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# MICRO-ELECTRONICS NICOSIA

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## I. NEWS AND EVENTS

### UN sets up bigger, cleaner data base

Moves to clean up industry by encouraging minimization of waste and the reduction or elimination of pollution has received a shot in the arm. At a conference at the University of Kent, delegates from 40 countries in the industrialized and developing world agreed to set up a computer data base to share expertise and R&D information, and facilitate technology transfer.

The conference was organized by the Paris-based Industry and Environment Office of the United Nations Environment Programme, UNEP, and the new data base is known as the International Cleaner Production Information Clearinghouse, or ICPIC.

The data base is based on the existing Pollution Prevention Information Exchange System run by the US Environmental Protection Agency but it aims to co-ordinate information currently held on many less comprehensive data bases. It is designed for research institutions, industry, Governments and non-government and public interest groups.

This UNEP initiative is highlighting the importance of a switch to cleaner production methods. For instance, one metal working company looked at substituting halogenated solvent degreasers with commercially available terpene-based substitutes, extracted from citrus fruit.

Trials proved effective and the company went further. They substituted the original mineral oils used in machining with vegetable-based biodegradable oils. This eliminated the need for any degreasers apart from a mild alkaline rinse, and removed the disposal cost of the mineral oil. (This first appeared in New Scientist, London, the weekly review of science and technology on 29 September 1990)

### REMLAC set up

The regional programme on co-operation in informatics and microelectronics in Latin America and the Caribbean (REMLAC) has now been set up in Buenos Aires, Argentina. Its main goal is to reinforce existing infrastructures and capabilities to sufficiently absorb and use informatics and microelectronics technologies through national action and the expansion of co-operation between the countries of the region. In this regard, the Programme aims to support and broaden the co-operation activities being carried out within the frame of the Conferencia de Autoridades Latinoamericanas de Informatica (CALAI) and of the Regional Network for Microelectronics in the Economic Commission for Latin America (ECLA) Region (REMLAC).

The Programme has been designed on the basis of priorities identified by the national informatics authorities (CALAI, November 1987) and, in various instances, by the REMLAC foral points. However, it does not cover the multiple asperts involved in the development of informatics and microelectronics but concentrates rather on those areas relating to building up an institutional framework and creating capabilities, which can be used in acquiring and using such technologies. The Programme also includes activities involved in one area of production, namely software, and of design, i.e., custom and semi-custom chips.

The decentralized Programme is carried out by the national counterparts under the co-ordination of a regional management unit, with actual participation of Governments, research institutions and private enterprises, which is so essential in order to mobilize resources and ensure continuity and impact of the different actions being undertaken.

Most of the expertise and inputs required for implementing the Programme are in the region itself, which is an important component in terms of horizontal co-operation between its countries, and here the co-ordination and complementarity with activities being undertaken by other international and regional organizations, such as United Nations Educational, Scientific and Cultural Organization (UNESCO), the World Intellectual Property Organization (WIPO), the Latin American Economic System (SELA), etc., is another vital criterion of action.

Lastly, while considering the needs and interests of all participating countries, the Programme emphasizes co-operation with the least developed countries of the region.

Areas of action cover informatics strategies and policies; informatics contracts; informatics legislation; production and commercialization of software; human resources; informatics dispersion in small- and medium-sized enterprises; monitoring of economic and technological trends; and design of integrated circuits.

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### Europe fails to agree on chip tariffs

A major row is brewing over semiconductor tariffs. The Japanese and the Americans want to see the 14 per cent rate on chips imported into Europe cut altogether. But the European chip makers are stepping up their opposition.

The GATT Secretariat wants to see a lowering of the semiconductor tariff from 14 to 4.7 per cent,

but the European Association of Semiconductor Manufacturers has lost no time in publishing a memorandum, denouncing the negative effects that would ensue from such a move.

A spokesman for the association said that a lowering of the tariff now would penalise the investment already made by European chip manufacturers in volume chip production capability. It would have a disastrous effect on Europe's competitive position in semiconductors. Job losses could increase, he warned.

However, European office equipment makers and computer manufacturers want to see the tariff disappear altogether.

But the EC's position on anti-dumping of semiconductors remains firm. Next month the EC expects to sign an agreement, fixing the minimum selling price for EPROMs, with a group of Japanese semiconductor makers. (Source: Electronics Weekly, 19 September 1990)

ESPRIT fights off its critics

The cracks in Europe's collaborative research began to widen as discontented officials argued over the value of ESPRIT, the Commission's programme of research in information technology.

A recent working paper by the Commission on industrial policy strongly opposed giving support to particular sections of industry, such as Europe's troubled information technology (IT) industry. This stance mirrors that long held by the department for competition, headed by Leon Brittan, which sees collaborative research as an obstacle to a competitive market.

ESPRIT organizes joint research between companies and academic institutions, which is intended to be "precompetitive", not geared towards specific products. It also provides half the funds for the research. The programme aims to foster links between organizations in different countries, speed up the rate of new innovations and protect Europe's ability to maintain its independent IT industry in the face of the rising dominance of Japan.

Despite the massive funds pumped into research, the European IT industry is still in turmoil. The Dutch company Philips, for example, was forced to pull out of the JESSI project to develop advanced computer chips and to scrap its loss-making computer division. Other factors, such as the takeover of the British computer manufacturer ICL by Fujitsu and links between Siemens and IBM, have muddied the concept of an exclusively European IT industry.

Jean-Marie Cadiou, the director of ESPRIT, pointed out in Brussels that the cost of borrowing capital is nearly twice as high in Europe and the US as it is in Japan. "In 1989 alone, Japanese IT companies would have saved $6 billion," he said, "enough to buy six ICLs".

Further debate over the fate of ESPRIT centres on whether the Commission should become involved in organizing industrial research or if it should let industry do its own R&D. Thomas von der Vring, chairman of the European Parliament's budget committee, asked whether the Community should go further than its original brief and encourage research into marketable products.

Michel Carpentier, head of the department in the Commission responsible for information technology research, acknowledged the disagreements between free-marketeers and interventionists over IT research policy. But he said there was "no real conflict" between the two sides.

ESPRIT's organizers rallied to its defence in Brussels, announcing its achievements: of 647 projects, 313 have produced concrete results and 152 have helped to develop new products and and services. The third phase of ESPRIT, which is due to begin in 1991, will concentrate more on marketable products rather than simply being driven by the search for new technologies. (This first appeared in New Scientist, London, the weekly review of science and technology on 24 November 1990)

Boost for the West

The improvement of relations with Eastern Europe could be a boost for Western communications companies, provided that they can establish a commercial infrastructure in the East.

Those conclusions are contained in an assessment of telecoms growth in Eastern Europe, carried out by Communications and Information Technology Research, which says that the opening up of Eastern Europe holds out the twin prospects of significantly increased international traffic and modernization of old telecoms equipment. Both could prove particularly attractive to Western companies coping with over-capacity and escalating R&D costs.

Comparison of communications in Western and Eastern Europe shows that the two markets are almost virtually unrecognizable as the same industry. CIT estimates the total West European telecoms market to be worth ECU 123 billion in 1989, making it one of the largest industries in Europe. But a rough valuation of the Eastern European market would put the figure at only ECU 10 billion.

Immediately, the suggestion is that Western European companies could get into manufacturing operations in Eastern Europe, where there is labour and plant capacity available. The belief is that there will be big opportunities for Western European countries, because the Eastern economies must develop communications if they are to become productive and competitive. But as well, they must also develop the high business users of telecom services, such as banks, insurance companies and retailers, in order to support the systems. (Source: AMI, October 1990)

VDU safety

The degree of safety of PCs is a growing controversy in business, Government and education. Specifically, the debate centres on the visual display units (VDUs) of personal computers, as well as keyboards. The hottest issue is whether some of the variations of electromagnetic radiation emanating from the VDUs can cause harm. The machine produces X-rays as well as ultraviolet light that can cause harm if the doses are big enough. However, such emissions from VDUs are not big enough, it is generally agreed, to cause any damage. The fears are at the other end of the radiation spectrum, which consists of low-frequency magnetic fields. (Extracted from The Economist, 7 September 1990)

International technology transfer

The globalization of technology put a premium on a firm's talent for transferring technical know-how across national boundaries faster and more effectively than its competitors. There is a right and a wrong way of going about this, however.

According to Robert T. Keller and Ravi R. Chinta, the wrong way is simply to rush in to foreign markets. The right way is to begin by recognizing that technology transfer is a process with barriers to the information flow as well as bonds, or bridges, that enhance that flow [Academy of Management Executives, Vol. 4, No. 1, 1990, pp. 33-43].

From Keller's and Chinta's study (done while they were at Louisiana State University in Shreveport), it was apparent that successful firms recognize the barriers and bonds peculiar to their situation and develop strategies for dealing with both. Such firms include IBM Corp., NV Philips, and General Electric Co., they said.

Constraints may be imposed by the home or supplier country, as well as by the host or recipient country. Worries about jobs, competition, threats to national security, and "economic imperialism" produce barriers, as do a lack of compatible standards and different cultural values.

Bonds that facilitate technology transfer arise within a company or between or among companies. Bonds within a company can be forged through strategies that create new products and processes or that redeploy existing ones. Each strategy has its variations together with advantages and disadvantages that it is vital to understand.

Bonds between companies include joint ventures, licensing, and even cultural compatibility between firms with similar or shared values; Japan, South Korea, Taiwan, and Hong Kong, in particular, are receptive to transfer of electronics, auto, and steel technology because they value assertiveness and achievement in economic matters.

Keller and Chinta observe that firms can create bonds by choosing the appropriate organizational design strategies and policies for organizational control and human resource management. To give three examples:

- Multinational firms with a global matrix organizational design (in other words, functions in several countries working on one project team), transfer product and process technology across national boundaries more successfully than more decentralized competitors.

- Rotating people through different jobs in different international subsidiaries creates a sense of community.

- Placing manufacturing and sales units in one profit centre, even though they are in different countries, creates a bond.

(Source: IEEE SPECTRUM, November 1990)

Broadcasters wield wide screen against satellites

European operators of terrestrial television are planning to upgrade their broadcasting technology to combat the superior technology on offer from the satellite stations. For over two years the electronics companies Philips, Nokia, Thomson and Grundig have been working with the BBC, IBA and West German TV stations on an improvement to the PAL system, currently used by terrestrial broadcasters, to offer wide-screen pictures.

They have kept quiet for fear of undermining confidence in MAC as used by satellite broadcasters such as BSB in Britain and TV-SAT and TDF in West Germany and France. They revealed their work at the International Broadcasting Convention in Brighton, at the end of October 1990.

Albrecht Ziemer, technical manager for West Germany's second TV network, ZDF, and chairman of the strategy group for the project, promises regular programming using the new system, called PALplus, beginning in 1995.

PALplus must be compatible with PAL, offering clearer, wide-screen pictures with a width-to-height ratio of 16:9 to anyone who buys a new set, but perfect pictures for everyone with an existing 4:3 screen size. PALplus picture will be transmitted in 16:9 format. Existing 4:3 TV sets will display a "letter box" picture with black strips at the top and bottom. A new PALplus set with wide-screen will fill it with the 16:9 image.

The disadvantage of letter box transmission is that one quarter of the horizontal scanning lines used to build the picture are wasted. For conventional PAL, 575 of the 625 lines are "active" and build the visible picture. For letter box, only 432 lines are used. The other 143 are wasted on the top and bottom strips. Inevitably, this reduces vertical resolution of the picture when it fills a large 16:9 screen.

The PALplus set will display each line of the picture twice to create the illusion of a fine line structure. Additionally, extra detail to enhance the picture will be transmitted as digital code hidden in the wasted picture lines that make up the black strips of the letter box image. Conventional TV sets ignore the digital code, treating it simply as a black picture signal. New PALplus sets will have circuitry to detect the code and use it to enhance detail.

Althogh PALplus group now agree on what they want to do, they have not yet agreed on a method, with different techniques under development in Europe and by the BBC and IBA in Britain. (This first appeared in New Scientist, London, the weekly review of science and technology on 13 October 1990)

Tokyo wins support for intelligent factories

The Japanese Government has finally overcome a wall of American and European suspicion to keep alive its dream of a world-wide effort to develop new technologies for automatic factories. The project, called the Intelligent Manufacturing System, will get under way with a feasibility study early in 1991.

The three main partners, Japan, the European Community and the US, agreed on a strategy for launching the IMS at the end of two days of talks in Tokyo. Australia, Canada and the European Free Trade Association are also likely to take part. However, the agreement watered down the original proposal, which Japan made almost a year ago.

Japan's Ministry for International Trade and Industry wants to spend £500 million over 10 years on a world-wide project to set standards for

computers and robots to communicate. The IMS's originator, Hirokyuki Yoshikawa of the University of Tokyo, believes the project will boost international trade in manufacturing technology. He also hopes it will help in a personal quest for "a universal theory of manufacturing".

MITI, the government department widely credited with organizing Japan's postwar economic miracle, adopted the project as an opportunity for Japan to make its mark in global research. Officials hope that it will make the manufacturing industry a more glamorous choice of career for young people. (Japanese science graduates are beginning to follow their European and American counterparts in choosing careers in service industries rather than in factories).

The would-be partners were less impressed. The Department of Commerce in Washington saw the project as Japan's latest attempt to gain access to American technology. The European Commission's information technology department, DG-XIII, criticised the project as too centralized a duplication of existing European efforts. Both western partners said that MITI's original proposals were too vague.

The agreement took on board both Europe's and America's original objections. Research on the IMS will be "interregional, geographically distributed and decentralized" while members will share results "through a process of controlled diffusion that protects any intellectual property created or furnished during collaboration".

The agreement also restricts projects carried out under the IMS to pre-competitive R&D. The feasibility study, which will run for a year, will design ways to put these sentiments into practice.

Officials from all sides said they were pleased with the discussions in Tokyo.

Officials at the meeting stressed that if the feasibility study shows the IMS to be unworkable, the project will not go ahead. However, Japanese industry seems to have more confidence in the project. More than 70 companies, including the country's largest manufacturers, have already signed up. (This first appeared in New Scientist, London, the weekly review of science and technology on 1 December 1990)

Computer networks

Academic computer users in Eastern Europe will be among the first to benefit as foreign manufacturers rush to fill the vacuum in the market for computers. Following a pattern set in the early 1980s in North America and Western Europe, IBM and other companies are offering their equipment to universities at little or no cost in the hope of persuading a generation of students and professors of the value of their products.

The scientific community sees the computer technology as essential to raising its standards.

The most ambitious project so far is the Academic Computer Initiative of IBM Europe under which it is installing mainframe computers (the largest computers ever installed in the region) in Czechoslovakia, Hungary, Yugoslavia and Poland. The countries will then be linked to the West through the Vienna node of the European Academic Research Network.

On 20 November, IBM signed a co-operative agreement with three universities in Budapest under which the company will provide a mainframe computer and Hungary's first-ever fibre optic network. The Budapest and Belgrade computers will be installed in early 1991. Earlier this month another computer of the same model, a 3090-120, was installed in Prague. At the same time, Digital Equipment Corporation (DEC) is about to sign an agreement with Eötvös University to install, at large discounts, both hardware and software for e ectronic mail within the university and, eventually, among several universities in Hungary. (Source: Nature, Vol. 348, 29 November 1990)

## II. NEW DEVELOPMENTS

The needle point with a 3D view of life

A holographic electron microscope has opened the way for biologists to observe, millisecond by millisecond, many of the chemical processes of life for the first time. The microscope, developed by Hans-Werner Fink and his team at the IBM research laboratory in Zurich, has a tungsten tip just one atom wide, which fires a laser-like beam of electrons. This enables it to produce three-dimensional snapshots lasting only 100 nanoseconds.

Conventional electron microscopes work in the same way as optical microscopes. A beam of electrons is shone on the object and the rays are magnified with lenses. Unfortunately for biologists, these older microscopes use electrons with energies of about 150,000 electronvolts.

Electrons with such high energies damage specimens and are not scattered by carbon - they shoot straight through the atom and so cannot be used to create images of carbon-based molecules. As a result, samples of DNA and other organic molecules have to be stained before they can be analysed. This may change the structure of the sample and stops researchers from watching life processes as they happen.

The new microscope uses electrons with energies of 20-80 electronvolts, which are less likely to damage samples and are scattered by carbon. The lack of lenses means the new microscope suffers no distortion.

The single-atom tip is the key to the technology. Electrons at the tip face an electrical barrier, which stops them breaking out of the metal tip. Quantum mechanics allows electrons to "cheat" and tunnel through the barrier.

When such electrons travel at high speeds they have characteristics of waves, such as phase and wavelength, as well as those of particles. Because the electrons escaping from the tip all come from a single point they are said to be coherent. Coherent waves all have identical wavelengths and are in phase, like the light from a laser.

Fink's team has tested the microscope on a carbon fibre. The tip is brought very close to the fibre and some of the electrons emanating from the tip are scattered by the fibre while others shoot past. On a fluorescent screen the electrons trace out a shadow pattern of the fibre. The image can be magnified more than 50,000 times by placing the tungsten tip closer to the object and the screen further away.

Around the edge of the shadow an interference pattern is created where the scattered electrons coincide with those that passed straight past the fibre. The two sets of electron waves reinforce one another where a peak meets a peak and cancel each other out where a peak meets a trough. This pattern contains three-dimensional information about the surface of the fibre. Decoding this to create a hologram is a problem Fink has yet to solve. (This first appeared in New Scientist, London, the weekly review of science and technology, on 29 September 1990)

Self-contained lights

Sandia National Laboratories researchers are developing glass-cube light bulbs for use in remote areas where power may not be available. The self-contained lights are powered by radioactive tritium in hollow, transparent glass cubes. Phosphor particles embedded in a sponge-like glass emit light when excited by electrical or other energy. The decay of tritium atoms, which are chemically bonded to the cube, produce radiation that excites the phosphors, which in turn emit light. Although light escapes from the cube, the nearly harmless radiation does not. The lights could be marketed within 2 years if a company is found to collaborate with Sandia. (Extracted from Business Week, 22 October 1990)

All-in-one publication machine

Xerox has introduced the first of its Docutech Publishing Series machines, which combine a printer, scanner and copier into one unit. The machines will produce off-set-quality publications. They are targeted at firms with electronic publishing needs. The machines can digitally scan and store images in its own memory, from where users can retrieve them. The machines will also take files from floppy disks. The first Docutech Publishing Series can scan 23 documents/minute and provides a resolution of 600 dots/inch. (Extracted from Computerworld, 8 October 1990)

Superconducting circuits: getting warmer

American researchers are taking the first steps towards building integrated circuits from the new high-temperature superconductors. These materials, which were discovered as recently as 1986, conduct electricity with virtually no electrical resistance at temperatures up to about 120 degrees above absolute zero. They hold the promise of superfast computers and very accurate sensors. But because they are brittle ceramics, it is difficult to fabricate devices from them. Now two teams, one at the Sandia National Laboratories in Albuquerque, New Mexico, and the other at the TRW Space and Technology Group in Redondo Beach, California, have developed circuits by two very different routes.

With the older low-temperature super-conducting materials, which only worked at temperatures very close to absolute zero, it was possible to make Josephson junctions. These consist of a very thin insulating layer between two layers of superconductor. Electrons can tunnel through the insulator from one superconductor to the other, but this tunnelling is very sensitive to magnetic fields. The current of electrons can therefore be turned on and off very quickly by switching the magnetic field.

Researchers around the world are working to develop Josephson junctions using the new high-temperature superconductors, but the Sandia scientists are using an entirely different technique. The new approach is based on a so-called superconducting flux-flow transistor, which Jon Martens, James Beyer, James Nordman and Gert Hohenwarter developed at the University of Wisconsin in 1988. It is made of thin films of material. Two parallel strips of superconductor are connected to each other by many weakly superconducting links 10 micrometres long, arranged like rungs on a ladder.

Current flowing through a nearby superconducting control line generates a magnetic field, which affects the conductivity of the links, and hence the current that flows through them between the superconducting strips. This in turn changes the voltage between the strips. This voltage responds very rapidly to the changes in current, so the device can operate at very high frequencies. It is called a transistor because a small input signal from the control line creates a larger output in terms of the change in the voltage between the strips.

John Talvacchio of the Westinghouse Science and Technology Center in Pittsburgh says the single-layer structure of the transistor is an important advantage when making devices from the brittle ceramic superconductors. Multiple layers are needed from Josephson junctions. The Wisconsin and Sandia devices are made from thalium-based superconductors, and normally operate at the 77 K temperature of liquid nitrogen.

Among those continuing to work on Josephson junctions is TRW, which has made a simple integrated circuit to convert analogue signals to digital format from an yttrium-barium-copper-oxide compound. The company says the key breakthrough was the fabrication of "reproducible Josephson junctions" in the ceramic superconductor.

However, the characteristics of the device remain uneven. Arnold Silver, chief scientist for superconductivity at TRW, concedes that the critical current in the device ranges over a factor of two. He hopes to reduce that variability to 5 per cent, but observers are sceptical. They also note that the TRW circuit does not perform the entire analogue-to-digital conversion: it provides electronic input to a silicon circuit which performs the final stage. (This first appeared in New Scientist, London, the weekly review of science and technology, on 24 November 1990)

New superconductor reported

Research scientists at Hitachi corporate laboratories have developed a material that superconducts at the highest temperature yet reported. The researchers report the development of a vanadium oxide compound that is able to superconduct at 130 K (-143°C), 8 K higher than the previous record. As the Hitachi material does not contain copper, it could be possible to sheath the material in copper.

But there is some scepticism about the Hitachi claim. The company says the new material has two superconducting phases with critical temperatures of 130 K and 30 K. But the Meisner effect, a key

indicator of superconductivity, has been observed only in the 30-K phase. The electrical properties of the material are described as "not stable in the ambient atmosphere" in a paper submitted to the Japanese Journal of Applied Physics. In the past, many reports of "unstable" superconductivity have been false alarms. Hitachi has filed for patents on the material. (Source: European Chemical News, 1 October 1990 and Nature, Vol. 347, 27 September 1990)

New record for organic superconductors

The world's record for highest transition temperature ($T_c$) for an organic superconductor keeps getting broken. At Argonne National Laboratory, a team of chemists headed by Jack M. Williams has made an organic superconductor with a $T_c$ of 12.8 K. That is significantly higher than the "old" record $T_c$ of 11.6 K set just recently, also at Argonne. The new salt, k-$(ET)_2Cu[N(CN)_2]Cl$, contains a polymeric copper-containing inorganic counterion in which ET is bis(ethyl-enedithio)tetrathiafulvalene and $[N(CN)_2]^-$ is the dicyanamide anion. In fact, it is the chloride analog of the bromide compound that set the earlier record. As such, it is the first k-phase ET-based superconductor with an isostructural counterpart, Williams points out. Thus, structure-property correlations for such organic superconductors are now within reach. Other teams headed by James E. Schirber at Sandia National Laboratories and Myung-Hwan Whangbo at North Carolina State University were major collaborators in the work. (Source: Chemical and Engineering News, 3 September 1990, p. 28)

How to "fine-tune" a superconductor

The dream of finding a superconductor that operates at room temperature has come a step closer with the discovery of a superconducting metal oxide with a critical temperature ($T_c$) that chemists can vary. This is important because superconductors can only carry electrical current without losing energy if they are below their individual critical temperatures.

The British research holds out the promise that scientists will be able to "fine-tune" superconductors, and eventually find one that works at room temperature. Such a material would be able to generate very strong magnetic fields cheaply, and might make body-scanners a routine feature of doctors' surgeries, for example.

Peter Edwards and Ru-Shi Liu of the Interdisciplinary Research Centre in Superconductivity at the University of Cambridge have produced the new superconductor in collaboration with a group from Taiwan. The chemists at Cambridge varied the metal content of their oxide, and observed how the critical temperature changed. By this means, they mapped out a critical temperature "surface" and discovered that the highest peak on the map is a surprisingly high 107 K (-166°C) (Journal of Solid State Chemistry, Vol. 86, p. 334)

Edwards and Liu are now searching for other metals that will give a composition "map" with an even higher peak $T_c$. Edwards admits that deducing which metals to use is more art than science, but the researchers have found one system that is looking very promising. They find that when they increase the number of different metals in the crystal, this has a profound effect on $T_c$. They believe that a system of seven or eight metals might well have a Himalayan landscape, with a Mount Everest reaching up to the magic 293 K (room temperature). Such a material would have the potential to revolutionize the world's electronic and power generating industries. (Extracted from New Scientist, 20 October 1990)

Intel claims processor sets speed record

Intel claims to have made the world's fastest computer with the launch of a supercomputer capable of speeds of up to 32 billion floating-point operations per second.

The parallel processing machine, costing around $10 million will be installed at the California Institute of Technology in Pasadena, where researchers will use its massive power to solve scientific problems.

Last year Ncube introduced what it claimed was the world's fastest supercomputer capable of executing 27 Gflops and costing $20 million. The company has yet to ship one.

The US Government - through The Defence Advanced Research Projects Agency - has already invested $32 million into private companies researching parallel supercomputers. Intel is among companies taking advantage of such funding. (Source: Computer Weekly, 15 November 1990)

Diamond-film breakthrough

Synthetic diamond sports higher thermal conductivity than any other material. It also boasts tremendous electrical resistance, is radiation proof and chemically inert, and has the same physical characteristics as Teflon.

The problem is that the material is difficult to synthesize, particularly in the sizes needed for semiconductor wafers. But Norton Co. of Northboro, Mass., may be changing that. It has emerged from a five-year R&D effort with a plasma-assisted chemical-vapour-deposition process that it says yields product size, shape, deposition rate, and quality that have eluded hundreds of other diamond film developers world-wide.

The key is diamond's usefulness in thermal management. It is such a good conductor that heat is quickly spread evenly over the film's total area. Immediate applications could be in laser diode heat sinks or large substrates for thermal management of multichip modules, or in dense advanced computer circuits. (Source: Electronics, November 1990)

New semiconductor mask

A new type of semiconductor mask for producing computer chips using an X-ray lithography process has been developed and patented by Herbert G. Waggener, a researcher at Lepton (Murray Hill, NJ). Lepton makes machines that use electron beams to produce these microscopic patterns. X-ray lithography, still in its experimental stages, could be used to etch circuits that are many times smaller compared to those that can be made using current technologies. The new mask is the only one that is precise and reliable enough to use because it will not expand or contract with temperature changes that occur during X-ray

lithography. The mask is held in a ring of temperature-stable glass ceramic to make it even more reliable and precise. Any distortion, no matter how small, would be intolerable when etching such tiny circuitry. (Extracted from New York Times, 1 September 1990)

Novel transistor

Researchers at Massachusetts Institute of Technology (Cambridge, MA) and IBM's Thomas J. Watson Research Center (Yorktown Heights, NY) report having made a novel transistor sensitive to a single electron. While the electronic device works only at temperatures below 1 K, the scientists say it could lead to new understanding of quantum mechanical processes and - if the transistor could be made to work at higher temperatures - to practical electronic devices. The experimental device is composed of various thin layers of gallium arsenide and aluminium gallium arsenide and metal electrodes. MIT scientists say the transistor exhibits the unusual property of having its current periodically oscillate with increased voltage - apparently the result of single electrons turning the transistor off and on. (Source: Chemical Week, 19 September 1990)

GaAs integration level climbs to 1 million transistors

A process developed by Vitesse Semiconductor Corp. of Camarilo, California, has pushed the level of integration for digital gallium arsenide circuits past 1 million transistors.

The basic transistor structure of Vitesse's H-GaAs III process achieves loaded gate delays of less than 100 ps while dissipating less than 200 μW at 1-GHz clock rates. By comparison, high-performance biCMOS offers 200- to 300-ps gate delay and 100- to 150-MHz, according to Vitesse. (Extracted from: Electronics, October 1990)

New bipolar transistor

A new bipolar transistor, said to be the world's fastest "ballistic collection transistor" with an operating frequency of 170 gigahertz, has been developed by Nippon Telegraph and Telephone Corp. (NTT).

The new semiconductor is made from layers of gallium-arsenide and aluminium-gallium arsenide.

According to NTT, the newly developed ballistic collection transistor features an operating speed more than five times faster than conventional silicon bipolar transistors.

It is expected to drastically improve the performance of optical and radio communications systems and supercomputers, NTT said. The gallium-arsenide semiconductor is being considered as a possible replacement for silicon in the eventual development of high-speed transistors, NTT explained.

The new technique developed by NTT researchers gives a slope to the same path by using three layers to form the collector, which formerly consisted of a single n-type semiconductor layer. Near the collector's entrance is a gentle slope made of the -i-layer of intrinsic semiconductor, NTT said. A steep slope made of the p-type semiconductor layer is next to the first slope, which is followed by a third flat slope made of the n-type semiconductor. (Extracted from American Materials Market, 11 July 1990)

New heat sink material

A novel heat sink material made from diamond dust and paraffin could enable multichip modules to hold silicon devices filling up to 90 per cent of their area, according to a researcher at Reading University.

The material, which is in paste form, is both a good insulator and dissipator of heat. It can be deposited directly onto naked devices and conduct heat away from the circuits.

Instead of mounting devices on a substrate, the idea is to place naked dice in square holes in the substrate and then use tape automated bonding technology to connect dice together electrically, either directly or via tracks on the substrate, running around the square holes.

After assembling the substrate and dice, it is housed in a heat sink package, which is then encapsulated with the paste. If the paste is placed under a slight pressure in the housing, it will secure the dice in the substrate. This is similar to the same way powdered coffee becomes "solid" when vacuum packed because the granules do not have enough space to move around, according to the researcher.

By mounting devices on both sides of the substrate the potential packing density of the system can effectively be doubled, he said. With the system, users could create a Eurocard-sized package around 2 cm thick that could hold 50 Mbytes of fast static RAM, using 256-Kbit dice or 200 Mbyte with 1-Mbit devices. (Technology Update, 10 September 1990)

New speed records for silicon and fibre-optic transmission

German research laboratories set two records in components speed recently, considerably advancing electronics technology and promising a major impact on systems performance. One is a 20-Gbit/s data rate for a silicon device and the other a data-transmission rate of, again, 20-Gbit/s over a glass fibre 71 miles long.

At the Ruhr University in Bochum and at Standard Elektrik Lorenz AG, the Stuttgart-based subsidiary of France's Alcatel NV, the two records are all the more significant since they were achieved simply by exploiting today's technologies. The Bochum and Stuttgart researchers did not resort to any expensive techniques, nor did they rely on sophisticated and unconventional methods.

In effect, the Bochum group, headed by Professor Hans-Martin Rein of the university's Faculty of Electrotechnology, has given silicon a new lease on life as a material for high-speed circuits.

The 20-Gbit/s switching speed is the highest ever achieved with a monolithic integrated circuit, Rein says. It is even one third higher than the 15-Gbit/s speed obtained with gallium arsenide, a material much more expensive and more difficult to

process than silicon. The highest measured speed for a silicon chip before this was 14-Gbit/s, according to the researchers.

The new device is a time multiplexer, which, once perfected, could find applications in fibre-optic transmission systems operating at extremely high data rates and in fast measuring equipment.

The Bochum device demonstrates that today's silicon technologies can achieve data rates at, and possibly above, 20-Gbit/s.

The other record - the 20-Gbit/s transmission rate that Standard Elektrik achieved over a dispersion-shifted optical fibre - corresponds to some 300,000 voice channels. To obtain this result, the Stuttgart researchers did not use new and rather expensive coherent techniques such as superheterodyne methods being tried out at other laboratories. Instead, they combined a number of relatively conventional and inexpensive technologies that SEL has developed recently.

So far the SEL researchers have achieved a gain of up to 30 dB and a bandwidth of about 5,000 GHz. The components used can be employed not only for digital point-to-point transmissions as they are in the experiments.

They are also good for multichannel, amplitude-modulated TV-signal transmissions, which may be used soon. (Extracted from Electronics, November 1990)

Toward the polymer chip

When Bruce Novak's undergraduate assistants noted in March 1990 that a polymer compound they were studying had an unusual electronic structure, Novak decided they might be on to something altogether unexpected. They were: Novak, a chemist at the University of California at Berkeley, announced that the compound can be turned into a conductor just by shining ultraviolet light on it.

Technically known as arylated poly (p-phenylene sulfide), or APPS, the new polymer, once photoactivated, demonstrates a conductivity similar to that of silicon and other semiconductors. Since conventional polymers, like organic compounds generally, are insulators rather than conductors, the Novak team has at least a theoretical breakthrough. And, if a number of technical hurdles can be overcome, the new material could eventually transform the manufacture of computer chips.

A broad range of applications could open up. Take display screens in computers and televisions, for example. Today's screens use a phosphorous coating that flickers to life when a cathode-ray tube sprays electrons across it. With photolyzed polymers, however, it might become possible to wire each coloured dot, or pixel, on the screen with a micron-wide line of conducting polymer, thereby obviating the need for the cathode-ray tube and making flat-screen display possible without liquid crystals.

Novak's more immediate goal, however, is to understand how APPS's electrical conductivity is achieved. In particular, he is anxious to determine whether the conductivity of the new polymer is ionic or electrical. So far, the circumstantial evidence amassed by his laboratory favours electrical conduction: APPS loses its conductivity when exposed to water. (Extracted with permission from Science, Vol. 249, 14 September 1990, p. 1249, by D. P. Hamilton. Copyright by the AAAS 1990)

Chemists make a molecular junction box

Molecular wires, long-chain molecules that can conduct electricity, could one day lead to microscopic devices for storing information, chemicals sensors and organic computers that might rival the power and efficiency of the human brain. But only if they can be made into circuits. Now a group of chemists in the US has made an important breakthrough by finding a way to cross-connect molecular wires and make the molecular equivalent of a junction box.

James Tour, Ruilian We and Jeffry Schumm of the University of South Carolina at Columbia have made a connection between two molecular wires - each a short chain of polythiophene rings (Journal of the American Chemical Society, 1990, Vol. 112, p. 5662). Chains of up to a thousand thiophene rings can approach the conductivity of a metal if they are "doped" with impurity atoms.

Molecular wires conduct electricity because they have double bonds along their chains, which allow electrons to flow from one end to the other. The electrons can be generated by doping the wires with a very strong acid, such as perchloric acid. The acid uncouples some of the electrons of the polymer, freeing them to flow when a voltage is applied between the ends.

Until now, joining two molecular wires with an organic link has posed problems for chemists. If the link itself has double bonds, then these react with the bonds of the chains. This forces the whole assembly into an inflexible arrangement with all the atoms in one plane.

The first attempt of Tour and his colleagues to make such a link - an organic junction box - was unsuccesstul because they assumed that the central atom should be carbon. This system proved impossible to construct; the molecule kept "short-circuiting" by forming unwanted bonds. But when the team turned to silicon as an alternative central atom, they found that a junction box formed easily.

The chemists started with silicon tetrachloride, which they reacted with an organic magnesium compound that contains a triple bond. Four of these groups were attached to the silicon. They treated this molecule first with butyl lithium and zirconocene, then with disulphur dichloride. These reagents formed the thiophene rings, and had silicon groups attached. Tour and his colleagues then reacted their junction box with other thiophene molecules and showed that they could add these on to extend the wiring at each side.

The next step is to grow longer molecular wires and show that conduction through the silicon atom from one wire to the other is possible.

In Britain, Martin Bryce and David Parker of the University of Durham have made several kinds of thiophene wires and it would be to these that Tour's junction boxes could be attached.

The British chemists have made wires that are soluble in organic solvents, a necessary prerequisite to making thin films of conducting

polymer. Such films could be used as chemical sensors or to protect other electronic devices against electromagnetic radiation.

In work about to be patented, Bryce and Parker have discovered ways of adding groups of atoms to the thiophene rings, not only to make them soluble but to make them stable to heat and oxidation. It should be possible to test the effectiveness of the junction box with relatively short chains of thiophene wires, because the conducting ability of these wires is independent of the length of the chains. (This first appeared in New Scientist, London, the weekly review of science and technology, on 8 September 1990)

Thin-film, conducting-polymer solar cells

Thin films of conducting organic polymers have been cast onto silicon substrates and doped with iodine to form solar cells. Up to now, synthetic routes to electrically conductive polymers have generally produced insoluble, intractable materials, preventing the fabrication of uniform, well-defined electronic or optical structures. Nathan S. Lewis, Robert H. Grubbs, and colleagues at California Institute of Technology have used ring-opening metathesis polymerization (ROMP), a recently developed synthetic method, to form thin films of soluble, processible, conductive polyacetylenes. They cast the thin films onto n-doped silicon substrates and dope them with iodine to form solar cells that produce photovoltages at the theoretical limit - much greater than those that can be obtained from n-silicon contacts with conventional metals. The researchers also show that ROMP can be used to make "sandwich" devices consisting of multilayers of conducting or insulating polymer films. Possible electronic and optical applications of the new thin-film devices include semiconductor/organic polymer junctions for solar cells and layered polymeric structures for use as polymer-based capacitors or optical waveguides. (Source: Chemical and Engineering News, 10 September 1990)

New thin film formation technology

A joint research group (led by Professor Hideomi Koinuma), from the Tokyo Institute of Technology's Engineering Materials Research Laboratory and Sumitomo Cement Co. Ltd., have developed a new thin film formation technology.

The new technology uses an electron beam and a 193 nm argon fluoride excimer laser, which work together to accurately stack layers of oxide one upon the other. The electron beam creates a RHEED oscillation pattern and this in turn determines how the layers are formed.

In experiments, the researchers used a silicon 10 nm diameter substrate on which they epitaxially grew a 90 Å film of cerium oxide. Since a single cerium oxide unit measures about 3 Å, the 90 Å film is believed to consist of 30 stacked layers. The film was formed under a vacuum of $10^{-9}$ Torr using a laser output of 1 J/cm$^2$. (Reprinted with permission from Semiconductor International Magazine, September 1990. Copyright 1990 by Cahners Publishing Co., Des Plaines, Illinois, USA)

Memory molecule with a mind like a computer

A group of Japanese chemists has discovered a molecule that can act like the short-term and long-term memory of a computer. The molecule, a compound of benzene, changes to a different form when it is struck by a photon of ultraviolet light, allowing it to store a binary digit. This change can not only be reversed to "read" the information, but can be made more permanent so that the information is not erased by the reading process.

Z. Liu, K. Hashimoto and A. Fujishima of the University of Tokyo use as their memory a molecule known as 4-octyl-4'-(carboxypentamehylene oxy)-azobenzene (OCAB). Usually, reading such a molecule, which involves exposing it to light, returns it to its original state, erasing the information stored.

But Liu and his colleagues can turn OCAB into a form that can be read many times by depositing it on the surface of an electrode. Here, it can be reduced, by an electric current, into a more permanent form. Eventually, this can be returned to the original form by reversing the electric current.

This electrochemical process is the key to the long-term storage of information. The short-term storage of information is possible because it allows the molecule to have two so-called isomers. These are the same in all chemical respects, but they have slightly different structures.

OCAB has a nitrogen-nitrogen double bond at its heart, which is very rigid. The other chemical groups can be locked at the same side of the molecule to make the "cis" form or on opposite sides to make the "trans" form.

Liu's team deposit trans-OCAB as a layer, just one-molecule thick, on the surface of a glass electrode made from tin oxide. When they shine laser light on to a region of the surface, this converts the trans-OCAB to the cis-OCAB form, so recording the event. The information can then be read by another beam of light, which "scans" the surface. But this gives the cis-OCAB molecules enough energy to relax back to the trans-OCAB form. The information is retrieved but at the expense of erasing the record.

Liu and his colleagues can fix the molecular memory by using the tin oxide glass as an electrode in an electrical circuit. By applying just the right voltage across the monolayer, the cis-OCAB can be reduced - a hydrogen atom is added to each of its nitrogen atoms - while the trans-OCAB remains unaffected. Such a surface can be read without its information being wiped clean in the process.

However, the Japanese chemists find that the permanent record is slowly lost if the electrode comes into contact with oxygen from the air. To keep it stored, they must either exclude the oxygen or keep the electrode at a small negative voltage.

Liu and his colleagues also find that they can wipe the memory clean by reversing the current and anodizing the entire film. This oxidizes the OCAB by removing the hydrogen atoms, a process that automatically returns the molecule to the trans form

The chemists were able to repeat the cycle of going from trans to cis, then to the reduced form, and finally back to the trans again several hundred times, although this caused a small amount of deterioration. Liu thinks that this is caused when some of the OCAB molecules are lost from the surface to the electrolyte solution. He believes that this could be overcome by the device of using a solid electrolyte.

The Japanese researchers calculate that if their OCAB electrode were to be read by a laser, it should be able to store a hundred million bits of information on a surface the size of a finger nail (1 $cm^2$). If it were to be read with a glass needle electrode, it would be possible to store a million million bits. Such a reading process is possible in theory; it would rely on the same technique now used to observe individual molecules in an instrument known as a scanning tunnelling microscope.

Cis-trans isomerism is only one kind of chemical change that can be exploited to allow molecules to record information. Other compounds can register ultraviolet light by breaking a bond, transferring a hydrogen atom from one atom to another, or even moving an electron. But these molecules act only as temporary memories, because reading them, even with visible light, reverses the chemical change, and so wipes out the information. The Japanese chemists are the first to make a permanent, but erasable system. (This first appeared in New Scientist, London, the weekly review of science and technology, on 3 November 1990)

New system to ease memory chip design

NEC has developed an economical system that uses supercomputers to facilitate memory chip design. The new technology will allow researchers to produce thinner capacity film and to speed large-scale integrated chip development. Capacity film covers printed circuit layers and is non-conductive. Making it thinner is necessary to reduce production costs and to develop next-generation chips. The system could lead to the development of 1 gigabit and 256 megabit random access memory (RAM) chips. To make 4-megabit chips, capacity film has to be 70 angstroms or thinner. Most semiconductor makers cannot produce capacity film that is thinner than 50 angstroms. NEC has discovered by using its system that too much silicon is contained in conventional capacity film. (Extracted from Japan Economic Journal, 8 September 1990)

TI makes advances in deformable mirrors

Texas instruments is moving closer to the first commercial application of its deformable mirror devices (DMDs).

The technology involves coating chips with 70 tiny mirrors suspended over control electrodes.

TI says it is close to incorporating the chip into the next generation of airline ticket printing machines. It would replace the laser polymer scanner head used in present laser printers.

TI is also working on a study sponsored by the US Defense Advanced Projects Research Agency (DARPA) to develop a projection system for high-definition TV.

This would involve putting rows and rows of these devices into the projection system. Each mirror on the TI device represents one pixel of an image, so that a light beam is either reflected down the projection system and onto the screen or deflected away so that no light spot appears on the screen.

The technology has taken some time to come to fruition. (Source: Electronics Weekly, 10 October 1990)

Sortek develops SOR exposure system

Sortek Corp., has developed a synchrotron orbital radiation (SOR) system that can generate soft X-rays. The X-rays can be used to process VLSIs at the 0.25 $\mu$m linewidth level.

The system consists of an incident electron linear accelerator (to generate an e-beam), an electron synchrotron (which accelerates the e-beam to 1 GeV), a SOR ring to extract the radiation and a high precision exposure system.

Sortek's SOR ring can carry a 200 mA e-beam, but the current tends to decrease by 50 per cent in 11 hours. The company solved the problem by injecting extra electrons every few minutes.

Sortek plans to use the new system to R&D next generation (larger than 64 Mb) VLSI memories. (Reprinted with permission from Semiconductor International Magazine, September 1990. Copyright 1990 by Cahners Publishing Co., Des Plaines, Illinois, USA)

New VLSI circuit

A digital VLSI circuit with on-chip learning that can be used to implement neural networks has been designed by Laboratories d'Electronique Philips (LEP), the French outpost of Philips Research. All learning rules can be implemented by programming the general learning unit.

The main feature of the new circuit, called L-neuro (learning neuro chip), is its on-chip learning capability.

Philips demonstrated the use of a neural algorithm for principal component analysis. This is the determination of the relevant features in an image and enables the image to be compressed. The PCA algorithm requires the learning of these features, and this is achieved by L-neuro in real time.

The chip has been fabricated in 1-micron CMOS. It incorporates RAM for the storage of 1,024 neuron connections. A typical response time for updating an 8-bit neuron is 1 mus, independent of the size of the network. (Extracted from Electronic World News, 23 July 1990)

Blue laser promises to increase storage densities

A new, blue laser light source developed at IBM may permit optical storage devices to operate at 4 times present storage densities. Infrared semiconductor diode lasers are now used to write information, in the form of a coded pattern of marks, to optical disks.

While the diode lasers can write marks as small as 0.8 $\mu$m in diameter, blue light, because it operates at a shorter wavelength, can be focused to 0.4 $\mu$m.

The laser uses yttrium lithium fluoride crystal, doped with 1 per cent erbium ions, a rare earth element. The new device boasts 10 per cent efficiency in converting electricity into blue light. This makes it at least 5 times more efficient than previous blue lasers, according to scientists at IBM's Almaden Research Center, San Jose, California. (Reprinted with permission from Semicontuctor International Magazine, August 1990. Copyright 1990 by Cahners Publishing Co., Des Plaines, Illinois, USA)

New photographic storage system

A system that aims to change the face of photography was announced by the American photographic film manufacturer Kodak. The system, known as Photo CD, converts conventional 35-millimetre camera pictures into digital data and stores them on a compact disc so they can be viewed on a TV and stored for printing out later. The discs, developed jointly with the Dutch electronics company Philips, will not be available to the public until 1992.

A Photo CD player, costing about £300 and to be made by Philips, will display them on a normal TV set. Photographic shops will convert film into CDs and also install printers and offer a printing service.

But a question mark still hangs over several practical aspects of the system. Each disc can store up to 100 photographs, and Kodak says that "photos from many different rolls of film can be combined on a single disc at different times". This is clearly an important feature both for cost and convenience. But there is no technology currently known that can do this with the non-erasable CDs that Kodak is using.

Kodak has so far not divulged how it plans to add more pictures to its Photo CDs. If it can, then the record industry has good reason to be worried about the prospect of domestic recorders of low-cost audio CDs.

Kodak says the disc is of the type known in the audio and computer industries as a write once, read many times (WORM) disc. Data can be written to the disc, but not then altered, so pictures cannot be lost. Kodak (and Philips) also say that their WORM disc is "fully compatible with a variety of CD data formats" such as CD-ROM and CD-ROM XA as well as Philips's soon-to-be-launched multimedia format called CDI.

But to retain compatibility with the existing CD standards, the Photo CD disc must have a digitally coded table of contents (TOC) at the beginning of the recording that tells the player what is on the disc and where. This TOC must be written as soon as the first recording is finished.

But Kodak says that pictures can be put onto the disc at different times. If this means that Kodak and Philips have found a way of updating the TOC to add data to a partly filled Photo disc, while retaining compatibility with the CD format, then this makes WORM discs an attractive proposition for domestic audio recording - which is worrying for the record companies. (This first appeared in New Scientist, London, the weekly review of science and technology, on 29 September 1990)

Many holograms multiply data storage ...

A technique to store many holograms on top of each other on a single polymer film offers the possibility of storing data at densities 100,000 times as great as conventional hard computer discs.

A hologram can store large amounts of data because it records information about the phase of light that falls on it as well as the light's intensity. This results in holographic images appearing to be three dimensional while normal photographs are limited to two dimensions.

Researchers at the Swiss Federal Institute of Technology in Zurich are working on a way of increasing this storage capacity by multiplying the number of holograms that can be recorded on the same medium. This potentially increases storage capacities to the order of 100 million million bits per square centimetre.

The Swiss work uses a film of a dye-doped polymer as the recording medium. When the polymer molecules are at very low temperatures, close to absolute zero, they can absorb light over a wide range of frequencies. Their absorption spectrum then appears more or less continuous.

In addition to the ability to store data, the system can be made to carry out simple logic operations on the data. If, at a particular laser frequency, a voltage value is chosen, which is half way between the values for two stored images, both images will be seen by the camera.

The data on the two images will be added together. Bits that are in phase with the corresponding bit from the other image reinforce each other, and those that are out of phase cancel each other out. So each bit in an image performs a logic operation (such as OR, AND or XOR) in parallel with all the others, depending on the value of the corresponding bit on the second image. (Extracted from New Scientist, 10 November 1990)

Compression extends life of "video on CD"

Video data compression will soon make it possible to store over one hour of full motion video on a single compact disc.

Californian company C-Cube plans to introduce a high speed video compression chip in 1991 that will reduce the amount of digital data needed to create 72 minutes of video so that it can be stored on a CD.

The image processor, which is a new version of C-Cube's existing CL550-30 video processor, will be fully compliant with the MPEG international standard for video compression.

This standard should be ratified before the end of 1990.

Video compression is important in the development of interactive compact disc, to called CD-I.

Philips has ambitious plans to launch a CD-I product next year based heavily on Motorola processors. Philips is believed to be less committed on its choice of video compression chip.

C-Cube's compression chips may also be of interest to British Telecom, which is currently perfecting its video-conferencing technology to allow transmission of two-way voice and image over two 64 kbit/s ISDN channels.

Like Philips, BT has developed its own compression systems, but C-Cube is hoping to interest both companies in its new high performance video chip.

C-Cube is not alone - Intel plans to introduce a video compression chip, which it claims will allow one hour of video to be stored on a CD. (Source: Electronics Weekly, 10 October 1990)

## III. MARKET TRENDS AND COMPANY NEWS

### Market trends

US buys Euro chips

US computer makers are flocking to Europe to buy their DRAM memory chips, since the reference price on Japanese-made DRAMs set by the European Commission (EC) is more than 30 per cent lower than the fair market value (FMV) price in force in the US.

Large computer companies such as IBM, DEC and Hewlett-Packard have established policies of scouring the world for the best component prices and are all reportedly exploiting the current situation. Prices for 1-Mbit DRAMs are around £2.30 in Europe at the moment.

In July 1990 the unexpectedly low EC reference price set for the quarter to the end of October 1990, which is responsible for the disparity with the US FMV price, was the result of a mistake made by EC regulators. The reference price for the next quarter will be significantly higher. (Source: Electronics Weekly, 12 September 1990)

Economist sees 15 per cent rise in chip sales in 1991

An electronics industry economist predicts semiconductor sales to North America will grow by 15 per cent in 1991. However, sales in 1990 will post a sluggish 1 per cent.

According to Elizabeth B. Baatz, sales to North America began dropping during the first quarter, and continued through the second quarter of 1990. Baatz, senior electronics economist for Cahners Publishing Co., believes sales will pick up by 3 per cent and 11 per cent in the final quarters of 1990.

The current slowdown in semiconductor orders has been apparent for over two years now. Order growth (compared to year-ago levels) peaked at 34 per cent in the first quarter of 1988. Last summer, however, they headed down for an 8 per cent drop. There was some relief in the final quarter of last year, when orders climbed back up 4 per cent.

Baatz believes world-wide dollar-value semiconductor sales will take off in 1991. She believes this could represent a 15 per cent growth, although unit sales growth will level off. Sales will favour dollar value because the next generation of chips is likely to be higher priced.

In 1989, in US dollars, nearly 40 per cent of sales were to Japan, with the US buying slightly over 30 per cent. Western Europe's share was 18 per cent and Asia, outside of Japan, bought 12 per cent. The total world-wide market, she reported, stands at nearly $49 billion.

The trend towards global selling began climbing in the late 1980s, she said. In 1986, semiconductor companies made 32 per cent of their sales on foreign shores. In 1988, that share rose to more than 41 per cent. While the trend for capital equipment makers has been less dramatic, nearly half of all revenue brought in by leading equipment makers is foreign, she said.

Technologies that will impact the industry include e-beam, CAE tools and design for test. In the packaging area, surface mount, tape-automated bonding and button connector technologies are key drivers.

According to Dataquest, world-wide semiconductor consumption will mark $50 billion, in 1990. By 1994, however, that figure will climb to $110 billion.

Semiconductor consumption, Dataquest noted, doubles every five years. A key market driver will be smart peripherals. (Extracted with permission from Semiconductor International Magazine, July 1990. Copyright 1990 by Cahners Publishing Co., Des Plaines, Il., USA)

European market holds its US appeal

US software companies are continuing to find Europe more lucrative than the home market.

Sales in Europe reached $219.4 million in the second quarter of 1990 - growing 48 per cent compared to the same period a year ago.

Over 30 US-based software companies, including Lotus, Microsoft, Ashton-Tate, WordPerfect, Borland and Software Publishing, submitted data to accounting firm Arthur Andersen, which prepared a report for PC software industry trade body, the Software Publishers Association (SPA).

The report found Germany and Austria to be the largest European market for US-based firms, followed by the UK and Ireland at $49.2 million.

The data was collected in 18 software categories - including word processors, graphics spreadsheets and others - and in six different software formats - including Macintosh and MS-DOS.

The report says sales of PC/MS-DOS software predominates in all regions, ranging from 81 per cent of total sales in Scandinavia to 97 per cent of total sales in Iberia. The Macintosh market is strongest in the UK, Scandinavia and France. Generally in European software markets, sales of US software products account for 70 per cent of the market in each country. (Source: Computer Weekly, 13 September 1990)

Business microcomputer sales up 25 per cent

The value of business microcomputers sold in the UK in 1989 rose to £2.8 billion, accounting for more than half the total sales of all computers for the first time. The size of the total market for microcomputers, minicomputers and mainframes is £5.4 billion, an increase of 12.6 per cent on the previous year. Sales of business microcomputers grew by 25 per cent between 1988 and 1989, stimulated both by the increased sales of portables and the release of computers based on powerful 80/386 microprocessors manufactured by Intel. By contrast, sales of mainframes declined by 5.6 per cent from £1.26 billion to £1.19 billion. Sales of home computers fell by 5.7 per cent from £57 million to £54 million, but sales of minicomputers and small business computers rose by 9 per cent from £1.2 billion to £1.3 billion. (Source: Financial Times, 13 August 1990, p. 6)

US computer market hits downturn

Times are getting tough for America's computer giants as hardware sales fall across the board and

profits come under pressure. Even IBM's dramatic increase in third quarter profits owes a lot to currency fluctuations and hides a fall in sales of computers.

Jobs are going as a result of the downturn, with DEC looking to shed some 5,000 of its 124,000 employees during 1991 and IBM looking to lose several thousand employees across Europe, including 1,200 in the UK.

Minicomputer maker DEC turned in sharply lower net profits of just $26 million for the quarter to 30 September; an 82 per cent fall on the $151 million for the same period in 1989. Sales for the quarter were slightly down at $3.09 billion compared with $3.13 billion last year.

IBM's superficially impressive 27 per cent rise in third quarter profits to $1.1 billion, compared with $877 million in 1989, have been boosted by the weak dollar which has inflated the value of its non-US sales. Total sales for the quarter grew by only 7 per cent from $14.3 billion to $15.3 billion and sales of computer hardware actually fell from $9.2 billion to $9.1 billion.

Similarly, US personal computer maker Apple saw its fourth quarter sales fall by 2 per cent to $1.3 billion although it reported sales for the year to the end of September of $5.6 billion up on 1989's $5.3 billion and profits up 5 per cent to $475 million from $456 million.

Apple's results indicate that demand for PCs, particularly in the US, may be slowing, with worrying implications for component suppliers and dealers. (Source: Electronics Weekly, 24 October 1990)

Semiconductor shipments

World-wide shipments of semiconductor manufacturing equipment grew 2 per cent in the second quarter of 1990, according to the trade association, Semiconductor Equipment and Materials International (SEMI). SEMI reported that second quarter equipment shipments were $2.04 billion, compared to $2.01 billion in the first quarter. Assembly and test equipment recorded the biggest increase, up 6 per cent to $620 million. (Source: Electronics Weekly, 12 September 1990)

Out with the old ...

When the electronics component industry entered the decade of the 1980s, it was an industry generally dominated by American suppliers and was riding a wave of rapid growth and high profitability. As we enter the 1990s, the conditions are dramatically different. The participants in the industry must adopt very different strategies, structures and operating tactics. For the distribution segment of the industry, the key issues will have to be profitability, focus and globalization if we expect to survive - let alone prosper - in this decade.

Distribution profitability has been slowly sinking throughout the 1980s, and every economic indicator suggests this decline will continue. Gross profit margins have been shrinking as both customers and suppliers attempt to squeeze out every pence of profitability from their own activities as component prices decline with advancing technology.

The result of all these pressures has been that some distributors have disappeared due to bankruptcy, some distributors have been acquired or merged just short of outright failure, and even the high flyers have seen the investment community turn away from them, causing the price of their shares to plummet. Fixing this profitability problem is the most critical task now facing management.

The profitability issue leads directly to the issue of focus. The time has come for distributors to recognize their inability to be all things to all people and to focus on areas where their skills, strengths and systems will allow them to be most profitable.

Finally, distribution must accept the inevitability of the globalization of our world. Geographically protected markets no longer exist and can no longer be counted upon to provide safety and profits.

Those distributors who adapt to the changing environment within the industry and incorporate profitability, focus and globalization into their strategic plans will emerge as the leading firms in the twenty-first century. (Source: Electronics Weekly, 26 September 1990)

Commercialization of superconducting materials

Superconducting materials, discovered four years ago, are beginning to be commercialized, with initial applications in space, defence and specialized scientific and medical equipment. However, "the markets do not look like billion-dollar markets at this time. They look like a collection of niches", according to Ora E. Smith, chief marketing officer of Conductus (Sunnyvale, CA), a start-up company specializing in electronic applications of superconductors.

Conductus' bolometer, a sensor that detects infra-red light, may be used in satellites or scientific instruments that analyse the composition of substances by measuring their effects on infra-red light. A strip of superconducting material is kept at a temperature that is on the threshold of losing its superconductivity. When exposed to infra-red light, the material heats up and starts to lose its superconductivity, which can be measured by other instruments. Illinois Superconductor's temperature sensor acts like a dipstick, measuring the level of liquid nitrogen in a freezer; as the level of liquid nitrogen falls, the rod loses its superconductivity and becomes more resistant to electricity. Several firms are developing microwave radio components. Other devices under development include superconducting quantum interference devices (SQUIDS) - ultrasensitive sensors to detect magnetic fields a thousand times smaller than the earth's. (Extracted from New York Times, 2 September 1990)

Facing up to Eastern trade

After the European Community, Eastern Europe is destined to become one of the largest high-technology markets in the 1990s, worth some $45 billion.

The export licensing controls, as framed by the Co-ordinating Committee for Multilateral Export Controls (CoCom) will continue to exist as long as the military capacity of the Soviet Union remains at its present-day strength. There is a possibility

that future changes will be made to accommodate the Soviet Union and exclude potentially dangerous countries

It is not easy for companies to plan their long-term strategy in Eastern Europe when events are outstripping government policies almost overnight.

Even Western government agencies have been caught out in the Middle East. For a long time they have been busy enforcing export controls in a region of diminishing threat.

Satisfaction over the recent CoCom relaxations in the export of computers, telecommunications equipment and machine tools should be muted.

In the race to access these fresh markets, it is obvious that Germany is turning out to be the main beneficiary.

Some of the largest UK companies, such as Xerox and ICL, have years of experience in trading with Eastern Europe when the only form of doing business was barter. The smaller companies have a lot to offer because demand from the East for Western products and services is insatiable.

Be careful though in dealings with East European organizations. As the economies of the individual countries move quickly towards privatization, State organizations are dropping out rapidly. This means that guarantees given previously can become worthless overnight.

Eastern European countries have a debt of $125 billion, so there is a limit to the amount of high technology they can afford, especially if they intend paying in hard currency. Added to this is a problem of getting managements to think commercially.

Japanese financiers see Hungary and Poland as the two countries with the greatest potential for turning their economies around. They have loaned $500 million to each of them. These loans take the form of united loans or overseas investment credits.

Poland is the larger opening market of the two countries, and with a population of nearly 40 million, it has a gross national product that is slightly smaller than that of Holland. A good telecommunications infrastructure is a major priority. While Poland is the most advanced in its approach to a Western demand economy, the recent cuts in living standards will impact the business sector's ability to buy high-technology goods.

Hungary was the first of the countries in Central Europe to open up its economy to foreign investors, and the first to sign an economic co-operation agreement with the EC in September 1988. State-run joint ventures are being replaced by private manufacturing ventures. Again telecommunications is at the top of the country's list of requirements.

Particular opportunities exist to help these countries export their products to the West so that they can earn hard currency. Both Hungary and Czechoslovakia have a good capability in contract manufacturing, but lack the opportunities to use their skills. The Soviet Union too is moving towards setting up a private industrial sector. The pace at which the Soviet economy is moving makes it look as though the rules will soon be changed to permit 100 per cent foreign-owned businesses in the USSR.

New methods for channelling foreign investment into the USSR are also expected to come into operation, such as leasing of existing enterprises or facilities. The USSR is adopting the non-discriminatory tariff agreement on imported goods from the European Community. This is good news for the exporters of the 20-30 million computers needed in the Soviet Union. (Source: Electronics Weekly, 26 September 1990)

### PC makers turn to portables for profit

PC manufacturers are pinning their hopes on portables helping them through what many observers predict will be tough times for the PC industry.

Market research company International Data Corporation predicts that sales of portables will grow by at least 20 per cent a year for the next five years.

In a report on portables, IDC warns: "Companies with a PC line lacking a mobile component are at a disadvantage and, in the long term, are in trouble."

Within the portables market, laptop computers are expected to show the biggest sales growth. Market Intelligence Research says that laptop sales will account for more than 50 per cent of the total portables market for at least the next two years. Smaller, lightweight portables (sometimes called palmtops) will become the biggest seller in 1993.

Top industry executives predict that portables will incorporate new types of technology including the use of multi-media technologies. (Source: Computing, 22 November 1990)

## Company news

### Chip giants lead SRAM exodus

More companies are poised to end making SRAM memory chips following recent decisions by National Semiconductor and VLSI Technology Incorporated (VTI) of the US, and Dutch giant Philips, to get out of this particularly cut-throat business.

Dataquest analyst Bipin Parmar points out that the SRAM market is hopelessly overcrowded and thinks a shake-out is inevitable.

He points out that some 35 companies currently make SRAMs compared with 15 companies in the world making DRAM memory chips, yet the world-wide SRAM market was worth only $3.3 billion last year compared with the DRAM business, which chalked up world-wide sales of $9.7 billion.

Both national Semiconductor and Philips are undergoing major restructurings and closing down loss-making operations. National's SRAM sales collapsed between 1988 and 1989, while Philips' SRAM business never really got off the ground.

Analysts expect the SRAM market to divide between high-volume products and more specialized high-speed and application-specific parts.

Japanese giants NEC, Toshiba, Hitachi, Sony and Sharp are well positioned to survive the shake-out, as are volume players Motorola in the US and SGS-Thomson Microelectronics in Europe. (Source: Electronics Weekly, 12 September 1990)

### European EDA firms join forces

Europe's small but clever electronic design software companies are joining forces in an attempt to fend off competition from their more powerful US rivals.

Several are negotiating cross-licensing agreements with each other while also drawing up plans to join forces when selling to major foreign chip makers.

Bath-based chip design software company Computer General ED, formerly Praxis ED, is currently negotiating licensing arrangements with German analog simulation start-up Anacad and Dutch software framework developer ESE.

Meanwhile, ESE and Anacad are also working with Dutch silicon compiler specialist Sagantec and others to forge a syndicate to sell European electronic design tools to application-specific integrated circuit (ASIC) makers, according to Sagantec director Hein van der Wildt. (Source: Electronics Weekly, 7 November 1990)

Siemens stalls on DRAM fabrication

Siemens has not yet obtained full board approval for the funding for its 16-Mbit DRAM factory building programme which is believed to involve some $450 million.

This was revealed at Electronica 90 in Munich along with the announcement that the German chip maker would start delivering first samples of its 16-Mbit DRAM to customers in November 1990. (Source: Electronics Weekly, 7 November 1990)

IBM/Microsoft sever software agreement

International Business Machines and Microsoft will sever their agreement to develop software for personal computers. The rift between the two firms will have a great impact on the personal computer industry, possibly more than any other occurrence in the last 10 years. It is now uncertain whether PC hardware or software developers will dictate the industry's standards, or a situation could arise where no dominant standard exists. Microsoft developed the operating system for the enormously popular IBM PC. The partnership between IBM and Microsoft influenced the design of subsequent generations of desktop computers. Due to the rift between IBM and Microsoft, the market for workstations and desktop computers will become more fragmented in the 1990s. Although the market fragmentation could spur innovation, it will result in uncertainty on the part of many customers. Microsoft's very successful Windows 3.0 runs on the MS-DOS operating system, which is used for most IBM PCs and compatible systems. Over one million copies have been sold to date since Windows 3.0 was introduced in early 1990. Although the program's simplicity makes it popular with users, especially novices, Windows 3.0 does not have the operating systems required for more complex scientific tasks or networking.

Meanwhile, IBM has tried to curb Microsoft's influence over the PC software market by forming a licensing agreement with Metaphor Computer Systems for a new category of software that relies less on operating systems. It has also agreed to license Go's operating system software for "notepad" computers. Unless IBM can come up with alternatives to Microsoft's Windows, it will lose control of the market to Microsoft, whose profits totalled $170.1 million on revenues of $803.5 million in 1989. (Extracted from New York Times, 24 September 1990)

Siemens-Nixdorf plans revealed

Although the ink is barely dry on the merger pact creating Europe's largest computer company, Siemens-Nixdorf Informationssysteme AG already has an aggressive product strategy worked out. At the high end, SNI plans to introduce a proprietary 170-million-instructions-per-second (MIPS) mainframe in 1991 to counter IBM's new S/390 family. In the mid-range, the merged company intends to create an applications programming interface in UNIX for customer information control system (CICS), on-line transaction processing (OLTP) and reduced instruction set computing (RISC) processors by 1992. At the low end, SNI will immediately begin reselling laptop PCs made by Matsushita Electric Industrial Co. Ltd. of Osaka, Japan. (Source: Datamation, 1 November 1990)

IBM pushes forward networking

While completely overhauling its mainframe line, IBM also announced major steps forward in networking products.

For mainframe users IBM said it would add peer-to-peer networking to Netview, its flagship network and systems management software, which now only controls hierarchically structured configurations. For local area networks IBM has introduced a new device access unit and is replacing the LAN Manager software with a choice of three network management software products.

Netview version 2 will become available in two stages. Release 1, for MVS and MVS/XA, will come at the end of 1990 and add a graphical user interface for monitoring SNA networks. More significant will be release 2 at the end of September 1991. This will add support of IBM's LU6.2 protocols, which allow computers to co-operate as equals and not just in a master-slave relationship.

For local area networking IBM has moved on from the position it shared with Microsoft on LAN Manager. While Microsoft has just launched a major offensive to make LAN Manager a shrink-wrapped networking product to compete with Novell's Netware range, IBM has developed more features to make a LAN fit better into IBM mainframe-based arrangements.

Ordinary LAN Manager has been replaced with a range of three software products called LAN Network Manager. For stand-alone local networks Version 1.0 has a new user interface conforming to Systems Application Architecture and uses the OS2 operating system data base for management data.

Version 1.1 allows Netview to issue 80 control commands; previously it supported 11. It also holds physical design data and allows for detailed asset management through the LAN Station Manager software that is loaded onto each workstation.

A cut-down version of Version 1.1 omits the operator interface to reduce the costs of siting central control of small, self-contained local area networks away from the host.

The access control unit, model 8230, is a powered hub for Token Ring networks. It supports up to 80 devices in blocks of 20. It also supports longer cable runs and shielded and unshielded copper and optical fibre cables.

Bringing fibre into the picture suggests that IBM may be planning to introduce much faster networking at a local level to complement the fibre-based Enterprise Systems Connection Architecture at the systems level. (Source: Computer Weekly, 13 September 1990)

Fujitsu works out direct challenge to IBM

Fujitsu plans to take on the might of IBM by marketing its mainframes direct to customers in the West.

The Japanese manufacturer, which takes control of ICL at the end of this year and has a 46 per cent stake in IBM plug compatible supplier Amdahl, plans to sell systems running its own IBM MVS look-alike MSP-EX operating system.

The news coincides with the announcement of a new top-end series of mainframes from Fujitsu. The M-1800 range will compete with IBM's ES9000 series.

Five models of the M-1800 include the world's first eight processor mainframe computer, the model 85. There are enhancements to the MSP-EX operating system which now supports ESA compatibility.

Fujitsu's Japanese rival Hitachi already sells its machines in the West through HDS and Comparex. (Source: Computing, 6 September 1990)

Motorola DSPs get micro bus

Motorola plans to use its Intermodule Bus (IMB) technology developed for its microcontrollers to produce a family of customized digital signal processing (DSP) chips.

Early in 1991 it intends to offer a range of DSPs based on the 16-bit version of the 56000 described at a US conference in March, with peripheral functions such as memory, timers and signal conditioning chips.

Motorola's 56000 DSP device is widely used in professional audio systems. Its 24-bit data paths allow 16 bits of digitized sound to be moved with 8 bits of processing information attached. Many DSP applications do not need the full 24 bits of resolution.

DSP chips are now finding uses in a wider range of applications. AT&T and TI have both recently announced expansions to their ranges, including cheaper devices as well as chips with extra logical functions.

DSP chips are now going into applications that need different mixes of memory and signal conditioning. Motorola's technology should allow it to build up a family of devices quickly.

The company has also been providing more software for its DSP chip users. Ready Systems says that it has been writing a real-time operating system for the 56000 device. (Source: Electronics Weekly, 24 October 1990)

## IV. APPLICATIONS

US builds super A/D converter

A superconducting analog-to-digital converter (ADC) has been built at Westinghouse Electric in Pittsburgh, Pennsylvania.

The 12-bit circuit has a resolution of about one part in 4,000 - high enough for air traffic control radar applications. Its extremely low power consumption will be useful for infrared cameras detecting objects in space.

ADCs convert continuous signals to discrete values, which can then be processed by digital circuitry. The Westinghouse ADC is made using superconducting materials, which need to be cooled to liquid helium temperatures - 4.2°C above absolute zero - to operate. But the ADC is sensitive to signals smaller than a nanoamp and switches at 100 GHz.

The Westinghouse ADC combines a signal detector and binary counter. Because of its low power dissipation, the ADC can be mounted inside an infrared camera used for tracking objects in space. (Source: Electronics Weekly, 8 August 1990)

SPARC-based multiprocessor debut

Solbourne Computer Inc. of Longmont, Colorado, has unveiled what it calls the highest-performing SPARC product to date: a server that houses up to eight processors - each running 31 million instructions/s - in a symmetric multiprocessing (SMP) configuration. The Series 5E/900, or "Enterprise Server", is the first SPARC-based SMP system, Solbourne says. It is based on a 40-MHz microprocessor from Cypress Semiconductor Corp. and a 40 MHz floating point controller from Weitek Corp. or Texas Instruments Inc. The Server uses an 11-slot version of Solbourne's Kbus, with data-throughput rates of 128 Mbytes/s.

Enterprise Server is targeted at applications that require high speeds and high storage capacity. It can be configured with more than 1 Gbyte of memory and more than 27 Gbytes of disk storage. The Server has a SPEC-mark rating of 19.1. (Source: Electronics, August 1990)

Super-parallel computer

Fujitsu is developing a super-parallel computer 40 times faster than its CAP computer. The CAP-II is based on the CAP graphics-processing parallel computer and will use 1,024 microprocessor units. Each microprocessor unit will contain four large-scale integrated chips and the computer will have a peak processing speed of 12.5 billion floating-point operations/s. A prototype computer with 256 microprocessing units is in development. (Extracted from Asian Wall Street Journal, 9 July 1990)

Transputer launch soon

Inmos Ltd., which plans soon to launch its transputer family in ASIC form, is putting the finishing touches on its new H-series microprocessors.

The first of the new transputers, the H1, will offer at least 100-MIPS and 20-MFLOPS performance. It is scheduled for launch in the second quarter of 1991.

The H1 is binary compatible with first-generation transputers, but will be manufactured in a sub-micron technology developed by Inmos. With the new geometry, the internal clock of H1 will be increased to 50 MHz - the process used to manufacture the first generation transputers is not expected to handle internal clock speeds above 30 MHz.

The designers of the H1 have also reduced the number of cycles required for certain bit manipulation instructions. The architecture of the

HI uses superscalar and pipelined techniques. (Extracted from Electronic World News, 23 July 1990)

Teleconferencing

An international symposium on plant biotechnology put on by Washington State University was the first interactive televised scientific conference to be broadcast world-wide, and although it was not without hitches it showed that satellite networks are finally up to the task of video conferencing.

The symposium illustrated strengths and weaknesses of teleconferencing technology. With an audience distributed at 70 viewing centres world-wide, it brought together plant biotechnology experts with scientists in developing countries who might not have been able to attend an international meeting. Conference officials estimate that at about half of the viewing centres, local organizers used the three-hour symposium as the nucleus of longer local meetings. Observers at all sites were able to fax written questions during the conference; by mid-point, over a hundred questions had been received. Several dozen questions were answered on-air, and the others received written responses.

The conference featured two panels of plant biotechnologists, one group in Pullman, the other at the Max-Planck Institute for Genetics Research in Cologne, Germany. The five-member panel was composed of scientists from the United States, Mexico and Australia. In Cologne, Jozef St. Schell, director of the Max-Planck Institute, led a four-person panel that included former International Rice Institute director M.S. Swaminathan and Konstantin Skyrabin of Moscow State University.

Except for a brief loss of audio from Cologne and some minor production hitches, the conference was technically flawless.

Much of the success was due to redundancy in the form of duplicate equipment at every stage of the link (which included seven satellites and an equal number of ground stations), and a large production crew of professionals and students from Washington State University's telecommunications programme.

But as technically impressive as the symposium undeniably was, it illustrated some of the traditional problems of international conferences, as well as some new ones. With an audience of biotechnology researchers, third world agricultural scientists, students, and even Washington state legislators, the conference oscillated wildly in tone, technical content and direction.

The basic problem, however appeared to be that because little more than a 5-metre satellite dish and a television set was needed to plug in to the conference, the audience became impossibly broad, ranging from leading researchers to interested but non-scientific members of the public. The organizers tried to include a little something for everyone, with the result that few participants seemed to find the conference very satisfying. An exit survey taken at the site showed that the symposium did a poor job of demonstrating research techniques, conveying useful scientific information or providing new research ideas.

On the other hand, most participants gave the conference high marks for providing access to scientists who would not otherwise have been available And many said that the conference had been their first introduction to the concerns of the third world - the issues of access to research, costs, and preservation of traditional farming techniques. In one exchange that clearly illustrated the debate within the developing world on the hazards of biotechnology, Luis Herrera-Estrella of the Mexican Centre for Research and Advanced Studies (and a member of the panel) said that Mexico "is most interested in food production. The ecological impact [of biotechnology] is less important". But Indian scientist Swaminathan, speaking from Cologne, quickly jumped in to warn against the use of the third world as a biotechnology laboratory. "I disagree that it does not matter as much in the developing world. Ecological ground rules must be the same wherever they are on the planet", he said.

Although the jury is still out on the scientific success of teleconferences, the symposium showed that electronic meetings can be substantially cheaper than their traditional equivalents. Total costs amounted to about $300,000, the majority of which was covered by in-kind donations from a half-dozen telecommunication companies. A traditional conference with the same attendance would typically cost the organizers about $1 million and the participants another $3 million for travel and lodging, according to Washington State University administrator Donald Hanna, who co-chaired the event.

But the larger lesson, he said, is that successful global teleconferences will have to cover fields that are changing too fast for the scientific journals to keep up with, stick to subjects like plant biotechnology and involve issues of world-wide importance, such as health, food, or population. (Source: Nature, Vol. 346, 23 August 1990)

Apple's upgraded operating system

When the next upgrade of Apple Computer Inc.'s Macintosh computer operating system, Version 7.0, ships, it is expected to contain three important networking enhancements: aliases, peer-to-peer file sharing, and the first manifestations of inter-applications communications architecture.

When a user is logged onto a server somewhere on a network, they can make an alias of any file or application and put it in the Macintosh's system file. From then on, whenever access to the file or application is wanted, a menu can be pulled down on the Mac desktop and click on the alias icon. The Mac will automatically make the connections to access the alias' object.

With Version 7.0, each Macintosh will also be able to function as a file server for every other Mac on an AppleTalk network. Macintoshes can now share files only through a dedicated file server or through other vendors' peer-to-peer products, such as Alameda, Calif.-based Sitka Corp.'s Tops file-sharing software.

The most ambitious networking undertaking in Version 7.0 is Apple's new interapplications communication architecture. In general, the architecture will provide ways for applications to cause processes in other applications to execute.

For example, a "hot link" updates information that has been taken from one file and copied to another whenever the original file is changed. (Extracted from Communications Week, 23 July 1990)

Dutch digital cassette does battle with DAT

A new type of audio cassette the same size and shape as a conventional cassette but which records digital sound like a compact disc has been launched by Philips, the Dutch electronics company. The new digital compact cassette (DCC) will be a direct competitor to digital audio tape, or DAT, a system which uses a smaller cassette. DAT was developed in Japan with companies such as Sony, Aiwa and JVC all marketing equipment.

DAT was launched in Britain in October after five years of wrangling between electronics companies and the record industry. It is the ability of DAT, and DCC, to make perfect copies of a CD that worries record companies. However, all the major record companies, with the exception of CBS, are supporting DCC because they see it as more of an evolutionary change than DAT. Sony, the owner of CBS, has a large investment in DAT.

Philips claims that the DCC signal can be copied at high speed, just like an analogue signal. So the record companies can mass-produce pre-recorded cassettes on duplicating machines that run the tapes at 64 times normal speed, as they do with analogue tapes. This promise helped sway the record companies. DAT duplication is difficult and expensive at high speed.

So far only one equipment company, Tandy of the US, has backed DCC. Japanese sources believe that Matsushita, maker of Panasonic and Technics hi-fi equipment, wants to support Philips but cannot because the Japanese Government fears commitment to DCC would slow sales of DAT machines.

When the system is launched in 1992 Philips says a hi-fi DCC recorder will cost around $600. Portable versions and car stereos will follow later.

The DCC cassette will be the same size as a conventional analogue audio cassette except that it will have a closed top and sliding cover to protect the tape. (This first appeared in New Scientist, London, the weekly review of science and technology, on 20 October 1990.)

"Tiny" Mosis chips available world wide

Up to now, the smallest chips made under the Mosis design rules were available only to US enterprises. These so-called Tiny chips, measuring 2.4 by 2.4 mm, were available only through Mosis, a program that is funded by the Defense Advanced Research Projects Agency, or DARPA. But that has changed.

Tiny chip capability is now being offered commercially throughout the world thanks to Orbit Semiconductor Inc., the Sunnyvale, California, chip prototyping and production foundry operation as part of its Foresight multiproject wafer service. What is more, Orbit can handle mixed-mode designs, verifying each analog and digital segment through fabrication.

The Foresight service, based on the company's ten years of experience as a provider of prototype services, features fast turn-around. It offers reduced engineering costs by running numerous projects on a single wafer. The customer provides the data base tape, and Orbit delivers packaged units within a guaranteed time period.
(Source: Electronics, October 1990)

IBM delays laptop launch

IBM has put back the launch of its latest attempt to attack the booming laptop computer market until 1991, according to US computer industry sources. The launch had been expected this autumn.

One reason being put forward for the delay is that the technology IBM planned to use is being bypassed by fast-moving laptop makers such as Compaq. IBM was believed to be working on a laptop which would use the 80386SX processor. But Compaq is expected to bring out an ultralight notebook computer using the same processor later this month.
(Source: Electronics Weekly, 10 October 1990)

New way of sending data via telephone

A young UK company has launched a novel device for sending data over the telephone wires.

Alfa Systems, of London, says data on disc should be as easy to send as an ordinary paper facsimile. So it is offering Discfax as a free-standing disc drive unit with built-in facsimile capabilities.

A user simply puts a disc into the unit, which is plugged into a telephone socket. The user dials the telephone number with another Discfax unit on it and presses a "send" button. The disc contents are then transmitted to a disc on the receiving machine.

"No other method of transferring information, with the exception of fax, is that easy", says Nick Godridge, sales and marketing director.

The product is intended to fill the gap between paper facsimile and conventional computer communications.

Godridge says the edge over facsimile is speed and cost savings. A 40-page document containing text and graphics would take just 90 seconds to transmit at a cost of about 90 pence compared with around £20 for faxing the printed document.

The edge over conventional data communications comes from ease of use and the absence of protocol compatibility problems. If the data applies to application-specific environments at either end that is all that matters.

Data is transmitted, with compression, at 9,600 bits per second. The built-in modem follows standards for regular facsimile to ensure reliable transfer over global telephone networks.

The system does not normally transmit the entire disc, but just files containing data.

The basic Discfax model, costing £995, has two floppy disc drives for 3 1/2 inch and 5 1/4 inch sizes. For each transmission the receiver needs to insert a blank disc. Unattended receiving is possible on a unit with a 20-Mbyte hard disc at £1,495. (Source: Computer Weekly, 15 November 1990)

Hand-held scanner handles 256 gray levels

Logitech has announced the Scanman Model 256, a hand-held scanner featuring several proprietary analog and digital chips created to enhance hardware-to-software communication and more closely simulate how the human eye perceives the spectrum of gray scales.

The scanner includes Ansel image-editing software, designed to run under Microsoft Windows 3.0 and featuring 256 gray-level image manipulation. Ansel is compatible with such file formats as compressed and uncompressed TIFF, TIFF CCITT, BMP, PCX, and EPS. It accepts a wide variety of input, from simple line art to full 8-bit 256 gray-level information.

Ansel is designed to overcome some of Windows' limitations, according to Logitech. For example, Ansel takes over control of the standard VGA colour palette from Windows to allow the display of the maximum number of gray levels.

Ansel's image-manipulation options include additional brightness, contrast, and gray-level adjustments. Users can resize, flip, rotate, and scale images, as well as smooth and sharpen textures and create negative and posterized images. The software also includes a "de-skew" command to realign documents that have been scanned at an angle.

The scanner has a retail price of $499 for the PC version ($599 for the Micro Channel version) and carries a lifetime hardware warranty. (Source: Computer, October 1990)

Hand-held scanner puts text directly into applications

Caere Corp. says its Typist hand-held scanner can import text and numbers directly into a user's application at 500 words per minute.

The 300-dpi scanner was designed specifically for page recognition and includes the company's Anyfont optical character recognition system, which recognizes text regardless of the font or number of columns, according to the company. (In multicolumn formats, the scanner recognizes only the centre column and throws away incomplete columns on either side). Anyfont supports 11 languages and reads nonstylized fonts from 6-72 points in either landscape or portrait orientation.

Caere says the Typist offers a scanning speed of up to two inches per second and resets automatically to allow for either horizontal or vertical scanning. As a user scans text with the Typist, keyboard operation is interrupted, and data from the scanner enters the application via the keyboard buffer.

The Typist can also scan graphic images using image capture software supporting PCX, TIFF, and Pict output file formats. A dither pattern switch lets the user choose from four patterns when scanning photos or line art.

The Macintosh version requires 4 Mbytes of RAM and at least a Machintosh SE. It includes a SCSI interface box and costs $695. The 286 and 386 versions require a PC compatible with an AT or Micro Channel bus, 640 Kbytes of RAM, 2 Mbytes of expanded or extended memory, and a hard disk. They include an AT or MCA-interface card and cost $595. (Source: Computer, October 1990)

Sharer offers cheap way to link PCs and printers

A UK company claims to have launched the first product which fully exploits packed switched communications between PCs and printers using simple mains wiring.

Portsmouth-based M-Net claims the breakthrough provides an alternative to expensive, complex networking and switching for small to medium-sized companies. The Intelligent Printer Sharer allows communications between up to 30 PCs and eight printers.

The product, which costs £200 a unit, would let users locate multiple file servers anywhere in a building, away from the file server, with no extra software.

M-Net says the sharer does not need any support software, and documents can be sent direct from all types of program, including word processing, graphics and spreadsheet packages running on any PC or word processor with a standard parallel printer port.

The printer sharer is also able to poll all the PCs on the system continuously for print requests, which it will then direct to a user-specified printer or plotter, or the first one available.

In addition it features an automatic queueing facility and will allow eight documents to be transmitted simultaneously by "interleaving" packets of data, maximizing efficiency.

"The average computer printer is idle 85 per cent of the time, yet switching and networking solutions are not only expensive but too complicated for many companies", says M-Net managing director Chris Fawell. "This is a useful investment for rapidly expanding companies. Each new system can be connected to the mains network using an Intelligent Printer Sharer unit." (Source: Computer Weekly, 27 September 1990)

New device eases printer servers dedication

Intel's new device makes the task of establishing dedicated printer servers on Novell Netware LANs much simpler and cheaper. Net Port, about 33 per cent smaller than a standard Hayes external modem, eliminates the need to set up a PC to function as a dedicated printer server. Net Port can receive files from any named printer queue via the Novell Pconsole utility. Net Ports on a LAN can be tracked down and modified through a number of utilities, and a TSR warns certain users of error conditions. By establishing "virtual circuits", users can eliminate the need to use Netware print queues to access the Net Port. (Extracted from Information World, 30 July 1990)

Mobile printers

Printers are now going the same way as computers: they are becoming mobile and compact. Thus the world's smallest printer fits comfortably into a briefcase beside the computer and needs an area hardly as large as a sheet of notepaper. The "High Print Compact" has a weight of only 3.5 kilograms and prints up to six standard typewriter pages per minute. It is also suitable for graphic work and printing on transparent film. Its battery only needs to be recharged after about 150 pages. (Source: Scala, August 1990)

New device to control cursor

Wang Laboratories has filed a patent application for a device to control a computer cursor without using hands on a keyboard or mouse. Wang's device is a sphere half-filled with fluid. The sphere is attached to a band that goes over the head. When the user tilts his or her head, some photodetector diodes in the lower half of the sphere are uncovered, allowing light from LEDs in the upper half of the sphere to reach them. The position and number of photodetectors that are uncovered indicates the position of the user's head. This information can be used to generate cursor control signals, allowing the user to move the cursor simply by moving his or her head. (Extracted from New Scientist, 28 July 1990)

Robot arm elbows into the jet washing business

An enormous computerized robot arm with a reach of 25 metres was on show at the annual conference at ESPRIT, the information technology research programme organized by the European Commission. The arm has recently been tested as a cleaning system for aircraft. Normally it takes 12 people eight hours to clean a jumbo jet but the robot arm with a rotating brush at the end did the job in three hours.

The robot arm is the result of a collaborative project involving companies and research institutes from Germany, Britain, Spain, France and Denmark. The actual mechanical arm is an adapted version of the type of arm used in the construction industry to deliver liquid concrete through a pipe to inaccessible locations. It was strengthened to carry a load of 1.5 tons in any position out to the full reach of the arm.

But the main aim of the project was to develop the integrated network of actuators and sensors and the software to control them.

The robot control system allows the arm to be controlled either manually, using a joystick, or to be programmed to carry out precise tasks repetitively.

Sensors in the arm's four hydraulic legs check for stability every tenth of a second to ensure it does not overbalance and topple over. Other sensors along the arm register the position of each segment every tenth of a second. The control software then calculates the distortion caused by the load so that it knows the exact position of the head at all times.

The arm has eight moveable joints, more than most industrial robots, so a considerable amount of computing power is needed to position the head accurately. The aim is to be able to position with an accuracy of 1 centimetre. (This first appeared in New Scientist, London, the weekly review of science and technology, on 24 November 1990.)

New image printing system

Toppan Printing has introduced a high-definition, TV-quality image printing system. The system transmits high-resolution colour images through a FAX machine and uses Japan Broadcasting or Nihon Hoso Kyokai's high-definition television standard. The unit was used at an exhibition in Osaka on a trial basis. Photos taken with a high-vision camera were converted into image data, processed and the data was transmitted over a FAX to Toppan's Osaka facility. A newspaper was published daily at the exhibit using the system. (Extracted from Asian Wall Street Journal, 25 June 1990)

Monitoring foetuses

A Welsh company, Huntleigh Technology PLC, Cardiff, has developed a hand-held foetal monitor for expectant women. Clinics in developing countries may also be interested in the pocket-sized monitor because of its relatively low price, $US 625. Full-sized versions, about the size of attache cases, detect foetal heartbeats as well as contractions and changes of electrical potential. They cost between $US 4,000 and $US 11,000.

Called Foetal Dopplex, the battery-powered device applies the same ultrasonic technique as much larger versions found in hospitals. The monitor detects heartbeats in foetuses at least 10 weeks old. It displays the readings on a liquid crystal display and amplifies foetal pulse sound through a built-in loudspeaker. The heart of a healthy foetus beats 120-160 times a minute.

A spinoff of the foetal monitor is the company's Bidirectional Pocket Doppler, the first hand-held flowmeter that allows doctors to diagnose varicose veins, venous ulcers, and atherosclerosis. The device, which sells for $US 750, indicates the velocity of flow audibly, by pitch, and visually, by up to three arrows. The arrows also signal the direction of flow. (Source: IEEE Spectrum, November 1990)

Blind guide sensor

An electronic sensor-stick for use as a guide for blind people has been developed at the Hyderabad Science Society. The guide-stick uses an induction sensor and miniature electronic signal processing circuits to detect a guide-wire laid on the floor of any room. The guide-wire carries an AC signal in the Af range. The entire circuit on the guide-stick is battery operated and will indicate by an audible tone the proper direction in which to proceed. At present the development at the Hyderabad Science Society incorporates four different routes that can be taken. These can be selected by simple press button switches on the stick handle and inscribed in Braille.

Such blind guide systems can be provided at welfare centres, community halls, etc. and can guide the blind to common facilities like restaurants, toilets, library, etc. by merely selecting the appropriate button. While the present development incorporates four switched routes, more can be provided by using appropriate circuits.

Apart from its obvious use in public places, such devices can also be used in residences of visually handicapped persons.

Further information may be obtained from The Hyderabad Science Society, 12-2-460 Mehdipatnam, Hyderabad 500 028, India. (Source: News Release, 11 October 1990)

Data with destiny

Computers and biotechnology are today as intricately entwined as two strands of the genetic material which makes up the DNA helix. Just about every aspect of IT is exploited in biotechnology, particularly the more recent developments such as

expert systems, robotics, relational data bases and parallel processing. Nor is the partnership confined to long-term academic projects.

Computers are heavily involved in the development of biotech products, as at the Wellcome Foundation in the UK.

In drug design, Wellcome - in collaboration with the Glasgow-based expert system specialist company Knowlegelink - has developed expert systems that help identify suitable organic molecules that produce a desired biochemical effect, while minimizing or avoiding toxic side-effects.

The main motive is to reduce expensive laboratory work and cut the time it takes to bring new drugs to market. Just a small reduction in time will bring big financial rewards.

When such advantages can be obtained by using appropriate software, it is not surprising that the field of biotech computing is attracting start-up companies as a lucrative market, in its own right. One such business is Oxford Molecular, set up in September 1989 to exploit the fast-growing pool of academic software in molecular sciences.

One of the programs developed by Oxford Molecular for the DEC Vax range is Asp, which can determine how similar a proposed molecular structure is to an existing one in terms of electronic properties.

Asp could help design a drug that has similar properties to an existing one, but without infringing the patent.

Asp can often be used in conjunction with another program, also developed by the company, known as Nemesis, and ported to the Apple Macintosh.

In the case of patent busting, Asp can identify molecules with the desired properties and then pass them to Nemesis, which picks out those with nuclei different from any existing molecule already patented.

The company has already sold software to pharmaceutical companies like Glaxo, to assist in drug design.

Over the next few years computers will become indispensable in the drug design business, as they have already become in DNA sequencing. For the latter there is going to be increasing demand for both high density storage for the huge amounts of data generated, and for more powerful processing techniques, exploiting parallelism.

The study of DNA and protein sequences within living cells is vital to understand the fundamental relationships between the DNA code and the vast numbers of different proteins, synthesized by even relatively simple organisms such as bacteria and viruses. Such an understanding is crucial to the future of biotechnology.

It is a task now occupying thousands of scientists around the world involved in a biotechnology initiative called the Human Genome project.

This plan's aim is to determine the complete sequence of genetic code constituting the human genome, which is another name for the DNA double helix.

The complete picture has to be built gradually by dividing the whole genome into much smaller fragments using biochemical methods, and then fitting the pieces of the jigsaw together.

This process relies heavily on computer processing power, to produce long, complex pattern matches of base pair sequences.

These are compared with known sequences in an attempt to determine where they are located on the overall genome chain.

One problem is that newly-obtained sequences contain gaps - there are letters missing so that fuzzy pattern matching techniques need to be used to compare them with existing sequences.

It is now possible to do this quickly and efficiently with algorithms that compare new sequences with existing ones while coping with imperfect sequence data.

One of the leading centres in this field is the biocomputing research unit at Edinburgh University, where a team has developed software that exploits highly-parallel programming.

It can compare long sequences of both DNA base pairs in genome fragments, and amino acids in protein fragments. The software runs on the Distributed Array Processor (DAP), originally developed by ICL, and now manufactured in the US by Active Memory Technology, a spin-off from ICL formed in 1987.

The algorithm uses a scoring system to compare new sequences with a known one stored in a data base, breaking each sequence up into smaller parts to exploit the parallelism of the DAP.

The architecture of the DAP permits flexible searching by allowing data to be shifted around the individual processors. These are arranged in a 64 X 64 grid - 4,096 altogether.

Each processor is connected to its four neighbours so data can be moved around the processor grid. This enables the algorithm to find partial matches between sequences, by shifting data around until a high degree of correlation is obtained between two parts of each sequence.

Some researchers are looking at a further level of automation to assist with the time-consuming process of collecting DNA fragments in the laboratory for sequence analysis. One method is to program robots to perform techniques currently carried out by laboratory technicians, while a more radical idea is to develop a new dedicated machine to carry out the tests more efficiently.

Looking ahead there is the hope that biotechnology may repay some of the debt owing to information technology. For example, it may be possible to create living tissue that can store data at densities close to that of DNA.

The idea is attractive in theory. DNA would make an ideal long-term storage medium for archival data, while RNA, which transmits the information stored in DNA into a cell's protein factories, could provide the high density shorter term on-line storage. (Source: Computer Weekly, 13 September 1990)

## V. COMPUTER EDUCATION

Online opportunities for disabled workers

PCs, together with special interface aids and facilities such as electronic mail, can be a real help to the disabled, opening the door to all sorts of job opportunities.

But it is now possible to adapt standard PCs for use by people with a wide range of physical disabilities, including those with cerebral palsy, the blind, and those with motor neurone disease or multiple sclerosis.

Small robots, originally developed by industry for the handling of objects in hostile environments, have also come to the aid of the disabled. They can pick up floppy disks, turn over pages of text, line up paper for the printer and even make a cup of tea for those with no use of their hands.

Newcastle-based Aptech specializes in computer systems for the disabled, including the Phoenix range of speech-driven workstations based on the voice recognition system Dictate developed by Dragon Systems of the US.

Dictate allows for free voice-to-text translation. The user first needs to "train" the system to understand his or her voice by speaking about 200 to 300 words of command. Thereafter, Dictate, which has an in-built dictionary of 80,000 words, will select a list of likely alternatives once a word is spoken.

If the word at the top of the list is the right one, the program continues. If not, the speaker indicates which of the other numbered options on the list is correct by saying "choose three", for example.

Users of Dictate include people who have suffered spinal injuries in an accident and lost the use of their hands as a result, as well as those suffering from wasting diseases with poor muscle co-ordination. These are often people who have held down good jobs and who face losing their livelihood if they cannot get back to work.

The point of the Phoenix workstations is that they enable disabled people to run the packages of their choice, and they can use any of the common business software, such as Wordstar, Wordperfect, Autocad and Lotus. They are simply replacing the keyboard commands with voice messages.

Earlier this year IBM opened its support centre for people with disabilities at Warwick, UK, which aims to promote opportunities for disabled people in work and education through the use of IT.

Staff at the centre offer specialist advice on equipment and adaptations for the disabled, including the PS/2 Screen Reader, which reads the contents of the screen to blind people. The product has an Autospeak facility that monitors the screen and alerts the user to changes such as updated status and error messages.

The Warwick centre maintains a data base of between 800 and 1,000 other items that will either connect to or run on IBM PCs and which are of interest to the disabled. It has a freephone number for advice and also operates a discount scheme on IBM equipment.

But despite the huge variety of specially adapted equipment now available, employment prospects for the disabled do not seem to have advanced as fast as they should.

Disability Matters is a management training company founded by a group of disabled people in Southampton, which provides courses for personnel managers, recruitment officers and line managers with recruitment responsibility. New technology is one solution to the potential problems posed in employing disabled people, but there are three basic barriers to getting disabled people into jobs. One problem is that some people who have been disabled from birth have been educated in special schools where they are segregated from other children and may come to suffer a loss of self-esteem. The next difficulty is that many workplaces are physically unsuitable for disabled people.

But the biggest problem of all, quite simply, is discrimination. Despite strong evidence to the contrary, many employers persist in believing that an able-bodied person will do better at work than someone who is disabled.

Yet a recent survey of employers with disabled staff found that 91 per cent of disabled workers were average or better on job performance, 93 per cent were average or better on job stability and 79 per cent were average or better on attendance.

For the past two and a half years the management centre at Staffordshire Polytechnic has been running a scheme called the Enabled Manager, which aims to give general management training to managers who have become disabled during their working life, and also to disabled people who have the potential to make good managers.

Those who took part in the scheme, who included blind people, deaf people, those with limited mobility and epileptics, used a standard IBM compatible PC for home study to reinforce and practise what they learnt during lectures on IT and management issues and techniques.

Two other disabled people who had university degrees but had never worked, found employment after taking the course. Of the 100 trainees, about 30 per cent were working before the course, but by the time it finished 60 per cent had found jobs.

"However, it has to be said that most of them went into self-employment. There still is prejudice from employers. Yet our people are at the forefront of what is happening in business today. Many so-called able-bodied managers do not know as much about IT and management as they do", project manager Ron Leigh maintains.

Leigh is trying to raise the necessary funding for a second course.

But so far progress is slow. It has even proved difficult to find applicants for training, again partly because several different government agencies hold details of likely candidates and partly because potential trainees are geographically diverse and frequently rather isolated.

Figures released last year suggested that IBM employs only about 300 disabled staff out of a total work-force of 18,000, with ICL recording only 52 registered disabled in a staff of 15,000. In many cases, however, disabled people choose not to register as such for fear of discrimination.

This situation looks likely to change in the coming years for two reasons. The first is the threatened demographic downturn expected in the 1990s, when there will be many fewer school-leavers entering the work-force.

Market forces will play their part. So, too, will social legislation particularly as 1992 approaches. In France and Germany the disabled quota is set at 6 per cent of the work-force and is strictly enforced. Companies are fined three times the minimum wage of the lowest paid employee if they are found not to have complied with the law.

In a development calculated to force some IT companies to think hard about their own policies, the US has also passed a law requiring electronics companies tendering for government contracts to show that their equipment is accessible to disabled people.

The necessary technology is already there to help as many disabled people as want to work into employment. Shortages of skilled workers and the pressures of new legislation may well combine in future to ensure that companies can no longer overlook a very valuable section of the work-force. (Source: Computing, 6 September 1990)

## VI. SOFTWARE

### Software for hard choices

Some agencies in the UK are experimenting with an electronic system that helps make funding decisions. Called Teamworker, the Agricultural and Food Research Council (AFRC) has been using this novel combination of software and hardware for more than a year to assess funding proposals. The Ministry of Defense finds it concentrates the minds of committee members assessing new strategies or firepower. Some universities are even toying with it as an aid to the staff promotion process.

"It is a room-based communication system for groups", says Tony Gear, one of the two people who devised Teamworker. Each member of the group holds a handset resembling a TV remote. They send messages to a master unit via radio transmission. From there the messages pass into a personal computer, which uses its software to analyse them, then displays the results for all to see. Cost presently is between $6,000 and $20,000, depending on the number of handsets, each of which carries a numerical keypad and a small display screen.

The process can be applied to any sort of choice among a set of options. Consider, as an example, a committee awarding grants to proposals by scoring them on criteria such as timeliness, importance, feasibility, and so on. That seemingly simple procedure hides a plethora of problems. Do all committee members agree on the meaning of the criteria? Do they attach equal importance to each criterion? How do they know when they disagree and how do they cope with disagreements?

All these problems can be dealt with by a good chair - and a set of mathematical procedures. But mathematics takes time and skill, and good chairpersons are hard to find. The electronic system does these things automatically. Take the problem of weighting the criteria. The computer asks each member to decide whether timeliness, say, is more important than feasibility and to value the difference on a suitable scale. Each person presses a numbered button on their handset and the computer stores the answers. Similar pairwise comparisons are made among all criteria, and the system calculates the relative importance that the group attaches to each criterion.

The next task is to score all proposals. The computer prompts members to respond via their handsets and calculates the average on each criterion; projects are then ranked according to their total, weighted, and scored.

The real strength of the system, according to everyone who has used it, lies in its output: a display of histograms of the scores each proposal obtained. The display shows the pattern of votes (preserving as much anonymity as the group wants). Specifically, it reveals what the disagreements in the group are and where they are centred: about a proposal's feasibility, for example. That information will help the chairperson call on those who have divergent opinions and encourage them to speak before the proposal is re-evaluated. (Extracted with permission from Science, Vol. 250, pp. 367 and 368, by J. Cherfas. Copyright by the AAAS, 1990)

### Computers in control

A new software system for plant management, developed over the past several years by a consortium of 37 European companies, will be marketed by Cogsys Ltd. SD-Scicon, British Gas and Salford University are partners in the joint venture.

The Cogsys software can be integrated with existing computer control systems in manufacturing and process plant. It could improve plant efficiency and quality control, and will be easy for plant engineers to use, the company claims.

The system is already in use in a gas synthesis pilot plant at the British Gas Midland Research Station. CMB Technology is also using the program.

A prototype was first demonstrated in 1986 at an ICI detergents manufacturing plant. The automation software emerged from a joint initiative to promote co-operation between British industry and universities. (Source: Chemistry & Industry, 1 October 1990, p. 587)

### Electronic signature - a new data security system

A new data-processing security system is soon to go on the market. The system, developed by the Gesselschaft für Mathematik und Datanverarbeitung in Bonn (GMD, the German National Centre for Computer Science), is claimed to be able to prevent break-ins - like the one three years ago when West German hackers penetrated the international Space Physics Analysis Network (SPAN) and caused great alarm. The GMD's new system - which could have counteracted this - is based on an expensive but interesting concept called the "electronic signature", a type of seal for electronic documents. It goes well beyond the protection of secrecy and is able, more importantly, to ensure that documents cannot be tampered with and falsified.

The electronic signature uses a chip card as protection instead of the usual password. To remove or store data, the chip card must be inserted in the receiving or transmitting terminal. The card not

only checks whether the person is authorized to have access to the data, but also produces an electronic signature - a complicated coding procedure - which is added to the document. This ensures that the sender of data can be identified beyond any doubt, even in an open system. The coding also rules out later falsification of data during transmission.

A problem arises, however, if the chip card is lost. Apart from the loser being left without access to the data, the card, if it ends up in the wrong hands, poses a serious threat to the security of the system.

But the motivation for card theft is quite different from that for hacking, and a card key would reduce the impact of "playful hackers". Most institutions - other than banking - regard data protection and security as tiresome necessities. Science in particular thrives on the rapid exchange of information, working with constantly open systems. The software operating system and network are all structured in such a way that large amounts of data can be made available world wide. Protection measures tend to be associated with restrictions and inconvenience. Scientists can hardly be expected to memorize hundreds of passwords to access different banks of information, so security procedures have often been lax.

An efficient security system must strike the difficult balance between total control and continuous access, and must calculate the risks. The GMD card system could solve the problem. (Source: Scientific European, October 1990)

Help for incompatibility problem

Netwise (US) distributed computing - with users sharing software across a network of different machines - is expected to be one of the great growth areas of information technology in the 1990s.

But users of traditional IBM mainframes still face formidable difficulties in linking these to products from other manufacturers in a "local area network", because the companies use different standards. A US company, Netwise of Boulder, Colarado, has developed a technology called Remote Procedure Call that helps to overcome the incompatibility problem. RPC provides programmers with a simple automated mechanism with which software can be written for use in computing environments with hardware from different sources (a typical mixture might include IBM mainframes, DEC minicomputers and both Apple and IBM-compatible personal computers). RPC makes the programming task much simpler by removing the requirement for programmers to write their own interfaces to link each different system in the network. (Extracted from Financial Times, 14 September 1990)

Aging products get an object lesson

Object-oriented programming may revolutionize aging mainframe software products with easy to use front ends, according to the developer of fifth generation programming environment, Clebern.

Clebern's Macroscope software is described as providing a way for "objects" such as IBM 3270 datastreams to be lugged into applications, and "enhance ponderous terminal interactions".

By improving user decision-making processes through analysis of images and space, Macroscope could replace the need for some rule-based expert systems.

The software, written in C, uses object-oriented programming techniques and an architecture composed of various "objects", which are effectively mini-experts. Programmers do not have to worry about making applications talk to Vaxes - the software has components built in and invisible to the developer, which do that.

The product works on any machine that can run a C compiler and plugs into IBM's co-operative processing scheme. (Extracted from Computer Weekly, 18 October 1990)

OSF three agree to develop software

Three of the largest sponsoring members of the Open Software Foundation (OSF), Hitachi, IBM and Hewlett-Packard, are jointly to develop applications software that runs on the OSF's version of Unix, OSF/1

ine agreement is another step towards the open systems concept. Each company will be able to use and market the products developed under the agreement, which was signed in Japan. Initially IBM will be developing a banking and finance product, while Hitachi's software engineering workbench development tools will be converted to run on OSF/1 by a team from Hitachi and IBM.

The move is likely to increase competition with rival Unix group Unix International, which is led by AT&T, but a spokesman for the group welcomed the move. "It is good news for the marketplace", he says. "Users buy solutions, not operating systems, and this will provide more tools and products which should be easily convertible to Unix system V.4." (Source: Computer Weekly, 6 September 1990)

New programming language

Bell operating companies may find it easier in the future to develop software to monitor their networks with a new computer programming language developed by researchers at Bell Communications Research Inc. The new language, called Laure, has been tested at US West Communications Group Inc., Englewood, Colo., where it was used to design software for a network management system. According to Livingston, N.J.-based Bellcore, the project was expected to take a year, but took only two months using the new language.

Laure is an object-oriented language prototype that makes it easier to write and reuse software programs, according to Bellcore. The language uses logical deduction - by applying mathematical principles - to solve programming problems. Laure's deductive abilities make it more efficient than the popular "C" language, Bellcore claimed. With Laure, half of the programmer's work can be automated. The prototype organizes facts and instructional data into sets of information and then defines specific relationships among all the sets in a program, according to Bellcore. Laure can work with just about any computer system, and is being tested currently in experiments with several universities, according to Bellcore. (Extracted from Communications Weekly, 30 July 1990)

Re-engineering product component

Viasoft Inc., a Phoenix, Ariz.-based developer of re-engineering technology, has added a new component to its re-engineering product line. Re-engineering, the overhaul of existing applications, is an under-exploited element of CASE (computer-aided software engineering).

VIA/Smartedit is an analytical tool that works within ISPF/PDF, IBM's Cobol editor product. VIA/Smartedit enhances ISPF with certain Cobol-specific capabilities, such as an extended Find command, which allows for group searches of related Cobol verbs. "We extend the ISPF environment", says Phil Myers, manager of the product marketing group at Viasoft, "by providing additional commands".

VIA/Smartedit is part of Viasoft's VIA/Center, a component strategy that includes modules for analysis, documentation, editing, and testing, and is priced from $25,000 to $39,500, depending on configuration. (Extracted from Information Week, 27 July 1990)

New MS-DOS eases "RAM cram"

Microsoft Corp. is working on a new version of its MS-DOS operating system that will feature a graphical user interface similar to the company's Windows products. But more important, say IS managers, the new MS-DOS 5.0 alleviates some of the memory constraints long-associated with the increasingly features-laden operating system.

Indeed, the difficulty of "RAM cram" is one reason why IS managers are excited about the new system. MS-DOS 5.0 frees up between 30 K to 40 Kbytes of random access memory.

The system is expected to be commercially available by late 1990.

One MIS manager who has a beta version of MS-DOS 5.0 says the new version frees memory on 286 and 386 machines that have at least 64 Kbytes of memory by loading part of the operating system above the 640 Kbyte address space. "The memory management will help a lot of people with RAM cram", says the manager. Users will have more memory for applications and be able to run DOS-extended programs such as Lotus 1-2-3 version 3.0. He says users will also be able to load network drivers and memory-resident programs in memory above the DOS address space.

The operating system's user interface may resemble Windows, say beta users, but it is not as powerful. The interface allows users to manage and sort files more easily and may eventually incorporate some rudimentary multitasking features. (Extracted from Information Week, 16 July 1990)

New software techniques simplify and speed analog circuit design

Scientists at the University of Rochester, Rochester, N.Y. developed three computer-aided design (CAD) software tools that enable engineers to design analog circuits hundreds of times faster than was previously possible. According to Robert Bowman, professor of electrical engineering at Rochester, "It takes minutes, not days, to create and test these circuit prototypes". He feels the greatest impact will be felt in the growing area of mixed signal ASIC (application specific IC) design.

Two of the CAD programs, titled ANASYN and URECA, are currently being tested by industrial affiliates such as Analog Devices, Siemens and others. Both programs allow for rapid, accurate circuit design. ANASYN is used to generate and modify physical layouts of analog circuits, while URECA simulates mixed signal circuits.

According to Bowman, the great reduction in design time has to do with the analog circuit design process. Because precision is an overriding concern in analog design, the physical layout has several design constraints put on it by the designer. Typically, the designer submits the physical layout and design constraints to a draughtsman. The draughtsman then drafts and submits the physical layout to the designer. At that point, the designer needs to take care of any parasitic effects that were generated during the layout process. These effects are much more likely to develop during analog design rather than digital.

Using ANASYN or URECA, however, this time-consuming step is eliminated and the engineer makes these design changes in a matter of minutes.

The programs use icons to represent all components in the IC including transistors, resistors, amplifiers and signal generators. The designer chooses the specifications of each, positions them in the circuit and runs the simulation. Given the results from the simulation, the component can be replaced and the simulation is re-fired to see how the change affects the circuit output.

In addition to providing rapid design, the programs automatically generate the dimensions for all mask levels based on the specifications.

Several types of templates are available. Once the designer outlines the constraints, the program automatically chooses the appropriate template and sizes it, based on the design constraints.

The third software program, titled "Project APEX", is an electronic workbench under which tools such as ANASYN and URECA fit, "just as a designer often keeps tools under his workbench", Bowman explains. APEX simplifies design by making the tools more accessible and easier to use. (Reprinted with permission from Semiconductor International Magazine, September 1990. Copyright 1990 by Cahners Publishing Co., Des Plaines, Il., USA)

Systems design takes an evolutionary turn

Computer scientists in Britain have borrowed concepts from the theory of evolution to create software that can match the design of a computer system to the problem it is asked to solve.

The project, called Gannet (Generation and Adpatation of Neural Networks by Evolutionary Techniques), aims to improve the rule of thumb approach that usually dictates the design of computer systems known as neural networks.

These are computer programs designed to represent a number of processing nodes connected in layers. The nodes collaborate to solve problems in a similar way to the human brain. The main advantage of neural networks is that they can be taught to do those things traditional

number-crunching computers find difficult, such as recognizing a face, or detecting the presence of explosives in a piece of luggage.

The aim of Gannet is to develop software that will use an iterative process to recognize neural networks that perform well, and exploit these to build a subsequent generation of networks that performs even better.

The team working on Gannet includes specialists from Logica and Meiko, two British computer companies, the engineering department of the University of Cambridge and the physiology department of the University of Oxford.

Clifton Hughes, a principal consultant at Logica's R&D centre in Cambridge, explains that the success of a neural network depends on parameters that dictate the links between its processing nodes (computer scientists can arrange any number of nodes in any number of layers), and the way the processors talk to each other.

Computer scientists usually choose these parameters by informed guesswork, because they have only a limited understanding of why certain designs work best on certain problems. It is also virtually impossible to predict the exact size and complexity of a network that will be required to solve any given problem. Often, as long as a neural network works, its designer will decide it is not necessary to tweak it to make it work better. This can mean that the network will be slow, or even fail to learn how to solve problems at all.

The Gannet program exploits an approach to programming known as "genetic algorithms". It starts by producing a pool of trial networks, the parameters of each differing only slightly from the next, and in controlled ways. The software asks each network to solve the problem at hand and monitors their performance. It then takes a proportion of the characteristics of each network as the blueprint for its next pool of networks. The amount by which each network is represented in this second pool will depend on how well it solves the problem.

The designer can dictate the criteria by which the software decides if a neural network is performing well. It might be chosen because it solves the problem quickly, because it uses only a limited number of processors, or because it performs well when trying to recognize a particular input.

Hughes believes that Gannet will help computer scientists to understand why certain designs are better than others, as well as producing the most effective neural network. He says the early results of this £260,000 two-year project are encouraging enough for the team to begin plying their networks with increasingly difficult problems. The current system is written in a programming language called C, and runs on a series of transputers. (This first appeared in New Scientist, London, the weekly review of science and technology, on 25 August 1990.)

Are you on speaking terms with your computer?

New computer interfacing methods are now making life easier (and more productive) at the fab. Cypress Semiconductor in San Jose, Calif., is boosting productivity by radically changing the way management accesses the company data base. Instead of forcing executives to learn a complex computer language, Natural Language (NL) interfacing enables them to "speak" to it by typing out an English question like: "How many dollars worth of backlogged orders did I have on 21 May 1990?"

Cypress' data base contains information on all aspects of the company's business and operations. Until recently, however, only about 10 per cent of the 150-some people who needed access to this data were proficient enough with the system's structured query language (SQL) to use it. Efforts to train and encourage users to learn SQL met with little success.

Greg Belt, Management Information Systems (MIS) manager at Cypress and his staff decided to try another tack - to make the language compatible with the users. Working with Natural Language Inc. (NLI) of Berkeley, Calif., they purchased and set up a language interface that allows access to the data base using simple English statements.

NL is a reasoning-based interface to SQL that draws on a knowledge base of not more than 11,000 English language concepts and root words. To build an NL application, developers use a product called the NLI Connector to teach NL about the additional relationships and concepts required to understand a specific data base application - in this instance, the quirky little words and slang that are part of the semiconductor business. The connection is made via an English dialogue between the developer and the Connector.

Users can have a free-flowing dialogue with the computer, asking unplanned questions about account, manufacturing and shipping information on an as-needed basis and without a set structure. This ad hoc data access ability, Belt says, will prove invaluable for market forecasting, trend analysis and future planning; thus greatly enhancing their "just-in-time" manufacturing philosophy.

At Motorola's Bipolar II Operations Facility in Mesa, Ariz., wafer inspection operators are excited about their new Voice Activated Data Entry System (VADES) - and so is management. Use of this new interfacing method has improved productivity by 23 per cent and, more importantly, made defect data instantly available for analysis, says Prasad Gavaskar, manager of Motorola's CIM group.

Using voice recognition technology, the inspector simply talks into the microphone. Her words feed into a "recognizer" which acts like the CPU in an intelligent terminal, passing the recognized data to the host. The host, in turn, can send a voice-synthesized response to the operator's headset to verify data entry. Once the operator issues the "end-of-lot" command, a hard-copy report is generated showing defect types and disposition information for each wafer. A wafer map showing the defect code and its location is printed for each failed wafer.

Manufactured by Verbex Inc., Edison, N.J., VADES is an application-specific system that requires the initial development of a general grammar file and voice pattern files for each user. This procedure took about two days to complete and, once in place, the inspectors felt comfortable with the system within a day of use. Gavaskar mentioned the only downside to the system: "Now that word has gotten out - all the other operators in the fab want it!". (Reprinted with permission from Semiconductor International Magazine, September 1990. 

Opening the book on the hypertext view of the world

Hypertext has moved from the realms of hype and into reality very fast.

Six months ago three pioneering products were available: the British-designed Guide from Office Workstations; a French offering, Hyperdoc from GECI, and Apple's Hypercard.

The concept's originator, Ted Nelson, was said to be secretly beavering away in his locked software laboratory, but the very name he had chosen for his is product - Xanadu - conjured a distant and illusory image.

Now almost a score of products have been launched on the market and the players include giants like IBM, Lotus and Xerox. Apple has launched a second version of the Hypercard, which is a serious contender. Even Xanadu is taking on a rather more tangible form with Nelson's announcement of a launch date in 1991 and the takeover of his company by Autodesk.

This flurry of market activity has involved not merely small entrepreneurial start-up companies but the research laboratories of the largest corporations as well. Predictably IBM has staked its claim in a potentially lucrative future market with two products, Bookmanager and Linkway. Xerox has come up with Viewcards. Less predictably, communications giant Bell Communications has just launched a hypertext product called Superbook.

Hypertext applications are often referred to as "books", which are a sequence of pages or screens of information, each page carrying a mixture of text, graphics, animation, video and even audio. Rather than menus, hypertext pages have "maps" and placing the mouse cursor on any of the objects on the screen enables the user to jump to further information. This might be explanatory text, an illustrative full-motion video, or perhaps a short animated graphics sequence that demonstrates a process.

The classic hypertext applications and the one most often quoted is the car maintenance manual. Conventional text descriptions of maintenance procedures are brought vividly to life by animated explosions of component parts showing not only assembly procedures but also naming and numbering parts for re-ordering.

Making hypertext a reality has been a process of harnessing virtually all of the leading edge software technologies: high resolution graphics running on powerful workstations; object-oriented programming techniques to manipulate the many objects composing a hypertext "book"; and relational data base techniques to link together the objects on each page. Hypertext is also one of the first practical applications for multimedia processing, linking text, graphics, full-motion video and audio. Hypertext also has important affinities with expert systems and at least one expert systems vendor, Information Builders, has included hypertext capabilities in its Level 5 Object system.

It is in the US and Japan that most interest is currently being expressed in hypertext systems and their potential. Europe does possess one other indigenous vendor - the French software house GECI which produces the Hyperdoc program.

The Service Bay Diagnostic System by Ford in the US is based around the Guide technology. This is the system that is most often flashed onto the screen at hypertext seminars and conferences. SBDS works in conjunction with Ford's top of the range cars, which are equipped with an on-board computer. When the car is driven into a service bay to be maintained, the service engineer uses a PC to perform diagnostics instead of conventional manuals.

Other industry sectors that have an obvious and desperate need for some form of simplification are the financial services industry and industrial processes such as oil production and refining, which are not only technically complex, but also hedged around with legal restrictions.

Shell UK Exploration and Production has implemented a Guide-based system for its North Sea oil production platforms. On the rigs, information has to be kept on many different plant assemblies, equipment and components from many different manufacturers, all with differing standards of documentation. The key constraints on an operational oil rig are that space is very much at a premium, changes in equipment are frequent and the distribution of technical documentation on paper is an expensive business.

In the financial field, American Express, Citibank, Fidelity Investment and Scottish Amicable are all experimenting with or already implementing hypermedia systems with a financial slant.

One well-documented case is that of NM Financial, which expects to save £1 million over the next three years by providing computer-based training to its branches, covering recruitment orientation, taxation and product knowledge.

Next year, when hypertext pioneer Ted Nelson finally lifts the curtain on his Xanadu product - conceived as long ago as 1965 - the hypertext industry will truly have attained its majority. In the mean time, the fledling business has taken off pretty convincingly. (Source: Computing, 22 November 1990)

Technology and books

Book-reading anti-technologists are suffering a humiliating infringement of their sensibilities. The UK's libraries, traditionally the bastions of paper-based media, have found the ideal soul mate in computer technology.

Once the technology emerged, it did not take long to discover that libraries and computers make ideal partners. One side has a potentially enormous body of data that users need to access, possibly from minimum search criteria; the other is geared to fast, accurate data base searching.

Apart from isolated examples in the US, the UK hosts the most advanced IT-driven library facilities - those of academic institutions of any single country.

One major initiative, the largest computerized library project in the UK, provides over 40 London University institutions with access to one another's catalogues.

The scale is remarkable. King's College library alone circulates over 250,000 books a year

and has over 750,000 annual visitors who almost invariably take a look at the catalogues. Each of the seven colleges and the central consortium comprising the many smaller institutions, such as Birbeck and the College of Tropical Medicine, has a DEC-based Libertas library management system from Bristol-based SLS (Information Systems).

The college libraries have their own Ethernet local area networks but piggyback inter-collegiate traffic along the university's backbone links, including a fibre optic FDDI ring, to accommodate spurs to some 1,300 individual terminals. As a result, users can make catalogue searches from their desktops or even remotely via modems without setting foot in a library.

A government-funded agency, the Computer Board, is responsible for university and, to some extent, polytechnic IT purchasing. In another project under the Board's auspices, Bath University will provide an ICL host mainframe to run the Science Citation Index, a 50-Gbyte data base of scientific references compiled by a US commercial organization, the Philadelphia-based Institute for Scientific Information (ISI).

At present, the estimated 250,000 ISI subscribers have to call the US and are forced to ask librarians to search the data base in order to minimize telephone charges. The Board's scheme will provide desktop access to the ISI data base for UK academics via the Joint Academic X.25 Network (Janet). It expects to accommodate several hundred concurrent users.

The removal of librarians as intermediaries in exploring the bookshelves is becoming common as IT takes hold. In this case, ISI is taking the gamble that end-user participation will offer opportunities to provide value-added services.

The project is expected to be expanded to include other data bases, each accessible by users from their own terminals.

The catalyst for IT in libraries was the emergence of the Marc format for catalogue entries. Machine-readable cataloguing began as a manual card system, passed to tape for customer libraries to run themselves, before becoming part of larger, on-line networked data bases.

Unfortunately, many countries have their own flavours of Marc, most differing only slightly in search terms or the organization of sub-fields, although the German MAB format is a total maverick. The European Commission is promoting the Unimarc as an internationally agreed model, offering libraries an Esperanto between incompatible formats of say, UK Marc and Library of Congress Marc.

A key player in this global industry is the US not-for-profit organization Online Computer Library Center (OCLC). Based in Dublin, Ohio, it has provided computer and communications facilities since 1968.

OCLC customers are libraries and educational organizations for which it runs the largest library information network in the world. There are around 9,500 affiliated libraries in 27 different countries, co-ordinated in Ohio and at Birmingham-based OCLC Europe.

OCLC's main computer facility comprises a suite of Tandem Non-Stop fault tolerant machines, holding over 22 million descriptions of library materials from books to cassettes and software packages - anything forming the basis of a library collection - amounting to over 250 million items.

Full members undertake to contribute all their Roman alphabet cataloguing to OCLC's on-line data base; partial users merely take advantage of the services, such as inter-library loans. Local data is usually added, to the extent of including the shelf number within a particular library, and services can include electronic ordering from booksellers.

Upgraded OCLC software, the Prism system, offers improved search, record editing and expanded facilities.

A massive overhaul of the OCLC network is due to be completed by the end of the year, involving links to Janet on 1 July.

The network nodes form a figure of eight throughout the UK and the Republic of Ireland, linked by BT X.25 circuits, dedicated lines or via dial-up modems. Once into the X.25 network via a node, the line shares a backbone at 9.6 Kbps.

Transatlantic inquiries pass through Birmingham to the fibre optic TAT8 channels at 64 Kbps, reduced to 54 Kbps to meet the requirements of AT&T's Digital Data Service in the US. Response times average under four seconds.

A new network management system, an 80386-based product called OPTIO from Leicester software house Camtec, is in place informing OCLC Europe of the status of every line and attached machine among its 200 UK user sites.

Expansion plans include interconnection with public networks in France, the Netherlands, Germany and Spain.

One of the most important OCLC services is retrospective conversion of catalogue records into Marc entries via its Retrocon software package, once the records have been shipped to the US. Its Microcon software allows batch off-line conversion by the user. A library's records will be checked against the OCLC entry and, if a match is found, downloaded and customized to the member's particular system.

Similar to OCLC, SLS customers' holdings are added to its data base in Bristol. The new interface to Prism gives them an immediate option of accessing OCLC's 22 million records from the same terminals. A DEC complementary software house, SLS, runs its Libertas system on Vaxes, most recently the Vax 6000, providing the applications software to search and manipulate the data provided by clients and now OCLC.

European libraries are proving rich seams to mine. SLS recently concluded a £1.5 million Libertas contract with three major Swedish institutions based on three Vax 6000 310s, with a combined terminal population of over 250.

Business looks set also to grow as a result of increased access through the various national academic networks, such as Janet and Sweden's Sunet. Exeter University is loading a drive towards a European-wide corporate research and academic X.25 network, for example.

Library computerization is not cheap; contracts of over £1 million are not uncommon. Even

taking advantage of the new system, it costs King's College some £5 per entry to create a catalogue record.

The advantages of user-involvement and control, however, justify the expense according to Derek Law, Librarian at Kings College. (Source: Computer Weekly, 25 October 1990)

Clever coding for consumers

There are more lines of code in a washing machine today than in the operating system software within the scientific computers sold by IBM in the early 1960s.

This eyebrow-raising statement comes not from a washing machine supplier or from someone trying to knock IBM, but from Michel Teyssedre, manager of IBM's European Technical CASE Competency Centre.

Defence and telecommunications systems are still the main targets for software developed by technical computer-aided systems engineering tools. But the variety of potential targets is virtually limitless, including any kind of reasonably complex consumer product like a car, television or washing machine.

This fact is helping vendors of CASE products for technical applications chalk up European sales expected to total $1 billion during 1990 with the market experiencing a 30 per cent compound annual growth rate.

The word technical in this context refers to applications that are typically real time and embedded in some kind of product or system. They are likely to be coded in Fortran, Pascal, Ada, C or maybe the emerging object-oriented language C++.

Any company manufacturing a product that could have its functionality enhanced by embedded real-time software is a potential user of technical CASE tools.

This is the view of Caroline Chappell, a senior consultant with research group Ovum, which published a report on the European technical CASE market late last year.

The task of improving the performance of products with embedded real-time software is not one for the lone programmer.

Teyssedre's centre is deliberately located within IBM's development laboratories at La Gaude near Nice, France, because of their experience developing real-time software for the communications processors in IBM's product line, including the IBM 3745 family.

The main aims of the La Gaude centre are to provide facilities for third party CASE tool vendors to port their products to IBM's RISC System 6000 workstation family - and to demonstrate them to prospective customers.

High-performance workstations with a Unix-based operating environment are by far the most prominent type of platform for technical CASE tools and these typically generate code for execution on a target system.

Technical CASE, like CASE for business applications, involves an analysis and design phase followed by coding. It can also benefit from control by an integrated project support environment (IPSE). Some of the analysis and design methods like Yourdon/De Marco and SSADM impinge on both markets. (Extracted from Computer Weekly, 6 September 1990)

## VII. COUNTRY REPORTS

### Austria

PC market

Some 115,060 PCs were sold in 1989, costing AS 5.3 billion. This compares with total European sales of 7.14 million PCs. Total market growth is estimated at 6 per cent for 1989/90 by International Data Corporation. Peak growth of 8 per cent will occur between 1992 and 1993, and the rate will fall to 5 per cent by 1995. Professional PCs are the fastest growing areas, and it is expected that 18 per cent of professional PCs sold in 1990 will be networked. This proportion is likely to reach 40 per cent in 1991. The laptop PC is also in demand, with 50 per cent of Japanese PCs sold in the first half of 1990 being portable. (Extracted from Die Presse, 30 September 1990)

### Bulgaria

Business in Bulgaria

Bulgaria provides an extreme example of the problems and the potential, especially for electronics manufacturers, because it has a highly developed electronics industry and no lack of skilled workers. But the things that the Bulgarians lack are not trivial: money, good products and markets.

Last November, when Bulgaria was transformed into a Western-style democracy, it found that it was $10.2 billion in debt, and had no means to earn enough hard currency to pay the interest. Electronics was one of the main culprits; millions had been borrowed to set up a full-scale computer and semiconductor industry.

The semiconductor plant in Botevgrad, near the capital, Sofia, can turn out 16-Kbit and 64-Kbit DRAMs that compare with those in the West. And the computer-manufacturing operation at Pravetz can make a competitive, 80286-based PC within the limitations that had been imposed by CoCom.

Bulgaria had set up these expensive manufacturing operations because the USSR was importing virtually 100 per cent of its electronics production, says Oliver Dziggel, a consultant with Bethesda, MD-based Enterprise Development International who specializes in Eastern Europe. The Soviets were buying all the computers, despite a 42 per cent failure rate. There were even small producers who bought cheap components in the Far East, assembled them in Bulgaria, and pawned them off on the USSR.

Then last year the USSR cut its imports from Eastern Europe to the bone, so Bulgarian electronics manufacturers suddenly had to discover marketing.

Now the pressure of the $10 billion debt is forcing subsidized firms to become productive. The new Bulgarian democracy allows them to keep 50 per cent of their hard currency. New laws allow business to offer real incentives to motivate workers. And, with the move to a market economy pushing up prices, people have a real need to earn more money.

Assembly in Bulgaria provides clear short-term advantages, but a joint venture with a Bulgarian firm can offer an entry into all the East European markets.

Curtis Instruments, a Mount Kisco, NY, maker of dashboard devices for forklift trucks, bought 51 per cent of a joint venture with Bulgaria's Balkancar, Europe's largest producer of forklifts.

ICL is planning to assemble its TX-3000 electronic telexes in Sofia, through its joint venture with the Bulgarian Academy of Sciences. Telephones do not work in any East European country, so telex service still provides the only sure means of communication.

Companies like Curtis and ICL can count on reinforced guarantees for their operations in Bulgaria. Profits can now be exported, whether they are in the local currency or in foreign currency. (Extracted from Electronics, November 1990)

**China**

PS/2 on assembly line

IBM is to assemble PS/2s in China through its first Chinese joint venture company.

IBM China/Hong Kong has teamed up with the Tianjin Zhonghuan Electronic Computer Corporation to form a new company, Tianjin Advanced Information Products, or Taipc. Both sides have made an equal investment in the company which will distribute the PS/2s through IBM authorized dealers.

IBM installed its first machine in China in 1934 and its first office opened in Shanghai two years later. IBM China/Hong Kong employs more than 100 people selling a range of systems.

Negotiations between IBM and the Chinese authorities began almost two years ago.

Taipc will employ 20 people and is the first joint venture that has been granted IBM patent rights to manufacture its computers. (Source: Computing, 13 September 1990)

Years of X-ray lithography research in the People's Republic of China

A recent issue of Suss Report - published by Karl Suss America - documented the progress of X-ray lithography in the People's Republic of China (PRC). In the PRC engineers have been working on X-ray lithography since 1980.

The PRC has two synchrotron rings with some beamlines dedicated to X-ray lithography research:

- The Beijing Electron Positron Collider (BEPC) located at the Institute of High Energy Physics has five beamlines dedicated to research work including lithography. Scientists will establish a synchrotron radiation facility specifically for X-ray lithography at this location by the end of 1990;

- The Hefei National Synchrotron Radiation Laboratory is located at the University of Science and Technology of China, Hefei, Anhui Province. Lithography is one of the key areas of study at this facility.

In the report, Pichai Pithayachariyakul of Karl Suss noted: "Similar to co-operative efforts found in Europe, Japan and the US, these two facilities are functioning as centres of activity. Various institutes in the PRC take part in developing equipment, materials and processes necessary for implementing X-ray lithography."

For example, the Institute of Precise Optical Mechanism in Changchunm and the University of Science and Technology in Hefei are responsible for the beamline interfaces to exposure stations. The Institute of Optics and Electronics under the Academy of Sciences in Chengdu has already completed a first-generation X-ray stepper. And the Microelectronics Research and Development Centre under the Academy of Sciences in Beijing is working on process development and mask fabrication.

"Although not yet completed, scientists at the Institute of Chemical Industry in Wuxi, Jiangsu Province, are working on X-ray sensitive resist", reported Pithayachariyakul.

In parallel with synchrotron-based X-ray lithography efforts, other Chinese groups are investigating alternative X-ray sources. These include research groups at the Institute of Electrical and Vacuum Devices in Hanzhou and Qinhua University in Beijing.

Pithayachariyakul said, "Although most activities are in the experimental and developmental stages, Chinese scientists believe that they can implement X-ray lithography to fabricate semiconductor devices on a laboratory level within two years. This will be done once they put source, mask, resist and stepper elements together."

Interestingly, the PRC has no formal X-ray lithography exchange programmes with Western nations or Japan. Engineers have developed most of the PRC's X-ray lithography equipment "in-country". Pithayachariyakul noted that a few scientists from the PRC have been working abroad on X-ray lithography research, notably in Europe.

"China is ready to take full advantage of this new technology if more advanced equipment is available to speed up the modernization process", said Pithayachariyakul. "The research work done during the last decade has given the PRC a better foundation than any Asian nation, with the exception of Japan, to implement X-ray lithography into the production phase", he said.

With the current stage of lithography development in China and the benefit of extreme process latitude observed with X-ray lithography, it is conceivable that the PRC may one day produce most memory devices using X-ray lithography. They could just by-pass the more complicated use of optical lithography, concluded Pithayachariyakul. (Reprinted with permission from Semiconductor International Magazine, September 1990. Copyright 1990 by Cahners Publishing Co., Des Plaines, Il., USA)

**European Community**

EUROCHIP: A plan for chip design education

The VLSI Design Action group, a part of the European ESPRIT program, wants to increase the number of VLSI design engineers in Europe by approximately 3,000 per year. To facilitate the achievement of this goal, a consortium of leading research institutions and academic institutes has

formed an organization called EUROCHIP, which will provide Europe's educational establishments with access to chip manufacture, IC design systems test equipment and advanced training. The five current members of the consortium are RAL (UK), IMEC (Belgium), GMD (Germany), DTH (Denmark) and CMP (France).

EUROCHIP has selected European Silicon Structures (ES2) of Sevres, France, as the vendor of the chip prototypes, which will be manufactured using ES2's double metal CMOS process in 1.5 μm technology (1.1 μm effective channel length). During the life of the program reductions in the dimensions will be made to submicron levels.

The EUROCHIP scheme is currently confined to Western Europe, but there is much speculation as to whether it should be extended to Eastern Europe as the political and trade barriers come down. There are currently some 58 participating institutions and 60 associated institutions involved in EUROCHIP, but about a further 100 sites are expected to join the project as it develops.

EUROCHIP is seen as the crucial factor in maintaining the competitiveness of the European industry. It is claimed that only through this co-ordinated and concentrated initiative can sufficient engineers gain the expertise to meet the current and future demands. (Reprinted with permission from Semiconductor International Magazine, October 1990. Copyright 1990 by Cahners Publishing Co., Des Plaines, Il., USA)

EC supremo blasts telecommunications

Europe's public telecommunications services are so far behind those in the US and Japan that using them amounts to an extra tax on companies who do business here.

This was the gloomy message from top EC civil servant Roland Huber to delegates at the National Computing Centre (NCC) annual conference held in Gleneagles, Scotland.

Huber criticized public telecommunications operators who charged nine times the rate in other parts of the world for leased lines and whose only reliable continent-wide network is X.25. He pointed to the US where 45-Mbits per second communications links are available now and where a public Gbit per second network called Giganet is under construction.

Huber, who is pushing for the development of so-called integrated broadband communications, pointed out that at the end of 1989 the heads of State in Europe had called for Europe-wide broadband communications capable of carrying images. (Extracted from Computer Weekly, 15 November 1990)

JESSI hit by setbacks

Funding problems are delaying the start of the major European microelectronics research program, JESSI.

Out of 54 projects within JESSI less than half have sorted out their financing arrangements because of delays in government funding and underestimates of the original costings. The JESSI board now reckons that the costs will be 25 per cent to 30 per cent greater than the original estimate of £2.8 billion.

The main reason behind the delays in payments from governments is the uncertainty over continued Dutch funding following the withdrawal of Philips from the SRAM (static random memory) chip project, a key part of JESSI.

The Dutch Government has postponed taking a decision until next year. According to a spokesman, it now takes a more critical view of the program.

The Franco-Italian company, SGS Thomson, has taken over in the SRAM program. (Source: Computer Weekly, 15 November 1990)

JESSI-CAD-Frame project under way

The JESSI-CAD-Frame project, intended to provide CAD tools with a uniform working framework and to be a central element in improving circuit design and programming, has got under way. The DM 30 million first phase will last 15 months and occupy more than 100 experts. The project is part of the ESPRIT program, and a common basis will be established for JESSI, CAD and ESPRIT projects. Applications will not be limited only to electronics. (Extracted from Marketing Technology, 20 July 1990)

**Hungary**

9,000-gate chip

An East-West collaborative effort has developed a new universal basic building block for massively parallel processors. The 9,000-gate chip, which has 64 identical computing cells, was developed by the UK's Densitron Computers Ltd. and Hungary's Cellware Ltd. The chip can be used to build a new kind of non-von Neumann computer called a cell-processor with a fundamental structure of mesh connecting identical microcells operating in parallel. The chips can also be connected to form a cellular field, where input data enters the field at its edges, ripples through it, with output data obtained at the opposite edges. A cellular field can speed up many tasks by several orders of magnitudes, including vector and matrix manipulations, image processing and recognition and associative processing. (Extracted from Electronic World News, 27 July 1990)

**India**

Computer peripheral industry's growth

The financial year 1989-90 has been a very good one for the young Indian computer peripheral industry. Compared to last year's size of the peripheral market of Rs 95 crores, this year the market was worth approximately Rs 145 crores, a growth of over 50 per cent. Interestingly the growth of the peripheral industry has been greater than that of the computer industry on the whole, which was 40 per cent: this despite predictions by experts that peripherals, at best, will keep pace with the industry. That no peripheral company is among the top 10 companies of the computer industry on the whole underscores the fact that if the computer industry is young, the peripheral industry is younger.

The top five companies alone did business worth Rs 87.8 crores, i.e. about 60 per cent of the total industry. This is in contrast to the previous year when the top five companies' share of the market was

about 48 per cent. They, among themselves, managed to sell about 45,000 dot matrix printers (DMPs) raking in over Rs 50 crores. The import content in the peripheral industry has come down drastically. Philips is expected to set up a floptical disk drive plant soon. TVS Electronics, which emerged as the top peripheral house in the country, plans to start manufacturing Winchester disk drives by the end of 1990.

Government also had a role to play in the industry's growth. Removal of floppy disk drives (FDDs) from the OGL window has led to a spurt in their indigenous manufacture. Laser printers, which have only been imported till now, may also start getting the "made in India" mark as some companies like ICIM and Essen have shown interest in its manufacture after its import, as part of a desktop publishing system, was banned by the Government.

The following companies emerged among the top peripheral players in the country. TVS Electronics has bulldozed its way through to become the top peripherals supplier. The company's product range includes dot matrix printers, switch mode power supplies, keyboards, cartridge tape drives, ups and various adaptor cards. Larsen & Toubro managed an 80 per cent growth with the turnover for the year standing at Rs 18 crores. Essen Peripherals' turnover for the year stands at Rs 16.72 crores. Exports are mainly to the Soviet Union, contributing about Rs 5.67 crores. Godrej & Boyce did business worth Rs 10.95 crores, a growth of 171 per cent. Wipro Information Technology sold 7,500 DMPs, worth Rs 20.05 crores, during the year. Sujata Data Products had a turnover of Rs 8.5 crores. Lipi Data Systems, the country's largest supplier of line printers, had a turnover of Rs 7.6 crores. (Source: The Times of India, 18 June 1990)

PC's high import content

The Indian PC market constitutes over 40 per cent of the total computer industry turnover. The foreign mania of Indian users suits the industry fine; from a turnover of below Rs 100 crores in the early 1980s, it has chalked up over Rs 1,500 crores at present. But it still has very little to show by way of value-addition. While on the face of it the machine sold in the market looks indigenous, a peep inside will reveal the preponderance of foreign components.

While transistors and diodes are available indigenously, the ICs, which constitute over 90 per cent of the cost of all electronic components on the motherboard, are all imported. The ICs inside a PC are mainly the microprocessor, direct memory access ICs and programmable peripheral interface ICs. What is more, even the PCB of the motherboard is imported by most manufacturers.

Switch-mode power supply (SMPS) is said to be manufactured in India. Some even say that the quality is comparable to international standard. A closer look, however, reveals that instead of saying manufactured in India, we should say assembled in India. The fan has a couple of manufacturers in India, but the switching transistors and switching ICs are, of course, imported. The floppy disk drive (FDD), a vital part of a PC, is the same tale as in the case of SMPS. The read/write head, the stepper motor which moves the head over the floppy and the spindle motor are all imported. This is the case as far as only a PC is concerned. If one were to go in for the PC/XT or an AT, which use a hard disk drive, the import content would only go up. The hard disk drive and the hard disk controller are not yet made in India. Keyboards too are being imported by keyboard manufacturers.

Who is to blame? Most tend to believe that the computer industry alone is responsible for this state of affairs and cite its insatiable appetite for short-term gains. But the Government has also made a short- and long-term contribution. In the short run it allowed the kit-import screwdriver culture to grow by turning a blind eye to rampant smuggling of kits. But more seriously, the Government has not been supportive in helping Indian manufacturers. In the mid-1970s, India, Taiwan and Korea were all at the starting line. Unfortunately, while Korea has developed a strong component base since this time and Taiwan became famous as an assembler of quality PCs, India is still struggling. Korea and Taiwan are today successfully exporting to the highly competitive European and American markets. (Source: The Times of India, 26 July 1990)

Literacy Program in Robots for Industry (LIPRO): Project for development of hardware, software and instructional material in kit form

LIPRO is a comprehensive program for teaching industrial robotics to the industrial technicians and engineers of tomorrow - the grass-roots of industry. The multi-level program is designed to bring automation and robotics literacy to technical schools, engineering colleges and industrial institutions.

The program is intended to initiate students into the exciting possibilities of robotics and automation in industries by teaching them the basics of automation in manufacturing industries and by enabling them to interact with robotics at the laboratory level.

The automation and robotics laboratory system will include multi-level texts, basic software and hardware with which to teach students from the elementary to advanced levels of applied robotics and automation for industrial applications.

All the instructional material will be designed in the form of several kits commencing at an elementary level to the advanced level. The hardware provided with the kits will enable the students to build up each sub-system with the help of instructional material and control software. These sub-systems can then be assembled to build complete robots of various types, viz. stationary, mobile, etc.

Industries and institutions outside India willing to collaborate in this venture may contact the Director, Hyderabad Science Society, 12-2-460, Mehdipatnam, Hyderabad - 500 028, India. (Source: News Release)

Dim prospects for Indian software industry: ILO study

Prospects are not too bright for India and many other developing countries trying to enter into software design so as to emerge as major offshore centres for software production, according to the International Labour Organisation (ILO).

A new study on international division of labour in the software industry for the third world, just

published by the ILO, said the prospects for these low-wage manpower-rich nations in tapping the employment and income potential of burgeoning software industry were not too bright.

This was not because of any lack of technical expertise, but because of a host of other bottlenecks such as the absence in many third world countries of infrastructural and other facilities, the study said.

The world market for software and computing services, which doubled in the first half of the 1980s to about $55 billion, is forecast to rise to $163 billion by 1991 and to about $340 billion by 1996.

It said the demand for packaged software would continue to grow rapidly, while the demand for data processing would decline.

Though it looked as if that trade in software and computer services would continue to remain a private preserve of the more advanced countries, the technological capability was present abundantly.

A survey carried out in 1985 in the US showed that foreign and naturalized citizens constituted 30 per cent of the scientists and engineers in the computer and electronics industries - a proportion much higher than the average for all industries.

Among developing countries, Brazil is by far the biggest market for computer service and software, estimated at $4,217 million in 1987.

It said India's market for these services expanded rapidly from an estimated $111 million in 1984 to an estimated $337 million by 1987, that of Mexico from $65 million to $130 million.

The ILO study pointed out that there is only "marginal" collaboration between developed and developing countries in the software and computer services industry.

While even the countries which are usually considered to be the most promising collaborators, such as Singapore, Taiwan and China, seem to be eager to collaborate for learning purposes, India seems to be an exception.

The study said India is exporting much more than others, presumably to earn foreign exchange and to create jobs rather than to learn. But it warns that there is no ground to support the view that the software and computer service industry could help create massive jobs and income opportunities in third world countries as export-oriented consumer goods industries had done in some countries.

At any rate, the study asserted that multinationals had as large, if not larger, a role to play in the development of the software industry in the third world as in hardware manufacture. (Source: Electronics Today, August 1990)

**Japan**

Japanese CAD/CAM organization

A group of 19 Japanese manufacturers and users of computer-aided design and manufacturing (CAD/CAM) systems have formed an organization to co-ordinate Japanese proposals for international standards for data exchange on CAD/CAM systems. The group, called STEP Center (for Standard for the Exchange of Product Model Data), is expected to spend about $6 million over the next four years to develop CAD data exchange systems. Members of the group include Nippon Steel Corp., Hitachi Ltd., Nissan Motor Co., Oki Electric Co., Sharp Corp., Toshiba Corp., NEC Corp., Unisys Japan Ltd., Fujitsu Ltd., Mitsubishi Electric Corp., Yokogawa Electric Corp., Ishikawajima-Harima Heavy Industries Ltd., Ogihara Iron Works Co., Komatsu Ltd., Sanyo Kiko Co., Toyota Motor Corp., IBM Japan Ltd., NKK Corp. and Ricoh Co. Also involved is Nippon Computer Graphics Association, a national organization of CAD/CAM systems manufacturers and users. (Extracted from Metalworking News, 3 September 1990)

IMS system

The Ministry for International Trade and Industry, MITI, hopes to salvage its Intelligent Manufacturing System (IMS) program to develop robotic factories. The $1 billion program was scheduled to begin in September 1990, but MITI now says that the EC is pressuring companies to stay away from the project. IMS would establish standards so that computers and robots from different manufacturers would be compatible. MITI hoped to unite Japanese plant technology with US software and European machine tool technology. MITI's proposal brought controversy everywhere. MITI has managed to convince 80 firms to join the project, including Hitachi, Toshiba, Toyota, Nissan, Fujitsu, NEC, three US firms, and Japanese subsidiaries of IBM and Xerox. MITI has been trying to get the US Department of Commerce and the EC Directorate of Information Technology to co-operate with the program. Of 114 research proposals for the program received by MITI so far, 79 are from Japan and 22 from the US. A major question that must still be resolved is who will control any commercial applications that result from the program. (Extracted from New Scientist, 28 July 1990)

Japanese involvement upsets ESPRIT members

Brussels appears to be taking a pragmatic approach to Japanese interests in some of the European Commission's ESPRIT research projects.

Since Fujitsu's acquisition of 80 per cent of UK computer maker ICL, a number of European companies, such as Bull and Siemens, have strongly objected to its continuing participation in EC R&D projects. But the EC directorate responsible, DGXIII, continues to sit on the fence.

Critics of the European Community are increasingly concerned that programmes like ESPRIT and JESSI have yet to show any positive results. (Source: Electronics Weekly, 7 November 1990)

**Korea**

Koreans take SPARC to portable market

A Korean-based computer firm is claiming the first SPARC-based portable for the US market, but it will soon be joined in the market by other companies.

Trigem Computer and San Diego-based design house Research Development & Innovations have shared in the development of the Sun OS laptop and both have equal rights to market the battery operated SLT-100.

The new SLT-100 unit features proprietary power-management and display-controller chips designed at RDI. The unit can run from either rechargeable nickel-cadmium batteries - which keeps the unit's total weight under 15 lbs - or from 10 D-size flash-light batteries for one-time-only emergency use.

An earlier SPARC laptop, sold only in Japanese markets by Toshiba, is an AC power-only machine priced substantially higher than the $8,000-$12,000 LST-100. (Extracted from Computer Weekly, 22 November 1990)

Samsung plans to have a European DRAM facility by 1992

Samsung, the South Korean electronics manufacturer, is carrying out a study at its Seoul headquarters of its plans to establish a European Assembly plant in 1991. This will be followed by a full-scale wafer fabrication plant for 4- or 16-Mb DRAM production in the following year. The company already has four DRAM plants in South Korea.

No decision has yet been made on the location of the facility, but a company spokesman said Germany and the UK (where the company operates) and the Republic of Ireland are the strongest contenders. The decision is expected by the end of 1990.

The reason for the move into European manufacture is to take advantage of the drive into a single European market that has a growing need for memories. Although the European Commission directive of setting a floor price for DRAMs imported from Japan will almost certainly be extended to include those from South Korea and other Far Eastern countries, Samsung expects to be largely unaffected by this because its price is higher than the Japanese and is above the floor price. (Reprinted with permission from Semiconductor International Magazine, October 1990. Copyright 1990 by Cahners Publishing Co., Des Plaines, Il., USA)

**Singapore**

New technical support centre

Thomson Digital Image (TDI) (France), the 3D computer graphics software firm, has created a technical support centre in Singapore to service the Asia-Pacific region. The new centre is the third of its kind in the world, the two others being in Paris, France, and Los Angeles, CA. It will be situated in TDI's ASEAN distributor Symbolic Images, which also manages the AppleCentre TechBiz Systems. It will offer advanced technical support as well as advice in system implementation and training. TDI's software, running on IBM and Silicon Graphics workstation, is priced at SDlr 100k and an estimated 1.5k to 2.k have been sold world-wide with a further 800 to 1k to be installed in 1990, according to TDI's president J. C. Hourcade. (Extracted from Business Times of Singapore, 19 June 1990)

**Spain**

New institute in Madrid

IBM Spain has helped to establish the Institute for Knowledge Engineering in Madrid, Spain, joined by other institutions and companies including the Autonomous University of Madrid, the Spanish Bank for Credit, the Spanish-American Bank, Iberia, INH-Repsol, Renfe, and Tabacaleria y Union Electrica Fenosa. The purposes of the institute include development of expert systems and development of knowledge engineering. The institute has 50 IBM PS/2s and RISC System/6000, provided by IBM Spain, linked by a token ring LAN to a 3090-170 mainframe, itself linked to the European Academic and Research Network, which links 2,000 universities and research centres world-wide. (Extracted from Datamation, 1 August 1990)

**United Kingdom**

UK Computer Bill

A new law affecting almost all corporate users of computers in the UK is due to come into force later this year. The Computer Misuse Bill has been drawn up as a result of intensive lobbying and closes several loopholes as well as trying to eliminate the ambiguities and inconsistencies surrounding the way in which existing law relates to computer "hacking".

It will become a criminal offence to access computer material without authorization and this will include preventing employees accessing a computer with the intention of finding out information for a friend for example, or prevent an employee from going through personnel company systems.

The new Bill joins legislation concerning software copyright and data protection, but is being regarded by sectors of the industry as an untidy piece of legislation, which will be difficult to police. (Source: AMT, September 1990)

BT in new line on broadband plans

A senior British Telecom executive has indicated a change of emphasis in plans to give Britain a national broadband fibre-optic communications network.

BT is already lobbying the Government to be allowed to justify the estimated £20 billion expense of such a network by being permitted to carry TV programmes to residential users.

Specialist groups of users, such as companies, universities and hospitals, could find themselves connected to 140-Mbit/s high speed fibre networks called metropolitan area networks (MANs) by the mid-1990s. The cost would be justified because these would be high usage networks offering voice, data and video services.

Such networks being built by Alcatel and Siemens will be trialled in Germany and Holland next year. (Source: Electronics Weekly, 12 September 1990)

Alvey joint venture

One of the first commercial joint ventures to result from the UK Government's Alvey programme of collaborative research into advanced information technology has been launched.

British Gas, SD-Scicon and Salford University Business Enterprises have set up a company, Cogsys, to market industrial automation software based on artificial intelligence technology. The company's first product, also called Cogsys, is an expert system designed to monitor the operations of complex

industrial plants and to provide warnings of possible hazards and advice on areas where efficiency could be improved. Cogsys is the result of several years' research and development, first under the Alvey programme and then under the umbrella of a co-operative club involving 37 large European companies. Prototype systems are running at a CMB packaging technology factory making plastic bottles in Wantage and at a gas synthesis plant in British Gas's Midland Research Station. The system runs on DEC Microvax computers. It can analyse several thousand external variables (for example, readings from sensors on factory equipment) simultaneously and almost instantaneously. Using artificial intelligence Cogsys can make deductions about the state of the plant which would be beyond the grasp of human operators. (Extracted from Financial Times, 14 September 1990)

**United States of America**

Congress fights to reverse electronics sale to Japan

A plan approved by President Bush to allow a Japanese company to buy a key American semiconductor supplier ran into intense opposition from politicians and industrialists.

At issue is Semi-Gas Systems, which makes the gases needed to manufacture semiconductors. It enjoys special status as a supplier and partner to Sematech, a consortium of companies in Austin, Texas, that is partly funded by the Government. Sematech exists to keep the US ahead of foreign competition. Semi-Gas provides toxic gases that are applied to silicon wafers in a technique called sputtering. Metallic ions from the gases create the semiconductor's circuitry.

Semi-Gas leads the US in making these gases and the equipment to contain and deliver them. It recently surpassed its main competitor, Japan's Nippon Senso, in the world market. Early this year, Nippon Senso, through an American subsidiary, put in a bid to buy Semi-Gas. The Government's Committee on Foreign Investment in the US (CFIUS), set up to review such sales in 1988, approved the sale, and Bush approved in July - causing uproar at Sematech.

The controversy hinges on the definition of national security in the trade law that set up CFIUS in 1988.

The debate has taken on unusual urgency because of the decline of the American semiconductor industry. In 1980, the top ten semiconductor manufacturers were American. Last year, four were American and five were Japanese. Since 1987, foreign interests have bought about 35 US companies involved in semiconductors, with most going to Japanese owners.

The sale cannot progress until the Department of Justice reviews it. In the meantime, members of Congress's Joint Economic Committee have written to the Justice Department advising against the sale. (Extracted from New Scientist, 20 October 1990)

US agrees on chip trade pact

US semiconductor manufacturers have patched up their differences with US computer manufacturers and have agreed on the terms of a new trade pact with Japan.

The two factions will now press the Bush Administration for a new five-year agreement to ensure American semiconductor makers a 20 per cent share of the Japanese market.

But Akio Tanii, chairman of the Electronics Industry Association of Japan (EIAJ), pledged to fight any new agreement. He says the present deal has achieved good results. US chipmakers currently have a 14.5 per cent market share in Japan.

The Semiconductor Industry Association (SIA) and the Computer Systems Policy Project (CSPP) say this is the first time they have managed to reach a unified position.

The two camps have clashed in the past, with the computer makers claiming that the trade pact protected US semiconductor makers but drove up costs of vital memory chips for computer manufacturers.

Computer manufacturers also disagreed with the way that tariffs, known as fair market values, were imposed on Japanese memory chip imports. (Source: Electronics Weekly, 10 October 1990)

US practices council formed to lift standards

US software developers are trying to improve the integrity of the industry with the formation of the Software Business Practices Council to "promote ethical business practices and higher business standards".

Users who are tired of software industry practices like vapourware software, which is promised but does not exist, and performance claims that do not actually match up with the real world, may be cheered to find the software industry is aware of the problems.

Ashton-Tate, Banyan, Ingres, Price Waterhouse, AI Corp., DEC, Lotus and Hewlett-Packard are among the founder members of the new organization.

Jeffrey Papows, head of the council and chief operating officer of fourth generation language company Cognos, has sent an open letter to US software developers and a White Paper, which he says is a first step to drawing up good business guidelines.

Software suppliers have to recognize the difference between "a product announcement and a statement of direction". They must also display adherence to emerging standards in performance claims; "truthful, accurate and verifiable explanation of product performance measurement" and clearing up of exactly what companies can claim is revenue. (Source: Computer Weekly, 22 November 1990)

AT&T calls for easing of telecommunications regulations

US telecommunications giant AT&T has warned countries with monopolistic telecommunications structures to ease up on regulations or suffer billions in revenue losses.

John Berndt, president of AT&T's international communications services division, says that as customer demand increases for better services, national administrations will lose out to better technologies from third parties.

Berndt believes it is imperative that countries relax their stiff regulatory frameworks soon to allow customers a wider choice.

Berndt singles out integrated services digital network (ISDN) systems and virtual private networks (VPNs) as being particularly good examples of technologies customers want more of but which are penalized by high tariffs and geographical restrictions set by the regulators.

Only recently have VPNs (basically private networks making use of public networks and services) come on-stream internationally. (Extracted from Computer Weekly, 27 September 1990)

CAMD - The Bayou Synchrotron

Top researchers in X-ray lithography gathered recently in Baton Rouge for a report on the $25 million Center for Advanced Microstructures and Devices (CAMD) at Louisiana State University (LSU). CAMD will be the first American-made "light" source built exclusively for X-ray lithography. The CAMD project started in 1987. LSU plans to commission CAMD by autumn 1991.

Through a grant, the US Department of Energy is paying for the CAMD facility and its storage ring. The state of Louisiana plans to pay for operating the facility and its research in X-ray lithography.

Unlike the liquid-helium superconducting storage ring that Oxford Instruments is installing for IBM in East Fishkill, NY, the CAMD storage ring will use conventional warm magnet technology.

CAMD officials have not yet determined what steppers they will install on their storage ring. It is likely, however, that steppers from both Karl Suss and SVG Lithography (a stepper developed by what was formerly Perkin Elmer) will compete on the ring. (Reprinted with permission from Semiconductor International Magazine, October 1990. Copyright 1990 by Cahners Publishing Co., Des Plaines, Il., USA)

Parallel computing to tackle big problems

The University of California at San Diego and the San Diego Supercomputer Center have acquired a 32-processor iPSC/860 parallel computer from Intel Scientific Computers in Beaverton, Oregon. The iPSC/860 is built around Intel's i860 microprocessor, a RISC chip containing more than one million transistors.

Scientists from UCSD's Computer Science and Engineering Computing facility will help create software for the system, as well as compilers capable of translating programs created for traditional computers for use on parallel systems.

The system, with a speed of nearly 2 billion floating-point operations per second, is a result of the Touchstone project, a three-year effort being carried out by Intel with the help of a $7.6 million grant from DARPA. The Touchstone project, launched in April 1989 with a total expected cost of $27.5 million, calls for a 2,048-processor machine with peak speeds of 150 gigaflops by 1992. The ultimate goal is a teraflop by 1995.

A report from the President's Office of Science and Technology Policy calls for a major jump in supercomputing performance to help solve some extremely difficult problems. These include world climate prediction, semiconductor circuit design and test, superconductivity research, mapping of the human genome, and support for advanced drug design.

Federal science officials have concluded that the best way to reach these scientific goals is through parallel supercomputers. The National Science Foundation is encouraging the four supercomputer centres it sponsors, one of which is SDSC, to become involved in parallel computing. (Source: Computer, October 1990)

Research programme seeks to improve CIM systems

The National Institute of Standards and Technology (NIST) Center for Manufacturing Engineering has joined the Applied Physics Laboratory of Johns Hopkins University in a one-year research programme to achieve productivity and quality improvements in computer-integrated manufacturing systems. Surface-mount printed circuit boards are typical of the products targeted.

The project will include the specification of process and quality control techniques and strategies, computer hardware and software, data requirements, and interface and support standards such as the standard for the exchange of product model data and the Defense Department's computer-aided acquisition and logistic support standards. In addition, new concepts for process control sensors will be tested.

The co-operative research project draws on NIST skill in process control sensors, automation and standards technology, and the Applied Physics Laboratory's expertise in applications and electronics manufacturing. (Source: Computer, October 1990)

**Union of Soviet Socialist Republics**

Chip licences

Cypress Semiconductor (US) has acquired licences for nine chips designed in the USSR, and is also participating in "Mir", a design project with 50 USSR designers. The chip licences include one for a graphics processor designed by Interevm. Angstrem, the largest USSR chip manufacturer, has supplied other designs. (Extracted from Electronics Weekly, 25 July 1990)

Computer Society chapter formed in Moscow

The most recent addition to the growing list of IEEE Computer Society chapters is the Moscow Chapter, which received official approval effective 15 August 1990. The interim chair is Nikolai V. Sazonov, pending election of officers.

An IEEE section, a prerequisite for the formation of a Computer Society chapter, was formed at the same time, with 65 members.

The IEEE reports that Romania has successfully concluded a 13-year-long effort to form an IEEE section and that Czechoslovakia is also working to establish a section.

According to Michel Israel, chair of the Computer Society's European Activities Committee, the Moscow Chapter was created through the co-operative efforts of his committee, the USSR Ministry of Education, and the Popov Society (named

for Aleksandr Stepanovich Popov, an early pioneer in the field of radio). Some of the top computer scientists in the USSR - academicians, directors of well-known institutes, and engineers - are included in the new chapter's membership, Israel said.

Benefits of Computer Society chapter status include participation in the Distinguished Visitors Program and the Chapters Tutorials Program, and support on conferences, workshops and publications from both the Area Activities Board and the Computer Society staff. (Source: Computer, October 1990)

## VIII. FACTORY AUTOMATION

### Intelligent manufacturing

Japanese plans for a $1,000-million international project in manufacturing technology have been further delayed by the postponement, at the request of the United States, of a meeting arranged for the end of September 1990.

If nothing more, the delay reflects big differences in the way research and development policy is set in Japan, the United States and the European Communities (EC).

The project, called Intelligent Manufacturing Systems (IMS), is for the development of the automated factories of the future, and would be supported to the extent of 60 per cent from Japan. Partnership has been invited from the United States and the EC.

The Ministry of International Trade and Industry (MITI) had planned to discuss reactions to the Japanese proposal in Tokyo, but the US Department of Commerce requested a further postponement of a meeting originally arranged for June.

IMS was first proposed by Hiroshi Yoshikawa, head of Tokyo University's Faculty of Engineering, and won backing from MITI and Japanese industry in January 1990. It will develop standardized manufacturing systems that are fully computerized from the design stage through to the retailing and distribution of the finished product.

More than 60 major Japanese manufacturers have contributed funds to help launch the project.

According to Fred Nichols of the Washington-based National Coalition for Advanced Manufacturing, US university-based research, driven by NASA and Department of Defense requirements, is more sophisticated than that of Japan, especially in visual simulation, artificial intelligence and sensor technology. These are essential talents for computerized manufacturing, together with the traditionally US skills in the large-scale software integration. And in some instances, Japanese companies are unaware of developments elsewhere.

EC officials admit that Japan clearly has a lead in the rapid conversion of design into manufactured products, but in their draft report argue that this is "due to cultural factors - stable career structures, shared objectives and experiences which promote communication, collective decision-making and staff movement across departmental boundaries - which could not readily be reproduced in the West".

Rather than a central organization for IMS, the EC report proposes a decentralized project, much like ESPRIT and other EC research projects, with each research consortium financed from its region of origin (Europe, the United States or Japan). Collaboration between the EC, Japan and United States should be carried out between partners of "equal weight", the document states, and research should begin with a "pilot" project on a few "limited and uncontentious" studies once there is a detailed agreement on intellectual property rights.

Kenzo Inagaki, deputy director of MITI's industrial machinery division, claims the European proposal is now "very close" to Japan's way of thinking. But it is hard to see how MITI can merge its ideas with those of the United States and Europe. The United States is certain to oppose control over industrial policy by a central body, but just such a MITI-style body has already been put in place in Tokyo with the several million dollars contributed by industry. (Source: Nature, Vol. 347, 27 September 1990)

### Wall climbing robot

A robot that can climb walls to paint, inspect or clean them has been developed by researchers at South Bank Polytechnic (London) and the Institute for Problems in Mechanics (Moscow). The unit can move over walls or ceilings by means of suction pads. It has its own sensors, but is largely controlled by remote control. The smallest of the new robots can carry 15 kg of equipment. The largest can carry 70 kg of equipment for cutting or welding. (Extracted from New Scientist, 30 June 1990)

### Robot passes new eye test

Researchers at Cambridge University claim to have developed a new strategy for giving pick and place robot systems the benefit of vision.

It is achieved by giving the camera system on the robot dominance over the robot arm control system and using a fast repeated glance technique to position it.

A loop is executed every 20 ms, more frequently than other systems, so that the robot moves continually in the right direction until it picks up the item.

Because it offers a direct vision feedback approach, calibration errors and distortion problems are eliminated from the robot.

The robot is driven by a state-of-the-art Cartesian space controller to bring together the vision and control strategies at the most fundamental level.

The software is based on X-Y co-ordinates, on which vision systems depend, and avoids the need to convert vision system co-ordinates into real-world co-ordinates to position the robot arm. (Source: Electronics Weekly, 10 October 1990)

### Robots mop up underground waste leaks

Researchers at Sandia National Laboratories have developed techniques that will enable robots to map and remove radioactive waste from leaking underground storage tanks, such as those buried at the US Department of Energy's plutonium and uranium processing plants in Hanford, Washington. Using robots to handle radioactive waste would make the clean-up job safer and more cost-effective than using other remote means, Sandia officials say. "With current remote-control technology, it might

take as long as a year to clean each one of the 149 tanks at Hanford, but with this type of intelligent system we may be able to reduce that time to less than a month", says Sandia's Ray Harrigan. Discussions are under way about whether to begin using the robotic technology to begin addressing DOE's massive radioactive waste problems. Sandia and Oak Ridge National Laboratory have been commissioned by DOE to devise a strategy for using robots to clean up radioactive waste nation-wide. (Source: Chemical and Engineering News, 1 October 1990)

## IX. STANDARDIZATION AND LEGISLATION

### Standardization

#### Triple accord on European network plan

The UK's three licensed personal communication network operators have signed an agreement to work together towards a common infrastructure for their services in Europe.

The signatories - Mercury PCN, Microtel Communications and Unitel - said the agreement will form the basis of an international memorandum of understanding for European PCN operators and will invite other countries' operators to add their names.

Under the agreement the operators will be expected to work towards the development of DCS 1800, the new standard devised by the European Telecommunications Standards Institute, and the provision of a common set of channels within the frequency band 1710-1800 MHz to allow roaming on an international basis.

Research is currently under way among the three operators on what constitute rural and urban areas and a way of segmenting the country into a 60 per cent urban, 40 per cent rural split.

In areas too small to support three operators, one will have responsibility for building the network with the other two sharing the cost.

A condition of the operators' licence is that 90 per cent of the population is covered by the network by the end of the decade. (Source: Computing, 13 September 1990)

#### Users condemn slow progress to open systems

Angered by the lack of progress towards open systems, a group of 30 large US-based corporations has declared "global war" against manufacturers and customers of proprietary systems.

The informal group, known as the Houston 30, has issued a report slamming the slow rate of progress towards open systems. Entitled "Overcoming Barriers to Open Systems Information Technology", the report calls for the formation of a large user group, which would exclude computer manufacturers and help promote open systems standards.

The Houston 30 was formed earlier in 1990 after a top level meeting in Houston of IS executives from some of the largest companies in the US. members include Eastman Kodak, Du Pont, Exxon Chemical, General Electric, Ford, General Motors and British Petroleum Exploration.

The Houston 30 report recommends "declaring global war against proprietary systems that hold data hostage. Systems entrapment is negatively impacting North American businesses and stifling creativity".

The report goes on to criticize computer manufacturers for failing to fulfil promises of open systems. Customers, though, are also criticized for paying lip service to open systems but then actually buying proprietary systems.

The Houston 30 believes that unless it can obtain reliable open systems computer products, organizations will suffer because they are unable to share information efficiently across their structures.

The Houston 30 also wants the creation of a strong and independent user organization that can influence suppliers with its recommendations on open systems.

The Houston 30 may soon, however, cease to exist. It is considering joining another established organization - the Corporation for Open Systems International - in order to take care of administrative overheads. (Source: Computing, 13 September 1990)

#### Committee drafts medical guidelines

The European Centre for Standardization's Medical Informatics Committee will meet to decide how best to develop a blueprint to draw up standards in medical computing.

The Brussels-based committee is expected to face recommendations that European standards development should be harnessed with those under way in other countries, notably the US and Japan.

According to a report by the European Workshop for Open Systems on medical informatics, standards for health care communications must be international and are a necessary condition for the support of system platform manufacturers.

The workshop is already considering the future in Europe of a de facto medical standard popular in the US.

The Health Level 7 application protocol has over 400 users, but is almost unknown in the UK.

The protocol is backed by a consortium of vendors and had the support of management consultancy Arthur Andersen, which has incorporated it in a US demonstration of integrated hospital systems.

It allows data exchange between business and clinical system applications, including patient admission and discharge, and data reporting for ancillary services provided by laboratories and radiology departments. But the protocol is non-OSI compliant, and may be superseded by Edifact message syntax. (Source: Computer Weekly, 15 November 1990)

#### MUSIC at UCC

A major international project, which will make computer programs easier to use, is being launched by a consortium of European software companies and research institutes. Dr. Kirakowski at the Human Factors Research Group (HFRG) in University College Cork is to play a leading role as the project's "architect". The project, which will last three

years, will develop techniques for measuring ease of use of computer programs. The techniques will be packaged in a toolkit, which will be commercially available by late 1993. The project will also propose and influence international standards which set up minimal requirements for ease of use. Potential spinoffs from the project for UCC include setting up a national usability certification laboratory and running specialized training courses in the use of the toolkit.

The project's title is MUSIC, Metrics for Usability Standards in Computing. It is part sponsored by the Commission of the European Communities. MUSIC is made up of a consortium of software companies and research institutes in Italy, Spain, Germany, the Netherlands and the UK.

Dr. Kirakowski, the head of the HFRG, has been nominated "project architect" for MUSIC. This means he will be ultimately responsible for "controlling the technical progress and direction of the project". The contract with the Commission of the European Community and the agreement between partners says his experience in "statistics, psychometrics and human factors in computing systems, as well as his extensive practical experience in computing and command of European languages make him an ideal choice for the MUSIC project architect". Thanks to the updating of the UCC campus computer network, a lot of this work will be done by plugging into international computer networks.

MUSIC is the fifth largest project in recent years that the HFRG have participated in. This project will give the HFRG opportunity to employ more Irish graduates and give them experience of European research. (Source: AMI, October 1990)

The evolving relationship between open standards and technology

by Wayne E. Rosing and Matt M. Perez,
Sun Microsystems

The relationship between open standards and technology is undergoing a change, particularly in the way standards are developed and deployed today and in their impact on business. In addition to integrating mature standards into its systems, the computer industry will have to invest more time and effort nurturing and promoting fledgling standards.

Standards represent a challenge and an opportunity. The challenge is to deliver the best performing, best integrated products that fully support a standard. On the other hand, each generation of standards represents a baseline to build on. Already, the more stable standards are influencing systems design to the point that, in some instances, the path to highest performance will be through a standard.

The dynamics of open standards

Open standards are hard to define but easy to recognize. In spite of that, most people today would agree that the nature of standards and the standards-making process is changing.

In the past, standards in the computer industry dealt mostly with technical issues, the concern of engineers and designers; today, they are a business issue and the concern of the executive suite. In the past, participation in standards required little or no investment, and individuals often worked on them in their own time; today, participation involves a significant amount of corporate investment and industry-wide alliances.

In the past, standards resulted in the codification of the state of the practice; today, they are defining the state of the practice as well. In the past, government purchasing practice set standards; today, commercial vendors and users develop them and promote their use.

The vendor's approach to standards has evolved. Sun Microsystems provides a good example of this. In its early history, Sun differentiated itself by integrating a number of existing standards into its products (for example, Ethernet). That practice proved successful, and many of those standards have been widely adopted throughout the industry. Today, Sun invests more in nurturing new standards in areas that will promote the growth of the industry.

Universal adoption of standards does not imply an end to competitiveness. The challenge will be to deliver the best performing, best integrated products that fully support a standard. This will be the focus of the competitiveness that drives the industry and has made it so successful.

Alongside competitiveness, industry-wide co-operation and alliances are on the increase. In cases where needed standards do not exist, vendors and users are working together and establishing organizations to create their standards.

Successful players in this environment will make their in-house technology openly available. As in the past, Sun will continue to support that practice (as with NFS). The needs of vendors and users will determine the need for new standards, and it will be more difficult (and less desirable) for any one player to impose its own technology on the rest.

For example, the Object Management Group, an industry-wide association, is dedicated to promoting applications interoperability in an object-oriented environment. This is an emerging technology, requiring long-term investment and nurturing before fruition. Industry-wide co-operation is a must in this case because, by its very nature, interoperability, like networking, can succeed only if it can work across heterogeneous systems.

Types of standards

What we call a standard, and the character of the bodies bringing forth these standards, has changed. Today, in addition to de facto and government-sponsored standards, we have consortium-backed standards. There are standards and would-be standards in many areas of our industry. For example:

- Software libraries: GKS, PHIGS, PHIGS+, PIK, Renderman.
- Window system server protocols: X, PEX, IEX, VEX, Postscript/News.
- File-based data interchange: CGM, IGES/PDES/Step, TIFF, Renderman's RIB.
- Open systems: Posix. 1, SVR4, OSF/1.
- Networking: Ethernet, FDDI, ISDN, ONC/NFS, NCS, HPPI.
- Multimedia: CD-ROM, CD-I, DVI, NTSC, PAL, HDTV.
- User interface: Open Look, Motif, Presentation Manager.

- Mass storage: SCSI, IPI.

- System buses: Multibus, VME, Futurebus, Sbus.

- Serial buses: RS-232/RS-422, IEEE P1394, ADB, MIDI.

- Character coding: 7-bit ASCII, ISO (e.g., 8859, 10646), Unicode.

Examples of new areas of focus are:

- Performance evaluation: SPEC, NCGA's GPC.

- Applications environments bodies: OMG, CFI (i.e., CAD Framework Initiative), ISO (e.g., SC24WG1).

From the perspective of the process that brings forth these standards, they can be categorized as follows:

- Official: GKS, PHIGS, CGM, IEEE 802.3 (Ethernet), FDDI, ISDN, NTSC, PAL, HDTV, SCSI, IPI, RS-232/RS-422; Multibus, VME, Futurebus; IGES/PDES/Step, TIFF, Posix.

- Government sponsored: FIPS, CALS, regulatory standards (e.g., FCC's EMI specifications).

- De facto: PHIGS+, ONC/NFS, HPPI, CD-ROM, Renderman, SVR4.

- Consortium-backed: X, PEX, IEX, VEX, CD-I, DVI, Open Look, Motif, Presentation Manager, MIDI, SPEC, GPC, OSF/1, SVR4, Ethernet (IEEE 802.3), XPG (X/Open Portability Guide), ONC/NFS, NCS, Unicode.

These categories are not always clear cut. For example, Ethernet can be categorized as both official (that is, IEEE 802) and consortium-backed (Xerox, DEC, Intel). In fact, many of these processes overlap, and these organizations must work together.

The speed and visibility with which some of these standards (such as PHIGS+) have developed show an increased sophistication in the development of standards. A sign of the maturing of the industry at large, this change went unnoticed for a time and surprised the few who held on to the stereotype of standards as "slow and irrelevant". The future is bound to bring us even more surprises and, as these standards gain in popularity, chances are the stereotype will shift to "if it is based on a standard, it must be fast".

Metric of success for open stabdards

A popular benchmark for a standard's success has been its popularity: If it is used by a large or influential sector of its intended user base, then it is considered successful, but today it is also very important that the technology be "open".

None the less, popularity alone is no longer enough. What makes standards significant today is their ability to lower the cost of development for vendors, lower the cost of ownership (including training and support) for users, provide users with vendor independence, and promote applications that can interoperate across heterogeneous, networked systems in multinational, multilingual environments. In the long run, only open standards can meet these goals.

An effective benchmark for what qualifies as an open system has beer given by Gilbert Williamson, president of NCR. First, are the vendor's systems built on non-proprietary industry standards, available from multiple sources? Secondly, if the vendor brings out new technology, does that vendor immediately make it available to the industry through nonrestrictive, practical licensing? Finally, does the vendor offer a migration path to an open environment for its proprietary systems users?

Motivation for open standards

The pragmatic motivation for integrating standards into commercial systems is to lower the cost of development for vendors and the cost of ownership for users. Users gain some measure of vendor independence that protects their software investment. In areas like networking and applications interoperability, standardization is a requirement (that is, no standards, no networking, no interoperability).

One example of across-the-board cost savings is in the use of CD-ROM as a distribution medium.

A key factor in fueling growth in the past has been the constant price/performance improvements from one product generation to the next. As a standard stabilizes, it makes business sense to invest in delivering the fastest, lowest priced implementation of it possible. In return for a relatively low-risk, low-cost investment (that is, fixed product specifications, accurate development cost estimates), a vendor can deliver a standard-based product that is both a product differentiator (that is, at the low end, customers can readily recognize performance improvements), and a source of extra revenue (for example, at the high end, hardware accelerator options). Users will inevitably benefit from an ever-expanding choice of high-performance systems at low prices.

Although price/performance continues to play a major role in workstation purchases, its importance to users has diminished. The main purchase criteria now focuses on networking, ease-of-use, interoperability, availability of applications, breadth of product line, and upgradability, all areas that can benefit from industry-wide standards.

Summing up

By and large, open standards benefit vendors and users alike, helping the market develop the high-volume applications required for dramatic growth. The industry understands these benefits, and this will continue to fuel standards-making activities. In our continued search for product solutions, technology will persistently move aggressively foward. Successful players in the industry will continue to drive their product technologies, integrate mature open standards, and nurture fledgling ones within industry-wide organizations. (Source: Computer, September 1990)

European security plans

UK security experts have hit back at US accusations that a new European Security standard is a disguised trade barrier.

## Glossary

| | |
|---|---|
| ADB | Apple Desktop Bus |
| ANSI | American National Standards Institute |
| CALS | Computer-aided acquisition and logistics support (see FIPS) |
| CD-I | Compact Disc — Interactive |
| CD-ROM | Compact Disc — Read-Only Memory (Phillips/Sony) |
| CFI | CAD Framework Initiative (Guidelines for design automation frameworks to enable the coexistence and cooperation of a variety of tools) |
| CFL | CAD Framework Lab (Microelectronics and Computer Tech Corp group offering CFI technical support) |
| CGM | Computer Graphics Metafile (ISO/ANSI) |
| CVI | Digital Video Interactive (Intel) |
| Ethernet | Local area network standard (IEEE) |
| FDDI | Fiber Distributed Data Interface (ANSI) |
| FIPS | Federal Information Processing Standard (see CALS) |
| Futurebus | 32-bit mass bus, backplane (IEEE) |
| GKS | Graphics Kernel Standard (2D graphics package driven by flat, non-hierarchical display list) (ANSI/ISO) |
| GPC | Graphics Performance Committee (see SPEC, NCGA) |
| HDTV | High Definition Television |
| HPPI (nee HSC) | High-Performance Parallel Interface (ANSI/ISO) |
| HSC | High speed channel |
| IEC | International Electrotechnical Commission |
| IEEE P1394 | Serial bus proposal |
| IEX | Imaging Extensions for X (see PEX, VEX, X Consortium) |
| IGES | Initial Graphics Exchange Standard (ANSI/ISO) |
| IPI | Intelligent Peripheral Interface |
| ISDN | Integrated Services Digital Network (AT&T/ISO) |
| ISO | International Organization for Standardization |
| MIDI | Musical Instrument Digital Interface |
| Motif | X Look & Feel and API (OSF) |
| Multibus | Trade name for popular 16-bit mass bus (Intel/IEEE) |
| NCGA | National Computer Graphics Association |
| NCS | Network Computer System |
| News | Networked Window System (Sun Microsystems) |
| NFS | Network File System (Sun Microsystems) |
| NTSC | National Television Systems Committee |
| OMG | Object Management Group |
| ONC | Open Network Computing (Sun Microsystems) |
| Open Look | Open Windows Look & Feel (see Motif) (AT&T, Unix International) |
| OSF | Open Software Foundation |
| OSF/1 | First release of OSF Unix (see SVR4, OSF) |
| PAL | Phase Alternate Line (European color televison system) |
| PDES | Product Data Exchange Specifiction (ANSI/ISO) |
| PEX | PHIGS Extensions for X (see IEX, VEX, X Consortium) |
| PHIGS | Programmers' Hierarchical Interactive Graphics Standard (3D graphics package driven by a central hierarchical data structure) (ANSI/ISO) |
| PHIGS+ | Surface rendering extensions to PHIGS (ANSI/ISO) |
| PIK | Programmers' Imaging Kernel (ANSI) |
| Posix | IEEE Unix standards |
| Postscript | Page description language (Adobe) |
| Renderman | Scene description language for photorealistic rendering (Pixar) |
| RIB | Renderman's Interface Binary (scene description file format) (Pixar) |
| RS 232/RS 422 | Serial interconnect (IEEE) |
| Sbus | Open mass bus (Sun Microsystems) |
| SC24 | Subcommittee 24 on Computer Graphics (ISO/IEC Joint Technical Committee 1) |
| SC24WG1 | SC24's Working Group on graphics architecture (includes rapporteur groups of user requirements and reference models) (ISO/IEC Joint Technical Committee 1) |
| SCSI | Small Computer Systems Interface |
| SPEC | System Performance Evaluation Committee (see GPC) |
| Step | Standard for the Exchange of Product Model Data (ANSI/ISO) |
| SVR4 | System V release 4 of Unix (see OSF/1) (AT&T/Unix International) |
| TIFF | Tag Image File Format (Aldus/Microsoft) |
| Unicode | 16-bit character encoding (Unicode Consortium) |
| VEX | Video Extensions for X (see IEX, PEX, X Consortium) |
| VME | Versabus Modified for Eurocard (32-bit mass bus) (Motorola/IEEE) |
| X | X window server and protocol (X Consortium) |
| XPA | X/Open Portability Guide (X/Open) |

At the end of September 1990 a conference in Brussels was held to discuss the Information Technology Security Evaluation Criteria produced by the UK, France, Germany and the Netherlands.

US companies including DEC and Sun have publicly complained that the proposed standard would make it difficult for them to sell computers in Europe by effectively raising a trade barrier.

The US has its own standard called the Orange Book. Officially this is only for computer systems used by the US Government in classified work but it has a wider range in the absence of a viable alternative.

Secure Information Systems, a computer security specialist, has contributed to the Euro-standard and strongly rejects the US claims. (Source: Computing, 27 September 1990)

**Legislation**

Software patents

Hoping to improve its protection of the rights of entrepreneurs, America is granting more patents than ever for computer software. This attempted kindness could wreak havoc with one of America's most successful industries.

Though paranoid about piracy, America's software entrepreneurs are shrewdly cool about the idea of patenting their creations. Many say they are applying for patents only in self-defence. Straw polls indicate that programmers prefer the much narrower protection of copyright - the usual legal tool for stopping software piracy. Some big companies fear that patents will bring an innovation-crushing series of lawsuits.

Lawyers are already busy. A New York-based company called Refac bought the rights to a basic patent on the technology of spreadsheets and has sued, among others, Lotus Development, whose 1-2-3 spreadsheet leads the market. Another tiny firm, called Cadtrak, acquired a patent with which it could threaten most programs that paint graphics on a computer screen. Both companies are accused of being more innovative in court than in developing computer software.

The sorting out of conflicting claims could take a long time. With little history to guide it, the patent office will find it hard to decide who really created which software innovation. As so often when America goes to law, patent regulation could impose significantly higher costs on the whole of the software industry. The problem lies in the different assumptions underlying patent and copyright.

Patents provide ownership rights to ways of doing things. Copyright covers the expression of ideas. One might, in theory, patent the spreadsheet as a tool for manipulating numbers. In theory, nobody could duplicate the functions of a patented spreadsheet without paying royalties. Under copyright, however, a company can protect only its specific version of a spreadsheet.

The difference could prove crucial to innovation. Copyright makes it easy to take a good idea and make it better. Patents, by contrast, require the great to pay royalties to the good. Though existing firms may be able to avoid royalties by swapping patents, the profusion of claims being granted by the patent office will make it much harder for newcomers, especially suppliers of low-cost software, to enter the market.

Patent law could also change the structure of the software industry in an expensive way. Patents promote an industry based on sales of components. When, for example, a computer-maker buys a chip for his new machine he can safely trust the chipmaker to make sure that the chip does not violate anybody else's patent. Unfortunately the technology of software makes it hard to link together components built by different authors. Though the use of software components is slowly growing, it is still cheaper and easier to build from scratch many vital (and possibly patentable) bits of code than it is to buy them.

That sort of re-invention makes the administration of patents on software a potential nightmare. Patent applications typically take two to three years, while copyright takes only a few days. Two or three years is about as long as the average software-product life cycle. So a program developer might not know to whom he owes royalties until after his product is obsolete.

To complicate things further, some legal scholars reckon that the patent office does not have the right to award patents on software in the first place. Traditionally, patents have been restricted to processes and innovations for the "transformation of matter". The extension to software rests largely on a 1981 Supreme Court case. (Source: The Economist, 18 August 1990)

Microprocessors patents

The US semiconductor industry's leading corporations and a self-employed engineer, Gilbert P. Hyatt, are getting ready for multimillion dollar negotiations following the announcement that the US Patent Office has awarded Hyatt a patent covering virtually every microprocessor in use today. The patent runs from its effective filing date of 1970, pre-dating the claim from the Intel Corporation team generally credited with creating the microprocessor.

Hyatt's strategy is crucial. Because patents are not self-enforcing, Hyatt will have to take on the semiconductor makers in order to receive payment. Last week, Hyatt claimed some early successes, saying that he has nearly completed licensing fee negotiations with one major electronics corporation and that several other companies are already waiting to do business with him. Although he will not name the amount of money he is asking, Hyatt says he is looking for "a reasonable royalty that won't be a burden".

But even modest fees may add up to large amounts of money if the patent's validity withstands legal challenge. Ironically, if questioned in court, the patent may benefit from the 20 years it spent under review. Lawyers will now find it hard to make new arguments but may attempt to narrow the patent's coverage to more specific types of microprocessors, or argue that Hyatt's claim is invalid because he did not actually transform the technology into working products.

Royalty fees in the semiconductor industry are typically one to five per cent of a company's revenues on that product.

Hyatt also has the right to seek royalties from foreign companies for the microprocessors that they make, use or sell in the United States.

Hyatt developed his microprocessor at a small company called Micro Computer, Inc. that he founded in 1968, then dissolved in 1971. The engineer, who holds over 50 other patents, supports his research

through consulting for the aerospace industry. This is his first profitable patent, and he says he plans to channel its proceeds into his current personal computer research, which involves a radical departure from current technology. (Source: Nature, Vol. 347, 13 September 1990)

Users fight Brussels

User concern over the way suppliers are trying to influence the European Community's controversial draft directive on software copyright has led them to club together to force Brussels to hear their views.

Computer Users of Europe (CUE), a 70-strong user action group including Barclays Bank, Bupa, W. H. Smith, German aerospace research centre DLR and Safeway, has been formed to combat lobbying from the hardware and software suppliers.

The directive has split the manufacturers and software suppliers into two vocal bodies - Sage (Software Action Group for Europe), led by IBM, DEC, Apple, Lotus and Microsoft, and ECIS (European Committee for Interoperable Systems).

SAGE argues that the directive will open the door to software piracy by allowing reverse engineering of programs. ECIS opposes what it says are moves to give large companies a monopoly by denying users and open systems suppliers access to interface code.

ECIS, backed by Apricot, Bull, NCR, Fujitsu and Olivetti, argues interoperability will be blocked if SAGE is heeded. (Source: Computer Weekly, 13 September 1990)

EC copyright rules may force firms East

Fears about the impact of the controversial EC draft directive on software copyright may lead some manufacturers to stop development in Europe.

At issue is whether published documentation is sufficient for a hardware and software developer to build products that can work with other manufacturers' machines, or if they have to dig into code to understand how the systems work.

This has blown up into controversy about so-called reverse engineering. One group, SAGE (Software Action Group for Europe) which is led by IBM, DEC, Apple, WordPerfect and Lotus, bitterly opposes moves by the EC in its directive to allow some form of reverse engineering.

It is opposed by ECIS (European Committee for Interoperable Systems) - which Insigna has joined - a body that includes Olivetti, Bull and Fujitsu. ECIS argues that public interfaces are insufficient. (Source: Computer Weekly, 22 November 1990)

EC law will monitor awarding of contract

Civil service IT procurement staff may have to go to court to explain their decisions to award contracts to specific suppliers when European legislation comes into effect in December 1991.

The legislation, covered by the European Community's directive on compliance with procurement procedures, will make individual civil servants accountable for their decisions after 1 December 1991.

For instance, under the directive UK courts will have the power to halt procurements that have not complied with EC regulations, and correct any infringements. Before a case reaches court, departments will have 21 days to correct such infringements or abandon the procurement.

The EC is investigating 100 advertisements placed in official European publications by UK government departments for IT projects to see whether they have adhered to EC procurement timetables. (Source: Computer Weekly, 13 September 1990)

False claims can cancel contracts

Users can throw equipment back at manufacturers and refuse to pay the bill if the supplier has made exaggerated claims for the performance of its products.

The contract would be null and void because of misrepresentation. Even if the system works perfectly well users can rescind a contract because of false sales claims, and companies which have received and paid for their systems could return the equipment and claim back their money.

Incorrect claims by sales staff, even if made without any direct intention to deceive, could give the user the right to refuse to pay an invoice on the grounds of misrepresentation.

This could include sales people telling users that a system would give them "instant access" to their data bases. The claim could probably not be justified in court, whereas the words "fast access" would be easily defended.

Other questionable marketing claims include "We have many satisfied customers". If, on investigation, half the customers were dissatisfied, the user could declare the contract with the manufacturer null and void.

It would also count as misrepresentation if a company said it had an active and participative user group if it had had one once, but user interest had diminished to the point where it met only rarely and had few members.

If suppliers persuade somebody to go into a contract because they have misrepresented what it is they are going to supply, the buyer has the right to rescind the contract as if it had never happened.

The supplier does not even have to lie deliberately for it to have been a misrepresentation.

The comments add a new dimension to IBM's investigation into the conduct of some of its sales staff who stand accused by users of making misleading claims. (Source: Computer Weekly, 18 October 1990)

Putting international patent data to work

Results of a new study should dispel some of the scepticism many industrial managers have towards the usefulness of patent data in technology planning and analysis.

Mary Ellen Mogee, a consultant and researcher based in Great Falls, Va., analysed statistically two technologies selected from "World Patent Index". This on-line data base is published by Derwent Ltd. in the UK and is available on Dialog

and Orbit. Mogee found it was possible to use the data to:

- Determine the stage of the life cycle a technology is in.
- Distinguish clearly between a mature and an emerging technology.
- Assess how much of the patent activity in a particular technology involves the United States, either as a source of invention or as a market, and how much is going on outside of the US patent system (in general, quite a lot, according to Mogee).
- Identify the most active areas of a technology.
- Identify companies doing the most important work, as indicated by how often patents are cited by other patents.
- Identify the technological directions a particular firm is pursuing.
- Recognize whether a firm continues to be active in a technology, has dropped out, or is a new entrant.

(Some of these indicators have been spotted by previous patent studies.) Moreover, after performing her statistical analysis on the two technologies (a mature industrial chemical and the emerging sol-gel technology), Mogee asked experts in the field to evaluate her findings.

They told her that her conclusions about sol-gel technology conformed "quite well" with their impressions, while the overall picture of the mature chemical conformed "moderately" to "quite well".

Although Mogee's analysis was somewhat less successful in identifying individual firms, inventors, and markets, she found that the technique is clearly useful in conjunction with such tools as technology forecasting, and can provide "strong hints" about future trends in a technology and the research directions competitors are pursuing. Mogee also emphasized the importance of using international patent data.

A report of Mogee's findings has been prepared for her sponsor, the Center for Innovation Management Studies at Lehigh University. Copies are available from Mogee at 212 Carrwood Road, Great Falls, Va. 22066. (Source: IEEE Spectrum, November 1990)

Network licensing

One of the more complex questions facing big corporate managers of local area networks is the unresolved matter of network licensing for PC-based software applications. Large companies are clamoring for consistency in the way software vendors dispense those licensing agreements. Meanwhile, software publishers are trying to protect their intellectual property and make a fair profit. The result has been a variety of sometimes confusing licensing agreements, ranging from the very conservative individual license - one license for every user - to the far more liberal site license - one license per site - with variations in between.

Many large software vendors consider site licensing, which usually amounts to a volume discount, to be bad business. WordPerfect Corp. of Orem, Utah, for example, says it wants nothing to do with an agreement that basically allows customers to make unlimited copies of its software.

WordPerfect says it stopped offering volume purchase agreements for big customers two years ago. Now customers may purchase either single copies, five-packs or 20-packs, and they must obtain the corresponding number of licenses whether they buy 10 or 10,000 copies.

Somewhere between all-out site licensing and individual licenses is "concurrent licensing". This is generally defined as licensing based on the number of simultaneous users on a network accessing a piece of software at any given time or at peak times. Keeping track of these network users is not easy, say some corporate network managers.

It is not surprising, then, that some vendors resist the notion of concurrent licensing. Nevertheless, a number of large software companies, including Ashton-Tate Corp. in Torrance, California, and Borland International Inc. in Scotts Valley, California, offer the option and audit corporate accounts to ensure compliance with the agreements.

In the absence of a simple way to determine the true number of individuals using networked software, many users are negotiating case by case with each vendor. The issues on the table include not only how many users should be included in the license but also how often those users run the software.

Still, software vendors are trying to accommodate their customers, at least their largest ones. Last spring, Microsoft initiated a new program it calls Microsoft License Paks (MLP). Under the terms of the program, a company buys a full retail version of a software package complete with software disks and documentation. It also buys an MLP, which consists of a license agreement allowing the company to make a copy of the package for a predetermined number of users. The company is then charged for each copy at 20 per cent less than its full retail value.

Everyone may agree on the problem, but the solution does not seem to be in sight.

For now, anyway, users may find themselves as mired in the fine print of licensing agreements as they are in managing the technical workings of their networks. (Reprinted with permission of DATAMATION[r] magazine[c], 1 October 1990. Copyright 1990 by Technical Publishing Company. A Dunn and Bradstreet Company - all rights reserved.)

## X. RECENT PUBLICATIONS

### The Information Engineering Strategy

An introduction to information engineering

From Strategic Planning To Information Systems, by Clive Finkelstein (Addison-Wesley Publishing Co., 393 pages. $39.75)

When business managers formulate strategies to achive corporate goals, they often fail to consider the information systems that will be needed to realize those objectives. The result is an information system that addresses current business needs rather than the overall corporate strategy. Information Engineering begins by considering the corporate strategic plan and then developing the information systems required to implement the plan. Aimed at IS, business managers and users, the book explains how to use strategic-modelling techniques to analyse and implement information, decision support and expert business systems.

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