The package has been designed for use with children as young as 12 as well as with A-level students and those on higher education courses.

Initially a hundred schools in Scotland will be sent a teaching package containing documentation and sets of the four custom-designed chips. The documentation details experiments designed to show the operation of basic products underpinning the electronics industry. (Source: *Electronics Weekly*, 18 November 1992)

Compass CAD tools for education

Compass Design Automation has won a major contract to supply CAD tools to a project, which promotes IC design at all the high schools, polytechnics and universities in the Netherlands. It means the Compass design tools will be installed on about 300 workstations spread over 18 sites. Compass joined with OEM partners Vantage Analysis Systems and Anacad Computer Systems to provide features including library compilers, full VHDL support, test automation and FPGA support. (Source: *Electronics Weekly*, 24 February 1993)

Videoconferencing lessons

To accommodate its growing number of college campuses, Mexico's Monterrey Institute of Technology and Higher Studies (ITESM) has upgraded its "Education by Satellite" videoconferencing distance-learning project.

ITESM has more than two dozen campuses in 25 cities throughout Mexico. To share resources among campuses, the Institute began videoconferencing live classes in 1989, using a one-channel, analog system. However, as the number of campuses grew, it became too expensive to expand the system and lease additional satellite transponder capacity.

By switching to a two-channel, digital video network - with satellite equipment and a broadcast television system - each campus can simultaneously receive two classes, transmitted from the Monterrey and Mexico City campuses. Students at remote sites are equipped with personal computers so that they can communicate with their instructors, who cannot see them, over a data network.

Because the digital network uses only a fraction of the bandwidth required for analog video, it has significantly lowered transponder fees. (Source: *Communications Week International*, 7 September 1992)

VI. SOFTWARE

UK firm seeks out hot spots that kill chips

Heat kills chips, which makes the issue of packaging even smaller, ever faster devices critical to electronics designers.

So it is worth noting that Wimbledon-based fluid dynamics specialist Concentration, Heat & Momentum (CHAM) has introduced a software tool, called HotBox, which uses computer simulation to predict fluid flow and heat transfer.

As a result, the design cycle and prototyping stage is shortened considerably.

Flow patterns and temperature distributions are calculated and displayed in a colourful and easily understood manner.

Damaging hot spots and stagnation areas are easily detected and remedial actions can be tried out by engineers in a matter of minutes, without leaving their desks.

A menu of materials and components is selected and the heat equations are then calculated. With HotBox the three dimensional structure of the item of equipment is defined using computational geometry, based on a grid structure

At the low hardware end, HotBox is available for use with any IBM PC-AT486 or compatible machine. (Source: *Electronics Weekly*, 25 November 1992)

Analogy sets design tool Pace

Analogy, the analogue design tool specialist, has launched an initiative to provide high-level behavioural simulation models simultaneously with the launch of analog and mixed signal semiconductor components.

Under the Pace (Programme for Analogue Component Exchange) scheme, Analogy will work with semiconductor firms at an early stage in their product development cycle to produce software models written in Analogy's Mast analog hardware design language.

The models will be ready at the same time as the chips are launched, so potential customers can model their behaviour in larger electronic systems.

Analogy has already tried the service on Motorola's new IGBT ignition coil drivers for the automotive industry. (Source: *Electronics Weekly*, 18 November 1992)

Microsoft wins race to market with Windows-based Access

Microsoft launched its long-awaited Access database in late 1992, beating rival Borland to market with a Windows-based product.

Microsoft has been racing against a two-pronged attack from Borland. Borland is close to releasing a Windows version of its Paradox database and has been working on an upgrade of dBase, which it acquired when it bought Ashton-Tate.

Microsoft acknowledges that, although Access has arrived, it remains a difficult task to convince users they should stop using a database that works with DOS.

Access is targeted at what Microsoft calls end users and power users, not at developers. With its Open Database Connectivity, the company plans to make Access the Windows front-end choice for users who want to query data held in various non-PC databases, such as DB2 or Oracle Server.

The software house has also announced version 2.5 of the FoxPro database for both Windows and DOS, which will be available in January next year. (Extracted from *Computer Weekly*, 19 November 1992)

Graphical approach to data analysis

A picture is said to be worth a thousand words and some researchers are exploiting this by using sophisticated graphics to help out in the analysis of large amounts of information.

The trouble is that creating and manipulating the complex images needed to represent multidimensional data sets demands the huge processing power found in multiprocessing and parallel processing computers - which requires clever graphics software.

Graphics software designed to exploit such multiprocessor applications has been developed by an American firm - CST Images.

Called Surface Scientific Tools, the package can make use of up to 16 vector processors in a variety of configurations.

Processors can be local or distributed over a network. Tasks can be divided between processors, for example a set of i860s on a multiprocessor board.

Surface will also support the addition of processors to an application without requiring modification of the software.

Surface can distribute processing for either interactive or batch mode applications. It runs under the Unix operating system with the X11 user interface.

One or more CSPI SuperCard array processors is required to develop and manage workstation resources.

Application areas for Surface include underwater acoustic analysis, electromagnetic analysis as well as the analysis of data from medical, biomedical, geophysical, sonar and radar devices. (Source: *Electronics Weekly*, 25 November 1992)

Janet link-up outstrips local nets for speed

Data will soon be moving across the UK faster than it currently moves around buildings, after the Joint Academic Network (Janet) is upgraded.

Janet connects local area networks at 200 universities, polytechnics and research sites around the UK. No fewer than 50,000 terminals and 2,000 electronic mail services are connected by fibre links, which operate at speeds of up to 2 Mbps, but at present sites can only swap data.

Now the £18 million contract to update the network has been finalized, and BT is putting in an infrastructure that will ultimately accelerate the network to Gbps speed.

The initial upgrade, based around BT's Switched Multi-Megabit Data Service, will involve six sites swapping voice, data and interactive images.

The trial will run from January to March 1993.

The pilot sites are departments within Cambridge and Manchester Universities, Rutherford Appleton Laboratory, University College London, Imperial College London, and Edinburgh University.

The University Funding Council (UFC) envisages that the applications run over the network will include distance learning, virtual libraries, medical imaging and multi-media information services. Already plans are being drawn up to allow medical students to watch and learn from operations being carried out elsewhere in the country.

BT is looking to use the project to try out services, which will eventually be rolled out to the general public. (Source: *Computer Weekly*, 19 November 1992)

Anti-viral programs

The computer virus threat is growing. Experts say there are at least 1,000 known viruses and their numbers are growing at the rate of 50 per month. Perhaps more disturbing, a recent study by Portland, Oregon-based USA Research Inc. conducted for Japan's Ministry for International Trade and Industry (MITI) found that, while most attacks are isolated, viruses inflicted an estimated $1.1 billion in damages on US businesses in 1991.

Most anti-virus solutions fight software with software. Last month Central Point Software Inc. of Beaverton, Ore., one of the leading vendors of anti-virus technology, announced a giveaway program called "Virus Free By 93", which posts a copy of the scanning engine of the company's anti-virus software on CompuServe and other on-line services. Users can download the software and make unlimited copies.

Meanwhile, Microsoft Corp. has incorporated an anti-virus program for the next edition of its basic operating system, MS-DOS Release 6.0, which is in limited beta test and will be available in 1993.

Perhaps an even more potent weapon is on the horizon. Western Digital Corp., an Irvine, California-based microprocessor manufacturer, has developed a system it calls the Immunizer, which automatically monitors disk I/O operations for virus activity at the lowest possible hardware level. The system is embedded in its WD7855 System Controller, which went into volume production at the end of 1992.

The Immunizer exploits a relatively new chip technology known as System Management Interrupts (SMI), which automatically turns off a computer when it is not being used. Originally developed for portables, SMI is now being targeted at desktop PCs in conjunction with a program from the Environmental Protection Agency to make systems more cost-effective and energy efficient.

Fifth Generation Systems has rolled out an antivirus product designed to run on Novell NetWare 3.X LANs. The Untouchable Network Netware Loadable Module (NLM) provides virus protection and data recovery from known and unknown viruses on NetWare servers. The software carries out integrity checks on files within the file server, ensuring that files stored one day are identical to those being accessed the next day. In this way it detects viruses that can add code or alter the existing code of the executable file of an application. Integrity checking eliminates the need for frequent software updates. (Extracted from *Information Week* and *Networking World*, 30 November 1992)

Micro CDS/ISIS Version 3.0

Version 3.0 of Micro CDS/ISIS, the database software produced by the United Nations Educational, Scientific and Cultural Organization (UNESCO) is now available for general distribution.

The most notable characteristic of the new release is its full support of Local Area Networks (LANs) (i.e. the ability for several users to access the same database simultaneously for both searching and updating). The system provides a locking mechanism preventing two users from performing incompatible operations, such as modifying the same record.

Version 3.0 will also, of course, function in a single-user environment. A number of problems reported by users of version 2.3 have been corrected and several new features have been introduced, including support for expanded memory and the ability to access DOS from within CDS/ISIS. The CDS/ISIS Pascal library has also been extended with several new procedures, providing, in particular, tools for the development of LAN applications.

For more information, contact: Mr. G. del Bigio, PGI/CII, UNESCO, 7 place de Fontenoy, 75700 Paris, France. TP+33 1/4568-3791. (Source: *DIT Info* [Newsletter of UNESCO's Bureau of Documentation, Informatics Services and Telecommunications], September 1992, No. 3)

Earthwatch

Watching planet Earth, and the impact of humans upon it, is the purpose of the United Nations Earthwatch. Management can only proceed on the basis of information. As human activities make their impact felt on the global environment, Earthwatch, a system-wide mechanism, collects information on the environment and the way it changes, and advises decision makers so that management actions can be taken.

In 1989, the United Nations General Assembly, in its resolution 44/224 on monitoring, assessment and anticipation of environmental emergencies, recognized the need to strengthen Earthwatch and called for broader participation in it as a continuing mechanism "to make authoritative assessments, anticipate environmental degradation and issue early warnings to the international community".

UNCED Agenda 21, as adopted in Rio in June 1992, repeatedly emphasized the importance of information on environment and development as a basis for policy-making and management action, and includes a number of specific references to the strengthening of Earthwatch.

Earthwatch should become the process by which the United Nations system, in cooperation with the international community, assembles information on the human and natural environment. This can then be combined with development information to determine progress towards sustainable development, and to alert the world community to ways in which human activities may be interfering with the functioning of the biosphere - and with human well-being.

For more information on Earthwatch, contact: Mr. A.L. Dahl, Deputy Coordinator, Earthwatch, United Nations Environment Programme (UNEP), Palais des Nations 1211 Geneva 10, Switzerland. Tel.: +41 22/789-40-82; Fax: +41 22/789-40-73. (Source: *ACCIS Newsletter*, Vol. 10, No. 4, November 1992)

WHOTERM - WHO terminology software

WHOTERM is a new terminology database management system created by the World Health Organization's Technical Terminology Service. Throughout the years, WHO technical units had each developed their own glossaries of preferred terms. Such a situation can lead to duplication and inconsistency (different units each using their own, different definition of a term like "epidemiology", for example). The need for a fixed set of terms was evident, for technical units and for translators, who needed to be able to use consistent terminology.

WHOTERM was designed as a tool for both technical writers and translators. It is multilingual, handling any number of languages, and can be used on PC compatibles, with DOS or WINDOWS. Its object-oriented design ensures optimum use of storage space. It claims to be user-friendly, and it comes with a variety of output formats, to facilitate desktop publishing.

While the fixed set of terms in the WHOTERM system cannot be changed by users of the Organization's LAN, the system can incorporate changes made on individual workstations. Once an individual's terms are approved, they can be transferred onto the LAN by the administrator.

WHO wants to make the package available as widely as possible to UN system organizations and Member States. Potential contributors of data to WHOTERM can, by arrangement, obtain a cost reduction, or even have the charge waived.

For details, contact: Mr. P. Lewalle, Chief, Technical Terminology Service, World Health Organization, Avenue Appia, 1211 Geneva 27, Switzerland. Tel.: +41 22/791-24-58; Fax: +41 22/791-07-46. (Source: *ACCIS Newsletter*, Vol. 10, No. 4, November 1992)

INTERNET - the electronic global village

From California to Antarctica, Sweden to the UK, computer users can travel without leaving the comforts of their desks to communicate with any number of categories of people, for business or just for fun. Electronic globetrotting is offered courtesy of NTERNET, a many-splendoured labyrinth of computer interconnections.

This criss-crossing of electronic links opens doors to a mesmerizing array of information resources, of enormous potential utility to the information professional. In the course of a typical browse through the options, the INTERNET user might come across the on-line catalogue of a university library in the UK (leaving an on-line message for the librarian *en passant*); then download some antivirus software from an American university; then drop in on any number of discussion groups where teachers, library administrators, romance readers or cat enthusiasts can pool information and resources.

With a current 3 million users in 33 countries, INTERNET is the closest thing we have to a universal computer network. However, it is not without its problems, such as a user interface that has been described as "savage". It is a communications weakling, capable of moving only 1.5 million bits per second between 13 hub cities - although this looks set to improve. Furthermore, INTERNET, a loose affiliation of private, academic and government-supported networks, is rather anarchic, without a single owner to police its lines and keep it running smoothly.

However, INTERNET has enormous potential, as the place where electronic mail was born. From it having sprung most of the de facto computer networking standards used all over the world. If INTERNET fulfilled the computer network ideal, computer users the world over could send messages, data files, pictures,

sound, software and video clips to one another, secure in the knowledge that what they sent would arrive at the intended destination.

With this convenience would come a welcome cut in telephone, fax and telex costs for users; computerized memos are electronically much leaner than voices or pictures. In theory, it is said that a 200-word computer memo should be able to traverse the USA for less than one cent.

INTERNET traces its origins to a network set up in 1969 by the US Government, and (for the moment, though things may change) runs off a US$ 20 million federal subsidy covering a cross-country link managed by the US National Science Foundation. Supposedly, not everyone can tap in, and blatant commercial traffic is banned. But, once on the system, INTERNET charges you nothing for the time you use. The only cost is the mental struggle involved in weaving your way through a network with no administrator and scant documentation.

Today, anyone with a computer and a modem can gain access to INTERNET by paying a fee to any one of half a dozen companies for an account. Many United Nations organizations are using INTERNET; evidence points to a steady increase in use by UN users during the last few months. For more information, contact INTERNET, National Academy of Sciences, 2101 Constitution Avenue, Washington, DC20418, USA. (Sources: *Wilson Library Bulletin*, June 1992; *Forbes*, July 1991)

Building Advisory Service Information Network (BASIN)

Operational for over three years, BASIN is the first attempt to coordinate and monitor, with the support of a data-bank, the accumulated know-how of four appropriate technology institutions/organizations in specific areas relating to low-cost building materials and construction technologies for the initiation of a free information flow into developing countries with a close coordination of its work with resource centres in those countries. The network partners are the German Appropriate Technology Exchange (GATE), Intermediate Technology Development Group (ITDG) of the UK, Swiss Centre for Appropriate Technology (SKAT) and International Centre for Earth Construction (CRATerre) of France.

GATE is a division of the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, a federal organization commissioned by the German Government with the planning and implementation of technical cooperation activities with countries of the third world. GATE is a centre for the dissemination and promotion of appropriate technologies for developing countries and is divided into the following three sections: (1) Dissemination of appropriate technologies;

(2) Environmental protection and conservation of natural resources; and (3) Research and development.

ITDG is an independent British charity, aimed at helping to increase the income-generating and employment opportunities of small-scale industrial activities in developing countries. ITDG offers expertise in a wide range of technical areas (eg. mineral industries, shelter, agro-processing, textiles), provides advice and assistance in the selection and application of appropriate technologies aimed at improving the productivity of communities and small enterprises, and provides several other services through the Group's subsidiaries.

SKAT is a Swiss documentation centre and consultancy group which is engaged in promoting appropriate technologies in the third world. SKAT's main fields of activity are Building Materials, Energy (with emphasis on hydropower), Small-Scale Industrial Development (with emphasis on the metalworking industry), as well as water, sanitation and wastewater.

CRATerre is a non-governmental, non-profit organization of the School of Architecture of Grenoble, France, dedicated to the promotion of earth as a building material. CRATerre has an integrated working method in which research, application, consultancy, training and communication are permanently linked. The three main programmes of development are: (1) industrialization; (2) economic housing; and (3) preservation. The competence of CRATerre covers every aspect of the different earth construction technologies at all levels.

Each of the network partner organizations, although possessing expertise on numerous building materials and technologies, however, specializes, within BASIN, in a single subject area in order to be able to provide a more qualified service. Thus, GATE, besides coordinating the complete activities of the network also looks after the "Wall Building Materials Advisory Service", ITDG handles the "Cementacious Binders Advisory Service", SKAT runs the "Roofing Advisory Service" and CRATerre provides the "Earth Building Materials Advisory Service".

The services of the four network partners are based on: (i) Information: data collection, preparation, dissemination; (ii) Experience: collection of feedback, analysis, evaluation of tests, projects, research results, etc.; and (iii) Consultation: advice on specific issues and consultancies offered. The BASIN data bank, coordinated among the partner organizations, contains information on: (i) documents; (ii) technologies, equipment; (iii) institutions, consultants projects in the respective subject areas; and (iv) question and answer statistics. With this constantly increasing and updated information base, together with a fast-growing collection of international literature and a pool of recognized subject specialists to refer to, BASIN is capable of providing highly qualified answers to technical inquiries on a large number of building issues.

The network also identifies subject areas in which more specific information or other supporting documentation is needed and arranges the production of necessary publications for dissemination. A primary aim of this is not only to establish a dialogue and an exchange of information between BASIN and the inquirer, but also between building professionals, firms and institutions within the developing countries themselves.

SKAT publishes an international newsletter called BASIN News on behalf of the network.

BASIN is a service available to all institutions and individuals concerned with housing, building and planning in developing countries. The network partners may be reached at the following addresses:

GTZ GATE, Section 4130, Dag-Hammarskjold-Weg 1, D-6236 Eschborn 1, Federal Republic of Germany. Tel.: (06196) 79-3130; Fax: (06196) 79-1115; Telex: 407501-0 gtz d; Cable: GERMATEC Eschborn.

ITDG, Myson House, Railway Terrace, Rugby CV21 3HT, United Kingdom; Tel.: (0788) 560631; Fax: (0788) 540270; Telex: 317466 itdg g; Cable: ITDG Rugby.

SKAT, Tigerbergstrasse 2, CH-9000 n St. Gallen, Switzerland, Tel.: (071) 302585, Telefax: (071) 224656, Telex: 881226 skat ch, Cable: LATAMI St. Gall.

CRATerre EAG, Centre Simone Signoret, PB 53, F-38090 Villefontaine, France; Tel.: (74) 966056; Fax: (74) 960463; Telex: 308658 f; Cable: CRATERRE Villefontaine.

(Source: *Tech Monitor*, July-August 1992)

Looking through Windows NT

Although the majority of desktop PC's run the Microsoft DOS operating system, several new operating systems are on the way, promising advanced features such as multitasking, virtual memory, security, a robust file system and powerful system administration tools.

These include offerings from IBM, Apple, SunSoft, Univel and Next. However the most eagerly awaited is Microsoft's Windows New Technology (NT) which is due for release in 1993.

This is because Windows NT is a progression from an already successful product: Windows 3.03 3.1, that has become an industry standard by virtue of the fact that some 9 million users world-wide have it on their machines.

One of the key strengths of Windows NT is a technology called HAL, or Hardware Abstraction Layer.

HAL is a simple concept that allows an operating system to be easily ported from one chip architecture (platform) to the next.

The operating system has a microkernel of only 60 kybtes, the raw code that needs to be microprocessor-specific to run, so the overall operating system can be adapted quickly to run on different systems.

Windows NT HAL also makes the software attractive to system suppliers. For example, NCR was an early supporter of Windows NT and has so far written two of its own HALs for its four and eight processor mid-range servers that are based around Intel microprocessors.

When Windows NT runs on these computers it does not care whether they have one or eight i486 chips because HAL handles all of the complexity of talking to multiple microprocessors.

This means that Microsoft will succeed in producing a shrink-wrapped operating system that will run in uniprocessor or symmetric multiprocessing (SMP) mode straight from the box.

Thus Windows NT lends itself nicely to computer users who want to downsize software from proprietary hardware, such as an IBM 3090 mainframe or AS 400 midrange, and onto an industry standard platform. True open systems. As well as Intel microprocessors, Windows NT will be ported to the Silicon Graphics (formerly Mips) R4000 and the DEC Alpha Risc microprocessors.

A major strength of the Windows NT architecture is its modular design that allows just about any software application to run on top of the operating system. For example, Windows NT will run existing 16-bit Windows applications, future 32-bit Windows applications, MS-DOS applications, OS 2 and Posix software via add-on application programming interface (API) software.

Microsoft is already talking about the future and the next version of Windows NT, due out in 1994 and currently code named Cairo, which will handle the advanced storage requirements of distributed object-oriented data.

Cairo will use a new file system, based around Windows NT's existing NT File System (NTFS), but more in line with the Open Software Foundation's Distributed Computing Environment (DCE) network model.

The core micro-kernel of this new operating system is called Mach, a Unix kernel developed by the Carnegie Mellon University in the US. (Source: *Electronics Weekly*, 28 October 1992)

Guide to engineering and scientific software

At a time when many companies and engineers are intensifying their struggle to maintain their competitiveness, indeed, to keep afloat, engineering software is more than ever an important ally to have on one's side. The third annual IEEE Spectrum focus report and guide to engineering and scientific software for PCs and workstations has accordingly been focused on areas of relatively heightened activity and interest, rather than the entire software field.

New in this report are four feature articles: a users' survey carried out for Spectrum by Erdos & Morgan MPG, an international market research organization with offices in New York City; an article on design software for mixed analog- and digital-signal circuits; another on multichip module routing and placement tools; and a discussion of the status and utility of frameworks in design automation, conducted by a panel of technical experts. Spectrum convened the panel for this report, and the group met in Anaheim, California, during the IEEE's 29th Design Automation Conference last June. Accompanying the discussion is a sidebar on the Computer-aided design Framework Initiative (CFI).

Also included are an update on tools for logic synthesis for application-specific ICs (ASICs), a feature on electromagnetic design and simulation software, and three reports - on data acquisition and processing software, on packages for math, graphics, and visualization, and on development tools for embedded digital signal processing.

All the technical feature articles contain tables of software packages that have been introduced since October 1991 or are updates of earlier ones. The selection is representative, not comprehensive. Because of space limitations, each company was allowed only one package per table - even though in the course of the year it might well have introduced more packages than the one item tabulated here. Spectrum compiled the tables in consultation with the article authors and an advisory board of five software experts, and companies checked their entries.

The "Defining terms" list that starts the report offers an explanation of terms. Wrapping things up are sources for further study and indexes of vendors of tabulated and advertised software packages. (Source: *IEEE Spectrum*, November 1992)

SQL front ends

During the 1980s, processing power slowly shifted from the mainframe to the PC, which sat in splendid isolation on your desk. Single-user databases also moved out onto the PC's hard disk, but shared data had to wait

until PCs were networked. Then it moved onto the file server, where multiple users could reach it. So for the first time data became physically separated from processing power, and this caused problems.

If you wanted to search a 50Mb file of company transactions in order to find the names of those who had placed orders over £5,000, the entire 50Mb had to be moved across the network to your PC. Despite the impressive bandwidth of modern PC networks, if 200 users simultaneously tried the same trick, the network rapidly ground to a halt. It was time to get data and processing together again, but without returning to the bad old days of the dinosaur mainframe.

Structured Query Language is a standard designed to allow data and processing to get together again and also to address the problems inherent in accessing data from various sources. As is usual with standards, there are various SQL, from Microsoft, IBM and others, but there is a common core in all the language derivatives.

The name is slightly misleading. While it is often used for querying a database, SQL also provides all the other functions associated with building and maintaining a database.

The hardware part of the SQL server is almost irrelevant as long as it is powerful enough and has enough disk space to handle all your data - it could be anything from a top-end PC to a big Unix box. This server is attached to the network, and the SQL software on it then listens for SQL commands which it receives from workstations on the network. When such a command arrives the SQL server searches through the relevant database and sends the answer back across the network.

The resulting reduction in network traffic can improve performance enormously and the real processing power can be concentrated where it is needed in the SQL server. And, as wide area networks, which can span continents, become more robust and common, one SQL server can be used by everyone in a multinational corporation.

The SQL language is loosely based on English, so the commands are reasonably readable. The problem is that SQL can become tortuously incomprehensible if queries are complex. Happily, there are several ways of accessing the power of SQL without learning it.

PC applications software often has bolted-on SQL functionality, which allows you to work in your favourite application and generate a query for the database using the commands you know and love. The SQL query is created transparently and dispatched to the server, and the answer is presented to you in the way you would expect from your chosen package. One example of this is the Datalens functionality in Lotus 1-2-3. There are obvious benefits in being able to increase

the functionality at your finger tips without having to learn a new language. Protected by a familiar interface and surrounded by well-understood tools, users need not be aware they are making requests via an esoteric querying language.

SQL bolt-on functionality also means that while one user on the network may be using Lotus 1-2-3 to access the information, another may be using another package to query the same database.

The second method of accessing data on an SQL server is via tools specifically built to be front ends for SQL. These can be graphically-based and provide an attractive interface for users. Gupta's Quest is a GUI end-user tool which can be used as a standalone product. But the user does need some understanding of the structure of the relational database being accessed.

SQLWindows (also from Gupta), PowerBuilder and EDA SQL are one step further up the complexity tree. They are developers' tools that can generate end-user interfaces, which can be customized to suit the user, obviating the need for training. The increased productivity on offer can reduce development time for a complex database interface from months to weeks or even days. Once in place, an easy-to-use interface, customized to the task in hand, gives further efficiency gains. Such interfaces will abide by all the security restrictions in place on the network and on the SQL server.

While it is true that graphical interfaces are slowed down by the huge amounts of screen handling and redrawing necessary, this has no effect on an SQL server because it is concerned only with handling the data; the GUI is controlled by your local processor. And, while it might take an extra fraction of a second to translate and transmit a query to the server, the gains in usability far outweigh any speed constraints.

SQL's great strengths are the standardization of communications with databases and the reduction in network traffic. The technology has been readily embraced by large corporations and it is beginning to filter down to smaller organizations as its benefits become more apparent and more software is able to offer SQL querying options. (Source: *Computing*, 26 November 1992)

Hitachi interface lets computers read sign language

In a further step towards increased computer understanding of user intention and non-verbal cues, Hitachi, Ltd. of Tokyo has developed a prototype of a sign language interpretation system that recognizes general continuous sign language. The results are displayed in natural written language.

In the new system, data is input using a data glove. Ten optical fibres are attached to the glove so that

finger flexion can be detected. The coordinates and direction of the hand are also detected with sensors fixed to the back of the glove.

Word recognition involves compression and various processing steps, one of which - dynamic programming - is often used in speech recognition. This data is then correlated with stored word patterns. Finally, sentence recognition is achieved, within five seconds, by adding prepositions and articles to the input data - a step required for conversion to natural text. (Previous attempts at the automatic recognition of sign language have been hampered because general sign language omits the prepositions, making translation difficult.)

One problem with the prototype, admit Hitachi officials, is that if the amount of stored standard data patterns increases, it becomes very difficult to identify the correct word. However, the problem is being worked on. (Source: *Electronics*, 12 October 1992)

Automated anaesthetist promises end to waking nightmare

Waking up from anaesthetic in the middle of an operation is a nightmare many people have experienced. To prevent it, an anaesthetist at Glasgow Royal Infirmary has built a system that monitors the patient's brain activity and then automatically supplies the necessary dose of anaesthetic.

Research suggests that roughly one per cent of patients emerge too soon from anaesthetic sleep, often suffering profound trauma. Anaesthetists normally rely on clues such as sweat and tears, changes in heart rate and blood pressure and even bodily twitching to detect when a patient is waking prematurely. However, these signals are not always reliable.

The best barometer of consciousness is the brain itself. For more than a decade, scientists have known that the brain responds in a predictable way to clicking sounds. Different anaesthetics affect this "click response" in a predictable way. A computer monitoring the click response during surgery could therefore gauge the changing influence of anaesthetic on the patient.

A lack of computing power stood between theory and practice. According to Gavin Kenny of Glasgow Royal Infirmary, the brain's response to clicks is so faint compared to the noise of other signals in the brain that older computer systems needed to analyse five minutes of brain activity to filter out a single reading.

Kenny has spent the past few years developing software that can detect the faint click response more quickly. His prototype Closed Loop Anaesthesia system yields a clear reading of the brain's reaction to anaesthetic with a lag of only 19 seconds. It runs on a standard personal computer.

Before the operation, earphones are placed over the patient's ears and three electrodes are attached to the skull. The computer records the brain's response to clicks fired into the ears at a rate of seven per second. By taking readings before the anaesthetic is administered, the computer establishes a "wakeful" level of response against which it can compare later readings.

Every three seconds, the computer updates its graph of brain activity. If the anaesthetic begins to wear off, the graph veers back towards the wakeful signal recorded before surgery. Automatically, the system replenishes the anaesthetic level until the brain slips back into sleep.

Similarly, if the brain activity becomes too low, the system cuts down on anaesthetic to prevent the patient going into too deep a sleep. Kenny believes that this helps patients recover faster after the operation.

Kenny plans to scale his system down to the size of a shoe box and add a motor-driven vaporizer for administering anaesthetic. The system must go through trials on 10,000 patients before being used more widely. So far, it has been tested on 350 patients, none of whom have reported even the slightest memory of the operating theatre. (This first appeared in *New Scientist*, London, 5 September 1992, the weekly review of science and technology.)

VII. COUNTRY REPORTS

Canada

Research programme on IMS

Canada is taking part in a feasibility study that could lead to an international research programme on intelligent manufacturing systems (IMS). The goals of the IMS programme would be to standardize present production technology and develop the next generation of production technology, according to Maurice Koroniak, an official with Industry, Science & Technology's advanced manufacturing technology directorate. Potential benefits would be that Canadian competitiveness could be increased utilizing new technologies developed in the programme; the international nature of an IMS programme would bring partnership opportunities for Canadian production technology providers; and Canadian know-how in certain market niches would be more extensively exposed via the IMS programme. The study also involves the US, Japan, Australia and the European Commission's European Free Trade Association. (Extracted from *Canadian Machinery*, September 1992)

Object software development

Objects are the key to the next evolution in software, that of being able to buy software in pieces and use it to create personalized applications. Objects are intelligent pieces of data with standard interfaces, whose internal operation is hidden from other objects. Objects provide increased reusability and flexibility because they can be put together to create many different applications. Combinations of objects will work together as seamlessly as today's integrated packages because they all adhere to some standard set of protocols. According to Gerry Blackwell, DOS will most likely be dead by 2001.

Software vendors involved in object software development include Microsoft and Serius (Salt Lake City, Utah), which has developed a library of easily and seamlessly connectable application modules, including relational database and word-processing objects. Its offering is growing and ultimately will cover virtually every standard PC function, according to Edwin Firmage, executive vice president. (Extracted from *Computers Canada*, 9 November 1992)

European Community

EC puts £2.5 million into medical expert systems

The European Community has given a European consortium of doctors and computer specialists £2.5 million to develop a commercial expert system to help doctors treat patients.

The GAMES II project has been given until 1994 to develop a general architecture for medical knowledge-based systems to build medical decision support systems for hospitals and general practitioners. The systems will run on Unix workstations.

The prototypes being developed around Europe will cover asthma, diabetes, organ transplant, critical care, radiation accidents, primary care and cancer research.

At the University of Ulm in Germany, which specializes in the treatment of radiation poisoning, programmers and doctors are developing a decision support system, based around GAMES II guidelines.

This will store the knowledge of the world's leading radiation specialists who gained their experience since 1940.

As systems become more tightly controlled, future generations of doctors who, although they understand the theory, lack the hands-on skills of treating patients following a radiation accident, will be able to refer to the database for guidance.

In the UK the consortium, working with Concurrent Healthcare Solutions, is defining a standard for linking the GAMES II decision support software into existing Hospital Information Support Systems and Patient Administration Systems. (Source: *Computer Weekly*, 12 November 1992)

Call to extend JESSI

Raimondo Paletto, chairman of the Joint European Sub-micron Silicon Initiative (JESSI) has asked for a six-year extension to the project to secure the future of European chip making.

The present JESSI life span takes the programme up to 1996. Paletto wants a five to six-year extension to 2001/2002.

In 1992 JESSI gave European chip-makers a 0.7-micron logic process and will give them a 0.35-micron process in 1993. A 0.25-micron process is due for transfer in 1996 - well up to speed, if not ahead of, the best Japan and America can offer. (Extracted from *Electronics Weekly*, 18 November 1992)

Pact on mobile phones

Switzerland, Germany and the four Scandinavian countries have signed Europe's first pact allowing mobile telephones to be used for international calls. The agreement will allow calls between mobile telephones to be made without the use of international dialing codes, and ensure that callers are billed on their home account, wherever the call is made from. (Source: *International Herald Tribune*, 29 October 1992)

EDI for libraries and booksellers

The European Community is funding a project called EDILIBE (Electronic Data Interchange for Libraries and Booksellers in Europe), which has now completed its first phase.

Aimed at producing Edifact-based standards for the European library sector, EDILIBE I has produced a public tool for discussion and consensus-building in the shape of format drafts for electronic data interchange between libraries and the book trade.

For further information, contact: Margot Wiesner or Berndt Dugall, Stadt und Universitatsbibliothek, Bockenheimer Landstrasse 134-138, D-6000 Frankfurt Main, Germany (Tel.: +49 69 21239 256; Fax: +49 69 21239 404), or Brian Green or Elspeth Hyams, Book Industry Communication, 39-41 North Road, London N7 9DP, UK (Tel.: +44 71 607 0021; Fax: +44 71 607 0415) (Source: *XIII Magazine*, Issue 3/92)

France

Ozone-friendly PCB process

Two French companies, Promosol and Air Liquide, have jointly developed a no-clean process for assembling surface-mount components on PCBs, which eliminates the use of the ozone threatening CFC 113 material. According to the two companies, the process is now in use at the Angers factory of French computer maker Bull. (Source: *Electronics Weekly*, 2 December 1992)

Italy

Cash strife may delay TI's plans

The Texas Instruments plant in rural Avezzano, about 100 km east of Rome, was formally opened in May 1992. As one of the most advanced facilities in the world, it is already producing 4Mb DRAMs in volume. However, at the inauguration of the plant, Robert Schisano, president of Texas Instruments Europe, warned that delays in payments from the Italian Government could jeopardize research there.

Since it was first announced in 1989, the Avezzano plant has been the subject of controversy. As Europe's indigenous semiconductor manufacturers struggle for survival, Texas Instruments has secured a commitment from the Italian Government to cover some $650 million of the total $1,200 million four-year investment programme at Avezzano, but the Italian economic position and legal problems have slowed down the government payments.

Plans for collaborative research in Europe were outlined by Schisano, with the possibility of Avezzano becoming the research centre for "European team approaches". The programmes would be jointly funded by Texas Instruments and its customers, but would be structured so that they would be eligible for funding from both European governments and from the European Commission. The European Engineering Technologies (EET) Group at Avezzano has started research for the company's consumer products division. It will develop VLSI devices, packaging, display technology, etc.

Work to develop 16Mb technology based on 0.5 μm dimensions is scheduled to commence soon, but 16Mb DRAM manufacture would depend on the market situation. Avezzano has a capability of some 40,000 wafer starts per month, with about half of its Phase 1 currently in production. Phase 2 will employ 200 mm wafers. At least part of the Avezzano facility will eventually be converted to the production of logic devices, most probably ASICs. (Reprinted with permission from *Semiconductor International Magazine*, October 1992. Copyright 1992 by Cahners Publishing Co., Des Plaines, Ill., USA)

Japan

Real world order

Japan's latest project, Real World Computing, is aiming to imitate more human talents with its machinery. But the money involved - $500 million over 10 years - is a drop in the ocean of world research spending.

Business is far more important than government in Japan, and this is reflected in a low emphasis on basic research. Western academic talent has drawn 203 Japanese companies to set up research centres in Europe, but only 18 per cent of these include basic research among their activities.

In this light, Real World Computing is a small but significant step towards sharing basic research goals with the West. But Western interest in the project is still mixed with apprehension. There are lessons to be learned as well. First is to reassess the notion that the Fifth Generation Project failed.

While the Fifth Generation Project did not take top place in the world artificial intelligence league, it did at least put Japan among the major players. And, in terms of the hugely powerful parallel machines developed to run their software, Japanese computers can match the best of the rest. Indeed, it is the hardware aspects of Real World Computing that have attracted most Western interest so far.

Real World Computing remains a Japanese project, but terms for cooperation have been discussed at an international level with the US, Canada, and both the EC and member countries, including the UK.

There are three levels of membership of the project: full partners pay $100,000 to join the inner circle. Japan's MITI may then fund 80 to 100 per cent of the research work by that partner, which also keeps full intellectual property rights over its work.

Subcontractors pay no fee, have no intellectual property rights over their work, but may also get MITI funding. Joint institutes simply pair up with their Japanese counterparts and exchange information about their research. No money dealings are involved.

Up to 15 per cent of Real World Computing's budget may be spent on research outside Japan, equivalent to $4.5 million a year on average. This has attracted most interest among academic institutions, although the initial $100,000 administration fee is a significant hurdle for them.

Given that funding is likely to be split between up to half a dozen countries, and maybe one or two research centres in each, the pie is being sliced very thinly if the intention is to attract companies' research facilities.

Another difficulty for Western research centres considering joining the project is the hollow framework described in the master plan; the projects in the programme have not yet been decided. Western research programmes have more "granularity" - that is, they comprise a number of defined projects. Apart from describing broad targets, the master plan stresses that later research directions will be determined by the success of the first phase.

The plan has four elements, with the common aim of introducing flexibility into information processing. The word flexibility summarizes much of the difference between traditional AI ideas, generally identified with expert systems, and new ideas, sometimes described as "intelligent systems", which include machine learning, the integration of different kinds of information, and self-evaluation by computers.

The first element of the programme aims at computer recognition of motion pictures and understanding of conversational speech. This is basically computing's unified theory of everything, which the project has scheduled into two phases: first phase - discover "novel functions" which allow machines to organize and adapt themselves for varied tasks; second phase - integrate these functions.

While the seeing, hearing robot may take a little longer than 10 years to invent, the novel functions may find applications in solving ill-defined problems. For example large-scale simulation of social and economic phenomena, assessing situations in noisy environments or understanding the intentions of someone in a virtual reality suit from their gestures.

The remaining three elements of the project are more concerned with the hardware needed to run novel functions - massively parallel computing, neural systems and lastly optical systems, which could offer technical solutions to some of the problems of the other two.

This research is also very closely related to problems that will soon face commercial computer developers.

The technology closest to commercial application is neural nets. Neural nets and their intellectual partner, fuzzy logic, are also all the rage in Japanese consumer electronics, from washing machines to photocopiers.

How significant this research effort will be in establishing a Japanese lead in neural technologies remains to be seen. However, the master plan states the goal of building a neural network with 1 million processing units, which will operate at 10 tera connection updates per second.

Similarly, the master plan aims to build a million-processor, massively parallel computer, together with a new operating system and programming languages to use

its huge power. One million processors dwarfs anything conceived of before.

The Fifth Generation Project, now winding up, is currently completing work on a 1,000-processor parallel machine. The largest commercial machine is the Fujitsu VPP500, which has up to 222 processors arranged in parallel. Its claimed operating speed is 355 gigaflops. Its nearest competitor in speed is the 16-processor Cray C90, which operates at 16 gigaflops.

The Real World Computing opto-electronics programme will also consider optical digital systems, which could do for optical devices what the silicon chip did for transistors. They will also research pattern recognition neural systems which work entirely with light, avoiding the electronic intermediary.

The picture of the whole of Real World Computing is therefore broader than the reputation it gathered as successor to the Fifth Generation Project. (Extracted from *Computing*, 3 December 1992)

European Community

EC urged to invest in high-performance IT

Europe needs to spend 1 billion ECU (£830 million) a year developing high-performance computers or risk being left behind by the US and Japan.

The call for massive investment in high-performance IT came in a report to the EC from Carlo Rubbia, Director-General of the Geneva-based physics research institute CERN.

Rubbia's report calls for 3.5 billion ECU to be invested over the next five years, and 1 billion ECU a year after that.

Cash for the project would be raised from the private and public sectors, including ESPRIT research budgets.

According to Rubbia, the investment will reap rewards for Europe. The Gartner Group has estimated that the world-wide commercial market for parallel supercomputers will reach almost 4 billion ECU a year by the year 2000, with Europe accounting for 1.2 billion of that figure. (Extracted from *Computing*, 3 December 1992)

EC takes commercial line on R&D strategy

Europe is changing its R&D strategy to compete with Japan and the US head-on. The new tactics, geared towards producing commercial products, will be incorporated in the EC's Fourth Framework Programme, scheduled for funding early next year.

The European Commission has come in for criticism from inside and outside industry for putting too much emphasis on pre-competitive R&D, and not producing real products that people want to buy. Now there is to be a change of course.

Priority is now being given to the production of large size active matrix LCDs. Following the earlier Philips initiative France has ben persuaded to join a Franco-Dutch consortium, part-funded by the EC, in a £70 million venture aimed at putting Europe ahead of Japan.

Philips in Eindhoven will be the main manufacturing centre initially, with Thomson and Sagem following suit. Fifty per cent of the funding will come from the Commission under an ESPRIT Priority Technology Programme. (Extracted from *Electronics Week*, 2 December 1992)

Commission considers limiting use of marketing information

In Europe, there is a growing movement to protect the information made available to telecommunications companies by private databases.

Since 1990, the European Community Commission has been considering a directive that would impose strict limits on any telecommunications company for the marketing of information it obtained through its communication activities.

The new directive would limit the phone company's ability to sell the information it gathers when it supplies a telephone. As far as the Commission is concerned, this information should remain confidential. (Extracted from *Electronics*, 14 December 1992)

United Kingdom

NT funds optical switching research

Optical switching research at Cambridge University should gain from new links with international telecommunications equipment supplier Northern Telecom. The company's European subsidiary is funding a five-year research programme to be headed by Bill Crossland, a scientist from BNR Europe, who will be the university's first Research Professor of Photonics. The work will look at optical space switching in telecoms networks. Professor Crossland emphasized the importance of the work for Northern Telecom's own systems development plans. (Source: *Electronics Weekly*, 25 November 1992)

Phase two of EC directive on terminal equipment

The UK is ahead of the rest of Europe in implementing the Commission of the European

Community's "Second Phase" directive on pan-European approval of telecoms terminal equipment.

On Friday, 6 November 1992, the Terminal Equipment Directive 91/263 EEC became Community law, and required national approvals and conformity testing schemes to be replaced by a pan-European system. The basis for the new testing regime is a series of Common Technical Regulations (CTR), mandatory pan-European technical standards with which all terminal equipment must comply.

The second phase directive provides for three options for approval: first a manufacturer can opt for EC Type Examination, together with Declaration of Conformity to Type. This involves testing samples that are representative of production against all relevant standards. In addition, the manufacturer must make a formal declaration of conformity to type, in which he asserts that all products supplied will be consistent.

Alternatively, a manufacturer can opt for Type Examination, plus Product quality assurance. Under the procedure, type examination is carried out as with the first option, but the manufacturer issues his declaration of conformity to type in the context of an approved quality system.

A third option is for full quality assurance. It does not involve separate EC Type Examination, but has a much more extensive quality system requirement. (Extracted from *Electronics Weekly*, 18 November 1992)

United States of America

SEMATECH's funds may be running out

The future of SEMATECH is now suddenly in question due to a possible lack of government funding. In 1987, when it was first formed, SEMATECH was guaranteed $100 million per year, for five years, through 1992. The funds are administered by the Defense Advanced Research Project Agency (DARPA), an arm of the Department of Defense (DoD). Now, according to a recent report from the General Accounting Office (GAO), DARPA says that it has earmarked only $80 million for SEMATECH in 1993 and even further reduced amounts after that.

While officials from SEMATECH appear confident that they will be able to restore the consortium's funding by the time the 1993 budget bills go into effect, DARPA's position on the matter seems clear in the GAO report. In a written response to the question "Does DARPA have a plan to phase out funding for SEMATECH?", DARPA stated that it plans to phase out funding specifically designated for SEMATECH after the Government's five year funding commitment ends in 1992.

Specifically, DARPA says that it has budgeted $80 million per year from fiscal years 1993 through 1997 for microelectronics manufacturing R&D, with all of its fiscal year 1993 budget designated for SEMATECH. However, in subsequent years DARPA would award microelectronics manufacturing R&D funding for projects at SEMATECH, individual companies, or universities that best address DoD's needs for high-performance information systems.

The problem here is that SEMATECH and DARPA do not have exactly the same goals. SEMATECH's goal is to make the US semiconductor industry more globally competitive by improving the semiconductor manufacturing capabilities of its member companies and US equipment suppliers. On the other hand, DARPA's main objective in supporting microelectronics manufacturing R&D is to provide DoD with access to semiconductor manufacturers capable of producing state-of-the-art logic chips:

- With multiple part types and processes;
- In small to moderate volumes at low cost; and
- With rapid turnaround.

DARPA said it is particularly interested in SEMATECH's R&D in lithography, computer-integrated manufacturing, ultra-clean manufacturing, modelling and simulation and modular process equipment.

The GAO report also investigated the likelihood of SEMATECH's member companies increasing their funding to make up for the possible decrease in federal funding. Ten of the 12 current member companies said they would be unwilling to increase their funding for SEMATECH above current levels. SEMATECH said its goals for the next five years cannot be met if funding is reduced below the current $200 million per year.

Normally, it would be likely that Congress would choose to restore the funding, as it has in the past, especially for a successful effort such as SEMATECH. But with the present emphasis on reduced defense spending, that likelihood is less certain. (Reprinted with permission from *Semiconductor International Magazine*, October 1992. Copyright 1992 by Cahners Publishing Co., Des Plaines, Ill., USA)

US voices fears over Big Brother data banks

Most Americans believe computers pose a serious threat to their personal privacy and think the situation will get worse, according to a major poll carried out late in 1992.

Most US citizens have a positive attitude towards technology but are increasingly concerned about how easily their personal records can be accessed.

This concern could lead to the first data privacy law in the US.

The poll was commissioned by Equifax, one of the largest credit bureaux in the US. Such bureaux allow almost anybody to gain access to personal credit records.

There are also concerns about the ease with which people's medical data can be obtained. This could make it easier for companies to unlawfully discriminate against job applicants. (Source: *Computing*, 3 December 1992)

VIII. AUTOMATION

Feelings at your fingertips

Engineers eager to endow mechanical grippers with some of the human hand's ability to explore and manipulate its environment by touch owe a growing debt to neurophysiology. And now technology is paying back some of that debt by offering researchers a way to address one of their chief handicaps: an inability to present controlled, reproducible stimuli to human or animal subjects.

Sure, say the researchers, you can measure how sensory nerves in the hand respond to, say, a piece of sandpaper - but how do you disentangle the complex blend of pressures, vibrations, and forces that impinge on the hand to work out what underlies the sensation of roughness? Psychologist James Craig of Indiana University sees a potential to end such doubts. With neuroscientist Kenneth Johnson of Johns Hopkins University, he has designed what they think will be one of the world's most sophisticated tactual stimulators, capable - as Craig put it "of simulating virtually any texture" to a finger in contact with the device.

Now being built by engineer Wolfger Schneider of the Johns Hopkins Applied Physics Laboratory, the device will consist of a 20 by 20 arrangement of 400 pins spaced as little as 0.4 mm apart, each controlled by its own microprocessor. Each pin in the device, called the "dense array", will be capable of vibrating up to 400 times a second, at a variety of amplitudes. Depending on the pattern of pin vibrations, the device could give you a tour of all the silks, cotton, and polyesters of a fabric shop, says Craig, who likens the tactual display to a visual one. "The frequency, amplitude, and separation of the stimulator tips permit the dense array to match or exceed the sensory capabilities of the skin", Johnson says.

By some time in 1993, Schneider expects to deliver a pair of the universal tactile stimulators to Craig and Johnson. "The dense array will be a nice improvement" for experimenters, remarks psychophysicist

Susan Lederman of Queens University in Ontario. She points out, though, that the device will only be able to stimulate a small patch of skin at once - about 64 square millimetres, or roughly the area of a fingertip. But that is a great improvement over present capabilities - and, of course, it raises expectations of much bigger and better simulations in the future. (Source: *Science*, Vol. 258, 27 November 1992)

Robodoc carves a place in medical history

The first patient to receive an artificial hip installed with the help of a robot "surgeon" has left hospital. The robot, supervised by William Bargar, a surgeon at Sutter General Hospital in Sacramento, California, drilled the cavity in the patient's femur into which one half of the prosthetic joint was fitted more precisely than a human surgeon could.

The Robodoc system is based on a conventional light commercial robot with five joints, originally developed by researchers at the University of California at Davis and IBM. Sensors check the robot's position and detect the forces on the cutting head so that if it deviates from the planned movements the robot will halt. The robot is controlled by a computer processor but as an additional safety feature it has a second processor. Both processors must agree with each other for the robot to proceed. At every step of the operation the computer also asks for confirmation from the surgeon.

Robots have been used before in the operating theatre to precisely aim the cutting tools in surgery, but they were not allowed to actually cut the person. In 1991 Brian Davies and his team at London's Imperial College carried out the first operation with an automated tool designed to remove prostate glands.

Robodoc is, however, the first multi-function robot to carry out an operation. Bargar hopes it will be able to prepare bones for different joints, such as knees, or different designs of prosthesis that would be too difficult to do by conventional surgery. (This first appeared in *New Scientist*, London, 28 November 1992, the weekly review of science and technology.)

Factory automation

Automated equipment as a substitute for workers does not necessarily bring about high quality and low costs, according to Jim Smith and Mark Oliver of Phoenix Group (US) Inc. (St. Petersburg, Flo.). Automated factories necessitate employees. In automation, costly maintenance and process engineers substitute for inexpensive assemblers. Often the total labour cost following a facility becoming very automated stays the same as the cost prior to automation being carried out. Numerous firms supply offices for process engineers away from the actual output areas. Furthermore, numerous engineers do not understand the fundamental technology involving the equipment.

Automation is best suited to large-scale output of standardized products. Automated faults are as probable as automated perfection, making a majority of spending in automation a gamble. Japan depends greatly on automation, but one reason is that there is insufficient labour there. Thus Japanese firms were compelled to develop and purchase labour-saving equipment. Numerous Japanese plants too employ costly automation equipment because the Government's carefully thought out programme of hyperinflation resulted in a special situation in which firms were able to obtain financing at under zero interest. (Extracted from *Machine Design*, 26 November 1992)

Neural network principles for robot

Researchers at Penn State and Iowa State Universities have applied neural network principles to control a prototype robot under laboratory conditions. The objective of the research is to create faster, simpler robots that can paint, weld, and perform laser cutting, among other tasks. The robot has two arms, connected at an unpowered joint. Each arm is powered by two motors. All the motors must work with each other to enable the passive joint to trace a particular shape. Conventional controls point the robot's arms in the required direction; neural networks refine the trajectory and power the robot to draw complex shapes. (Extracted from *Design News*, 26 October 1992)

IX. STANDARDIZATION AND LEGISLATION

Standardization

Consortium supports a speedier Ethernet

An updated version of the Ethernet network standard, offering ten times the present speed, may prevent users phasing it out in favour of faster alternatives.

Ethernet is the most popular network standard with nearly 4 million nodes installed. In contrast, only 2.5 million Token Ring network nodes are in existence.

The Ethernet standard allows data to be sent around networks at speeds of up to 10 Mbps, but with the growth of applications that demand a lot of data, this bandwidth rapidly gets used up.

A proposal has now been put to the IEEE Committee that oversaw the development of the original standard, as well as the 10BaseT upgrade, that a 100 Mbps version of Ethernet be developed.

The proposal was initially pioneered by 3Com but now has the backing of Synoptics, Communications Inc., Sun and Lan Media Corporation.

This consortium has put its proposal before the committee in the shape of four goals that should speed the development process and make it easier to upgrade:

- To use the same data traffic control system as the 10 Mbps version: Carrier Sense Multiple Access/Collision Detection (CSMA CD), that stops data colliding as it tries to get to its destination;

- To use cable types that Ethernet runs over, such as STP/UTP, so users looking to implement fast Ethernet have to change as little as possible;

- To adapt existing interfaces as far as possible, so the upgrade is only a case of swapping a card in a PC and a card in a central hub;

- To start development work as quickly as possible.

(Source: *Computer Weekly*, 12 November 1992)

Rivals gang up on Microsoft's database connectivity standard

IBM, Novell, Borland and WordPerfect have banded together and launched a new database connectivity standard to challenge Microsoft's rival standard, Open Database Connectivity (ODBC).

The Integrated Database Application Programming Interface (IDAPI), which is based on Borland's own Open Database API technology, will allow users to transparently access data held on databases from different suppliers and on different platforms across a network.

WordPerfect will include support for IDAPI within OS/2, Windows and DOS applications to be released next year, such as its database Dataperfect.

IDAPI is pitched as a direct competitor to Microsoft's standard, which is rapidly gaining ground among database companies. Oracle, Sybase and Informix are all developing drivers - software which makes their databases accessible by ODBC. (Extracted from *Computer Weekly*, 19 November 1992)

Industrial field bus standard

A powerful group of factory-automation companies from three continents has come together to create a de facto standard in the area of industrial field buses. Siemens A.G. of Germany, Rosemount Engineering Inc. and Fisher Controls Inc. from the United States, and Yokogawa Electric Corp. from Japan launched the Interoperable Systems Project (ISP) at Interkama, one of the world's largest factory-automation trade shows.

The group has been working together since May 1992 to define a set of specifications, function blocks and a device-description language and to develop tools and conformance-test suites for what aims to become the dominating field bus a few years from now. According to the group's schedule, a first draft of the specifications would be distributed by November 1992. Field trials are scheduled for next summer. The first products based on the new standard could be introduced within a year.

Field buses are seeing broader use as computers move deeper into the factory and assume a greater role in control applications. The buses, primarily serial buses that connect field sensors and actuators to controllers, are used in control applications, automated factories and building-control sytems. As field-bus technology advances, it is being considered for linking data-entry units, displays, and even other computers to hosts, trends that underscore the need for standards.

The initiative is, however, a blow to standardization efforts by both the International Electrotechnical Committee and the Instrument Society of America. Those efforts have been under way for more than five years and still have a fair way to go. (Extracted from *Electronic Engineering Times*, 12 October 1992)

Ethernet LANs to go standard

Second generation Ethernet local area networks (LAN operating at 100 Mbit/s data rates may appear in 1993 as a result of new standards work due to start in the US.

The influential IEEE 802.3 LAN committee started technical work in January on a new Ethernet protocol to support 100 Mbit/s data rates over voice-grade 10Base-T unshielded twisted pair LANs. AT&T, Hewlett-Packard and SynOptics will all make technical proposals.

Networking companies want to see a 100 Mbit/s Ethernet standard by 1994.

This could be another blow for the introduction of high-speed LANs based on the alternative FDDi protocol. (Source: *Electronics Weekly*, 25 November 1992)

X.500 for bibliographic data access

An OSI (Open Systems Interconnection) Directory Service has recently been standardized in accordance with the CCITT's X.500 recommendations. This OSI Directory (or X.500 Directory - the terms are used interchangeably) was developed with the primary intention of providing support for electronic mail services, address look-up of networked applications, and also white- and yellow-pages directory services.

However, a paper published in the October 1992 issue of *Program* points out that the OSI Directory has many of the features required for providing access to widely distributed bibliographic information. It offers the possibility of a unified bibliographic information framework; homogeneous access to bibliographic information; built-in facilities for distributed searching; and "natural" integration with other OSI services that may be used to provide bibliographic services, for example, electronic mail and file transfer.

The paper, written by Paul Barker of the Department of Computer Science at University College London (UK), first provides a brief tutorial on the OSI Directory. It then considers how the directory might be used to provide access to a range of bibliographic information, and be used in tandem with other OSI services to allow the retrieval of documents. The paper then examines some of the problems of providing access to bibliographic information, given the current version of the X.500 standard.

A project (ABDUX - Accessing Bibliographic Data Using X.500) to investigate some of the ideas described in this paper is being funded by the British Library, and the paper notes the goals of this project. (Source: *Program*, Vol. 26, No. 4, October 1992)

Broadband marches on regardless of standards

ATM - asynchronous transfer mode - is the next generation of switching architecture and is expected to be all things to all men.

It will be fast enough to replace most of BT's System X telephone exchanges in the next century, flexible enough to combine voice, data and video switching, and cheap enough to be used in local area networks as well as public backbone networks.

ATM designers are still feeling their way in the local area network (LAN) market, and teaming up with semiconductor technologists. Without firm international standards most are wary of committing themselves into costly VLSI silicon designs.

The speed and flexibility of the ATM architecture derives from carrying information in small, fixed-sized cells that are routed through the network at high speed. The small 53 byte cells reduce transit delay so that compressed video can be sent as easily as voice and data. (Extracted from *Electronics Weekly*, 25 November 1992)

Legislation

EC strengthens privacy protections in data protection proposal

The European Commission has revised its data protection proposal to ensure that an individual's privacy is adequately protected regardless of whether the public or the private sector is responsible for processing information.

The Commission hopes it will be approved by the EC's Council of Ministers by the end of next year. It would then enter into force in 1995.

Under the proposal, all processors of personal data will have to notify an independent data-protection authority, which will be set up in each of the 12 EC member States. This body will be responsible for monitoring all processing operations and dealing with complaints from individuals.

The proposed law has also been revised to allow some international transactions, such as air and other travel reservations, bank transfers, and credit card checks to be carried out with any country. (Source: *Electronics*, 9 November 1992)

Minc programme patent

Minc, the US programmable chip design tool firm, has been granted a US patent for its constraint-driven partitioning technology, which automatically selects the best combination of programmable devices to use for a given circuit design.

The patent covers automatic partitioning of Boolean equations into physical devices, protecting the synthesis technology on which Minc's original PLDesigner product and its extensions are based.

Minc's tools start with design requirements and constraints set by the designer and produces a list of 10 possible partitionings, each given a cost value, with the design that most closely matches the specifications at the top of the list. The tools are distributed exclusively in the UK by Direct Insight, based in Lutterworth, Leicestershire. (Source: *Electronics Weekly*, 18 October 1992)

US colleges wary of software battle

A subsidiary of the American telecommunications giant AT&T is suing the University of California at Berkeley for stealing trade secrets and infringing the copyright on a software system it developed. Computer consultants are worried that if AT&T wins the case it will deter universities from developing software.

AT&T designed Unix, a computer operating system, in 1969. The company also licensed Unix to a number of universities for non-commercial use. The universities were allowed to develop the system for commercial use as long as they shared royalties with Unix Systems Laboratories, the subsidiary of AT&T that licenses the system.

In August 1992, Unix Systems sued the university on 106 charges ranging from false advertising to theft of

intellectual property for assisting a Virgina-based company called Berkeley Software Design with a software package, BSD/386. This package is based on a computer system called Networking Release 2, which the university developed.

Unix System's lawyers say that whole sections of the program have been taken from its system. Berkeley says the program was specifically designed to be "AT&T-free". The charges against the university are very vague, says a spokeswoman for Berkeley Software Design, and do not specify what has been "stolen". Unix Systems says it is willing to prove which parts of the program belong to AT&T.

The Berkeley package sells for $995, while comparable Unix Systems packages cost $5,000. (This first appeared in *New Scientist*, London, 29 August 1992, the weekly review of science and technology.)

X. RECENT PUBLICATIONS

United Nations system databases available on CD-ROM

There are 26 CD-ROMs known to ACCIS which are or will be available to external users and that contain United Nations system databases or information. Though most of these are produced by United Nations system organizations or contain their databases, some simply contain information provided by these organizations. Readers knowing of other United Nations databases on CD-ROM are encouraged to bring them to the attention of the Secretariat.

AGRIS

Organization:
Food and Agriculture Organization of the United Nations (FAO)

Database type:
Bibliographic

Subject scope:
Agriculture; animal and aquatic science; forestry

Status:
Available

Contact:
SilverPlatter Information, Inc.
One Newton Executive Park
Newton Lower Falls, MA 020162-1449, USA
TP+1 800/343 0064; +1 617/969 2332
FAX+1 617/969 5554

SilverPlatter Information, Ltd.
10 Barley Mow Passage
Chiswick,
London W4 4PH
United Kingdom
TP+44 81/995 8242
FAX+44 81 995 5159

Aquatic Sciences and Fisheries Abstracts (ASFA)

Organization:
Food and Agriculture Organization of the United Nations (FAO), UNESCO, Inter-governmental Oceanographic Commission (IOC), United Nations Environment Programme (UNEP), United Nations Office of Ocean Affairs and the Law of the Sea (UNOALOS)

Database type:
Bibliographic

Subject scope:
Aquatic sciences; fishing and fisheries; oceanography

Status:
Available

Contact:
Cambridge Scientific Abstracts
7200 Wisconsin Avenue
Bethesda, MD 20814-4823
USA

CCINFO

(Note: This CD-ROM contains ILO's CISDOC database)

Organization:
International Labour Organisation (ILO)

Database type:
Alphanumeric, bibliographic, graphics, full text

Subject scope:
Occupational safety and health

Status:
Available

Contact:
Canadian Centre for Occupational Health and Safety
250 Main Street E
Hamilton, Ontario L8N 1H6
Canada

Compact International Research Library

Organization:
Consultative Group on International Agricultural Research (CGIAR)

Database type:
Bibliographic, full text

Subject scope:
Food and agriculture

Status:
Available

Contact:
Knowledge Access International
2865 Marine Way, Suite 1305
Mountain View, CA 94043, USA
TP+1 415/969 0606

Development Activity Information (DAI)

(Note: This CD-ROM also contains information taken from the ACCIS *Register of Development Activities of the United Nations System*)

Producer:
Co-ordinating Unit for the Exchange of Development Activity Information

Database type:
Bibliographic, numeric

Subject scope:
Development activities

Status:
Available

Contact:
International Development Research Center (IDRC)
PO Box 8500
Ottawa, ON K1G 3H9
Canada
TP+1 613/236 6163
FAX+1 613/238 7230

DOCPAL

Organization:
Economic Commission for Latin America and the Caribbean (ECLAC)

Database type:
Bibliographic

Subject scope:
Economic and social development; population

Status:
Available

Contact:
DOCPAL
CELADE
PO Box 91
Edificio Naciones Unidas
Avenida Dag Hammarskjöld
Santiago
Chile
TP+56 2/48 50 51
FAX+56 2/48 02 52

ESPACE-FIRST

Organization:
World Intellectual Property Organization (WIPO)/European Patent Office (EPO)

Database type:
Bibliographic, full text

Subject scope:
Patents

Status:
Available

Contact:
European Patent Office (EPO)
Erhardstrasse 27
D-8000 Munich 2
Germany
TP+49 89/2399 0
FAX+49 89/2399 4465

ESPACE-WORLD

Organization:
World Intellectual Property Organization (WIPO)/European Patent Office (EPO)

Database type:
Bibliographic, full text, images

Subject scope:
Patents

Status:
Available

Contact:
European Patent Office (EPO)
Erhardstrasse 27
D-8000 Munich 2, Germany
TP+49 89/2399 0
FAX+49 89/2399 4465

ILO-LEX

Organization:
International Labour Organisation (ILO)

Database type:
Alphanumeric, full text

Subject scope:
International labour standards and their application

Status:
Available

Contact:
Kluwer Academic Publishers Group
Order Dept.
PO Box 322
3300 AH Dordrecht
The Netherlands
TP-78 524400
FAX-78 524474

Kluwer Academic Publishers Group
Order Dept.
PO Box 358
Accord Station
Hingham, MA 02918-0358
USA
TP-617 871-6600
FAX-617 871-6528

IMDG CODE

Organization:
International Maritime Organization (IMO)

Database type:
Full text, graphics

Subject scope:
Index of dangerous goods, chemicals, materials

Status:
Available July 1993

Contact:
IMO
Publications Department
4 Albert Embankment
London SE1 7SR
United Kingdom
TP-44 071 735 76 11
FAX-44 071 587 32 10

Información para el Desarrollo

Organization:
Economic Commission for Latin America and the Caribbean (ECLAC)

Database type:
Alphanumeric, bibliographic

Subject scope:
Economic and social conditions; economic and social planning; population and development

Status:
Available

Contact:
ECLAC CEPAL
Casilla 179-D
Santiago, Chile
FAX-56 2 208 50 51

INIS

Organization:
International Atomic Energy Agency (IAEA)

Database type:
Bibliographic

Subject scope:
Nuclear science, technology and safety

Status:
Available

Contact:
SilverPlatter Information, Inc.
One Newton Executive Park
Newton Lower Falls
MA 020162-1449
USA
TP-1 800 343 0064; -1 617 969 2332
FAX-1 617 969 5554

SilverPlatter Information, Ltd.
10 Barley Mow Passage
Chiswick, London W4 4PH
United Kingdom
TP-44 81 995 8242
FAX-44 81 995 5159

INRES-SOUTH Database

Organization:
United Nations Development Programme (UNDP)

Database type:
Full text

Subject scope:
Developing country institutions, training and expertise capacities

Status:
Available

Contact:
> INRES-South SU TCDC
> UNDP
> PO Box 1608
> Grand Central Station
> New York, NY 10163-1608, USA
> TP-1 212 906 5734
> FAX-1 212 906 6429

International Financial Statistics

Organization:
> International Monetary Fund (IMF)

Database type:
> Alphanumeric, full text, numeric

Subject scope:
> Macroeconomic statistics

Status:
> Available

Contact:
> IMF
> Bureau of Statistics
> 700 19th Street
> Washington, DC 20431, USA
> FAX-1 202 623 4661

> Microinfo (UK distributor)
> PO Box 3
> Omega Park
> Alton, Hants. GU24 2PG
> United Kingdom
> TP-44 420 86 848
> FAX-44 420 89 889

International Frequency List

Organization:
> International Telecommunication Union (ITU)

Database type:
> Alphanumeric

Subject scope:
> International database of radio frequencies and stations

Status:
> Available

Contact:
> ITU
> Sales Service
> Place des Nations
> 1211 Geneva 20, Switzerland
> TP-41 22 730 51 11
> FAX-41 22 733 72 56

IPC:CLASS

Organization:
> World Intellectual Property Organization (WIPO) German Patent office Spanish Industrial Property Office

Database type:
> Alphanumeric, full text, graphics

Subject scope:
> International Patent Classification (IPC) and catchword indexes

Status:
> Available

Contact:
> WIPO
> Sales and Distribution Section
> 34 chemin des Colombettes
> 1211 Geneva 20,
> Switzerland
> TP-41 22 730 91 11
> FAX-41 22 733 54 28

JOPAL-ROM

Organization:
> World Intellectual Property Organization (WIPO)

Database type:
> Bibliographic

Subject scope:
> Patent-related data

Status:
> Available May 1993

Contact:
> Mr. P. Claus
> WIPO
> 34 chemin des Colombettes
> 1211 Geneva 20,
> Switzerland
> TP-41 22 730 91 11
> FAX-41 22 733 54 28

LILACS: Latin American Literature in the Health Sciences

Organization:
> World Health Organization (WHO), Regional Office for the Americas Pan American Sanitary Bureau, Latin American and Caribbean Health Sciences Information Center (BIREME)

Database type:
> Bibliographic

Subject scope:
Latin American health literature; medical science and research; health

Status:
Available

Contact:
BIREME
Rua Botucatu 862
Vila Clementino
04023 São Paulo
Brazil
TP+41 22/791 21 11
FAX+41 22 791 07 46

Linnaeus Interactive Taxonomy

Organization:
United Nations Educational, Scientific and Cultural Organization (UNESCO)

Database type:
Bibliographic, full text, graphics

Subject scope:
Identification of selected marine organisms

Status:
Available

Contact:
Dr. F. Rey
Institute of Marine Research
PO Box 1870
N5024 Bergen
Norway
FAX+47 5/238531

Books in Print of the United Nations System

The first, pilot edition of a major new ACCIS publication went on sale at the end of 1992. *Books in Print of the United Nations System* (UNBIP) is a comprehensive listing of over 14,000 United Nations system publications that are available from United Nations Sales Offices, United Nations co-publishers and external publishers who publish for the system.

Collectively, one of the world's most prolific publishers, the United Nations system produces a vast range of printed materials in almost every area of learning, research and development. While individual organizations provide information on their publications through a variety of means including publications lists and catalogues, there has been no one source of information that has covered, in a comprehensive way, the totality of these available publications.

By bringing this information together in a standardized, easily accessible format, UNBIP attempts to meet this need. It is intended as both a useful tool for the identification and acquisition of individual titles, and a means of raising general awareness of the full extent of United Nations system publishing.

The role of ACCIS in what is considered, for the present, as an experimental venture, has been that of coordinator and producer. It is hoped that the existence of this pilot volume will permit the evaluation of the usefulness of an actual product to end users, and that it will provide an initial model for the future production of standardized data by United Nations publishers.

Books in Print of the United Nations System (ISBN 92-1-100379-2; UN Sales No. GV.E.92.0.18) is available, price US$ 50 from United Nations Sales Sections in New York and Geneva. (Source: *ACCIS Newsletter*, 10(4), November 1992)

Telecommuting reviewed

"If only 50 per cent of commuters in Los Angles telecommuted one day each week, they would save 205 million miles of travel each year and keep 47,000 tons of pollutants from entering the atmosphere", according to an official source in support of US teleworking initiatives in 1990. The sentiments behind these statistics are striking a chord within the European Community as cities become ever more clogged with commuter traffic and polluted with its inevitable by-products.

A new review of experiences and perspectives for teleworking in Europe is now available, prepared for the European Commission in the context of research on telecommunications technologies and telematic systems for rural areas.

The report reviews recent teleworking initiatives on both sides of the Atlantic. It focuses on a number of specific case studies of telecommuting, work centres and decentralized business opertions, and looks at why some initiatives succeed and others fail.

The introduction of multimedia communication facilities could radically change the way in which many people work and greatly extend the range of jobs that can be done outside central offices.

The report analyses current technology trends and highlights key new research initiatives on both sides of the Atlantic. It contains an extensive bibliography of recent reports and publications on teleworking and is available, free of charge, from: CEC-DG XIII F, ORA Office, rue de la Loi 200, B-1049 Brussels, Belgium. TP+32 2/236 32 47; Fax+32 2 235 06 54 (Source: *XIII Magazine - news review* (a publication of the European Community), issue 2/92)

World pirates threaten book by Database

McGraw-Hill are piloting a scheme whereby students can go to a university library, choose a section of the book they want from a catalogue held on an electronic database, have it printed out and bound while they wait and then pay a small fee as they would for a photocopy service. They have sold systems to campus bookshops enabling professors to tailor a textbook to their own teaching needs by selecting material from an electronic database of M-H texts, journals, case studies and combine them with their own supplementary writing. M-H ensures that the publishers and authors are paid their due. Such development would need agreements between universities, copyright licensing agency etc. over collective photocopying licensing agreements. (Source: *THES*, 23 October 1992)