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MICRO-ELECTRONICS MONITOR

N.B. Special in this issue is an article on the impact of technological change on software development: implications for the LDCs and NICs prepared for the Monitor by Dr. Robert Schware of the World Bank's Department of Information, Technology and Facilities, Washington, D.C.

Issue No. 30

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1. NEWS AND EVENTS

Computer Society establishes task force on expert system applications

The IEEE Computer Society has announced the formation of the task force on expert systems applications established to improve the capabilities of organizations and individuals in working with expert systems technologies.

The society's Technical Activities Board authorized creation of the ESA task force at a March meeting in San Francisco. The new task force is being organized under the direction of Dan Yurman, a member of the information management staff of the US Environmental Protection Agency's Hazardous Waste Program.

The task force will sponsor activities at national and international levels and will also support local events. On the national and international scale, it will publish a newsletter, exchange electronic mail, provide speakers for conferences, organize tutorials and symposia, and convene meetings on standards both on its own and in conjunction with other Computer Society entities.

MIS and end users are experiencing an explosion of interest and activity in expert systems applications in almost all sectors of business, government, and education, Yurman said. This is taking place due to the wide distribution of expert system shells on personal computers and workstations.

Expert systems are the most mature and resilient products to emerge from the AI community, and they are being adopted by corporations and government departments to improve productivity. Expert systems applications to specific knowledge intensive systems return high yields. Success stories for expert systems are more common today than they were two years ago. An estimated 2,000 operational expert systems are in current use, and 80 per cent of them run on personal computers.

A number of people have agreed to serve on the task force's steering committee, including Laurel Kaleda of IBM, the Computer Society's vice president for technical activities.

Additional information can be obtained by writing to TAB Co-ordinator, IEEE Computer Society, 1730 Massachusetts Ave. NW, Washington, DC 20036-1903. (Source: Computer, May 1989)

Computer centre for Thurso

An international centre for research in the computer sciences could be established in Thurso, the most northerly town in mainland Britain. One aim is to create a centre to train computer scientists from the third world along the lines of the International Centre for Theoretical Physics in Trieste, Italy.

The initiative comes from the Highlands and Islands Development Board and the UK Atomic Energy Authority, whose fast reactor at nearby Dounreay faces closure within the next eight years. The proposed new centre would provide both teaching and research facilities in advanced computing. The involvement of the UKAEA would mean the centre could draw on existing computer facilities at Dounreay and gain access to the authority's Cray computer system.

Around 2 million pounds sterling is needed to provide the start up finance for the computer centre. Public and private sector cash is going into the scheme and the Commonwealth Secretariat is showing interest, partly to develop computing capacity to allow member countries to model the implications of climatic change.

Earlier this month, British Telecom announced proposals to upgrade northern Scotland's telecommunications network at a cost of 16 million pounds sterling. This would bring data communications in the region alongside major British centres like London, Glasgow and Manchester. (This first appeared in New Scientist, 17 June 1989, London, the weekly review of science and technology)

New consortium for high temperature superconductor applications research

AT&T, IBM and the Massachusetts Institute of Technology (MIT) will form a consortium to handle high temperature superconductor applications research, the Consortium for Superconducting Electronics, the latest in a string of co-operation among US firms that are normally fiercely competitive. MIT provost J. Deutch said "it is a model of how universities, government laboratories and industry have to co-operate in the future to address a number of issues". The Government has relaxed restrictions for such activities to help make the US more competitive. The consortium will seek $4 0 million in funding from the Pentagon's Defense Advanced Research Projects Agency, most of which would go to MIT. The consortium members would contribute an equal or greater sum for a total $10 15 million per year in financing.

A somewhat surprising aspect of the effort is that the first corporate members already have substantial programmes in superconductivity. AT&T Bell Laboratories' director of chemical physics research R. C. Dynes notes that the consortium organizers thought that involving such large firms would lend some weight to the idea and attract other members. The consortium will focus on electronic devices, especially those for military surveillance and signal processing, highly sensitive magnetic sensors for use in diagnosing brain disease and mine detection, and high-speed chips for use in telecommunications and computers. Some 25 researchers, assigned to four teams, will remain at their own institutions. MIT will administer the consortium, which will have a 5 to 10 year life span. (Extracted from New York Times, 24 May 1989)

American companies hasten research into fast chips

A consulting firm in the US wants to form a consortium of companies to exploit research on a type of chip that works much faster than its conventional counterparts. The new chip, known as an*integrated optoelectronic circuit, works by converting light to electricity.

Research on the circuits is already under way in the US, but observers in the computer industry fear that the US will fall behind its competitors in this area.

Representatives of 35 companies attended a closed workshop at the Department of Commerce in Washington DC, organized by the David Sarnoff Research Center, a consultancy based in Princeton, New Jersey.

To boost photonic and other optoelectronic circuits, officials at Sarnoff advocated a $165 million programme of research in three stages. In the first stage, researchers would seek to integrate optical transmitters and receivers with electronic integrated circuits. In the two

succeeding stages, they would make prototype chips, then develop technology for full scale production. Research would begin in 1990, and production in 1995. (This first appeared in New Scientist, 15 April 1989, London, the weekly review of science and technology)

WIPO meeting looks at data base protection

Copyright protection for data bases was the subject of discussion at a recent meeting organized by the World Intellectual Property Organization (WIPO). The meeting, of the Committee of Experts on Model Provisions for Legislation in the Field of Copyright, took place at the Organization's Geneva headquarters between 20 February and 3 March 1989.

The WIPO meeting brought delegates of Member States together to discuss Draft Model Provisions for Legislation in the Field of Copyright, intended to offer a model for certain elements of national copyright laws of countries party to the Berne Convention for the Protection of Literary and Artistic Works, adopted in 1886. The Berne Convention, which WIPO administers, is one of the world's foremost copyright treaties; 82 countries are signatories.

While "mere facts and data" do not receive protection under the model provisions, it was suggested that copyright should be extended to cover data bases which, because of the selection and arrangement of their contents, could be considered original works. It is hoped that, ultimately, the provisions will become an international standard.

A report of the meeting (C/MPC/I/3, 3 March 1989) has been produced, and can be obtained from: WIPO, 34 chemin des Colombettes, 1211 Geneva 10, Switzerland. (Source: ACCIS Newsletter, May 1989)

Japan and US both claim supercomputer lead

NEC Corporation of Japan has launched what it claimed to be the world's fastest supercomputer, raising fears in the United States that Japan has taken the lead in this key technology. But Cray Research Incorporated, the world's leading supercomputer manufacturer, is unperturbed. Officials of the US company's Japanese subsidiary say that Cray's fastest computer can already match the NEC supercomputer and that a new model will leave its Japanese competitor behind.

On the face of it, the top model in NEC's new SX-3 series of supercomputers is faster than anything Cray or anyone else has to offer. NEC's model SX-3/44, which has four central processing units, can, in theory, churn out 22,000 million floating point operations per second (flops), a speed that is more than five times faster than Cray's fastest computer, the Y-MP 8/8. But in practical use, when computers operate far below peak speed, Cray may have the advantage.

Tazeniko Kato, an engineer at Cray Research Japan Ltd., has simulated the performance of the two computers for a range of operating conditions. He claims that NEC's computer is comparatively slow at scalar processing (calculations on individual numbers) and can gain an advantage over Cray's computer only when performing calculations where vector processing (simultaneous calculations on lists of numbers) can be used more than 85 per cent of the time.

That means a Cray will be faster on almost all practical applications, including drug and chemical design, structural engineering and aerodynamics. Only in special fluid-dynamic calculations where vector processing exceeds 85 per cent will the high speed of NEC's computer be an advantage, Kato says. His simulation relies, however, on an estimate of 160 million flops for the NEC computer's scalar processing speed. NEC refuses to reveal a precise figure but claims Kato's estimate is "misleading".

Cray uses the IEEE standard that has been generally adopted by US scientists and engineers, but Japanese manufacturers, including NEC, are using the IBM standard for their supercomputers.

The Cray-3, which is expected to be on the market around the same time as NEC's new computer (shipments of which will begin in June next year), will be the first supercomputer to use logic chips made of the ultra-fast gallium arsenide, rather than silicon. It will be able to execute calculations much faster than NEC's new model because of its higher scalar processing speed (close to 1,000 million flops), Kato says, despite a lower top speed for vector processing (16,000 million flops). (Extracted from Nature, Vol. 338, 20 April 1989)

Italy gets ST chip plant

French-Italian chip maker, SGS-Thomson (ST), is investing 130 million pounds sterling into smart power semiconductor development and production in southern Italy.

The four-year programme of investment, which is separate from the European chip initiative, JESSI, will draw in the co-operation of the company's ASICs subsidiary, IST, and local universities. Eventually, some 360 researchers will be employed, including 200 newly created posts.

SGS-Thomson is seeking to reinforce its already strong position in intelligent power. The market for such devices in the automotive, aviation, and automation markets is growing rapidly. The decision to site the operation in southern Italy helps the Government to boost a depressed part of the country.

The firm's Vertical Intelligent Power (VIPower) product combines low voltage signal circuitry and high voltage, high current power semiconductors on the same chip. Such devices can be used for motor control and driving up to 2kVA of output. (Source: Electronics Weekly, 28 June 1989)

France may open JESSI R&D programme to Americans

JESSI could be open to US companies, said France's Minister for Research and Technology, Hubert Curien.

"There is no rule excluding anyone from the project," claimed Curien. "There is nothing that says non-European companies cannot participate." European industrialists and EEC officials believe that substantial mutual advantages would accrue from reciprocal membership.

Until now, European partners involved in JESSI have insisted that while they remain excluded from the American microchip R&D programme Sematech, American companies should be excluded from JESSI.

In a bid to break the impasse IBM has offered its 4 Mbit DRAM technology to JESSI. Siemens already has 4 Mbit DRAM technology developed under

its joint R&D programme with Philips called the Megaproject.

The EEC has agreed to back JESSI with one quarter of the programme's funding, and the companies' Governments will pay another quarter.

JESSI work in Grenoble to begin

SGS-Thomson Microelectronics (ST) has given orders for work to start in Grenoble, France, on JESSI, the European venture to design the microchips of the 1990s.

"Grenoble 92" has already been chosen as the slogan for an initial 90 million pounds sterling research and development project sponsored by ST.

The enterprise brings together ST's components plant, which it inherited from Thomson Semiconductors, with high profile laboratories operated by France's national telecommunication research centre and atomic energy authority in the Grenoble area.

The French ministries for post and telecommunications, defence and research have all committed themselves to supporting the venture.

Like the Federal Republic of Germany's Siemens and Philips of the Netherlands, the other JESSI partners, ST has told the Governments concerned - France and Italy - that it counts on the costs being shared between the industrialists and the taxpayers.

In the framework of JESSI, ST has been entrusted with the mission of developing advanced EPROMs while Philips will work on static RAMs and Siemens on dynamic RAMs.

The Grenoble venture involves creating a brand new clean room and production facility for developing and manufacturing semiconductors with 0.5-micron feature widths. (Source: Electronics Weekly, 5 April 1989)

European micro plans axed

Europe's chip manufacturers have abandoned plans to jointly develop a microprocessor under the collaborative chip research programme JESSI.

Hopes for a European-developed microprocessor were raised at last year's electronics exhibition in Munich when Jurgen Knorr, president of Siemens' semiconductor division, said efforts were under way to link the resources of his company, SGS-Thomson and Philips to develop a European architecture.

Since then Siemens has signed up with MIPS Computer Systems to produce that company's 32-bit reduced instruction set computing (RISC) chip, and SGS-Thomson has bought Inmos and its Transputer technology.

Industry analysts believe Philips could follow Siemens into the MIPS camp. (Source: Electronics Weekly, 14 June 1989)

Report examines PCB growth in Europe

Printed circuit boards have developed into a global business because they are customer specific products not commodity items, according to a report on the European PCB market from Frost & Sullivan.

The European market for printed circuit boards will be worth nearly $11.7 billion by 1992. The Federal Republic of Germany is the largest sector worth $1.3 billion last year. It constitutes 47 per cent of the entire market. Domestic manufacturers fared well, capturing most of the country's home sales to automotive, telecommunications, communications and other end use sectors.

The UK has the second largest European presence in PCBs, with the market being worth $545 million last year. Most of the demand is from telecommunications, communications, consumer, instrumentation and data processing sectors.

In France, where imports exceed exports fivefold, PCB production was $500 million in 1988. By 1992, production is forecast to be running at $600 million.

For several years now, the trend has been away from the single-side and conventional double-side PCBs, towards multi-layer and flexible types. The upswing in demand for multi-layer boards is a reflection of the desire to run more complex circuits in less space. (Source: Electronics Weekly, 12 July 1989)

US firms in bid to kill trade pact

US computer makers want to kill the Semiconductor Trade Agreement between the US and Japan claiming it keeps the price of the chips that they have to buy artificially high.

Large computer companies are talking about setting up a lobbying group to persuade the US Government to modify or scrap the 1986 pact when it comes up for renewal in 1991.

Hewlett-Packard has swung its weight behind the companies opposed to the pact and joins a group which includes IBM, AT&T, Tandem, Tektronix, NCR, Prime, Compaq and Unisys.

These companies claim that the pact hurts equipment makers by keeping the cost of vitally important components high, and that it hurts US chip makers because it guarantees the high prices and therefore high profits to their Japanese competitors which they will use to fund development of the next generation of chips.

The consortium of computer makers wants the Semiconductor Trade Agreement to finish on its scheduled date, it wants a study on how the trade agreement has affected systems manufacturers, and it also supports free trade. (Source: Electronics Weekly, 17 May 1989)

US eases Cocom IT export restrictions

European computer companies will soon find it easier to export to the Soviet Union as the US eases restrictions on its export policy.

The US has regularly used its veto as a member of the 16-nation Cocom committee to stop exports of high technology products to the Soviet Union. That policy will soon end, according to Paul Freedenburg, a former high level official at the US Department of Commerce.

Freedenburg, who was Commerce under secretary for export administration until recently, told a meeting of top Silicon Valley executives that there would soon be a major relaxation of US export regulations that will make it easier to export previously sensitive high technology products to the Soviet Union and China.

IT export restrictions to the Eastern bloc have also been eased in the UK, with the recent extension by the Government of permitted technologies for export. (Source: Computing, 25 May 1989)

Network service delayed by EC fears

Europe's ambitious managed data network service, MDNS, which will compete against US suppliers like IBM, Geisco and Electronic Data Systems (EDS) will be at least a year late, after shareholders called for a major review.

The European Commission has asked the group of 22 telecommunications authorities, the PTTS, to show its proposals are not anti-competitive.

The unprecedented co-operation between Europe's fiercely competitive PTTs would provide the one-stop shopping and guaranteed service levels which are the main selling point of the US multinationals. Ironically, when the PTTs agreed to set up a joint company last year, the European Commission looked set to give it full backing.

The service, which will offer network management protocol conversion, consultancy, and hardware and software to ensure incompatible telecommunications systems work together, may get off the ground by the end of the year. At least 35 million pounds will be invested to build the service.

Europe's PTTS are keen to play down the delays, but they have just rejected an EC plan to speed up deregulation of Europe's telecommunications market, in preparation for 1992. (Source: Computer Weekly, 15 June 1989)

Europe pins last hope on HDTV

European electronics companies striving to stay in the vital consumer electronics market will give a major demonstration of Europe's high definition television (HDTV) technology at the international television festival in Montreux.

Firms led by Philips and Thomson of France will show off working HDTV broadcast equipment and receivers, developed as part of a Europe-wide EUREKA research project.

Electronics experts in Europe and the US regard HDTV as the last chance to save the consumer electronics industry from Far Eastern domination. Sales of HDTV sets alone are expected to run into billions of dollars during the late 1990s and the technology spin-offs will benefit everything from medical equipment to computers. (Source: Electronics Weekly, 14 June 1989)

Thumbs-up for Euro initiative

A project to create pan-European standards for computer systems and software looks likely to get the go ahead at a key meeting of the ESPRIT research organization's management committee in Brussels.

Called the Europe Systems and Software Initiative (ESSI), the project will go a long way towards getting software that can operate effectively on faster hardware.

Systems and software development will be one of the biggest growth areas in the high technology business over the rest of the century. There is also talk in European circles of tying ESSI up with the JESSI advanced chip project run by EUREKA, to further standardize links between components and the software.

The number of companies involved in ESSI will go into double figures if the funding comes through. Once support is established for the initiative, the final funding decisions over ESSI will go before financial authorities in the European Commission.

Up to five other major project proposals will be considered by ESPRIT at the meeting. (Source: Electronics Weekly, 26 April 1989)

Cheaper flash chips to take memory by storm

Toshiba, the world's leading dynamic RAM maker, has said that the price of flash electrically erasable PROM (EEPROM) will match the price of DRAM in 1990. This backs up similar claims made by Intel in March 1989.

Unlike DRAM, flash EEPROM is able to hold its memory when power is switched off but it is about five times as expensive and density is around one generation behind. Toshiba is working on a new approach to flash EEPROM which could lead to it overtaking DRAM in density.

Toshiba's new approach to flash EEPROM is to use a NAND cell instead of a conventional NOR cell. The advantage of the NAND cell over the NOR cell is the size of the memory cell. Flash EEPROM already has an advantage over DRAM in that it needs only a transistor to make a memory cell whereas a DRAM needs a capacitor as well as a transistor. With the added advantage of super-small NAND cells the price per bit should drop below that of DRAM.

One customer is Toshiba's own lap-top computer division which is pushing the semiconductor side to get high-density flash EEPROM as a replacement for floppy disk. Another set of customers are the smart card manufacturers where flash is replacing static RAM. A third bunch of customers are the solid state camera makers. (Source: Electronics Weekly, 31 May 1989)

Battle to win the world's greatest memory contest

The race to make the next jump in microchip technology is turning into a contest of technological machismo across the Pacific Ocean. The chip in question is the 4-megabit DRAM (pronounced dee-ram), a slice of silicon that is capable of storing and retrieving 4 million bits of digital information. This is four times the capacity of 1-megabit chips, which came into mass production only two years ago.

DRAMs are useful because they are a cheap and convenient form of storing information electronically, whether for computers or, increasingly, in cars and electronic devices for the home. Each generation of equipment needs more memory than the last: today's personal computers need at least 1 megabyte (8 million bits) of electronic memory to run programs properly.

DRAMs are important politically, because virtually all of the chips produced for the open market are made in Japan. Syndicates of European and American companies have won government backing to try to regain the lead. Most of them, however, are running hard simply to catch up.

A 4 megabit chip can store the equivalent of 520,000 characters, or the contents of a 16 page

newspaper, as tiny charges of electricity in microscopic capacitors. Each chip contains some 9 million components packed into a piece of silicon less than 15 millimetres long and 5 millimetres wide. To make the chips, factories must work to a "design rule" of 0.8 micrometres: this means that the smallest features in the circuit cannot be smaller than 0.8 micrometres across. The Japanese company, Toshiba, was in 1988 the first to produce commercial samples of 4 megabit chips. The difficulty, however, is to produce them in large quantities with an acceptably low failure rate. This has always been one of the strengths of Japanese companies.

Surprisingly, the American-based computer company IBM was the first to announce that it was mass producing the chips. IBM said earlier that its factories at Burlington in Vermont and at Sindeltingen in the Federal Republic of Germany began mass-producing the chips in 1989. The company will set up another plant in Japan shortly. IBM, however, makes its chips mainly to go into its own products.

Toshiba still hopes to be the first company to lead the industry through two successive generations of memory chips. The company now makes 9 million 1-megabit chips each month - one third of the world's total. It has just announced plans to spend more than 300 million pounds sterling on factories to produce 4-megabit chips. These chips have a radically different design from those of present circuits.

In today's chips, the components are laid out on a flat surface. In order to squeeze in four times the memory, designers have developed a three-dimensional structure called trench architecture. The structure is so called because it involves building components into the side of trenches cut in the chip's surface. The result is a much more compact design than chips that have flat, or planar, architecture - but one that is fiendishly difficult to build.

Toshiba shipped its first samples of 4-megabit chips in November 1988. The company aims to produce 100,000 chips a month by September 1989 and break the 1-million barrier in March 1990.

Meanwhile, companies already have teams of engineers working on the next stage, the 16-megabit DRAM. Toshiba says that it will make its first 16-megabit DRAMs in 1992, at a new factory 300 kilometres west of Tokyo. In order to build such chips, the company will have to work to design rules of 0.5 micrometres, but Toshiba's engineers say that they will be able to do this without radical changes to the trench architecture.

Despite the resurgence of effort in the West, Japanese companies will be hard to beat. In the present financial year alone, they have announced plans to invest more than 600 billion yen (2.7 billion pounds sterling) in new factories and equipment. (This first appeared in New Scientist, London, 22 July 1989, the weekly review of science and technology)

Trade bodies to link up

Rationalization of the UK's electronics trade associations looks set to snowball following the merger of the Electronics Engineering Association and the Business Equipment and Information Technology Association.

With the full title of The Electronic and Business Equipment Association the new body will be known as the EEA. It will represent 200 members with combined annual sales of 40 billion pounds sterling in the information technology, industrial and defence electronics equipment markets.

The merger was a response to the wishes of the UK's major IT companies who were looking for stronger representation among the European trade associations.

Current discussions with other groups could lead to further rationalization which could be important for the future of the UK's electronics trade associations. (Source: Electronics Weekly, 31 May 1989)

"Green" look for computer print outs

One of Europe's largest suppliers of paper has launched the world's first "environmentally friendly" stationery for computers. Roffs Stralfors, a Swedish paper company, has run trials of the paper on the Swedish market and now plans to exploit the large potential market in Britain. This market has been created by growing concern over the use of chlorine as a bleaching agent in the paper industry, and its implication in the release of harmful dioxins into the environment.

Stralfor's new paper, Stralfors Zero, is produced by Holmen, one of Sweden's major paper mills, which uses hydrogen peroxide rather than chlorine as a bleach. Several large companies in the computing and banking industries have tested the paper, which Stralfor's sales director, Iain Morrison, describes as "November white".

Homen's mill, at Hallstavik, north of Stockholm, uses a pulping process called thermomechanical pulping (TMP). This process relies on steam and brute force to soften the fibres of wood, rather than the traditional chemical pulping process that is still the most popular way of producing paper.

The main advantage of TMP is that it softens the wood fibres and extracts more lignin, so leaving the pulp whiter than that created by chemical pulping. In order to produce an acceptably "white" paper, the mill need use only hydrogen peroxide, a less powerful bleach than chlorine. Bleaching with hydrogen peroxide gives out only hydrogen and oxygen as by-products. The main drawback has been that the lack of lignin in the pulp means that the fibres are less tightly bonded, so more likely to flake off from the surface of the paper. This is not acceptable for computer rooms.

However, mechanical pulping has other advantages. It is less likely to chop the fibres, as happens in chemical pulping, so the resulting paper is stronger. TMP also makes use of all of the wood so it needs roughly half as much timber to produce the same weight of paper as chemical pulping.

The mill at Hallstavik uses spruce wood from forests in Sweden, and claims to be planting more trees than it harvests, to meet Swedish law. Holmen was the first mill in the world to use the TMP process when it opened its plant in 1974. Since then, it has produced relatively low grade paper for the newspaper industry by this "clean" process.

Paper produced by TMP has proved hard to turn into stationery for computers. This is because the paper has to be of a very high quality in order to be suitable for laser printing. It must also be able to run as a continuous roll through a printer. The paper must also stack well and have a high surface strength, so that it does not produce paper "dust".

Holmen's mill uses very high temperatures and pressures to produce its paper. This means that the fibres in Strafford's Zero are so well bonded that none can rub off the surface of the paper. (This first appeared in New Scientist, 15 April 1989, London, the weekly review of science and technology)

US firms hot up on neurals

US company Micro Devices has begun shipping neural network chips that have the capability of learning complex tasks by themselves. Another US company Syntronics Systems recently began shipping the first neural net microprocessor called Dendros 1.

Micro Devices is shipping beta test versions of what it calls the Fuzzy Set Comparator. The company's neural network chip is part of an evaluation kit priced at $250. The board plugs into an IBM XT or compatible personal computer and can be used for adaptive rankings and for rankings with fuzzy data. The rankings are then processed by the personal computer.

The Fuzzy Set Comparator chip is built in CMOS and has a video interface so that it may be used to recognize images such as people's faces. Micro Devices is experimenting with a system using the neural network chip in identifying fingerprints.

Although it contains only 128 neurons, Micro Devices based the design of its Fuzzy Set Comparator on the human brain.

The Dendros-1 is designed to work with one particular neural net architecture called adaptive resonance theory, designed at Boston University. It has an analogue operation and offers vector processing in parallel and can perform 4.3 million floating point operations a second. (Source: Electronics Weekly, 31 May 1989)

GPT first off mark into Soviet telecommunications

GEC Plessey Telecommunications (GPT) has secured a unique foothold in the Soviet telecommunications market, creating a joint venture company to operate its payphones in Moscow.

The agreement to form the company, called Comstar, with Moscow's telephone network operator, MGTS, was signed at the Soviet-British trade fair in Moscow.

An initial investment will be made by GPT to set up a network of 100 of its credit-card payphones, offering international telephone services at Moscow's airport and tourist hotels later in the year.

The long-term plan is to develop GPT's business as a provider of voice and data services such as payphones and mobile communications, which the Soviets are anxious to adopt.

Soviet plans to modernize its network are expected to create a 1 billion pounds sterling market over the next five years. GPT, like other European telecoms equipment manufacturers, would like to win a share of this market with its System X digital telephone exchanges, private exchanges and payphones. (Source: Electronics Weekly, 19 April 1989)

Batteries limit portable electronics

Portable electronic equipment is now about as small as it will ever be. The designers of portable video cameras and recorders, personal computers and pocket telephones all face the same problem. If the equipment is made too small it becomes impractical to use, and the rechargeable battery needed to provide its power will weigh almost as much as the equipment itself.

The problem is typified by a new cellular telephone now on sale from the US electronics company Motorola. The 9800X personal cellphone, which is smaller than any other radio telephone available, can easily fit into a jacket pocket. But developments in the miniaturization of electronic circuitry have now outstripped developments in battery technology.

The 9800X is only 162 millimetres long, and 61 millimetres wide. The body, including its keypad, display panel and aerial, weighs less than 200 grams. Motorola has incorporated all of the electronics into five custom-made chips. The transmitter can radiate 0.6 watts, but the chips continually monitor the strength of the signals that the unit receives and reduce the transmitter's power to match the signals. This process saves current.

There are virtually no further savings in power that can be made. So manufacturers face a trade-off between the length of time for which the unit can operate and the size of the battery. Motorola is offering subscribers the choice. Each cellphone, costing 2,295 pounds sterling, comes with a choice of two nickel cadmium rechargeable batteries. One weighs around 100 grams and the other weighs around 150 grams. (This first appeared in New Scientist, 6 May 1989, London, the weekly review of science and technology)

Refining human interfaces

Watch for European-developed human factors techniques to hit Xerox's product lines over the next few years. Tom Moran, head of Xerox's three-year-old European research centre Europarc, which is based near the university city of Cambridge, England, is busy working on the technologies of future end-user systems - imaging systems, voice recognition, video communication, video link, shared work spaces, etc. It is part of Xerox's programme to master the deeper problems of the human interface - how machines deal with people and how people deal with machines. From real-time videophones with the camera behind the display screen, to interconnected electronic work-pads, to an almost constant large-screen video link between the Europarc laboratory and colleagues in laboratories at Xerox's Parc in Palo Alto, the centre is drawing on a broad base of European human factors research for both staff and inspiration. (Reprinted with permission of Datamation® magazine© 15 April 1989, copyright by Technical Publishing Company, a Dunn and Bradstreet Company all rights reserved)

Chip set adds muscle to PC group's cause

The group of personal computer (PC) makers challenging IBM's attempt to dominate the 32 bit PC market became more credible when Intel demonstrated new PC chips vital to its cause.

The chip set is designed to support the extended industry standard architecture (EISA) developed by leading computer companies such as Compaq, Hewlett Packard and Zenith to rival the IBM backed Micro Channel Architecture (MCA).

EISA will allow personal computers to make full use of 32 bit processors while remaining fully compatible with existing PC standards. MCA is also

destined to set the [illegible] unlike EISA it is, MCA machines can't take all the plug in cards developed for earlier 8 bit and 16 bit PC's.

To squeeze the best performance out of Intel's 32 bit processors the EISA and the MCA specs need to be able to squirt 32 bit packets at least at high speed on 32 bit buses. The extra complexity effectively sets a standard for 32 bit PC's which is why the competition between EISA and MCA will be important.

For the last month, Intel has been supplying the chip set needed to build the EISA bus and the company hopes to go into full production in September 1989. The two chip set includes a device that controls memory access and the flow of data around the PC as well as a chip which acts as a link with the older style 8 bit and 16 bit AT bus. (Source: Electronics Weekly, 12 July 1989)

II. NEW DEVELOPMENTS

Cell opens door to 64 Mbit memory

Mitsubishi Electric of Japan has taken another step towards making the 64 Mbit dynamic RAM a reality by developing a stacked capacitor cell which can store a capacitance of over 30 femtofarads.

The cell can be used to produce a memory cell with an area of a 4-Mbit DRAM memory cell.

The announcement, at a symposium on VLSI architecture in Kyoto, Japan, is the second claimed breakthrough in the development of 64 Mbit technologies. In December last year, Fujitsu said it had developed a memory cell of a 64-Mbit DRAM using 0.2 micrometre design rules and a new three-dimensional structure.

Mitsubishi's breakthrough is to employ the conventional stacked-capacitor cell structure which it uses in its 4-Mbit and experimental 16-megabit DRAMs. The capacitor's electrode is cylindrically shaped with a diameter of 0.8 to 0.7 microns and a height of 100 nanometres. The fabrication process for the capacitor cell is the same as that of conventional stacked-capacitor cells with the addition of extra chemical vapour deposition, wet etching, and plasma etching stage. (Source: Electronics Weekly, 31 May 1989)

New diagnostic tool for semiconductors

Scientists at Lawrence Berkeley Laboratory, Berkeley, California, are using a powerful new diagnostic tool called an electron paramagnetic resonance (EPR) spectrometer to gain sometimes startling insights into semiconductor defects. The technique has allowed them, among other things, to discover a new type of defect in gallium arsenide.

The technique works by measuring the characteristic frequency of energy that a paramagnetic material like GaAs absorbs in the presence of a magnetic field. By finely matching a beam of microwaves to this frequency while exposing a sample to a changing external magnetic field, yields an EPR signal. This signal can serve as a "fingerprint" for identifying the chemical nature of any paramagnetic material in the sample. "The signal comes from an unpaired electron that aligns the axis of its spin parallel to the direction of a magnetic field, like the needle in a compass," explains Eicke Weber, a physicist at LBL.

By identifying an impurities, or their defects, such as vacancies, into semiconductor materials and tracking the resulting EPR signals, scientists are able to catalog those defects and later link signatures to signals detected in unknown samples. The silicon catalog, for example, lists the characteristic EPR signals for more than [illegible] different types of defects.

Using EPR, Weber and his colleagues have already identified and characterized an important defect called "EL2" in GaAs. "What surprises us is that thin film gallium arsenide grown by molecular beam epitaxy at low temperatures contains extensively high concentrations of antisite defects," says Weber. (Reprinted with permission from Semiconductor International Magazine, June 1989. Copyright 1989 by Cahners Publishing Co., Des Plaines, IL, USA)

Ice particles blast dust off chips

The world now knows that the use of certain chemical solvents is destroying the Earth's protective shield of ozone. So the search is on for safer alternatives, particularly in the electronics industry where "black-listed" solvents such as chlorofluorocarbons (CFC's) are used for cleaning circuit boards and microchips.

Two Japanese companies, Mitsubishi Electric and Taiyo Sanso have developed a technique which uses a high pressure spray of ice particles to "scrub" submicron dust particles from the surface of semiconductor wafers after chemical vapour deposition.

On the face of it this is a simple process where a fine spray of water droplets are frozen by passing through liquid nitrogen at -50°C.

Unfortunately though, dust comes in many shapes and sizes and accordingly ice particles of different sizes are needed to effectively remove all contamination from semiconductor surfaces. This Japanese system has been designed to produce two grades of ice particle ranging from 0.1 micron to 300 microns in diameter.

To produce the larger particles pure water is sprayed from a spiral sprat nozzle before being frozen by the liquid nitrogen. The smallest particles are created using a vapour system which freezes super-heated steam. The ice particles are then sprayed using the vapoured nitrogen pressure.

The system is only intended for use on semiconductor wafers, but the companies are planning to extend it to larger objects such as circuit boards, glass substrates and even dishwashing. There is evidently work still to be done, but the first step to water cleaning in electronics has been made and where there is a will there is hopefully a way. (Source: Electronics Weekly, 12 July 1989)

NHK shows ATV hardware

The world wide pioneer of high definition television (HDTV), the Tokyo based Japan Broadcasting Corp. or NHK, has developed its first hardware for advanced television (ATV) images for three pilot types using multiple sub Nyquist encoding (MUSE), a band width compression technique. Only computer simulated images were previously available.

The pilot types use the same basic technology as the five year old, 9 megahertz MUSE E system, also

known as Hi Vision, which NHK in April 1989 is using daily to transmit and receive an hour long HDTV broadcast by satellite.

At a recent industry exhibition, the three prototypes were shown privately to February to some US broadcasting industry representatives. The 8 MHz narrow MUSE has the sharpest images, which are between HDTV and enhanced definition TV (EDTV) quality, but it is not NTSC compatible because it is designed for simultaneous broadcasting over an NTSC and an ATV channel. The 9 MHz MUSE 9 prototype provides EDTV, and the 6 MHz MUSE 6 system yields images only slightly better than NTSC quality. Both are NTSC compatible. (Source: Spectrum, May 1989)

Reversible computers take no energy to run

An Australian physicist has proposed a simple optical model for a reversible logic gate. The gate uses no energy and therefore could have long-term implications for the computer industry. In principle, the device could operate, without producing errors, on the quantum level; that is, with individual photons representing "1"s.

Logic gates are the basic building blocks of all computers. They combine in various ways the signals used to represent 1s and 0s inside computers. If a gate were to be reversible - that is, if it were to give the same answer when its inputs and outputs were reversed - it would be very efficient. This is because any physical process which is reversible takes no energy. Logic gates commonly used in today's computers are not reversible.

The optical model for a reversible gate has been proposed by G. J. Milburn of the University of Queensland. It realizes a device, with three input lines and three output lines, known as a Fredkin gate. Richard Feynman previously proposed a way to implement the Fredkin gate using a two-state quantum system, which involved the spin of electrons. But his device was rather impractical.

In a Fredkin gate, one of the lines, designated the control line, has a logical status (that is, a state representing a 0 or 1) which is not changed by the gate. If, however, the bit on the control line is "1", the bits on the other lines are interchanged. If the bit on the control line is 0, their status is untouched. All components, such as AND gates and flip-flops, can be built from Fredkin gates.

Milburn proposes a Fredkin gate built from optical components. Essentially it is a device of mirrors and beamsplitters, known as a Mach-Zehnder interferometer. In each arm is placed a crystal with a refractive index which varies with the intensity of the light that falls on it. Light passing through it, therefore, undergoes a phase shift which depends on its intensity.

The device couples three travelling electromagnetic fields. Two input fields are combined by a beamsplitter, while the third, control field, couples through the crystal. When the control field is present, it induces a phase shift in that arm of the interferometer. It is this phase shift which can effectively switch the outputs when the fields are finally recombined by the second beamsplitter. Adjusted correctly, therefore, the crystal acts as an optical switch.

Such a device may, in principle, be operated at the quantum level with single photons carrying the logical states. According to Milburn's calculations, "quantum uncertainties need place no limit on the accuracy of a Fredkin gate". A device working at optical frequencies, his device would be isolated from thermal noise and so ideal for analysing the "ultimate limits to reversible computing". Milburn admits, though, that "it would be extremely difficult to make the device operate at the one photon level".

Nevertheless, such logic gates might one day enable computers to be built which are enormously more efficient than today's. Not only would they use little energy but they would be compact, too. At present, there is a physical limit on how close components can be squeezed, because the waste heat they generate has to escape to the outside world. (This first appeared in New Scientist, London, 10 June 1989, the weekly review of science and technology)

SX-3 supercomputers claimed to be fastest

NEC's (Japan) new SX-3 series supercomputers are reportedly the fastest in the world. The top-end model is capable of carrying out 22 billion floating-point operations per second. It employs 4 CPUs in parallel. The single-processor SX-3 machines are capable of 5.5 G FLOPS. Until now the VP-2600 supercomputers from Fujitsu, with their 1.7 speed of 4 G FlOPS, were regarded as the world's fastest supercomputers. The SX-3 series can use either a standard NEC operating system or a NEC-adapted Unix-based operating system. With the Unix-based OC users can run a total of 180 application software packages.

As of June 1990 Japanese users will be able to lease the SX-3 computers for Yen 52-170 million per month. Foreign customers will have access to them from late September 1990. In the four years beginning 1990 NEC expects to lease 80 of the machines domestically and 40 overseas. In the US it will focus its marketing efforts on corporate users rather than public research institutes and universities to avoid aggravating trade friction. In 1987 the US Government opposed its attempt to sell a supercomputer to MIT, and it does not want a repeat of that controversy. Cray Research (US) says that it is still the world's supercomputer leader despite NEC's introduction of the SX-3. It will introduce the Cray 3, with a top speed of 16 G FLOPs, by 1990. The Cray 3 will use GaAs chips rather than the usual silicon. Cray Research is also working on a more advanced computer called the Cray 4. (Extracted from Japan Economic Journal, 22 April 1989)

Honeywell reaches VHSIC goals

Considered a milestone, engineers at Honeywell's Solid State Electronics Division in Colorado Springs, Colorado, have fabricated an interface IC using fully scaled half micron VHSIC (very high speed integrated circuit) technology. Reportedly, this is the highest density VHSIC technology demonstrated to date and the ultimate density goal of the US Government's "first generation" VHSIC program.

Honeywell's VHSIC technology uses 0.5μm minimum circuit geometries and features four levels of metal interconnect. Metal linewidths are 1

small [illegible] chip - a [illegible] interface - is fabricated with 150,000 circuit elements and [illegible] of wiring, all in an area of [illegible]. (Reprinted with permission from Semiconductor International Magazine, April 1989. Copyright 1989 by Cahners Publishing Co., Des Plaines, IL, USA)

[illegible] thin films

[illegible] at Cambridge University in England aim to [illegible] thin film microcircuit fabrication down to dimensions of just 1 nm. They have already succeeded in making a continuous wire only 5 nm in width that is claimed to be the narrowest wire ever made.

This $4 million nanofabrication facility is devoted to the absolute extremes of fabrication using a 500 keV e beam lithography machine based on a transmission electron microscope (TEM) and a scanning tunnelling microscope.

Although this laboratory has not yet advanced beyond test structures to the fabrication of complete devices, it appears to be leading the field at the present time. (Reprinted with permission from Semiconductor International Magazine, April 1989. Copyright 1989 by Cahners Publishing Co., Des Plaines, IL, USA)

Lift off GaAs laser bonded onto glass substrate

Researchers at Bellcore (Bell Communications Research), Livingston, N.J., have fabricated the first semiconductor laser directly on glass, using an epitaxial lift-off technique that can put thin-film gallium arsenide epitaxy onto glass, silicon, metal and even diamond substrates. Bellcore has filed a patent application on the process.

The technique portends an end to current production problems in pairing incompatible materials, promising simpler integration of GaAs optical devices with silicon microelectronics. It could also directly couple the semiconductor devices that generate and detect optical signals with glass substrates that can transmit the signals.

Bellcore sees other promising applications. Placed directly on a thermally conductive metal or diamond substrate, the lift-off electronics could boost the operational efficiency of devices like high-output lasers by enabling them to handle considerably more power without an increase in temperature. Conversely, nuclear radiation-resistant electronics could be made simply by placing the electronics on an insulating substrate such as glass. And the cost of high efficiency solar cells could be significantly reduced: by reusing the GaAs substrate, only the lift-off epitaxial portion need be made again. (Reprinted with permission from Semiconductor International Magazine, May 1989. Copyright 1989 by Cahners Publishing Co., Des Plaines, IL, USA)

opto electronic integrated circuit being developed

A laser operated computer chip, the opto electronic integrated circuit, is being developed that could revolutionise computer technology. The chips would use lasers to transmit signals in the same manner as long distance telephone calls are transmitted using lasers and optical fibre. Scientists are experimenting to develop a new chip that could hold fibre optic channels and tiny lasers, which would emit coded light pulses that [illegible] [illegible] failure [illegible]. A [illegible] and [illegible] chip [illegible] [illegible] [illegible] electronic [illegible] [illegible] equipment, defence systems and a range of devices that need electronic components to be small, [illegible] in aerospace equipment [illegible] the appliances.

Researchers predict that opto electronic devices could be in commercial production within five years if a consortium is formed that could handle the huge amount of R&D work required. No companies, except perhaps IBM or AT&T, are [illegible] large enough to handle a project of this scope. Laser chips, which transmit distortion free with [illegible] the resistance encountered with wiring, could increase the speed of data communications by [illegible] hundred times compared to current technology and will be important to the development of new generations of supercomputers. Scientists, concerned about growing Japanese competition in the field, are seeking formation of a US consortium to develop opto-electronic ICs. (Extracted from New York Times, 13 May 1989)

Silicon chips stay cool for greater purity

Electronics companies could soon increase the number of components on a chip from millions to billions, thanks to a researcher in the US. Al Tash at the University of Texas in Austin has developed a new process that enables silicon crystals to grow at much lower temperatures. These crystals have fewer defects than ordinary silicon crystals.

The active part of a silicon chip is usually a single crystal of silicon. Normally, factories make these crystals by heating a substrate to 900°C in the presence of a gas called silane. When the gas comes into contact with the hot substrate, it reacts with it to form a layer of silicon. In time, this process builds up a single crystal of silicon.

Although manufacturers take great care to ensure that the crystal is free of defects and impurities, some inevitably arise due to the high temperature of the reaction.

These defects pose few problems in today's chips, but they are holding back the development of the next generation of electronic devices. Researchers claim that these devices will be orders of magnitude faster than those available today, because it will be possible to pack many more components onto a chip.

Tash's technique enables single crystals of silicon to grow at 300°C. He does this by supplying the extra energy for the reaction from an alternating electromagnetic field.

Tash excites atoms of an inert gas, argon, by placing them in an electromagnetic field. These atoms then form an energetic plasma of electrons and ions, which in turn pass their energy on to the silane gas, which provides them with the energy to form single crystals at 300°C. (This first appeared in New Scientist, London, 20 May 1989, the weekly review of science and technology)

New [illegible] chip

Mitsubishi Electric has developed [illegible] chip with a heterojunction type bipolar transistor that can convert light at 850 nm [illegible] with a [illegible] circuit current density of 0.2 micro amps/cm². The chip has aluminium

electrodes attached to the two sides of the 100 A thick membrane, which can be made with flavin or porphyrin. The membranes are made by adding alkyl chains to flavodoxin or by replacing the iron in cytochrome C with ruthenium and then adding the alkyl chains. (Extracted from Japan Chemicals, 4 May 1989)

VLIW technique can increase computer speed

The very long instruction word (VLIW) technique, a form of parallel processing, can make computer speeds significantly. The process involves simultaneous execution of various instructions compared to older techniques that break down a computation into its most elemental parts and then do each part consecutively. If a problem took eight steps under the old system, it may take only four steps and half the time under VLIW, which calls for software programs to be changed so that several processors can be put to work. Among the VLIW pioneers is Multiflow Computer (Branford, CT), a firm that has combined hardware and their compiler software to allow the issuance and computation of up to 28 instructions simultaneously. Another participant in the VLIW field is H. T. Kung, leader of a research group at Carnegie Mellon University. The group has developed Warp, a parallel VLIW computer, which is being sold by General Electric. A second-generation version, iWarp, is under development with Intel; Intel's new i860 microprocessor has some VLIW characteristics. (Extracted from New York Times, 31 May 1989)

"Hot electron" bipolar transistors developed

AT&T Bell Laboratories has developed "hot electron" bipolar transistors, which operate five times faster than conventional transistors. The underlying physics for the device were patented (US 4,829,343) for Bell Laboratories by A.F.J. Levi. Unlike recently developed hot electron transistors that require temperatures of around -200°C, the new device operates at room temperature. Hot (ballistic) electrons speed through a transistor in a straight line, compared to current transistors that pass electrons in a random, erratic path. The new devices operate at frequencies of up to 165 gigahertz, or 165 billion on-off cycles per second. The indium/gallium arsenide-layered transistors are paving the way for a breakthrough in communications technology that could allow the speed of data transmission to reach 1 trillion bits per second by 2000, when compared to 1.7 billion bits per second on the fastest lines currently operating. (Extracted from New York Times, 13 May 1989)

Prototype transistor

The University of Houston's Texas Center for Superconductivity has developed a high temperature superconducting magnetic-field effect transistor, which should be faster and more efficient than presently used transistors. The prototype device is about 500 times larger than the final envisioned chip, which should be 10 microns or less in size. (Extracted from Aviation Weekly, 5 June 1989)

Warm superconductors pick up magnetism

Researchers at IBM are now close to making detectors based on high temperature superconductors for measuring minute magnetic fields. These devices, known as Squids (Superconducting Quantum Interference Devices), can measure magnetic fields as small as one billionth that of the Earth. Scientists can use them to design magnetometers sensitive enough to measure the magnetic field given off by the brain and heart.

Roger Koch of IBM's research centre in Yorktown Heights, New York, announced the development of a Squid made from a high-temperature superconductor which works at 77 kelvin. This means the device could be kept cool with liquid nitrogen, and would need far less insulation than usual, making it less bulky. The development should enable scientists to miniaturize sensitive magnetometers to the size of a fist. Doctors could therefore, in theory, carry out a preliminary diagnosis of heart and brain disorders in their surgeries, rather than send their patients into hospitals.

The magnetometers can also be used to detect the very small magnetic field of rocks caused when their molecules originally oriented themselves with the Earth's magnetic field, when the rock was still molten. Because the Earth's magnetic field has changed over the years, geologists can use Squids to date rock formations. Scientists have developed Squids from high-temperature superconductors in the past, but the changes in magnetic field generated by the superconductor swamped the external signals that the Squids were trying to detect. This internal noise results from the thermal energy of the superconductor itself.

Koch decided to use a family of relatively new superconductors based on thallium. He found that, although these materials are just as noisy as other high-temperature superconductors, they are much more sensitive to the external signals that they are supposed to detect.

Koch has not managed to wrap his Squids in a coil which would carry signals from the outside world to the Squid itself. However, he says that this is a simple manufacturing problem and claims he should be able to solve it by the end of the year. He says that he should have demonstrations of working Squids within two years. (This first appeared in New Scientist, London, 1 April 1989, the weekly review of science and technology)

New material trips up superconducting theory

Physicists claim to have found a new superconducting material whose behaviour confounds prevailing theories to explain superconductivity. Allen Hermann of the University of Arkansas unveiled the results of early studies of the material at the annual meeting of the American Physical Society in St. Louis.

The material, a blend of thallium, barium and cerium, probably conducts electricity by the transmission of electrons, whereas most superconducting materials discovered so far conduct through "holes" which represent the absence of electrons. Scientists recently discovered a few materials that rely on electrons to conduct charge, but none superconducts at such high temperatures as Hermann's (below 85 K).

He stressed that because his material consists of a mixture of materials made up from the three constituents, some of his observations may arise from parts of the mixture that do not superconduct.

The recent discovery of superconductors that rely on electrons to transfer charge (n type superconductors) prompted some researchers to question some of the theories to explain high temperature superconductivity.

If Hermann's material turns out to be an n type superconductor, then its transition temperature (below which it superconducts) is too high to accord with conventional theories. Another oddity is that uniquely, Hermann's material contains a part that

does not have a layered structure. If the superconducting part of Hermann's mixture is n type superconducting, then "the theories will have to go back to first base", says Hermann. (This first appeared in New Scientist, London, 1 April 1989, the weekly review of science and technology)

Depositing superconducting thin films on silicon

Bellcore, Nippon Electric (NEC) and Rutgers University have jointly deposited superconducting thin films on silicon with critical current densities three hundred times higher than those previously obtained. Critical current is the maximum current that can be carried by a superconductor before it loses its superconducting properties. Bellcore claims that the new materials have a critical current density of 60,000 amperes/cm^2 at 77 K. The research could have a major impact on the development of high-speed electronic devices, including computers. It has been difficult to deposit high-temperature superconducting thin films on silicon, since the materials undergo chemical reactions. Orienting the thin films properly on the silicon substrate has also been a problem. Nippon Electric developed a buffer layer that was placed between the silicon and high-temperature superconductor. It also supplied silicon wafers coated with thin layers of barium titanate and magnesium aluminate. Thin films of yttrium-barium-copper oxide were then deposited on the silicon wafer via pulsed-laser deposition by Bellcore and Rutgers University researchers. (Extracted from Chemical Week, 19 April 1989)

First electrical generator using superconducting material

Northern Engineering Industries (Newcastle, UK) has built the world's first electrical generator using superconducting material discovered in early 1986 by International Business Machines scientists. The experimental generator was developed by UK researchers at the power engineering concern and Imperial Chemicals Industries, and tested at the University of Bath. It contains a 15 ft. coil made by ICI using the new superconducting materials that conduct electricity without normal materials' energy-wasting resistance. The generator is the first successful use of such a material in a power engineering application, according to T. Appleton, technical director and head of the superconducting research team, Northern Engineering. The company, which supplies parts for power stations, believes that the generator can be developed commercially. (Extracted from Wall Street Journal, 30 May 1989)

New superconducting materials may not be able to carry large electrical currents

New superconducting materials may never be able to carry large electrical currents. Researchers at AT&T Bell Laboratories and at IBM's Thomas J. Watson Research Center say that magnetic flux lines that penetrate the superconductors become distorted and produce resistance to current. Most large scale applications that have been proposed for superconductors (energy storage, power line transformers, medical imaging equipment, etc.) would produce or require large magnetic fields, but further investment in superconductors could be discouraged by the new reports. A few specialized applications of superconductors may still be developed, however, including military and medical devices. Such equipment would be very expensive, and would not likely generate a very large market.

The new superconductors apparently have magnetic bundles of particles that remain rigidly fixed at low temperatures, apparently allowing electricity to flow without resistance. Increasing the temperature beyond a transition point or increasing the magnetic field disrupts the arrangement of bundles. Although this type of "creep" occurs in standard low temperature superconductors, they are able to maintain their structure well enough to continue as superconductors. But the arrangement of the new compounds is apparently highly susceptible to dislocation by current or magnetic field. Even W. F. Doyle of American Superconductor (Cambridge, MA) says that development of something like superconducting wire will take many years. In addition to the problem of flux creep is the brittleness of superconductors and their tendency to absorb oxygen and water from the air.

Conductus (Sunnyvale, CA) hopes to develop superconductors for use in superconducting quantum interference devices (SQUIDs), which are used to detect minute changes in electromagnetic fields. SQUIDS might be used in measuring brain activity or in detecting submarines or missiles. Even when technical problems for making high-temperature SQUIDs are overcome, they will cost something like $1,000 per square inch. (Extracted from New York Times, 6 June 1989)

Snapshot of a superconductor in action

Researchers in Japan have developed a technique which gives them a direct view of magnetic lines of force passing through a superconductor. The technique enables researchers to see individual units of the magnetic lines of flux, known as fluxoid quanta, passing in and out of the superconductor.

The team, working for the company Hitachi, produced the image by making a hologram of a thin film of superconductor which they bathed in beams of electrons. The apparatus, in which liquid helium cools a thin film of metallic superconductor to 2.5 kelvin, has a resolution of 2 nanometres. The result, Hitachi says, is a direct image of individual fluxoid quanta as they enter the thin film.

The researchers admit that the image itself is not particularly exciting. But they say that a reliable way of observing fluxoid quanta directly may lead to a better understanding of the way magnetic fields behave around superconductors. In turn, this may lead to the development of superconducting materials capable of handling large currents - an important limit on today's superconductors. (This first appeared in New Scientist, London, 24 June 1989, the weekly review of science and technology)

Fastest 1 Mbit chip

IBM has developed what it says is the fastest 1-Mbit dynamic memory chip ever at its manufacturing facility in Yasu, Japan. The experimental chip is two to three times faster than existing 1 Mbit chips. It retrieves one bit of information in only 22 ns and can accommodate the equivalent of 100 pages of double-spaced typewritten text. The chip was achieved via a new Complementary Metal Oxide Semiconductor (CMOS) method developed at IBM's Technical Application Center in Yasu. (Extracted from Information World, 5 June 1989)

iWarp processor may challenge the Transputer

So far Inmos' Transputer chip has been the only microprocessor on the market specifically designed to be strapped together in large numbers to make powerful parallel processing computers.

But competition may be on the horizon. US chip giant Intel is working on a processor called iWarp that incorporates many Transputer like features. This is being developed under a contract for the US Government's Defense Advanced Research Projects Agency (DARPA).

Some 64 iWarps will form the heart of each of three parallel processing computers, which Intel is building as part of the DARPA contract for delivery in the middle of 1990.

Pennsylvania's Carnegie Mellon University and Intel have joined forces to develop iWarp, which they describe as an architecture for scientific computing and high-speed signal and image processing. The work has evolved out of an earlier project called Warp, a programmable systolic array designed by Carnegie Mellon and built by General Electric of the US. The Warp name comes from the faster-than-light speeds of the Enterprise in TV's Star Trek.

Although the three DARPA machines will feature 64 processors, the iWarp architecture is designed to build computers with up to 1,024. Each processing cell consists of a custom iWarp chip hooked to local memory chips.

An iWarp processor chip contains some 600,000 transistors and is clocked at 20 MHz. It sports a floating point processor, an integer processor and an on-chip communications processor.

Each chip can talk to its neighbours on equal terms (peer-to-peer) rather than the more typical master-slave set-up needed for harnessing conventional microprocessors together. It is this peer-to-peer communications ability that makes iWarp suitable for parallel processing and gives the chip its Transputer-like properties.

Each chip has four input ports and four output ports designed so that the output port of one chip can be physically connected to the input port of another. Each port can cope with data rates as high as 40 Mbytes per second allowing the chip as a whole to deal with peak rates of up to 320 Mbytes per second.

The floating point unit is capable of adding and multiplication. It can handle some 20 million floating point operations per second (MFLOPS) with single precision (32-bit) numbers or 10 MFLOPS of double precision (64-bit) arithmetic. The integer unit delivers some 20 million instructions per second.

The big difference between iWarp and the Transputer is that the Transputer has on-board memory while the iWarp depends on local SRAM chips.

Computers built from iWarp chips will run programs written in everyday languages such as "C" and Fortran like a conventional multiprocessing computer. But to exploit the real power of parallel processing, special parallel program generators have been developed for scientific and image processing applications.

iWarp chips can be hooked together in a number of ways. The simplest method is to connect them end to end in a ring.

iWarps can also be configured into two dimensional arrays. The three DARPA prototypes will feature 64 iWarp processors arranged in an eight by eight torus array with a total of 32 Mbytes of SRAM serving as 0.5 Mbytes of local memory for each of the processors.

Up to 1.5 Mbytes of memory can be attached to each iWarp cell in the DARPA machines. However, each iWarp processor can address up to 64 Mbytes of local memory, so there is plenty of scope to exploit shrinking memory chip technology.

The most powerful iWarp computer possible can be built from 1,024 processors arranged in a 32 by 32 array of 1,024 processors and can deliver a staggering 20,480 MFLOPS. (Source: Electronics Weekly, 3 May 1989)

III. MARKET TRENDS AND COMPANY NEWS

Market trends

GaAs semiconductor sales in US on the increase

US gallium arsenide (GaAs) semiconductor sales are predicted at $1.9 billion by 1992, a four-fold increase of present sales, according to Frost & Sullivan. The reason is that the utilization of GaAs will become more extensively used in such non-military areas as logic chips and optoelectronics. However, military uses will still make up almost half the GaAs market in 1992 because of enhanced utilization of microwave and mm-wave devices for electronic warfare and radar systems along with the launching of GaAs logic chips in an extensive equipment range. (Extracted from Machine Design, 25 May 1989)

European position in world semiconductor market

The director of Dataquest's European components group, Jim Beveridge, is in a pretty good position to judge the semiconductor scene, and he believes that Europe stands a good chance in its bid to become a semiconductor superpower.

"The major European groups - SGS-Thomson Microelectronics (ST), Philips and Siemens - look very much like any Japanese multinational. And with the EEC's population of 323 million, it is a larger market than the US or Japan," he said.

ST's pre-tax profits last year were $2.2 million on world-wide semiconductor sales of $1,085 million. The company managed world-wide growth of 26.3 per cent, with a regional split of 39.9 per cent in the US, 33.3 per cent in Japan, 21 per cent in Europe, and 29.3 per cent in the rest of the world.

Philips joined the billion dollar club last year, with sales of $1.002 billion. Only 15 companies, out of 240 firms world-wide, have sales exceeding 1 billion. And companies in the top ten accounted for over 50 per cent of the total market last year.

The complexities of the product mix and the escalating cost of developing and manufacturing leading edge products is going to make it difficult for even the largest broad based semiconductor suppliers to go it alone.

As the cost of capital investment continues to rise, participation in particular commodity products and high margin businesses such as ASICs will be more difficult to support, says Dataquest.

A major reason for this is that these product development paths are becoming increasingly divergent - while future DRAM generations will depend on trench and other 3-D technologies, Actel will continue to stress CMOS technology and multiple metal deposition.

In spite of their differing demands, companies will have to have their feet in both worlds if they intend to be major suppliers to the data processing market. The Hitachi/TI agreement suggests one way of meeting this challenge.

The European Commission accepts the importance of having a stake in the consumer electronics business through development of high definition television (HDTV). And Dataquest predicts that the European Commission, supported by local receiver manufacturers, will spurn adoption of Japan's Multiple Sub-Nyquist Sampling Encoding (MUSE) standard in favour of the European High Definition Multiple Analogue Component (HD-MAC) transmission standard.

Europe's HD-MAC transmission standard will lag five years behind Japan's MUSE, says Dataquest. It will be preceded by a number of intermediate MAC receivers, before it finally reaches consumers in the mid-1990s.

Overall, Dataquest paints a positive picture of Europe's consumer electronics business. It is now generally accepted that an inward looking approach would be fatal for the European chip industry. And collaborative ventures, like JESSI, look like carrying this initiative forward.

The decision by the EC to call for wafer fabrication in Europe in order to quality devices as European is expected to increase the number of wafer fabrications being built in there. Previously parts only had to be assembled and packaged in Europe in order to avoid the 14 per cent import tariff.

Europe is expected to see an increasing amount of activity on the part of JESSI in the months ahead. There will also be an attempt to seek reciprocity with the American microelectronics initiative, Sematech. All in all, the prospects for the European semiconductor industry are looking good. (Source: Electronics Weekly, 19 April 1989)

Corporate networking

Computer manufacturers are integrating their processors with PBXs to link voice traffic and data in what is becoming the next wave of corporate networking. Recently, IBM, AT&T, Wang and DEC introduced new interfaces to hook their data processing hardware and applications with their voice communications equipment. The idea is to improve telemarketing and customer service applications in banking, insurance and consumer goods. IBM introduced CallPath, which hooks CICS applications on 370 mainframes with voice switching abilities of the Rolm 9750 PBX. AT&T has developed hardware and software that exchanges information between host computers and its Systems 75 and 85, and the Definity PBXs. The company also has an ISDN which provides one way communication from a phone line to a computer. Wang's Intercom subsidiary recently upgraded the automatic call distribution capabilities of its Integrated Business Exchange. DEC has introduced its Computer Integrated Telephony, which connects VAXes and PBXs from Northern Telecom. (Extracted from Computer Systems News, 15 May 1989)

Use of portables and laptops on the increase

Portable computers are posing a strong challenge for desktop computer manufacturers. Portable and laptop computers are being introduced with faster processing speeds, improved video displays, and improved video options. Dataquest (San Jose, CA), a market research company, notes that desktop personal computer sales represented 90 per cent of the computer market in 1988, with portables and laptops accounting for the balance. Dataquest analyst R. Charlton says portables will account for 15.5 per cent of the computer market in 1992, compared to about 83 per cent for desktop computers. Laptops will account for 1.5 per cent. The growth is substantial, compared to the overall market, which is growing at about 10 per cent per year.

Dataquest expects the portables market to grow by 37 per cent by 1992. Size is an obvious attraction. Portables leave more room on desks for other tools. But improved quality at a reasonable cost is also a selling point now, thanks to surface-mount technology, lower heat radiation, smaller and more rugged disk drives and flat-panel display technology. While most laptops cannot accommodate more than one add-in expansion card, larger portables may feature additional expansion slots built in. On the other hand, Dataquest's Charlton noted that since some laptops and portables have proprietary architectures, expansion cards that function in one machine may not function in another. (Extracted from PC Week, 29 May 1989)

Application maintenance

Increasingly, users are handling applications development themselves instead of using a central information system group (IS). However, they turn to IS groups for applications support. According to a poll, companies will develop a spreadsheet into a database that becomes so important that an IS is asked to take over the data base. A poll of 53 information service executives in New York, NY, shows that 27 per cent of them are having their IS departments take over application maintenance. Another 48 per cent felt that their firms would follow suit in three to five years. Some 40 per cent are growing less dependent on IS departments on application development. Some 60 per cent felt that will be the case in their companies in three to five years. About 60 per cent indicated spending for [illegible] development tools is increasing. Budget support for computer-assisted software engineering (CASE) is reported to be increasing. Systems are becoming more complex with round the clock use and maintenance. Establishing a company wide system requires answers to questions of ownership and control of data. (Extracted from PC Week, 12 June 1989)

IT revenues

Revenues of the information technology sector rose by 11.2 per cent to $604.7 billion in 1988, according to the Computer & Business Equipment Manufacturers Association. Computers and other electronic data processing equipment accounted for $304 billion of this, compared to $112.2 billion for telecommunications equipment, $62.1 billion for office equipment and $126.4 billion for software and services. Revenues from the information industry rose an average 10.8 per cent per year between 1980-88, but will rise only 8.7 per cent per year between 1988-93. All equipment markets will decelerate except for telecommunications equipment.

Economic conditions, such as a slight recession predicted for start 1990, are responsible. The growth rate for electronic data processing equipment averaged 12.3 per cent per year in 1980 88, and will fall to 8.9 per cent per year in 1988 93. Office equipment likewise rose 9.3 per cent per year in 1980 88, as against 7.7 per cent per year forecast for 1988 93. The software and services sector had a growth of 19 per cent per year, against a forecast for 11.9 per cent per year. Telecommunications equipment will rise to 5.3 per cent per year in 1988 93, compared to 4.5 per cent per year in 1980 88. (Source: Journal of Commerce, 25 May 1989)

SPARC products on the threshold

The workstation industry is poised to introduce products based on the Scalable Processor Architecture (SPARC), based on Sun Microsystems' 12.5-mips SPARCstation 1, according to industry analysts. Several Taiwanese companies may enter the market in the second half of 1989 and first half of 1990. SPARC clones could cost $5,000-10,000. If industry members agree on hardware standards, software sales could mushroom and prices drop. Some products coming out include a server by Solbourne Computer and a SPARC machine with an MCA bus and add-in card by Mission Cyrus Group (Vancouver, BC). Many vendors are enthusiastic about the MCA bus for SPARC products. Sun Microsystems (Mountain View, CA) is working on a laptop SPARC machine. The company is also supportive of SPARC clones, believing that a small share of a large market would be as profitable as a large share in a small market. (Extracted from PC Week, 12 June 1989)

The rosy future of multi-chip modules

World-wide demand for multi-chip modules will increase to 105 billion packages, for all package types in 1997, according to a forecast by BPA - an international electronics business consulting firm, based in Surrey, UK. This figure is significantly higher than the total 1987 demand of 31.8 billion packages and the 1992 prediction of 57.2 billion packages. The demand for specific IC packages can be divided into three sectors. There are packages for insertion, packages for surface mount technology (SMT) and a third sector for TAB, chip on board and flip chip bonding. The curve representing SMT indicates that multi-chip module (MCM) technology will emerge as a major and new IC packaging technology. This prediction comes from Maurice G. Sage, founder and managing director of BPA, who presented the results of the World-wide Multi Chip Module Study forecasting the future of MCMs through 1997 at Nepcon West in Burlingham, Calif., last March.

According to Sage, the MCMs thin film multilayer interconnect structures will act as an important space transformer between the IC and the next level of interconnection. The MCM is essentially a hybrid for wafer scale integration (WSI) in that it comprises a collection of dies substituted for a single IC. Sage explained that because of unsolved technical problems, wafer scale integration will not be a practical solution to the package density problem until the late nineties. In the meantime packaging engineers will investigate MCMs as a new packaging and interconnection technology. (Reprinted with permission from Semiconductor International Magazine, April 1989. Copyright 1989 by Cahners Publishing Co., Des Plaines, IL, USA)

Disks and drives in 1992

Erasable optical disks are set to dominate the data storage market over the next 10 years, according to Frost and Sullivan, the market research organization. It foresees world sales of disks and drives peaking in 1992 at $1 billion. Most of the products on offer are in the evaluation stage with computer systems houses and other large users. Details are contained in its 175 page report, costing 390 pounds sterling, entitled Erasable Optical Memories. The report predicts that, by 1993, nearly one million drives will have been installed and 10 million disks sold. Optical recording uses a very narrow laser beam to make microscopically small digital marks on the disk surface. Techniques include altering the direction of magnetization of a magnetic coating, changing the chemical state of a surface material and making tiny bumps. All result from a pin-point of heat and are reversible through a second exposure to laser heat. The report says that the first uses of the medium will be in computer-aided design, image processing, desk-top publishing and wherever large amounts of data are stored. Later, use will spread to ordinary business and industrial systems. By 1993, it adds, the recording cost per bit of data will be 10 per cent of that of magnetic media. (Source: Financial Times, 31 March 1989)

Networks fastest growing segment of computer industry

Fifteen per cent of the 40.1 million business PCs in the US are linked together, making networks the fastest-growing segment of the computer industry. World-wide sales of network hardware and software reached $4.8 billion, up 85 per cent compared with 1987, according to Dataquest. Companies that make network hardware and software are benefiting from the trend. Novell pushed its 1988 sales up 53 per cent to $281 million, while 3Com had a 61 per cent gain to $252 million. Networking should also help computer makers as a whole, as demand will increase for PCs, disk drives and other equipment. IBM is showing its confidence in the market by spending $500 million in two years to develop software packages that allow PCs, minicomputers and mainframes to easily share information. Though many PC networks are currently relegated to such simple jobs as sending documents to a laser printer, ultimately they will be able to integrate pieces of information from far-flung memory banks in a matter of seconds. One factor hindering attainment of this goal is the inability of manufacturers to agree on technical standards, which in turn slows development of networking software. (Extracted from Business Week, 5 June 1989)

Estimated World-wide Revenue and Market Share of Major Workstation Vendors
(Millions of dollars)

Vendors	1988 Revenue	1988 Market Share	1987/1988 Point Change	1987/1988 Growth
Sun Microsystems	1 165	28.3%	+4.2	80.6%
Digital Equipment	765	18.6%	+1.8	70.8%
Hewlett Packard	695	16.9%	+1.7	89.8%
Apollo	555	13.5%	-4..	18.1%
Intergraph	275	6.7%	N/A	81.4%
Silicon Graphics	180	4.4%	+0.7	81.8%
IBM	105	2.6%	1.1	10.5%
Others	370	9.0%	-4.5	10.4%
Total	4 110			54.0%

(Source: Dataquest)

Critical point of image processing industry development

The imaging processing industry is at a critical point in its development. Some early leaders are now facing stiff competition from large computer companies such as IBM, Wang, DEC and others. One early leader, Plexus (San José, CA), has filed for Chapter 11 bankruptcy. Overall, the market is expected to grow from $1.2 billion in 1988 to $2.1 billion in 1993, according to Dataquest. In 1988, 5,000 image processing systems were shipped; in 1993, the figure is expected to climb to 35,000 and above. However, hurdles stand in the way. One obstacle is that the industry is in its infancy. Buyers take a long time to make a purchase, sometimes up to 18 months. As a result, vendors must have large investments, which favour larger companies. A large investment is also needed for the technology; vendors must provide strong hardware, work flow software and applications software.

IBM seems to be a likely candidate to become the industry standard, according to P. Thomas, analyst at International Data. It already has key accounts with United Services Automobile Association and Citibank's credit card processing centre (Sioux Falls, SD). Other companies in the battle for image processing leadership are Wang, DEC, FileNet and AT&T. According to analysts, networked PC systems should show the fastest growth, while growth in the stand alone PC market should be minimal. Analysts say small vendors can still enter the market. In 1987, 73 per cent of image processing systems were for storage and retrieval. This number should drop to 39 per cent in 1993, when check and credit card processing become major uses. (Extracted from Computer Systems News, 15 May 1989)

Changes in design automation tools

The electronic design automation (EDA) business will become primarily a software business in the early 1990s, according to a recent study by The Technology Research Group, Boston, Mass. Software revenue growth will outpace application vendors' sales in general, as users buy more add-on software for systems already in place and fewer new systems are sold turnkey.

The per cent of systems sold turnkey will decline to about 10 per cent in 1992, says the group, down from 23 per cent in 1988. Factoring out MS-DOS/OS-2 platforms shows an even more dramatic decline. In 1986, 55 per cent of UNIX/VMS workstations were shipped turnkey. The turnkey portion peaked at 58 per cent in 1987, and will fall to just 20 per cent in 1992.

The study also indicated that - by the early 1990s - all software suppliers will have to offer network licensing of their products, and all hardware suppliers will have to offer the facilities to support it. In addition, UNIX based platforms will continue to dominate new sales through 1990. When a 32 bit operating system for IBM's PS/2 machine will begin to gain ground, as it exploits the 386 chip with graphics based OS/2 and multitasking software. (Reprinted with permission from Semiconductor International Magazine, June 1989. Copyright 1989 Cahners Publishing Co., Des Plaines, IL, USA)

US chip makers on upward trend

A marked improvement in America's semiconductor industry has been revealed in results from leading chip makers.

Motorola's sales rose 11 per cent in its chip business and overall the firm made profits of $123 million on sales of $2.17 billion in the first quarter of this year.

Intel also saw chip sales rise during the first quarter, which helped it post profits slightly higher at $97 million from $94 million (55.9 million pounds sterling) the year before. Andy Grove of Intel sounded a note of caution by adding that orders were unusually biased to the short-term end, making predictions for future sales difficult.

Micron Technology, the dynamic RAM specialist, said that during its second quarter, which ended at the beginning of March, sales had nearly doubled at $113.8 million, producing profits of $29.2 million from $16.9 million in the same period of last year. Micron chairman and chief executive Joe Parkinson said the result reflected a broadening acceptance of its memory products. (Source: Electronics Weekly, 19 April 1989)

Company news

Japan's giants fight it out in 4-Mbit arena

The battle for dominance in 4-Mbit dynamic RAMs now has at least eight Japanese competitors.

The front runner must be Toshiba, which still leads in production of 1-M chips. Toshiba's plant at Oita, on the island of Kyushu, is turning out samples of 4-M chips at a rate of "several tens of thousands a month". The company plans to spend ¥70 billion (300 million pounds sterling) on a second line for 4 M chips at the plant. By mid 1990, it aims to produce one million 4-M chips a month.

Hitachi, which came within a whisker of abandoning the DRAM business altogether, is now producing 4-M chips at the rate of 10,000 a month at its main R&D base in Musashi, Tokyo. In September, it plans to install production lines in its plant at Kofu, just west of Tokyo and Naka. The two plants will produce a combined total of 200,000 chips a month, rising to 400,000 by the end of the year.

NEC, which says it is producing commercial samples of 4-M DRAMs at its laboratory, will have its first 4-M line running by March 1990. This will start at the rate of 200,000 chips a month.

Fujitsu is shipping commercial samples of 4-M DRAMs, but has not yet released details of investments in Japan.

Mitsubishi Electric is also shipping commercial samples of the new chips. It plans to begin mass production by the end of the year.

Matsushita is building production lines for 4 M chips at its plant in Toyama Prefecture, north west of Tokyo. The lines are scheduled to begin production by April 1990.

Another company best known for its consumer electronics products, Sharp, plans to begin shipping commercial samples of 4 M DRAMs later this summer. The company plans to begin mass production at its plant near Hiroshima in late 1989.

Sanyo Electric plans to begin shipping samples of 4 M DRAMs by April 1990. (Source: Electronics Weekly, 3 May 1989)

Sematech rolls out its first silicon

Sematech, the US chip production equipment consortium, has reported a major technical milestone, in fabricating its first devices.

This achievement is essential to moving to the central purpose of Sematech - developing leading-edge manufacturing techniques and equipment. With the fabrication of this "yield-learning" device that has state-of-the-art 0.8-micron lithography, Sematech can begin the essential work of yield improvement, tuning manufacturing methods, and improving production equipment.

Spokesmen claim engineers have been working literally around the clock, with 16 hour shifts each, to meet the end-of-March 1989 schedule to produce these devices. Sematech opened the facility in November 1988.

They are 64 Fbit SRAMs designed at AT&T, run primarily on AT&T-supplied production equipment, and with AT&T-made masks.

The next major milestone for Sematech is the fabrication of 4-Mbit dynamic RAMs, scheduled for the end of 1989. (Source: Electronics Weekly, 5 April 1989)

US giants rev up chip production

Faster microprocessors for personal computers and workstations have been unveiled by US chip giants Intel and Motorola amid speculation that both sides are preparing to launch powerful chips into the embedded control market.

Intel unveiled its latest 32-bit microprocessor, the million transistor 60486, as well as a 33 MHz version of its hugely successful 80386 chip while Motorola announced a souped-up 50 MHz version of its 68030 processor.

Motorola will launch a new family of embedded controllers. Intel is also expected to deliver a major new embedded control product based on its reduced instruction set computing (RISC) technology.

All these devices use the latest 1μm CMOS chip-making processes. Both companies are racing to exploit their 1μm CMOS technology and deploy products in as many areas as possible. Both companies are active in conventional microprocessors, RISC processors and embedded controllers.

The 80486 delivers between 15 and 20 million instructions per second (MIPS) and incorporates 80386-based integer processor, an 80387 floating point co processor, as well as fast cache memory on the same piece of silicon.

The 33 MHz 80386 is already in volume production, while the 80486 is currently being sampled and will go into production in late 1989, according to Intel's microprocessor marketing boss Claude Leglise.

Arch rival Motorola has announced a 50 MHz version of its 68030 32-bit microprocessor which will deliver some 17 MIPS, around twice the performance of the Intel 80386. The device will be sampled in May and go into full production in the third quarter of 1989. But the company is still not releasing any numbers or dates about its forthcoming million transistor 68040.

Laptop personal computers (PC's) weighing less than 1 kg and fitted with the equivalent of a 10 Mbyte hard disk built from flash memory chips, will be appearing before Christmas, according to Intel's Dr. Dick Pashley, who runs Intel's flash operation which has just unveiled 512 Kbit and 1-Mbit flash chips which can be erased more than 100,000 times before they wear out. Pashley reckons that the non-volatile electrically erasable flash memory chips will replace hard disks and their associated dynamic RAM memory chips in most PCs. However, flash will not completely eliminate non-volatile memory from PCs: fast DRAM and static RAM will still be needed to keep the microprocessors happy. Intel has already signed up five PC makers around the world and other computer firms have been signed up by the likes of Seeq, Toshiba and AMD. (Source: Electronics Weekly, 12 April 1989)

Intel to launch complex chips

US chip giant Intel is planning two major announcements for the autumn.

One will be a 66 MIPS 1.2 m transistor enhanced version of its 80960 32-bit microcontroller, called the 80960C. The other is a 4-Mbit EPROM - the world's first at this level of density.

The 4-Mbit EPROM was sampled, said Hans Geyer, Intel's assistant general manager for Europe, at the Dataquest Semiconductor Conference in Munich.

The 4-Mbit chip will be on general sale at a price somewhere between $100 and $250 in the fourth quarter of 1989.

Geyer said the key improvement that the 80960C brings to the microcontroller market is the ability to execute multiple instructions per clock cycle. Next year the chip will be upgraded to 100+MIPS performance.

Geyer told the conference that future second sourcing of Intel microprocessors was becoming a practical impossibility. He reckoned the production processes needed to manufacture them were so complex, that no other company would be able to successfully replicate the process to manufacture versions with comparable performance. He predicted that in ten years' time evolving microprocessor technology would result in 1 in^2 processor chips containing 100 m transistors, split 60 m for logic and 40 m for memory, which could perform 1 billion FLOPS and supply 2,000 MIPS running at 250 MHz. (Source: Electronic Weekly, 14 June 1989)

IBM eyes role in European project

IBM is trying to get in on a $2,000 million European advanced microelectronics project, although the European partners are against the move because they are not allowed to join a similar US project.

But IBM could find another way in because the European team is seeking funding from the EC's ESPRIT research and development programme, which does not exclude non European companies as long as they have research centres here.

The JESSI project - Joint European Sub micron Silicon - involves Philips, Siemens and SGS Thomson. It aims to cut the width of the data paths on silicon chips by more than half.

The companies expect to put up half the funds and want the rest from the Commission and from their own governments through EUREKA, the programme which

co-ordinates national research initiatives set up by individual EC countries.

Funding for JESSI is expected to be finalized in June.

The US equivalent of JESSI is Sematech, set up by leading companies, including IBM, with 50 per cent government funding. Its budget is $200 million a year. (Source: Computer Weekly, 11 May 1989)

Fujitsu links with China on printers

Japan's top computer maker, Fujitsu, has announced plans to set up a joint venture in China to make personal-computer printers.

It would be the first joint production of computer printers by Japanese and Chinese companies.

Under the accord reached with Changjiang Computer Union Corp. of China, Fujitsu officials said production will begin with Fujitsu supplying major parts and components to the Chinese company for assembly.

Officials said Fujitsu hopes to establish the venture in the first half of 1990.

Among details to be worked out is the scope of production. It is believed that the joint company may manufacture between 100,000 units and 200,000 units a year when full production gets under way. (Source: Electronics Weekly, 24 May 1989)

Hitachi R&D

Hitachi has become the latest Japanese chip maker to announce European R&D facilities. The company will help fund research into ultra-miniature optical and electronic devices, in collaboration with Cambridge University's Cavendish laboratory, whilst a team at Trinity College, Dublin, will look at neural networks and high-level computer languages.

Under the terms of the Cambridge tie-up, up to ten researchers will spend periods working both in the UK and Japan. The results, both in terms of knowledge and commercial gain, will be shared between the university and the company. (Source: Electronics Weekly, 26 April 1989)

National cuts losses by dropping flash chips

US chip giant National Semiconductor is pulling out of the flash non-volatile memory market as a direct result of its financial problems.

It has halted development of future flash products and the factory needed to make them. This move will worry National's flash partner, non-volatile memory start-up, Seeq Technology, which relies on National as a second source.

National will use the 0.8 micron process to make other devices such as CMOS erasable programmable read only memories (EPROMs). National's chief, Charles Sporck, sees EPROMs as an area ripe for profits. He promises a company wide return to profits this year.

The company has been very successful in the CMOS EPROM market since it joined in 1984, claiming some 20 per cent of the market at densities of 512 Kbits and lower. But Japanese competition has surged in recent months.

Cheap, the profit pinch and the Japanese rush at high density EPROMs is pushing National to respond by increasing its EPROM effort at the expense of planned flash developments. (Source: Electronics Weekly, 14 June 1989)

Zenith, AT&T team up for HDTV R&D ...

Promising a multibillion dollar industry, high definition television (HDTV) has attracted a US partnership for a $24 million project, strengthening the country's chances of catching up with Japan and Europe.

In late February, AT&T Co. and Zenith Electronics Corp., Glenview, Ill., signed an agreement to develop a receiver and terrestrial transmission system for 35-mm film quality images based on Zenith's proposed Spectrum Compatible HDTV transmission system, which is compatible with the US National Television System Committee (NTSC) 6-megahertz bandwidth.

In Zenith's proposed Spectrum Compatible HDTV system, video information composed of frequency components up to 200 kilohertz is transmitted digitally, while information above 200 kHz is sent in analog form. Because more than 99 per cent of the power is in the low-frequency range, the high-frequency data can be transmitted at low power for a high signal to noise ratio. The low-frequency data are sent at a low video bandwidth and so can be sampled, digitized, and sent during the vertical blanking interval, the time in which the scanning electron beam returns from the bottom right to the top left of the screen. To further minimize the potential for interference, their plan would phase-lock all vertical synchronizing pulses broadcast in the United States.

The system's low power and special signal structure would make available frequency channels now left unused to prevent signal interference. Existing channels could continue to broadcast NTSC-quality images, while unused channels could broadcast HDTV images.

AT&T Microelectronics, Berkeley Heights, NJ, plans to use its existing 0.9-micrometre CMOS chip process as well as bipolar and gallium arsenide technologies to design and manufacture microprocessors for the system's signal processing, analog-to-digital and digital-to-analog conversion, error compensation, and horizontal, vertical, and temporal filtering.

Zenith and AT&T plan to have a demonstration model by late 1989. (Source: Spectrum, May 1989)

Optical memories score

When Steve Jobs of Next Computer Corporation and co founder of Apple Computer launched the first personal computer from his new company a few months ago, it featured, among other innovations, a novel optical disk drive which could not only store data but the data on disk could be rewritten, the first time such a drive had been incorporated in a volume computer product. The Next innovation was a milestone in a history of a technology which could influence the development of personal computing and document processing just as profoundly as the latest, very fast microprocessor chips from Intel or Motorola. Information technology specialists are as excited about the potential of optical memory technology in general and rewritable disks in particular. Optical memory technology essentially

offers the possibility of huge storage capacity at very low cost. As such, it represents a serious threat to conventional magnetic disk and tape storage. To give an example, a conventional 2,400 foot computer tape can store about 100 million bytes of data. ICI of the UK has developed an optical storage tape of the same length which stores one billion bytes of data. What gives optical memories the advantage over magnetic memories is the way in which more information can be packed into the same space. The technology depends on the use of a high powered laser to create a physical change in the surface of the tape or disk. (Source: Financial Times, 8 May 1989)

First fuzzy processor

Omron Tateisi Electronics has delivered the world's first product line of fuzzy processors. Omron sold fuzzy processor engineering prototypes in 1988, but the FZ-3000 rack-mount and FZ-3010 tabletop processors are ten times cheaper and process ten times as many rules (128 maximum). Both processors can have eight analog inputs and two analog outputs. Each uses seven levels of fuzziness and a "don't care", with a seven points membership function that is piece-wise linear. The processors are composed of a special fuzzy chip, standard microprocessor, RAM, ROM, and connect to a host via serial I/O. An NEC PC-9801 personal computer programs the system via a system console control program. Omron forecasts 1989 revenues of Y1-2 billion, or $7.6-15.2 million, and up to $767.6 million in 1994 revenues. (Extracted from Electronic Engineering Times, 22 May 1989)

IV. APPLICATIONS

Space industry seeks out tough transputers

The European Space Agency is to evaluate a parallel-processing computer in space, built from transputers. These chips will travel on a small satellite built by the University of Surrey, which Arianespace, Europe's commercial satellite launch company, will put into space in the autumn.

Chris Elliot, from Smith Associates, the company that completed a feasibility study of the idea for the ESA a year ago, believes it will be the first parallel-processing computer to fly in space. The ESA is to pay about 100,000 pounds sterling for the computer.

Transputers are one of Britain's most successful electronic developments. They are produced by Inmos, the British semiconductor company which Thorn EMI sold last month to the Franco-Italian company SGS Thomson.

Transputers can process more data more rapidly than conventional chips, because they combine processing power and memory on a single chip. They are designed so that they are easy to link up to form a parallel computer. Computers that process data in parallel work much more quickly than conventional machines of a similar size.

The array of transputers could process and compress remote sensing data so that the satellite would not need bulky computer memories. The transputer is also more resistant to damage by cosmic rays than conventional chips. Cosmic rays harm the electronics on satellites in two ways, one irreversible, the second reversible. Irreversible damage is caused by a gradual accumulation of charge. During its study, Smith Associates found that the manufacturing process by which transputers are made means that they do not accumulate charge to the same extent as conventional chips. Elliot says that the tolerance of the transputer to radiation is three times as high as the original specification NASA produced for chips in the space station.

The reversible damage caused by cosmic rays occurs when they flip a transistor from on to off, or vice versa, thus changing a piece of information. The parallel processing computer on the University of Surrey's satellite is designed so that it carries out the same calculation three times, simultaneously, and compares the answers. If cosmic rays have changed a piece of information so that one of the processors gets the answer wrong, the other two outvote the third and flip the maverick transistor back to the right position.

The array of transputers is being built at Surrey's Spacecraft Engineering Research Unit. Two very successful satellites built by the group are already in orbit. The two satellites to be launched this autumn cost 500,000 pounds sterling. By comparison, larger communications satellites can cost up to 30 million pounds sterling. (This first appeared in New Scientist, London, 15 April 1989, the weekly review of science and technology)

Low-cost blue to the light-emitting diode spectrum

A tiny Durham, NC, company has developed a silicon-carbide blue-light-emitting diode that will sell for a small fraction of the $45 to $80 charged by other companies for similar LEDs. Cree Research Inc., is pricing volume quantities at $2 apiece packaged and $1 unpackaged. Samples are priced at $40. Used with readily available red and green LEDs, the low-cost blues mean LED displays can now compete with incandescent lights in giant-screen displays for stadiums and other applications. The new diodes can also be used in digital colour printers and medical equipment, where there is a need for near-ultraviolet light sources. Cree plans to offer a variety of diodes, ranging from single-colour LEDs to chips that will emit multiple wavelengths and colours. (Source: Electronics, May 1989)

Systems for small firms

New computer hardware and software has made it possible for even small firms to use computer-controlled manufacturing. One such system is ToolChest, developed by Battelle Memorial Institute specifically for small shops. The system is based on the CAD/CAM equipment used by large manufacturers, which allow design of a part on a computer screen, followed by drawing up of instructions so that a machine can cut out the desired shape in wood, metal or plastic. Small manufacturers are using this type of technology to increase production, improve quality and produce more complex products. With such capabilities, small companies are winning contracts from major auto, aerospace and machinery firms to make parts that might otherwise have been made by contractors in the Far East or Latin America. Manufacturers that have not adopted computerized production within the next 10 years will likely find it difficult to remain competitive. (Extracted from Wall Street Journal, 17 April 1989)

New tape drive, tape cartridge system

Kodak has developed the technology for a tape drive tape cartridge system with 3 Mbytes per second

data transfer rate. The data transfer rate is accomplished via an 8-channel, magneto-resistive head. The 2-Gbyte MCR will be the first version demonstrated by end-1989. According to E. Deller, business research director at the company's Mass Memory Division, Kodak will make and sell the media and license the drive technology to drive and head manufacturers. The data transfer rate is as fast as the quickest current disk drives, and five-ten times faster than alternative tape technologies. Transfer rate of 6 Mbytes/s is expected in later versions. (Extracted from Electronic Engineering Times, 5 June 1989)

Geographic information systems

The meshing of automated mapping and data processing to make electronic maps can help solve a variety of problems that might improve the bottom line. Many companies are using a geographic information system (GIS) which permits the storage of dozens of various types of data and then provides an understandable, integrated display of all or some of the data. The field is considered one of the fastest growing sectors of computing. Its uses continue to be expanded, ranging from planning marketing strategies to identifying crime patterns to plotting tracks of wildlife in locations where there may be development of natural resources. Potlatch, for example, placed information on its 4,900 separate timber stands on a computer. Previously, the data on even one timber stand was housed in several hundred office files. In many cases, the information was miles apart. Now, by using a terminal, a forest manager can quickly research data on the stand by zeroing in on a map of a certain location. (Extracted from Fortune, 24 April 1989)

A new IC application: the human heart

The 200,000 or so people that survive sudden cardiac arrests each year can now look forward to a longer and more productive life - by having sophisticated computer systems implanted in their bodies.

IC designers at companies like Ventritex (Sunnyvale, Calif.) and Cardiac Pacemaker Inc. (St. Paul, Minn.), have taken pacemaker technology to new levels of sophistication, far beyond the simple devices with which most of us are familiar. The latest pacemakers are actually combination pacemaker/defibrillators that monitor heart activity. If the unit senses that the heart starts beating too quickly - a condition called tachycardia - it will automatically try to pace the heart back to its normal rhythm. If this anti-tachycardia scheme does not work, the next step is defibrillation - the delivery of a sizeable shock (up to 750 V) directly to the heart.

The real sophistication of the new generation of pacemakers, however, is in their programmability. Physicians can program and reprogram them - from outside the body - and can even play back EKG activity recorded by the unit before and after shock treatment. This lets them adjust the sensitivity as well as the treatment.

Two of the four ICs in the Ventritex pacemaker-defibrillator are full custom, fabricated in 3 and 5μm CMOS. Another is an eight bit semicustom version of an industry standard microprocessor. The fourth IC is a static RAM, used to store digitized EKG waveforms.

According to the author, John Ryan of Ventritex, the design challenges of these devices include: very low power dissipation (less than 20μA), real time telemetry and storage of EKG waveforms, programmable delivery of up to 750 V, and high resolution measurement of several system voltages.

The low power requirements are especially important, since the power is self-contained in the form of a battery. The longevity of the device is also affected by how often it must apply a high voltage shock. Each unit is capable of delivering about 300 shocks and monitoring the patient up to four or five years. Of course, the reliability of the chips and the system are important as well - field failures have some rather unpleasant after-effects for the user.

Future generations of pacemakers will be even more advanced. There is talk of using advanced oxygen and vibration sensors so the pacemaker can adjust to the patient's activity level. Beyond pacemakers, chips will continue to find applications in various types of biomedical devices. Other companies, like 3M and Choclear Corp., have almost perfected an implantable hearing aid. (Reprinted with permission from Semiconductor International Magazine, May 1989, Copyright 1989 by Cahners Publishing Co., Des Plaines, IL., USA)

Benefits of CAD/CAE CAM

Injection moulded component production can benefit from the use of CAD/CAE/CAM, through improved product design, a reduction in time to market and a smoother scale-up to production tooling. The capability has fallen in price, with $25,000 workstations now able to perform the work which million dollar computers performed a few years ago, according to G. Forbes, Eastern Region manager for MoldFlow, a software producer. Pitney Bowes Corporate Engineering and Technology used the technology to reduce the cycle time for the complex injection of a business machine over 28.5 per cent, and also reduced the forecast 35 week development cycle for the product by 10 weeks through improved team communication; CAE for designing the part, transferring data and producing the tooling; and finite element, cooling and flow analysis.

Huron Plastics (St. Clair, MI) has attributed a 5 per cent increase in sales to use of CAD technology, and notes that machine time efficiency has been improved 18 per cent due to superior melt flow analysis. The company has studied the effectiveness of its use of computer-aided technologies in 30 CAD/CAM jobs, finding a 29 per cent improvement in profitability versus traditional methods. In one instance, a $1,000 modification was made in a gate location after a flow analysis, improving product profitability 73 per cent in one year. (Extracted from Modern Plastics, May 1989)

First commercial application of superconductors

Ciss laboratory (Milan, Italy) will launch new bearings which allow the first commercial application of superconductors. The high speed bearings have magnetic levitation without attrition and take advantage of the properties of new superconductors. The bearings are made of a ceramic oxide consisting of yttrium, barium and copper. When the bearings are at a temperature of under 196°C, they allow electricity to pass through them

without resistance; they also repel magnetic objects. The superconductor bearings could be used for precision mechanics, electronics, computing, medicine and the aerospace industry. (Extracted from Sole 24 Ore, 18 April 1989)

Stereolithography for fast creation of prototypes from CAD systems

Fast creation of prototyes from CAD systems is now a reality and the technology is improving rapidly. One system currently in use, stereolithography, is available from 3D Systems (Sylmar, CA). The company feels it can be used by 10 per cent of the 400,000 manufacturers' CAD workstations now in use. Stereolithography uses an ultraviolet laser to cure thin layers 0.005-0.030-in - of liquid plastic. Working from bottom to top, a prototype can be created. Curing in an ultraviolet oven is required and the entire process can take a few minutes up to a few hours. The model can be up to 10-in square.

Micro-cut Engineering (Streamwood, IL) offers stereolithography as a third party service and charges $1,500-3,000 per job. Other, newer, technologies may soon rival stereolithography. Laminated object manufacturing (LOM) is being developed by Hydronetics, and selective laser sintering (SLS) has been licensed to DTM (Austin, TX). DTM, in turn, received $500,000 worth of funding and technical support from BF Goodrich in return for an equity stake. Both processes use powders instead of a liquid plastic. Hydronetics thinks its process may be better than stereolithography because LOM uses a carbon dioxide laser, which is more powerful, and possibly quicker, than ultraviolet lasers. Other prototyping systems are being worked on by Automated Dynamics (Troy, NY) and the Battelle Memorial Institute (Columbus, OH). Some people believe finished products may eventually come straight off the computer screen. (Extracted from High Technology Business, June 1989)

New portables

US producers are introducing pocket-size portable computers with desktop computer power. New portables include Atari's 1-lb, 8-line screen portable, which has captured the interest of NASA. Scientists at the US space agency could use the portable as an electronic note taker. Poget Computer (Sunnyvale, CA) will introduce a 1-lb, 25-line pop-up screen portable in summe. 1989 that runs IBM-compatible software. NEC's 4.4-lb UltraLite is already on the market. It is faster than many desktops and has sufficient memory to run such top-selling word processing and spreadsheet programs as WordPerfect and Lotus 1-2-3. One drawback: the battery must be energized every 90 minutes and the recharger increases the portable's weight by 1.2 lb. Sceptics say the restrictions of a portable are human, not technical. The prospect of eye strain and cramped typing could turn away potential customers. Dataquest (San Jose, CA) is projecting global shipments of portable computers of 3.8 million units by 1993. The majority of portable users are travelling executives and sales personnel. Currently, there are only 1.8 million laptops in service in the US, compared to 20 million desktops. (Extracted from US News, 29 May 1989)

Computers may create experimental data

Supercomputers are gaining in popularity for scientific computing. Scientists have found that computers can also be used to create experimental data, not just process such information. NASA found that simulations done on computers were more accurate at projecting the space shuttle's aerodynamics than were windtunnels. A key to the popularity of scientific use of computers is the machinery's power. For example, a problem solved by a Cray 2 supercomputer in about an hour would have taken an ENIAC vacuum-tube computer about 25 years of continuous operation to solve. (Extracted from The Economist, 16 June 1989)

Safety could become the computer's job

The battering in recent months by a plethora of disasters and crises with technological origins - rail and air crashes, food processing scares and a range of environmental threats, reflects the truism that the greater efficiency achieved by new technology does not always equal greater safety. In the search for solutions to avoid future disaster, one area of increasing interest is the use of intelligent computer systems, such as expert systems. An expert system can provide a sophisticated and ever alert assistant to the human operator, whose concentration may be on other matters at a critical moment - or who may simply be bored and not sufficiently attentive to possible dangers. An expert system can identify risks and either prompt the operator, or take the necessary cautionary action itself. Expert systems can also ensure that engineers follow accepted procedures preventing further work from being carried out until each stage is correctly completed. But there are a few catches. One of them - and one of the most easily rectified - is that, although expert systems offer many improvements in the safety and quality of systems, they are themselves a product of technology and so subject to the same sources of error. Much of the problem derives from the fact that many developers of expert systems come from a background where the development of large-scale or safety-critical systems is not common. Guidance is needed to ensure that all concerned with the development of expert systems in critical areas conform to the same standards for quality and safety as are applied to to other computer systems. The Computing Services Association, the industry's trade association, has long been active in the quality assurance area and has produced a set of guidelines. Key issues centre around the way that expert systems are developed. This usually involves a succession of prototypes that evolve into the final system. (Source: The Times, 13 April 1989)

The dangers of over-reliance on thinking computers

A major catastrophe could hit humanity through military reliance on so-called thinking computers, says a report published by the working party of the Council for Science and Society. By far the most worrying potential use of artificial intelligence (AI) is the "autonomous decision making system that not only makes decisions but also commands machinery to act on them". KBS, knowledge based systems - the report says - should, wherever possible, complement human workers rather than replace them. It should be designed to replace its reasoning, allowing the human user to direct the task and exercise judgement in interpreting the results. KBS should be a tool for our use, not a decision maker in its own right. The report says that the Data Protection Act should be extended to cover the rules by which personal data are processed. There may also be a future need for statutory regulations of KBS standards. It mentions some of the useful and simple KBS applications now proven, such as the banking system in France which gives advice on home loans to customers at its branches and the Australian system

hich offers guides to multiple connection rans continental train journeys. It points out hat other uses - such as the "seeing, thinking" obot running a factory production line - have yet o pass the prototype stage. The report, while enerally optimistic, does not swing the pendulum erilously the other way. Computers, it says, are ot "objective"; they function as models of epresentations of the real world and, as such, heir "judgements" are essentially fallible. They hould always, in principle, be challenged. The orking party suggests that any KBS available for ublic use should include a clear statement of who ade it and on whose expert knowledge it is based; f what it claims to be able to do (and not to do); f the foreseeable risks and dangers it holds; and f the general danger of relying on a machine in reas where human advice is available. The report inpoints the current balance in one superb entence: "The mind's fundamental intelligibility s suggested by successes in AI: its enormous ichness and power are emphasized by AI's many urrent failures". (Source: The Guardian, 1 May 1989)

New sensor designs through advanced modelling methods

Advanced modelling methods have brought about ew sensor designs that overcome prior limitations. long with mature, high-quantity production methods orrowed from the microprocessor sector, the result s a stable and precise product offered at a oderate price. High-pressure sensors are presently oming about as commodity products, which promise o open up many uses in mobile and industrial ydraulics, auto braking and suspension systems, and ome consumer products. Sensor makers are working o enhance execution while reducing costs, and there s a slow but steady trend towards placing more lectronics in the sensor. A longer-term ossibility is adding microprocessor power to the ensor, which would expand a sensor's capacities and mprove execution. (Extracted from Machine Design, 1 May 1989)

3-D graphic real-time image manipulator

Sony has developed the DME 9000, a commercial 3-D graphic real-time image manipulator. The system an manoeuvre images as quickly as the operator can load commands from a mouse - far faster than the resent state-of-the-art supercomputer/supermicro raphics systems. The machine has a trackball onsole that puts the 3-D editing controls at the ser's fingertips, doubles incoming image data line ounts to remove jagged lines from the screen and an produce warping - the mapping of 2-D moving magery onto a 3-D object in real time to form a omposite graphic. The DME 9000 has an 8-bit colour epth, a signal-to-noise ratio of 56 dB, takes in ideo data at 13.5 MHz (detailed images at more than 40 pixel width) and processes it at 5.75 MHz to roduce 5000x400 pixel images. (Extracted from Electronic Engineering Times, 10 April 1989)

Flat screen visuals

What are claimed to be the world's first flat creen visual display units to be free of any adiation emission have been announced by a UK ompany.

H. Bollmann Manufacturers in London has nitially launched two products for DEC and Wang orkstations, with a VDU for IBM personal computers o follow in September.

The VDUs are based around a flat liquid crystal display developed by Hitachi in Japan and being free of radiation cannot be remotely read by electronic eavesdroppers. (Source: Electronics Weekly, 21 June 1989)

Computer notebooks

Computer "notebooks" are a new category and a hot consumer market. Computer notebooks can accept other applications than word processing, and can connect to external units. The Sharp Brain accepts IC cards for memory and for auxiliary software; existing cards include fortunetelling, translation (from Japanese into English, Korean and Chinese), a Tokyo restaurant guide, and English lessons. Like Sharp's earlier "organizer" - of which 2 million were sold in 2.5 years - it keeps track of phone numbers, schedules, expenses, and time in different cities; addition of IC software acceptance created the Brain, of which 60,000 were sold in 1988. Sanyo and Sony competitors use less expensive floppy discs rather than IC cards. (Extracted from Electronic Engineering Times, 15 May 1989)

V. COMPUTER EDUCATION

Activities of the UKCCD

The UK Council for Computing Development was founded in 1981 and is a professional, independent, non-profit-making organization funded by its members.

Membership is available to individuals and organizations in the UK, who, quite apart from any charitable motives, find that participation in UKCCD's projects provides an opportunity to market their goods and services.

The UKCCD acts as a two-way communication channel between those in the UK who have an interest in working with developing countries and want to assist in extending the use of IT, and those in such countries who seek and welcome support and assistance to this end. The UKCCD also acts as a focal point in the UK for national and international funding bodies who provide money for collaborative projects between members in the UK and users in developing countries.

These may be expressed in terms of the following objectives:

- To provide a channel of communication between developing countries and international agencies on the one hand, and the UK computing community on the other;

  To establish agreements with selected developing countries for the UK to help them in forming national policies in the application of computer technology, in creating related strategic plans - particularly those concerned with education and training - and implementing those plans;

  To formulate activities and projects in the terms of such agreements;

  To enable appropriate goods and services originating in the UK to be exposed to the potential marketplace overseas;

  To assist developing countries to make the best use of goods and services emanating from the UK;

To assist developing countries to identify or establish sources of finance for suitable computing projects;

To assist the creation of training programmes appropriate for the needs of developing countries;

To organize seminars, conferences, training courses, inward and outward missions;

To increase participation of members in the above activities.

The UKCCD provides information to developing countries about the resources available to help in solving their particular problems (journals, consultants' register, publications on particular topics, such as procurement, index of education and training courses).

The Senior Managers appreciation course has been developed and presented in some countries. Others will be developed for particular application areas, such as agriculture, health, water resources, transport and customized data bases.

High-level inward missions are arranged for senior professionals and study and training programmes are organized for visitors from developing countries.

The UKCCD established the Kent Conference on Information Technology in Developing Countries. This is now run by the British Council. Conferences are also being arranged overseas on the lines of the Cairo Conference on Procurement.

Members are given the opportunity to become involved in projects both directly, as part of a UKCCD team put together at the request of an overseas organization, or indirectly through the information service. In particular, they are kept informed of projects being funded by the World Bank, the UN agencies and the Asian Development Bank. Some of these are multi-million pound projects with components on information technology, e.g., setting up a data base or microcomputer applications.

Consultants, who are members of UKCCD, when bidding for projects, may refer to their association with UKCCD and their ability to draw on its resources.

The UKCCD is not involved in all aspects of computing, but specializes in a restricted range of topics and aims to provide a high-quality level of service in those areas. The following list itemizes those topics where some members of UKCCD have been involved:

Procurement;

Developing a National Computer Strategy;

Automation of libraries and information bureaux;

Establishing training courses;

Computing in schools;

Selecting a local area network;

Setting up data bases on, for example, urban development;

Computing for agricultural development;

Computer applications in health services;

Computer applications in transport;

Personnel applications;

Administrative project management;

Establishing a national data communications infrastructure.

Members are consulted to determine which topics are of greatest interest, and working parties are set up to plan and coordinate activities on those topics. Commercial organizations are invited to sponsor specific activities or projects in areas where they have the opportunity of extending their sales of goods and services.

Projects

The UKCCD, since its international launch in 198., has:

- Assisted the Sri Lanka Government in the creation of a national computing policy;
- Advised the Sri Lanka Government on the development of a higher education programme, now being implemented;
- Assisted the United Nations aid agencies by identifying British candidates for senior technical posts in development projects;
- Assisted overseas organizations with introductions to appropriate bodies in the UK;
- Undertaken projects in Egypt, Iraq, Kuwait, Malaysia, Morocco, Sri Lanka, Tunisia, Turkey, Zimbabwe, Pakistan, Zambia, India, China and the United Arab Republic;
- Arranged inward missions of senior representatives from Egypt, Iraq, Kenya, Pakistan, Philippines, Singapore, Sri Lanka, Tunisia, Turkey and the World Health Organization;
- Held courses for the chief executives of national training institutions;
- Published a directory of UK professional advisory and regulatory bodies in the field of computer technology;
- Organized a conference on computing systems procurement in conjunction with the Egyptian Government;
- Developed an appreciation course for senior managers and presented it to public sector organizations in Zimbabwe, Pakistan and China;

Established an annual conference for senior IT students from developing countries;

Published a quarterly journal entitled Information Technology for Development;

Initiated formation of an accreditation body for IT training organizations in the UK;

Organized and directed multinational seminars on IT in Government for the Commonwealth Secretariat;

Prepared a report for the Zimbabwe Government on IT training needs;

Arranged training programmes for IT specialists from developing countries visiting the UK;

- Assisted the Zimbabwe IT community in setting up a training accreditation body.

Benefits of membership

There are three categories of membership: individual, corporate and overseas. Within each category the benefits of joining UKCCD are various, but, for UK members, are summarized as:

- To be involved in the objectives;
- To open up new business opportunities, aiming for increased sales of goods or services;
- To provide the opportunity for participation in projects funded by the international agencies,
- To provide access to lists of important contacts in developing countries, funding agencies and other international organizations concerned with IT;
- To promote their image by being seen to be involved;
- To help improve the knowledge and understanding of UK staff to the needs and particular requirements of developing countries;
- To participate in an exchange of information with other members in the UK and overseas;
- To meet or have contact with like-minded professionals.

Individual members may join the UKCCD Consultancy Register, which enables them to receive regular information about consultancy and recruitment opportunities.

A new class of affiliate members for overseas organizations has been introduced, and is aimed at:

- Government departments;
- Computer equipment companies/retailers;
- DP and computer centres;
- Companies;

System houses;

Libraries.

Overseas affiliate members would:

Benefit from learning how their problems have been tackled in the UK or in other developing countries;

Have access to a wide network of professionals working in the IT field;

Have access to independent sources of advice.

Overseas affiliate members are supplied with the Journal, Newsletter and other information.

Membership subscription rates are as follows:

Commercial organizations with more than 20 professional staff	500 pounds sterling
Commercial organizations with 20 or fewer staff	200 pounds sterling
Educational organizations	300 pounds sterling
Institutional members	200 pounds sterling

A new class of overseas affiliate member has been introduced for overseas organizations at an annual subscription rate of 40 pounds sterling.

Further information from the UK Council for Computing Development (UKCCD) at PTRC Education and Research Services Ltd., Glenthorne House, Hammersmith Grove, London W6 0LG, telephone: 01-741 7305, fax: 01-741 5993, telex: 335269 COMET G (Attn: UKCCD).

UKCCD sets up interest groups

1988 saw the establishment of UKCCD interest groups to bring together members with a common interest to plan and initiate activities in their area of interest in furtherance of UKCCD objectives.

Membership is open to all individual members and respresentatives of corporate members, with a chairman appointed by the UKCCD board. Non-member specialists may be invited to join UKCCD later.

The purpose of the interest groups is to prepare and publish position papers aimed at institutions and individuals in developing countries. These papers are intended to give an overview of the UK state-of-the-art together with special considerations in developing countries and relevant actitivities, and incorporating the experience of UKCCD members.

The interest groups will also be expected to consider possible UKCCD project activities and make recommendations. They will provide a means of response to external inquiries and will direct projects approved by the board.

The first groups to be set up have been to cover developing a national computer strategy, establishing training courses and administrative project management.

Letters and papers wanted for UKCCD journal

UKCCD and UNESCO combine with Oxford University Press to publish the thrice yearly learned journal Information Technology for Development.

Edited by James Robertson with Jack Howlett as managing editor, the journal sets out to provide a forum in which management and IT practitioners can share their experience in the application of IT in developing country environments.

It is planned to devote one or two issues a year to a single theme, with authors invited to prepare papers, starting with a collection of the papers presented at the Commonwealth Secretariat's meeting at Cambridge [illegible] June, together

with an overview of the results of the meeting and an introductory paper by secretariat director Dr. Kaul.

The board wishes to launch a correspondence section, and letters are invited. Technical readers could also submit papers and encourage their colleagues to do likewise - or offer to act as a specialist editor.

UKCCD corporate members obtain a free copy of the journal. It currently receives a grant from UNESCO and will be underwritten by OUP for another two years. However, its long-term success will depend on subscription income. Please encourage others to subscribe.

Current rates are: UK - 44 pounds sterling, North America and Japan - US$110, elsewhere - 55 pounds sterling. There are reduced rates for bulk subscriptions. (Source: UKCCD Newsletter, April 1989)

On-line data base on the way

UKCCD is developing an on-line membership information service using the COMET mailbox system.

With a microcomputer and modem, members will be able to use the normal telephone network to interrogate UKCCD headquarters' data base. Full information will give members' addresses, interests, profiles together with addresses and profiles of useful contacts and potential clients and agencies - both in the UK and overseas. Short CVs of member experts available for specialist work will also be included.

In addition, information will include events, publications, software packages and projects made available by members. The system can, of course, be used for communication between members and with UKCCD and contract manager PTRC.

OMIS includes its own instructions for use in a step-by-step form, so that once logged-on you will have a self-sufficient system. (Source: UKCCD Newsletter, April 1989)

Training data base

OMIS forms part of the UKCCD data base being established at Hammersmith. As part of the service UKCCD is recording all relevant training courses on computing and information technology. This is available to members through OMIS, but will also be of direct benefit to UKCCD in its activities when customizing training and study tours for member organizations and visitors from overseas.

PTRC Education and Research Services, which services IKCCD, has developed an enviable record for its professional development programme in the fields of highways, transport and planning, including a specialism in applications to developing countries. UKCCD will be able to draw on this experience as it develops its own arrangements for visitors to the UK to study IT and visit companies and installations of particular interest to them. (Source: UKCCD Newsletter, April 1989)

VI. SOFTWARE

Writing software in 4GLs

Computer hardware has gone through a revolution in the last 10 years. Today's best home micros are as powerful as the minis of the early 1980s and the mainframes of the early 1970s. Most software, however, is still being written using the languages and systems developed in the 1950s and 1960s. All these were called "third generation languages". They were quickly adopted because they enabled programs to be developed faster and maintained more easily. There has been no similar take-up of fourth generation languages (4GLs). As a result, some programs have millions of lines of code and there is a huge backlog of unwritten software. 4GLs and CASE (computer-aided software engineering) packages allow small teams of programmers to produce large systems quickly. 4GLs offer high-level commands which cut all the drudgery out of data base and file handling, report writing, screen creation and similar tasks. They also simplify maintenance and make rewriting programs extremely easy. Indeed, it is almost always easier and cheaper to rewrite an old program in a 4GL than to keep maintaining it. Presumably either short-termism or ignorance prevents this. There are, of course, objections. The main one is that 4GLs are inefficient in their use of hardware resources. Another common complaint is that there are too many 4GLs and people just get confused. Very soon we will have minis and even micros that are more powerful than today's mainframes. They do not need a dozen people to maintain the systems software; many do not even need operators. We also have 4GLs and CASE tools that can be used by small teams to generate large, complex programs - it is just that they are barely being exploited. Where the advanced tools do not exist to enable small teams to tackle big projects, it might be better to use resources to develop the right tools, instead of cobbling programs together in the dead language of the past. (Source: The Guardian, 6 April 1989)

Computer-aided software engineering: A few words of caution

CASE is computer-aided software engineeing. It is usually defined as the use of mathematical and engineering techniques to produce economic and reliable applications to meet stipulated objectives. The surge of interest is welcome, but a few words of caution might not come amiss. CASE products are usable and powerful, but there does not seem to be much thought given in them to the nature of data processing applications. Development starts with real world requirements and finishes with a system that meets them. Requirements are defined in terms of the existing situation, but the application produces a new situation which changes the requirements. The more substantial the system, the more likely it will change the status quo, giving rise to changed requirements. At the other end of development there are further difficulties. The first is how to structure application programs. The question is posed by intelligent workstations, data base machines and networks. One answer is given by many fourth-generation languages (4GLs) which assume that most program functionality should reside in the workstation. The program works out what it needs and tells the data base machine to find it. The other approach is for the workstation to tell the data base machine what it wants to do and leave it to work out the details. Much program functionality transforms general requirements into detailed update statements. Everyone agrees that some functionality should be transferred to the data base machine, but no one knows what the limits should be. As workstations become more powerful, it seems a waste to leave them with only screen generation and dialogue management. (Source: The Guardian, 6 April 1989)

Instant facts at your fingers

Ted Nelson, the inventor of the terms "hypertext" and "hypermedia", dreams of the day when

we will have instant access to any piece of literature published anywhere in the world. Nelson identified the need for hypertext in 1960. He wrote a word processor which was, in some ways, advanced even by today's standards. But Xanadu, his hypertext design, took another 19 years to unfold because no one was willing to back his ideas. Now that backing has been won and the hypertext idea may have finally come of age. A year ago, Autodesk, arguably the world's most successful publisher of computer-aided design (CAD) software, decided to fund Nelson's team. It will announce the first implementation of its "Xanadu" hypertext file storage and access system in November this year. The product will begin its working life as a single-user system, first running on Sun computers, then Macintosh, then on the PC. (Source: The Times, 6 April 1989)

Cutting through the CASE hype

Computer-aided software engineering (CASE) is the latest offering in 30 years of promised panaceas for curing the pain of systems development. Still, meeting project deadlines remains the world's number one IS problem and the delay in delivering programs, rather than any technical shortcomings, has become the single, overriding constraint on IS progress.

Can CASE prove successful in remedying the problem? It should - eventually. CASE makes use of CAD/CAM techniques, which have already realised massive improvements in cutting through the layers of detail design that stand between the production engineer and his objectives.

What works for one branch of engineering should work for another. But not yet; not according to a recent DATAMATION and management consultants Price Waterhouse survey of over 3,000 IT executives in the US, Japan, Australia, France and the UK. The survey found that, so far, only 20 per cent of installations world wide are using the technique, 7 per cent have tried and rejected it and over 30 per cent of the respondents feel the main problem is "cutting through the hype" of unsubstantiated claims for the products.

French wallets seem to have succumbed to the sales pressure more than most, however, and France leads the world in the automation of programming, with over a third of its installations claiming to use CASE tools in one shape or another. This compares with only a fifth of installations using the techniques in the land of CASE sceptics - Japan.

CASE tools come in three distinct shapes: upper CASE, which helps the analyst discover and specify systems requirements; lower CASE, which aids and abets programming; and IPSE (integrated programming and systems engineering), which aims to automate the technical management task.

Upper CASE and IPSE can be bought relatively cheaply, so experimentation in these areas can be a low cost project. But lower CASE, which typically generates working COBOL programs, can knock a sizeable hole in the IS budget and it is hats off to France and the UK, who are leading the world's investments in this area.

Respondents perceive the main benefit of CASE to be improved productivity. The improvement being achieved world wide by those using the technique today is an 84 per cent cut in systems development delivery time. The best performers are Australia and France, who claim to have more than doubled their productivity. In five years' time, most IS executives believe the technique will come good, however, with a world average expectation of a four fold speed up in programming resulting from the use of CASE. Australians are the most optimistic and have pinned their hopes on producing systems in less than a fifth of present delivery times.

French IT executives, who are among today's leaders in claims for improved productivity, reveal an interesting trend of future expectations. Fifty-nine per cent of installations in France state the main benefit now is faster systems development. In five years' time, however, this figure will fall to 46 per cent and, by then, 49 per cent expect the main benefit to be the increased life of programs developed using CASE tools and the beginnings of a solution to the widespread problems of program maintenance.

Interviews revealed that many panelists feel the claims of increased productivity are just part of the sales hype and that the initial programs developed under a CASE environment actually take longer to produce. But, while delivery times went up, so did user satisfaction.

Cracking the program maintenance problem is stated as a main benefit of CASE by 29 per cent of installations in the UK and 18 per cent in the US. But these figures rise to near 50 per cent, alongside France, when it comes to examining expectations of CASE for five years' time.

Interviews in the US, where the stranglehold on progress exercised by vast existing COBOL programs is the greatest in the world, also showed strong hopes for a fourth set of CASE tools - reverse-engineering products. (Reprinted with permission of DATAMATION[r] magazine[c], 1 April 1989, copyright by Technical Publishing Company, a Dunn and Bradstreet Company - all rights reserved)

Computer security plan

Fourteen large companies have joined forces in an effort to increase the security of their computer systems. Coopers and Lybrand, the management consultants, have launched the European Security Forum in recognition of the growing dependence of companies on computer systems, and the threat of hacking, viruses, computer fraud and other breaches of computer security. The companies, which include British Telecom, IBM, Rolls Royce, Fiat and Plessey, are paying 12,500 pounds sterling a year for membership of the Forum. The intention is to allow companies to learn from each other's problems and successes in tackling the security problem and to help develop practical solutions. The Forum will have a budget of over one million pounds sterling as new members come on board. (Source: The Independent, 16 May 1989).

Iron out the computer bugs

Researchers at the University of Edinburgh's Laboratory for the Foundations of Computer Science (LFCS) are now examining the logical foundations of computer science in an attempt to make programming as reliable as architecture or electronics. They are using mathematics and logic to do computer science, rather than computers to do mathematics. The main aim of their work is to develop a mathematical theory of programming and to apply that theory to problems such as software reliability. Programmers usually test programs by running them on typical sets of input data. Unfortunately, such tests cannot prove programs are bug free. Almost

ery large program in use today contains bugs, even ter years of development and several releases. th computers now controlling aircraft, nuclear wer stations and battlefield weapons, as well as eping track of people's money, proving that grams work correctly has become urgent. Some searchers have tried to find ways to prove the rectness of existing programs, discovering stead that the languages and techniques currently use make this task practically impossible. The y solution is to change the way people program the tools they program with and to introduce the quired rigour at the beginning of the programming cess. The future of computer technology is med up by the research being done at the LFCS - aim is to develop ways of describing and soning about complex systems. (Source: Independent, 8 May 1989)

ruses" used as blackmail

The threat of infection by computer "viruses" being used to blackmail large companies for huge soms, a leading computer security expert said. h viruses, which take the form of extremely small grams constructed to slow machines and destroy a, can be slipped onto computer discs of a pany or sent down telephone lines connected to puters. The viruses lie dormant for years inside hines before bursting into life when the host puter's internal clock reaches a certain date. Friday 13 January, a virus code-named 1813 did cisely that on computers used by a number of panies and colleges in Britain. Only compatible computers are affected. The 3 virus, which will next come to life on Friday October, is thought by experts to be the work of omputer enthusiast with a warped sense of our. Professor Henry Beker, a mathematician and ptologist at the Royal Holloway College, London, d that such viruses are now being used iberately to blackmail leading companies. panies which think that they may be at risk from uses can call in computer consultancies which e developed programs capable of tracing the uses and killing them. "Vaccines", or special tware to prevent the invasion of a system by uses, are also becoming available. (Source: Times, 18 January 1989)

tually a virus, but for a good cause

Computer viruses - and other programs that rupt networks or otherwise play havoc with puter systems - have been in the limelight ely. Now an over-the-counter program advertises tility that lets it clone itself from one rocomputer to another over a cable.

The facility is not a virus, but it behaves e one - except that the target must agree to be vaded". Nor is it a simple COPY command, since opies the file from the domain of one pendent system into that of another.

The program is LapLink III, a file-transfer ity from Traveling Software Inc., Bothell, ington. To transfer files from a PC with ink installed to a second machine without it, s enter a one line command and the program will a copy of itself across the wire.

However, Traveling Software has built in a guard: the program installs itself only if the types the MS DOS MODE command to alert the ed PC's operating system that a file is to be ived. By requiring that the receiving machine otified of the transfer, LapLink's designers reduced the chance of malice.

The kernel then sends a standard output command to a host adapter primitive module for an individual SCSI adapter. This isolated code fragment is the only hardware-specific software in the system.

Under such an arrangement, high-level language programs could be compiled for different operating systems without changing output commands; the modules would handle all hardware variations.

Columbia Data Products Inc., Altamonte Springs, Florida, has written an SDLP and is now promoting it to software developers and manufacturers of SCSI peripherals. The company has also proposed to the SCSI Common Access Method Committee that it become an open standard. (Source: Spectrum, June 1989)

Data protection

Intelligent power protection systems are now required to protect data. Companies selling power protection used to provide just short-term protection against surges, noise and blackouts. However, as users become more dependent on computers, downtime is becoming less acceptable to them and their clients. Loss of data due to downtime creates even more delays because of data re-inputting. In addition, computer processing is becoming less decentralized as workgroups are formed, requiring many power protection sites. Intelligent power protection systems can perform unattended shutdowns and signal users that a power failure has occurred while switching to battery power. These systems keep reminding users to save their data and logoff. After users logoff, the systems shut off their inverters, preventing any further drain on the battery and leaving a power reserve. The power is needed in the event of a sequential power failure soon after power is restored. Non-intelligent power protection systems usually do not have time to recharge before sequential failures hit. (Source: Computer Reseller News, 1 May 1989)

Patent applications may endanger software industry

Some observers fear that the computer software industry is being endangered by the recent flood of patent applications. Some of the applications are for basic programs that are quite common in the industry and regarded as being in the public domain. Since new software development often consists of refining old ideas, software companies worry that broad patents on widely-used processes could stifle creativity. Both analysts and companies question whether the US Patent Office is qualified to evaluate software innovation. Patents could be awarded for processes that are already industry standards and the holder could then demand royalties from unknowing violators. Already, some small patent holders are attending trade shows and approaching the exhibits of software companies for royalty payments.

Before a 1980 US Supreme Court ruling, no patents were awarded for computer software. Now, according to lawyers, almost any program or segment of a program can be patented. The problem is complicated by the fact that patent applications are confidential. A developer could write a program containing features that infringe without even knowing someone else is attempting to patent them. P. Petersen of Wordperfect says that, because of the nature of the software industry and software development, 'you're stuck, forced to infringe'. Wordperfect has already been approached by various patent holders and is filing a large number of applications to protect itself. IBM files 600 patents each year, with software accounting for

33 per cent. For some time it has used its patents as trading material. (Extracted from New York Times, 12 May 1989)

Copyright cases

How similar can the form and function of one software program be to another before it violates the other program's copyrights?

This tricky legal problem is generally referred to as the "look and feel" issue. Its resolution goes beyond the commercial software industry and affects the production of any device that uses software, including microprocessors.

There have been several "look and feel" court cases in the US and several more are pending. There is, however, no solid legal precedent yet in this area and the creation of one is a long, painstaking process.

But what exactly is "look and feel"? The term first arose in a US judge's ruling, two and a half years ago, in which he said that a software package from Unison World had copied the "look and feel" of a similar software package from Broderbund Software. The judge said that the Unison program had screen displays and commands that were identical or very similar to the Broderbund product.

This was a radical departure from most software copyright lawsuits which allege straightforward copying of the software code. In the Broderbund/Unison case, if you examine the software code of each product there is no outright copying of code. But, although the code may be different, the effect is to produce a "look and feel" that is almost identical.

Since that ruling, top US software companies have used it to file lawsuits against small software companies that produce look-alike software.

These cases involve a large and rich company against smaller companies who normally do not have the money to defend themselves in court. This has led to several "look and feel" cases being settled out of court, which denies the software industry a clear legal precedent. Without such a precedent, software developers are uncertain on how similar their product can be to another without violating someone's copyright. This uncertainty stifles software development and also helps protect market share for the larger companies.

This situation may be changed by the biggest and most important "look and feel" legal dispute so far. It is a lawsuit filed by Apple Computer against Microsoft and Hewlett Packard for allegedly illegally copying the Macintosh computer user interface in products such as Microsoft's Windows and Hewlett-Packard's New Wave. This case could take several years to resolve. It also involves some of the industry's largest companies who can afford the enormous legal expenses involved and it should generate a clear ruling on how similar software programs can be before they violate another's copyrights.

The "look and feel" issue also affects the semiconductor industry, especially microprocessors. NEC's creation of Intel compatible microprocessors in its V Series and its subsequent legal battle have generated a useful legal precedent.

The first legal precedent set in the Intel/NEC case was the judge's ruling that microprocessor microcode is a software program, even though it is hardwired.

If the major software and computer companies are successful in preventing other companies from mimicking their products with a similar look and feel, it will mean a monopoly and high profits on that type of product. The loser is the customer and computer user. It means high software prices and it also means that users will have to learn a whole new set of commands to change to other software packages. Having common user interfaces helps the user get the most from their system.

In the US, where legal disputes are accepted as a legitimate way to cripple competition, clear legal precedents will protect smaller companies. So far, the few legal precedents that do exist serve as guidelines that may produce cheaper compatible microprocessors. (Source: Electronics Weekly, 3 May 1989)

Software licensing

Contrary to the popular notion that once bought, software is automatically owned, a user who hands over the money is actually paying a licence fee to use the package. The developer or holder of the copyright still owns the software.

Companies' control of licensing has long been thought monopolistic. The refusal to allow users to transfer licences has provoked a barrage of complaints. These problems are compounded in networked configurations which allow easy transferral of data and programs. This is adding to the confusion surrounding software licensing. Experts agree that networks will be a potential licensing minefield.

The problem facing software companies is that their main assets are the talents of their staff. These companies make their money by licensing this intellectual property which is sold as software. Selling the software along with the copyrights would mean never making money out of that product again. So software is generally protected by strict copyrights, and users are required to pay for a licence which gives them certain rights of use. For example, there is a distinction between run-time licences which limit the customer to using the software as it is, and development licences which give the user rights to modify the software.

Normally, application software is bought to serve a particular function and the prospect of transferring it to another user is rarely considered. But there are certain circumstances where this is necessary and where the current approach to licensing can become a hindrance.

Enabling suppliers to keep a check on where their software is being transferred is only fair. But some of the software and hardware vendors are taking advantage of their right to license software and are using the high level of protection to commercial advantage.

One of the ways in which hardware companies have used software licensing to their advantage is by issuing non transferable licences for their operating system as well as applications software.

This is the approach that IBM has taken with its System 36 and AS 400. With both these systems, users obtain perpetual system software licences, which cannot be transferred when the user discards the hardware.

IBM is not alone in restricting the transfer of operating system licences. Data General was one of the first hardware vendors to unbundle its system software and charge users for a perpetual licence. Although users objected to this move, the company has sat tight on its policy.

Resistance from users in other hardware environments has been more successful. Users of DEC and Wang systems, for example, were able to overcome restrictions on software licensing imposed by their respective hardware vendors. With DEC the saga started when it introduced a non-transferable system software licence for its VAX range around three years ago.

DEC finally backed down and now allows users to transfer its VMS operating system and networking software without any charge. Users are none the less expected to pay the full licence fee for layered products such as DEC's office automation software if a machine is transferred.

Wang users also acted together to coerce the supplier into concessions on software licensing. They complained about the Wang 'Accord' licensing agreement, which required users of Wang VS systems to pay a fee for a non-transferable licence for the operating system that had previously been bundled with the hardware.

The users reached an agreement with Wang last August when the company withdrew its policy of insisting that a full licence fee should be paid when a system was transferred. Instead, the company imposed a flat fee of 695 pounds sterling for transferral of operating system software.

Richard Stahlman, founder of the Free Software Foundation based in Boston, believes the strict licensing techniques used by some companies help to mystify computers by making the software secret.

The foundation is dedicated to removing restrictions on copying, redistribution and modification of computer programs. Its main project is the development of an integrated software system called GNU - GNU's Not Unix - which will be upward compatible with the Unix operating system.

Stahlman believes in what he describes as copyleft - copyright being for right-wingers and copyleft for left-wingers - which is basically copyright with permissions. This means that programs which constitute GNU, such as the GNU emacs text editor, are free for everyone to use and redistribute, but they are not in the public domain. The software is still copyrighted.

GNU programs can be obtained in a variety of ways. These include sending the foundation $150, obtaining a copy from a friend or finding the software on a new machine. In addition, access to Internet, the worldwide computer network, affords the latest versions plus the associated "copyleft".

Ironically, the ability of networks to ease distribution of software, which is proving increasingly attractive to users, poses numerous problems for those suppliers that prefer to keep tighter control on their software. If someone takes out a licence for 10 users, how can the supplier prevent more than 10 users having access to the software in a network of 50 processors?

Roger Tuckett, chairman of the United Kingdom's Federation Against Software Theft, says that, although the industry may be moving towards distributed systems, it has not yet encompassed all the ideas behind software licensing for networks.

Meanwhile, the licensing issues affecting centralized computer installations remain. The European Commission has just sponsored a study on the legal enforcement of shrink-wrapped software licensing. In addition, the new Copyright Act, which includes clauses covering software, comes into force on 1 August.

But, given the strength of feeling among users, vendors and the money at stake, the confusion is not going to disappear overnight.

Stepping through the minefield

Shelagh Gaskill, a solicitor with experience of software licensing, gives 10 points to check before signing a software licence.

1. Check that the users granted access to the software are the ones that should have access.

2. Check that the right licensees are named if you are members of a group.

3. Check the licence gives the rights of development, support and enhancement as needed.

4. Always read the termination clauses.

5. Tell employees the terms and conditions of the licence.

6. Check you can have source code deposit.

7. Check that licence cost increases have a maximum level, for example 10 per cent above the original fee.

8. Make sure you know the restrictions laid down in the licence.

9. Check your rights to migrate software from one machine to another.

10. Remember software licences are generally non-assignable. Therefore, if you are thinking of selling a computer and it depends on a particular piece of software to meet the new user's needs, under most licences you will have nothing to sell other than a piece of second-hand hardware and, if you are lucky, the operating system. (Source: Computing, 29 June 1989)

IBM's Officevision introduced

IBM has introduced Officevision software to address the changing role of mainframe computers, and "bring mainframe power to workers' desktops". Although designed to integrate IBM's diverse hardware systems, Officevision will also run in a personal computer network without the support of larger systems. In the past, all processing was done in large centralized machines, and users viewed the results on desktop terminals; in the future, the mainframe will become more of an information repository, with processing functions distributed throughout a network of powerful personal computers, or intelligent workstations. Officevision consists of programs designed to run on IBM's PS/2 personal computers, AS/400 midrange systems and MVS and VM mainframe computer operation systems.

Joining IBM in the announcement were a dozen software companies. Lotus Development and Microsoft demonstrated their respective 1 2 3 and Excel spreadsheet programs running in conjunction with Officevision programs. IBM has not chosen a spreadsheet program yet. It will also offer a Data Interpretation System developed by Metaphor Systems

to permit computer users to analyse such data as market information by selecting on screen symbols. (Extracted from New York Times, 17 May 1989)

Japanese target software for development

Japanese companies have targeted software as a major area for development. Fujitsu opened a software centre in the Silicon Valley, CA, in 1983. Other companies, such as Sony Microsystem, Hitachi America and Ricoh Software Research Center are importing software into the United States. The portion of R&D budgets allocated for software has increased dramatically. However, Japan needs 1.6 million programmers by 1990 but it will only have 1 million. Slowing down Japan's drive to dominate the world software market are the process of software development as well as Japan's own culture, according to C. Morgan, analyst at Hambrecht & Quist (San Francisco, CA) and N. Negroponte of MIT's Media Laboratory. Manufacturing efficiencies or incremental development, areas in which the Japanese excel, are not appropriate for software development. (Extracted from Computerworld, 8 May 1989)

Hard times for software

The reasons accelerating off-shore shift are closely linked to the world's worsening software crisis. The decades-old software backlog is not going away despite the introduction of new productivity tools; in most countries there is a severe shortage of software programmers and developers and those that are available are becoming increasingly expensive; the demand for new systems, particularly competitive edge applications where there are few packages available, is increasing; and corporate managements world wide are trimming IS budgets.

In this environment, industrializing nations - particularly those in the Asia-Pacific region where labour, resources and overhead costs average about half that of industrialized Western countries - see an opportunity in the ever-growing international market for software services.

Yet despite the growing offshore sourcing trend among Western companies, South-east Asia still exports only a small amount of software services compared to Western nations. The Philippine computer industry, for example, exports about $10 million worth of software and services a year. And Singapore exported just under $11 million in 1986. India, meanwhile, exported $54 million of software and services in 1987. India's target for 1989-1990 is a massive $250 million of exports. However, as a percentage of total revenues for Asian software companies, exports are strong. Tata Consultancy Services of Bombay, one of India's largest software services companies, claims that about $24 million of a projected $34 million revenues in 1988 will have come from exported services.

In addition to low costs, the region offers a work force that works harder and is more enthusiastic about technology than its Western counterparts. However, there are disadvantages. Expertise on a par with the West is harder to come by.

Economies such as Thailand and the Philippines have less to spend on high technology projects, therefore providing local professionals with less exposure to the state of the art systems. However, contractors are beginning to do more than crank out COBOL code.

The larger, more experienced Asian companies are getting a bigger share of major projects in the region, increasing their credibility and expertise. IBM, for example, sub contracted CSA to design and produce several million dollars worth of applications for Singapore's public electronic data interchange network, expected to go live this year. And, in a twist that surprised Hong Kong's international IS community, a local software house, TA Consultants, was selected over international consultants Logica and Price Waterhouse to design the specifications for a clearing system for Hong Kong's stock exchange.

Corporations also worry that sending precious projects too far offshore may reduce their control over the end result. That is why American Express restricts the amount of work it farms out to Asian sub-contractors.

Some customers pay to bring Asian programmers to their own site on a retainer basis. However, these companies may be missing out on savings: this process tends to increase costs, such as higher salaries, travel expenses, living or hotel expenses, to a project.

Boeing Services dealt with this problem by dividing a project into phases. It hired a Philippines software house, Systems Resources, to create base operation support systems, and had initial design performed in the United States, and succeeding design, development, and testing finished in the Philippines. After the $1 million project was successfully completed in 1987, Systems Resources gained other clients, such as Goodyear, United Laboratories, and the Asian Development Bank.

Competition to attract high-technology business is strong among Asian nations, and each has its advantages and disadvantages. Singapore, Malaysia, Hong Kong, India and the Philippines are considered the key spots, partly because English is widely spoken in those countries.

Of these, Singapore and Hong Kong enjoy most-favoured status in terms of skilled labour, though rising labour and living costs are also increasing prices. A Singapore programmer with three to six years' experience earns about $16,500 a year; a Hong Kong programmer with six years' experience averages $20,000. Singapore's information technology industry is probably progressing faster, due to government efforts to establish the country as a centre for high-technology research and development. The policy has attracted companies like Hewlett-Packard, Apple, Data General, Hitachi, and NEC to establish software development centres. Nixdorf also has a development site there.

India and the Philippines offer the highest cost savings - a programmer/analyst fresh out of one of India's five technology institutions earns about $3,000 a year. However, skills are not as well developed as in Singapore and Hong Kong, largely because of their third world economies and prohibitive government policies.

Despite low costs and cheap labour, Asia is not about to take over the world's computer services business, as it has the manufacturing marketplace, but in the face of a worsening software and budgetary crisis among many Western firms, going offshore for low cost software development may become increasingly popular. (Reprinted with permission of DATAMATION® magazine®, 1 February 1989, © copyright by Technical Publishing Company, a Dunn and Bradstreet Company all rights reserved)

Software for educational statistics

The Office of Statistics of the United Nations Educational, Scientific and Cultural Organization (UNESCO) has announced the availability of a new software package called EDSTATS, for the analysis of educational statistics. Developed with financial assistance from the Swedish International Development Authority (SIDA) for use on PC compatible microcomputers, EDSTATS is guaranteed to be easy to use even for those with no prior computing experience. It includes a broad range of analytical tools to facilitate the analysis, diagnosis and assessment of the quantitative development and efficiency of primary and secondary education systems.

It is hoped that EDSTATS will encourage Member States to analyse their education systems on a regular basis and induce them to promote and improve the collection of basic education statistics. Of particular value for educational planning, EDSTATS can also be used to reinforce teaching activities. Tested in February 1988 at a training seminar in Ethiopia, it will complement other courses in Botswana and Zambia as part of a UNESCO/SIDA programme to upgrade the skills of statisticians in 13 African countries and in Nicaragua.

For further information, please contact: Office of Statistics, UNESCO, 7, place de Fontenoy, 75700 Paris, France. (Source: IFLA Journal 14 (1988) 4)

POPLINE on CD-ROM

POPLINE, the world's largest bibliographic data base on population, is now available on Compact Disc, Read-Only Memory (CD ROM). Maintained by the Population Information Program at The Johns Hopkins University, the Center for Population and Family Health at Columbia University, Population Index at Princeton University, and the Carolina Population Center at the University of North Carolina at Chapel Hill, POPLINE receives most of its funding from the United States Agency for International Development (AID) and the United States National Institute of Child Health and Human Development. The CD-ROM version has been funded by the United Nations Population Fund (UNFPA).

POPLINE, distributed on CD-ROM by Silver Platter Information, Inc., contains more than 160,000 citations from world-wide literature on population, family planning and related health care, law and policy issues. Around 30 per cent of the records represent unpublished documents which would otherwise be difficult to obtain. While the majority of items date from 1970 onwards, some sources were published as early as 1886. All records are in English, although some 10 per cent of the sources are in other languages. The POPLINE Thesaurus, included as part of the CD ROM product, provides specific subject indexing and serves as a guide to retrieving document records.

The entire POPLINE data base has been fitted onto one disc, which will be distributed commercially by Silver Platter at a cost of $US 750 in Canada and the USA, and $US 825 in other countries. With UNFPA funding, it is hoped to be able to distribute POPLINE CD ROM free of charge to selected developing countries which have the capability to use and to share it. Such potential users are requested to indicate their interest. For further information, please contact: Population Information Program, Center for Communication Programs, The John Hopkins University, 527 St. Paul Place, Mount Vernon Centre, Baltimore, Maryland 21202, United States of America. (Source: ACCIS Newsletter, May 1989)

UNFPA Core Library

The United Nations Population Fund (UNFPA) has developed a Core Library Collection as part of its information support to UNFPA field offices and UNFPA assisted projects. The collection, containing around 100 items, was compiled by the UNFPA Library in consultation with staff. While making no pretensions towards either authoritativeness or comprehensiveness, the collection attempts to cover, as competently as possible, basic population information needs with currently available publications. It will be updated as significant new publications appear. Divided into 20 categories of reading list in the broad area of population and development, the Core Library Collection can be made available for under $US 1,000 per set.

To promote effective use of the collection, the UNFPA Library has provided subject access by creating a data base using the CDS/ISIS (Mini-micro Version) software for bibliographic data base management, produced by the United Nations Educational, Scientific and Cultural Organization (UNESCO). Additional assistance to users comes in the form of two instruction folders: one dealing with physical and organizational aspects of the Core Library, and the other looking at aspects concerned with computerization.

In 1988 the Core Library package was sent to 10 UNFPA field offices and, based on feedback from this round of distribution, will be sent to 15 more in the course of 1989. While at present the Core Library Collection can be supplied only to UNFPA field offices and UNFPA-assisted projects, other organizations can request the accompanying documentation folders and data base diskettes. For further information, please contact: Mr. Avi Green, Chief, Library and Information Services Unit, UNFPA, 220 East 42nd Street, New York, N.Y. 10017, USA. (Source: ACCIS Newsletter, May 1989)

CD-ROM project from PAHO

What developed countries consider basic knowledge, in areas such as health, may be of life-or-death importance in less privileged regions. Disseminating this basic information can be one of the most effective means of assisting developing countries. In recognition of this, the Pan American Health Organization (PAHO) has produced a Compact Disc, Read-Only Memory (CD-ROM) containing a number of health-related data bases produced by the United Nations system and other organizations.

The disc is the second produced as part of a pilot project started in 1987. It contains two major data bases produced by PAHO centres: the Latin American Data Base on Health (LILACS), generated by the Latin American Health Sciences Information Center (BIREME), and the REPIDISCA data base, created by the Pan American Center for Sanitary Engineering and Environment. LILACS includes conventional and non conventional documents on the subject of health, produced in the region. It is accompanied by the DECS thesaurus developed by BIREME, which involves the dissemination of knowledge by establishing, at the national level, a state of the art system for specialized scientific and technical information.

INIST replaces the Centre de documentation scientifique et technique (CDST) and the Centre de

documentation sciences humaines (CDSH), and intends to continue and expand the activities of both centres.

INIST produces the PASCAL and FRANCIS data bases. These data bases are bibliographic, multidisciplinary and multilingual. They cover world literature in science, technology and medicine, in the case of PASCAL, and economy, humanities and social sciences in the case of FRANCIS. INIST is also co-producer of the World Translation Index Database (WTI) and of GAPHYOR UPDATE. These data bases are accessible online via Questel. The economic data bases of FRANCIS are online on G CAM. PASCAL is accessible via the ESA-IRS and DIALOG hosts. PASCAL and FRANCIS are available by subscription on floppy disk or magnetic tape. In 1989, INIST will make PASCAL available on Compact Disc, Read-Only Memory (CD-ROM).

INIST offers researchers from all over the world a wide range of other services, including Selective Dissemination of Information (SDI), bibliographic journals and translations. For users in developing countries, agreements for these services can be obtained from the French Ministère des affaires étrangères, which can give special subventions to INIST according to individual cases.

For further information, please contact: INIST - Mme. Nathalie Dusoulier, General Director, or Mme. Anne Lhermitte, Communications - Château du Montet - F-54514 Vandoeuvre-les-Nancy, France. (Source: ACCIS Newsletter, May 1989).

Teleconferencing eye to eye

People who travel a lot to meetings now have an alternative: a visual teleconferencing system over which they can interact in real time with several others. It was developed over the past three years by Bell Canada, Toronto, with Bell Northern Research Ltd., Montreal.

The software-based Group TeleConferencing System (GTCS) has a versatile new protocol, called the Multipoint Communications Layer, which can connect systems through local-area networks, voice and data networks, and integrated-services digital networks.

The system allows up to four users to simultaneously alter any text, image, or computer screen display before them with instant feedback to the others. Software is available for IBM PC AT-compatible computers and is being developed for the Macintosh II. GTCS is sold with hardware and options are available. (Source: Spectrum, May 1989)

INSTEAD - technological alternatives for developing countries

INSTEAD - the International Labour Office's Information Service on Technological Alternatives for Development - has been operational since January 1988. Launched as a response to mounting requests for technological information received by ILO in recent years, INSTEAD is part of the Office's strategy aimed at promoting the development, dissemination and application of technologies suitable for the socio-economic conditions of developing countries.

INSTEAD can supply information in the following areas:

- Technical data on specific products and processes, in particular information relating to energy, food processing, agricultural tools and implements, building materials for low cost housing, and handicrafts;

- Appropriate technology institutions: their location, areas of competence, geographical coverage, types of information and services supplied, etc.;

- Equipment suppliers and manufacturers;

- Appropriate technology events such as fairs, exhibits, training workshops, meetings, technical assistance projects, seminars, etc.;

- Socio-economic effects of alternative technologies.

INSTEAD's services are available free of charge to anyone involved in "appropriate technology", from cottage-industry workers to United Nations system organizations and government departments. Depending on the request and the availability of materials, the inquirer will be supplied with catalogues, brochures, books, reports, bibliographies and or address lists. To increase the volume of information it can provide to users, INSTEAD is keen to collaborate with other technological information sources. This collaboration can include the exchange and dissemination of publications.

For further information, contact: INSTEAD, Technology and Employment Branch, International Labour Office, 1211 Geneva 22, Switzerland. (Source: INFOTERRA Bulletin, Vol. X, No. 2)

Translator software

IBM is offering new Electronic Data Interchange (EDI) translation software for mainframes operating under the MVS/ESA and MVS/XA operating systems. The new ExpEDIte DataInterchange Series lets users send and receive business documents in the American National Standards Institute's (ANSI) X12 and the United Nations Edifact EDI standards. The translator software will be available for System 36, System/38, and AS/400 midrange systems in September 1989. A version for OS/2-based PS/2s will be released in February 1990. (Extracted from PC Weekly, 10 April 1989)

US software houses fear EC directive

US software companies are worried about a directive issued by the European Community that appears to prevent copyright protection for software interfaces and programming languages.

The directive is being examined by the major US trade organization ADAPSO and the Business Software Association, which represents the top US PC software companies.

The BSA has sent a detailed report to the US International Trade Commission which will report to Congress. Congress will then discuss the software directive with counterparts in the EC.

The BSA said it is unlikely that, in the event of a dispute, member companies would retaliate by withdrawing from the European market. But school

markets where software piracy is widespread, such as in Italy, may be avoided.

ADAPSO is consulting its members about the EC directive, which is designed to encourage the growth of a strong European software industry. (Source: Computing, 8 June 1989)

Accustomed to your face

Whoever said that the personal computer would lead to the paperless office must have been living in a dream world. PCs must have been responsible for the felling of many a forest.

The increase in office paper has resulted in a common problem: if the material on the print-out you have in your hand did not originate on one of your computers, how do you get that data into your machine so that you can use it in your work?

To date, the answer has for the most part been to employ a copy typist. The hordes of dedicated workers who perform this thankless task could soon find their typing days numbered, however, as working optical character recognition becomes a reality.

Omnipage, which has been available on the Macintosh for about a year, has just been launched for the PC.

Without a shadow of doubt this is the best optical character recognition system currently available for the personal computer.

The need for an accurate and speedy optical character recognition package is significant in many offices. Getting previously typed or printed material into a personal computer has meant many hours of laborious typing.

Good copy typists are accurate and fast, but inevitably too much work in too short a period means an increase in the chances of error. In addition using a person to copy-type something which has already been typed once is a drastic waste of labour, and frequently a dreadful squandering of talent.

Secretarial staff could be doing far more useful things than simply rekeying someone else's work.

The power of something like Omnipage depends upon developments in scanner technology which have followed the rise in popularity of desk-top publishing.

Until the production of the latest range of scanners and the introduction of Tagged Image File Format (TIFF) files, optical character recognition was limited in its application. Dedicated machines were able to swallow pages of text which had previously been printed in one of a few typefaces in a limited range of sizes and pitches.

Now Omnipage will read entire newspaper pages, getting headlines, captions, and the body text right, even though these are all in different fonts.

Until the development of Omnipage such work was virtually impossible on a PC. It is capable of doing this because high resolution scanning can prepare quality bit map images in Tiff. Agfa scanners, for example, have a resolution of 800 dots per inch (dpi) both horizontally and vertically, thus producing 640,000 dots per square inch.

Such resolutions are required to provide as much information as possible about the characters on the printed page.

Low-resolution scanners would find it difficult to distinguish between, say, an 8 and an S. Higher resolutions provide a much greater degree of accuracy, enabling the system to determine each individual character.

Most optical character recognition systems depend upon "type tables", which the program uses to assess each character. Each typeface and size requires a different type table.

Therefore offices which use material from a large number of sources will need to construct new type tables for each differently-typed document they receive.

On average, a reasonable type table will take a couple of hours to produce. Unless you are going to receive mountains of material in the font defined in the table you will waste time, since it is quicker to copy-type.

Omnipage, by contrast, has inbuilt intelligence and can distinguish virtually any character in any size in any typeface. It will even separate text from graphics.

It is also remarkably fast, although it has to be said that the PC version does appear to be slower than the Macintosh equivalent.

This is almost certainly not a fault of Omnipage, but a reflection of the different machine architectures and capabilities.

Omnipage comes on four discs with a co-processor board which requires a full-length slot. The program requires a great deal of memory, and this is provided on the board as well. A software-only version is available for Mac IIs which have four Mbytes of RAM.

A hard disc of at least 20 Mbyte capacity is also required, and you will need some free space on this as Omnipage produces temporary files during its processing.

To use Omnipage you need a high-resolution scanner. The ability to produce images at 300 dpi is highly desirable, with greater resolutions working even better. Omnipage will function with lower resolutions, but the accuracy is obviously reduced. The program works with Hewlett Packard Scanjet scanners or with Canon machines.

If you do not have one of these scanners, Omnipage will interpret any uncompressed Tiff file which has been scanned in with other machines. As a result, Omnipage works with virtually every scanner on the market.

If you have a Scanjet or Canon machine you can scan directly with Omnipage. If you have another scanner you must first save your Tiff files with your scanner software before loading Omnipage. You can then open these files in Omnipage for recognition.

Getting Omnipage to recognize the text on the scanned image is easy. The program runs under Microsoft Windows, and you simply select Recognize on the Text menu and the program sets to work.

A dialogue box appears which provides options for you to select the type of output you require.

You can have straight ASCII text or it can be formatted in a wide variety of popular word-processing formats. If the material is multi-columned you can preserve the columns or not, depending on your requirements.

The level of accuracy is astounding. Of the entire page, only 17 characters were incorrect. This is an accuracy level of 98.62 per cent and the image was only scanned at 200 dpi. When the resolution was increased to 300 dpi, the accuracy level shot up to 99.8 per cent - only two characters on the entire page were interpreted incorrectly.

On examination of the original, these characters were smudged when typed, hence the difficulty. Any optical character recognition system is only effective if the originals are of sufficiently good quality.

Nevertheless, attempts to get Omnipage to interpret faxes and poor quality photocopies still achieved high results, with nothing ever falling below the 98 per cent level of accuracy. (Nothing, that is, except for handwritten material, which understandably dropped to a very poor level of accuracy.)

The savings in copy typing will be recouped in weeks, which makes Omnipage a highly cost-effective product, even with the scanner. (Source: Computer Weekly, 25 May 1989)

VII. COUNTRY REPORTS

China

Copyright laws

China will begin to cover software in its new copyright laws coming in late 1989, according to a United States Government official. China recently topped a list of 11 countries with piracy problems, according to the International Intellectual Property Alliance (IIPA). The organization estimates that the US lost $300 million to Chinese piracy in 1988. (Extracted from Computer Systems News, 15 May 1989)

European Community

Europe aims to catch up on semiconductor research

Europe's most ambitious bid so far to join forces on research and development has formally got under way. JESSI, the Joint European Sub-micron Silicon Initiative, is aimed both at developing the next generation of integrated circuits, and at improving Europe's dismal share in the world's production of computer chips.

JESSI is the biggest project under EUREKA, the programme for co-ordinating joint research among European companies. It is expected to cost 2.7 billion pounds sterling over the next eight years, with an initial 18 month phase costing 385 million pounds sterling to start immediately.

Philips of the Netherlands, SGS Thomson of France and Italy, Siemens, Bosch and Electrotech of the FRG and STW, a Dutch research institute, have so far signed on.

Filippo Pandolfi, the European Community's commissioner of research, announced that the European Commission, which is not involved in EUREKA, would pay for up to a quarter of the initial phase. The Community is funding the research programme in order to avoid duplication between JESSI and related research funded by the European Community, such as the ESPRIT programme.

JESSI's major goal is to pack electron pathways on integrated circuits at over 10 times the density possible now, as little as 0.3 micrometres (thousandths of a millimetre) apart. Along with this goes an increase in the size of the chips from 200 to 500 square millimetres, allowing the number of memory elements per chip to be increased to 40 million, then to 200 million by 1995. Logic elements, which are more complex, will be increased to 2 million, then 10 million per chip.

JESSI's goal is not only to produce the next generation of chips, but to mass-produce them as "commodity chips", a market in which Europe now has virtually no share. The JESSI planning group, located at Itzehoe, outside Hamburg, claims that access to foreign chip technology "can be cut off at any moment", by the Americans for security reasons, by the Japanese for economic ones. This, they say, would threaten Europe's electronics industry with its eight million jobs. They say European chip users had trouble obtaining some Japanese chips last year.

If Europe keeps pace, however, the JESSI team says it could take a 17.5 billion pound sterling share in a world microelectronics market of 100 billion pounds sterling by the year 2000. Half the predicted market will be for "dedicated chips" that perform specific tasks, especially in the automation of manufacturing. The JESSI team says Europe could excel in this market, because its strength is in designing systems. If Europe is not manufacturing its own chips, they say, it will have to sell its designs abroad, then buy back the finished chips.

The question underlying JESSI is whether collaborative research is really what European chip manufacturers need to boost their performance.

Industry experts say what really hampers the development of Europe's chip industry is not fragmented research, but fragmented markets that are too small to pay for new products. The telecommunication and defence sectors which are Europe's biggest users of chips are the jealously guarded preserves of national suppliers under government purchasing monopolies. These are meant to end by 1992. JESSI will include participation from chip users as well as makers, in projects to design chips for specific uses. This participation could also improve cross-border contacts and lead to a more open market. (This first appeared in New Scientist, London, 1 July 1989, the weekly review of science and technology)

France

Investment in CIM

Investment in computer integrated manufacture (CIM) was FF 21.2 billion in 1988, according to BIPE, of which FF 3.8 billion was accounted for by equipment for development and management of CIM, FF 8.7 billion by command control equipment, and FF 8.7 billion by automated machines. Of the

investment in command control, FF 2.9 billion was for pilot computers, FF 3.2 billion for peripherals and logistics, FF 1.4 billion for programmable automata, FF 0.7 billion for regulations systems, FF 0.4 billion for digital commands for machines or robots, and FF 0.2 billion for local industrial networks.

Of the investment for automated machines, investment for those with digital command was FF 4.3 billion, for the plastics industry was FF 1.6 billion, for automated handling equipment was FF 2.1 billion, and for robots was FF 0.7 billion. Flexible cells accounted for investment of FF 520 million of that for machines with digital command, of which FF 170 million was for machining installations and FF 350 million for assembly units as a whole. There are currently about 7,800 robots in use in France, according to Association francaise de robotique industrielle (AFRI). Their number is expected to rise 15 per cent per year, while other CIM equipment is expected to grow at 10 per cent per year, according to BIPE. The use of local industrial networks is expected to rise 30 per cent per year. The sector which uses CIM the most is the automotive industry, followed by the chemical industry, oil, electrical and electronics, mechanical engineering and the food crops sector. These six sectors use 60 per cent of the total electronic CIM equipment used in France. The European CIM market is estimated at FF 140 billion for 1988, with the FRG holding 40 per cent and France 15 per cent. (Extracted from Les Echos, 17 May 1989)

France's ISDN hors d'oeuvre

France aims to become the first major Western country to have a nationwide integrated services digital network (ISDN) by the end of 1991. But while the country's ISDN entrée is still three years away, the hors d'oeuvre, covering the Paris area, has already been served and a selection of large and small Parisian users are implementing live applications on the new citywide network.

France's national telecom authority, France Télécom, plans to spend over FF 1 billion ($164 million) in 1989 on the development of the ISDN network, named Numéris by PTT minister Paul Quilés.

Most of those Parisian users are taking up the ISDN offer as members of a series of partnerships that include France Télécom and local software companies. Some of these consortia plan to test applications that are predominantly image-based, building on their experience with the Minitel videotex information retrieval system, which is now accessible to over 4 million users.

Jean-François Berry, president of AFUTT, the French telecom user group, says that ISDN will allow small companies access to high speed data transmission without the expense of a digital leased line. It will allow high speed facsimile links, and it will give better sound quality on phones while the caller identification facility will let busy users prioritize calls. (Reprinted with permission of DATAMATION® magazine©, 1 April 1989, copyright by Technical Publishing Company, a Dunn and Bradstreet Company - all rights reserved)

German Democratic Republic

Technological feat: 1 Mbit DRAM.

The GDR's ability to develop and build high density memories has industry analysts shaking their heads. Not only will pilot production of 1 Mbit dynamic random access memories be started this year by the optical equipment and electronics producer VEB Carl Zeiss Jena, but the company plans to develop 4 Mbit DRAMs as well. The 1 Mbit parts, the Eastern bloc's first, uses 1-μm CMOS technology and sports a 50 ns fast-page mode access time. The 58 mm² chips come in a standard 18-pin package and are compatible with similar devices from Toshiba, Siemens, and Texas Instruments. The development of the 1-Mbit part and its 256 Kbit predecessor accounted for most of the $7.6 billion that the GDR Government allocated to microelectronics R&D during the past several years. West European industry analysts consider it a feat that a country as small as the GDR can muster the financial and technological clout needed to develop high-density memory chips, and do it without access to Western technology. (Source: Electronics, April 1989)

Germany, Federal Republic of

5-Gigaflops supercomputer

Joining the small ranks of high-performance supercomputer makers, Suprenum GmbH of Bonn has unveiled the first clusters of a system that, fully configured, will boast a computing power of 5 billion floating-point operations per second. That performance would put the machine in the class of supercomputers built by the likes of Cray Research Inc., Fujitsu Ltd., and Hitachi Ltd. The system, also called Suprenum, is the result of a four-year research and development effort at a number of FRG universities, institutes, and industrial firms. Suprenum GmbH co-ordinated the project and is marketing the machine, which carries a $14 million price tag. The company says it has already held sales talks with 10 research institutes and universities in the FRG. Suprenum plans to extend its marketing effort to the rest of Europe next year and eventually to sell its system in the United States. The first Suprenum clusters, each consisting of 16 processing nodes that together offer 320 megaflops of computing power, was shown at the Industrial Fair in Hanover. A fully configured system, slated to be available by the end of 1989, will comprise 16 clusters, making for a total of just over 5 Gigaflops. (Source: Electronics, May 1989)

Hong Kong

R&D up in air

The Government will decide whether to set up a technology centre that is capable of fostering the territory's high-technology research and development. While Korea, Singapore and Taiwan are already competing on a world scale in the IS industry, Hong Kong's tradition of innovation has not progressed much beyond electronic toys and telephones. With Chinese rule coming in 1997, the Government must decide whether there is the necessary business interest and qualified people to staff such an R&D centre. (Reprinted with permission of DATAMATION® magazine©, 15 May 1989, copyright by Technical Publishing Company, a Dunn and Bradstreet Company - all rights reserved)

India

National Centre for Software Technology

The National Centre for Software Technology (NCST) was set up in 1985 by the Government of India as a major R&D centre under the aegis of the Department of Electronics. The Centre has evolved from the National Centre for Software Development and Computing Techniques (NCSDCT) at the Tata Institute of Fundamental Research (TIFR) to an

autonomous centre of excellence in the area of software technology and related computer science. The Centre now operates from a smart new building on Ninth Gulmohar Cross Road in the JVPD Scheme, Juhu, Bombay.

The Centre's objectives are to:

- Carry out research and development at the frontline of a carefully identified subset of the rapidly developing software technology;
- Design and develop high technology software in selected sub-areas;
- Make a significant contribution to high quality continuing education of professionals in the software industry in India.

The R&D Divisions of NCST and their areas of interest are briefly described here.

Data Bases and Office Information Systems

The main interests of the DB&IOS division are in data base systems and office information systems. Significant data base applications which were developed by this group are in active use in Government departments today in domains such as rural health information and land lease information.

Computer Graphics and Computer Aided Design

The CG/CAD division works in the areas of computer graphics, computer-aided design, image processing and desk-top publishing in Indian languages. This division has developed products such as Indo-GKS basic graphics software, and Aalekh (a bilingual word processor). These two software systems were developed in collaboration with CMC and Hinditron respectively.

Real-Time Systems and Networks Division

This Division, which works in the areas of computer networks, real-time systems and distributed systems, has extensive experience in satellite based data networking. Currently, this group is working on academic networking, electronic mail and bulletin board services and remote computing. A real-time monitor, named NCRTM, has been developed recently by members of this Division. The Division is an active participant of the Department of Electronics (DoE) project named ERNET, assisted by the United Nations Development Programme (UNDP).

Knowledge Based Computer System Development Project

In addition to the three Divisions, there is a node at NCST of the nation-wide Knowledge Based Computer System Development Project of the Department of Electronics (also assisted by UNDP). The KBCS group at NCST is interested in natural language understanding, machine translation, applications of AI to education, expert systems and logic programming. NCLISP, an interpreter for a subset of Common LISP, and Vidhwan, an Expert System Shell, have been developed by members of this group, and are used in courses run by the Centre.

The Software Promotion Centre (SPC) and the Hardware Division have together created an excellent software development and computing environment at the Centre. This environment includes:

A VAX8n00 running the ULTRIX operating system;

MicroVAXes running the VMS operating system;

A local Area VAX cluster of VAX2000s; and

A number of workstations and PCs,

all integrated together in a Local Area Network. NCST also operates a DEC System 20 and MicroVAXes at the Air India Building, Nariman Point. Data Communication facilities provide access to all NCST computers from both locations. Those working in offices equipped with dial-up modems and a terminal PC can access NCST computers from their own place of work. They can also use electronic mail to communicate with staff at NCST.

A variety of software development tools has been acquired and developed around these machines. This excellent software-development environment created by the Centre is accessible to other institutions such as software development groups, software export groups, consultancies, engineering designers, R&D laboratories and universities.

Computer systems at NCSDCT/NCST have generally been installed and maintained by the Centre's Hardware Division. Hardware engineers have also contributed significantly to some software projects, and have been associated with managing systems at the Centre.

NCST's educational programmes have usually been oriented towards those already employed, and most courses conducted by the Centre are best described as continuing education.

NCST conducts a very popular part-time, post-graduate course in Software Technology (PGCST). This one-year course, which usually runs from January to December each year, attracts about 800 applicants of which about 90 are granted admission. Admission is on the basis of performance in an on-line test administered using software (named Veda) developed at the Centre. The course is divided into several modules, and participants are allowed extensive access to computer facilities, so that they learn a lot by doing extensive practical work.

In addition to the one-year course, NCST conducts advanced courses on a variety of topics all year round, for professionals from all over India. Participants in these courses can also acquire post-graduate diplomas in one of two areas of specialization: Graphics or Knowledge Based Computer Systems.

Educational institutions can get free access to some facilities available at NCST, if they can access NCST's computers using datacom facilities offered by the Mahanagar Telephone Nigam Ltd. (MTNL). (Source: NCST News'Release)

Services and technologies from India

Over the years, India has developed a sound technological and production base that has not only made it self reliant in many areas and provided it with a sound infrastructure, but has also made it competent enough to provide various types of services to many countries in the world. These services include undertaking projects on a turnkey basis, consultancy services, supply of know how, equipment, material and manpower.

The Indian Electronics Industry, though relatively small, has immense capabilities both in terms of resources and technologies in view of the availability of large technically trained manpower.

One of the most successful developments in India is the concept of industrial estates completely dedicated to electronics. It has not only helped the industry to achieve a higher growth rate but has also created a widespread bank of trained manpower and technologies. Such estates can also be set up in other countries with the help of industry to boost the overall growth of the electronics industry.

India has established a strong R&D base in electronics through the various laboratories operating under the Department of Space, Department of Atomic Energy, Department of Defense R&D, Department of Telecommunication and other user ministries, IITs and academic institutions. Besides these, a number of production agencies have strong in-house R&D groups.

Technology development in India is also being supported by the Department of Electronics of the Government of India, mainly through three agencies, the Technology Development Council (TDC), the National Radar Council (NRC) an the National Microelectronics Council (NMC). The major thrust areas for technology development have been identified and these are: electronic switching systems; LSI/VLSI devices; computer architecture; software engineering; special microwave products and strategic electronic systems including electronic warfare devices, infrared and laser based equipment.

One of the major achievements in the area of technology development has been the enhancement of technological bases and capabilities in the country. A major objective of technology development in the coming years is the achievement of excellence in selected priority areas. The approach would be mission oriented and aimed at closing the identified technological gaps through a programme of "Technology Push". (Source: AEU, No. 2/1989)

Future growth prospects for the electronics industry in India

The electronics industry in India both at the level of production and application is being given a major thrust by the Government. During the studies conducted by the Department of Electronics through various working groups, it has been revealed that the present production of electronic goods in India bears no relation with the actual demand, i.e., the capacity to absorb the demand. It has been shown that the economy can absorb at least twice the present production. It is also expected that with increase in production and competition, prices of the electronic products will be reduced, thereby increasing the demand further.

With this growth in electronics items, it is estimated that the 1984-1985 level of electronics, worth about 0.8 per cent of GDP, would reach about 3 per cent in 1989-1990.

The Government plans to intensify the use of electronics in the core industries to achieve higher productivity, efficiency and safety of operation. This aspect of the contribution of electronics would be a major factor in deciding funds for application of electronics in power, steel, coal, oil, mining and various other manufacturing industries. Special emphasis will be drawn to the fact that increased per capita usage of electronics related items leads to increased economic benefits and employment opportunities, rather than the thrust on increased manufacture of electronic items. (Source: AEU, No. 2/1989)

Ireland

Computer conferencing

University College Dublin has been awarded a 3.5 million Irish pounds contract for the continued provision of electronic mail and computer conferencing services to researchers working on EC programmes, such as ESPRIT.

These services are provided by Eurokom, a service which started in 1983 as a pilot ESPRIT project. At first Eurokom was expected to serve a few hundred users, but now 1,500 researchers from 23 countries are linked up.

The new contract is the largest to date and in announcing their success Dr. Dennis Jennings, Director of the UCD Computer Centre, said it is significant that most of the users are outside Ireland. Only 70 users are in Ireland, so revenue comes mainly from abroad.

UCD have also formed a campus company, UCD Computing Ltd., to develop and market services available from the Computer Centre. (Source: Technology Ireland, April 1989)

FAMOS launch

Manufacturing industries in Europe need to lower their cost of assembly. Assembly accounts for about 40 per cent of the cost of cars, electronic products and clothing, and European firms are at a disadvantage because their labour costs are high. To overcome this disadvantage the technology of assembly has to be improved, and this is the aim of the FAMOS programme. The FAMOS programme promotes co-operation between European firms who are working to improve their technology and of the 100 plus projects submitted since 1987, 17 are now at an advanced stage.

The Irish FAMOS programme is being promoted jointly by EOLAS and the IDA and is aimed at two groups of companies:

1. Companies involved in any way in assembly - electronics, engineering, clothing, footwear, printing, packaging, timber products, food. These would be the users of the systems;

2. Companies involved in the automation sector. These would be the suppliers of the systems.

FAMOS links the European users with the European suppliers via technology co-operation agreements. The user gets a relatively low-cost, latest-technology assembly line while the supplier gets R&D support for product development as well as European links for technology and marketing. (Source: Technology Ireland, April 1989)

Italy

Italy says bonjour to Minitel

Italian and French videotex users can look forward to expanded options when the two countries' systems are connected. France Telecom's

successful Minitel will officially connect to the Italian phone company Sip's videotel system at the end of July 1989. Initially, users of both systems will receive the other's services free. In October, Minitel's billable services will become available to Italian users. Sip expects to distribute 60,000 Minitel type terminals made by N.V. Philips' GL and Alcatel NV to Italian users within the year, bringing total installations in Italy to 100,000. The Italian company hopes to have about 330,000 terminals in use by 1991. In contrast, over 4 million France Telecom terminals have been installed. (Reprinted with permission of DATAMATION[r] magazine[c], 1 July 1989, copyright by Technical Publishing Company, a Dunn and Bradstreet Company - all rights reserved)

Japan

Laptop popularity

Circumstances can create a national market and become a criteria for laptop computers. Japanese offices are so small that laptops are more desirable than desktops. Japanese urban travel is largely on crowded trains, so heavy and bulky laptops are unsuitable. Major tradeoffs are weight, cost and performance - e.g., too thin a computer has an unsatisfactory keyboard "feel", too fancy a display pushes the cost up, and cutting down the weight of the battery can produce a lockup halfway into a business trip. The Japanese liquid crystal display market, a beneficiary of laptop proliferation, is growing some 45 per cent per year, and 1989 sales should top $1 billion.

World-wide laptop sales in 1989 will total 1.42 million units, up 56 per cent when compared to 1988, in which year some 250,000 were sold in Europe, according to Dataquest (San José, CA). Some 15 per cent of all personal computer sales are laptops, according to Compaq Computer. (Extracted from Electronic Engineering Times, 15 May 1989)

The Fifth Generation project

The first major commercial results of Japan's bold Fifth Generation computer project are likely to come in the form of software, rather than hardware.

Some of the programming expertise developed at the Japanese Institute for New Generation Computer Technology (ICOT), particularly in "fuzzy logic" techniques, is already being passed on to NASA scientists at the Johnston Space Center. Research into fuzzy computing, unique in not requiring precise definitions, has attracted such attention that 40 Japanese companies - including financial, steel and camera concerns - have together backed a new $35 million, six-year research programme and last month instituted a new Laboratory for International Fuzzy Engineering (LIFE) research in Japan.

But as the existing Fifth Generation project, which is backed by Japan's Ministry of International Trade and Industry (MITI) and local firms, enters the third and final phase of its 10 year programme, and despite progress in some key research areas, most potential users in Japan remain cautious about its eventual results.

When the Fifth Generation programme was launched in 1981, it was Japan's highest profile project, but it gradually has been downgraded in the nation's eyes. In part, this is because expectations about what the project can achieve have become more realistic. ICOT has certainly attracted less money - $600 million was promised at the start, but by the end of 1991 it will have received only $350 million. As a result, ICOT has been able to attract and hold onto fewer researchers than it would have liked.

Shunichi Uchida, one of ICOT's leading researchers, concedes that the ultimate target - a 1,000-processor dedicated parallel system called the parallel inference machine (PIM) - is "risky and difficult". The machine is supposed to operate at between 100 million and 1 billion logical inferences per second (LIPS). Using today's computer techniques, a logical inference would take around 100 machine instructions to carry out.

The machine language - Kernal Language 1 (KL1) - needs some major modifications to handle the knowledge-based management system that must sit alongside the PIM, and to ease debugging operations. American computer scientists point out that no language has yet been designed to cope well with debugging. But the operating system Pimos is nearly complete, and Uchida expects ICOT to develop many applications running under Pimos. These may be written in ICOT's constraint logic languages CIL and CAL, and in AUM - a new language.

According to Takashi Chikayama, the co-designer of AUM, the language is well suited for writing operating systems and should make programming on the parallel machine easier.

Ironically, researchers at Japanese electronics giant NEC Corp. who are working on expert system applications for ICOT are not using the PSI development workstation produced in the first phase of the project and built by Matsushita Electric Industrial Co. Ltd. in 1986. They say it is too slow and are using their own Unix-based workstation instead. Nevertheless, 300 PSI workstations are being used in the programme, 100 outside ICOT. There have been no takers outside Japan, however.

According to observers, ICOT is doing some impressive work in resource management on a newly developed 64-processor multi-PSI machine.

Jean-Marie Cadiou, director of the European Commission's ESPRIT programme in Brussels, believes ICOT has developed enough basic tools to get on with the final phase.

The major challenge for the final stage of the Japanese Fifth Generation computer project will be to move from a 128-processor machine to one with 1,000 processors. ICOT believes it has the cluster technology about right, but achieving the ultimate goal depends on doing the same with the software.

ICOT has been experimenting with a range of logic programming languages, which it hopes will provide the basis for the complex knowledge processing intended to be carried out by the projected parallel inference machine, a 1,000 processor dedicated parallel system. The first language, Guarded Horn Clauses (GHC), was inspired by Concurrent Prolog, a language designed by Ehud Shapiro at the Weizmann Institute of Science in Israel. Shapiro points out that GHC was flexible but demanded heavy processing overheads. ICOT implemented a subset of GHC, called Flat Guarded Horn Clauses, which has been further refined to Kernal Language 1 (KL1).

This seems to be a promising machine language. KL1 has additional features over GHC for meta control. Programs can be written that also

control their own execution. This saves programmers also having to write an operating system macro. In this respect, KL1 is similar to the language C.

ICOT plans to implement one of several application languages on top of KL1, based on a new technique called constraint logic programming. Here, ICOT has made big strides, much to the surprise of leading logic programming experts. Programmers can take chunks of a program - in the form of equations (or constraints) - out of the main body of the program, to be executed in a separate software routine. This approach promises a big speed-up in parallel processing. (Reprinted with permission of DATAMATION[r] magazine[c], 1 May 1989, copyright by Technical Publishing Company, a Dunn and Bradstreet Company - all rights reserved)

New Zealand

Electronics firms take stock

The New Zealand electronics industry may be poised for an export-led recovery, according to a recent survey of leading electronics manufacturers, although the future profile of the industry will probably be different from that of the past.

The survey, carried out by Bevin Cornwall of the Department of Scientific and Industrial Research, sampled 14 companies, responsible for about 70 per cent of electronics production in New Zealand. These firms had all shown growth over the last three years, while the industry as a whole had contracted by half. The firms surveyed were exporting about half of their production.

The findings represent some hope to an industry hit hard by an economic deregulation which opened the country to international competition.

The change has forced New Zealand electronics manufacturers to assess their strengths and weaknesses. Most now agree that large-scale manufacturing, especially of consumer electronics, is not an option for a country that cannot take advantage of economies of scale.

Cornwall says the industry should be concentrating on adding value to overseas sourced products by using the country's intellectual resources. The survey results suggest the industry is moving in this direction. For instance, although employment in the industry as a whole has halved since 1980, over the same period the number of professional engineers employed by the surveyed firms has doubled. The surveyed companies were also allocating about 8 per cent of their budgets on research and development, and were sharpening their marketing skills. Less encouraging was the fact that these best performing companies had started up in an era when there was some support for the industry; the more daunting current economic climate is not a great incentive for business startups. (Source: Asia Electronic Union Journal, No. 2/1989)

Spain

Spain produces its first commercial IC

AT&T Microelectronics of Spain produced the first chip that has been totally designed, fabricated and encapsulated in its factory in Tres Cantos, near Madrid. This chip is an ASIC fabricated in 1.25 µm CMOS technology with a single level of metalization. It was designed by engineers of AT&T and Telefonica Investigación y Desarrollo.

The chip contains 80,000 transistors - consisting of 12 K of ROM, 1 K of RAM and standard logic circuitry cells of 5,000 equivalent gates - together with a small analog sector to control the crystal oscillator. The use of 1.25 µm technology at Tres Cantos - rather than the 1.75 µm technology originally slated - signals AT&T's intent to support advanced technology at this site. According to William J. Warwick, president of the company's Administrative Council, the step to submicron (0.9 µm technology) will be taken "when the market requires it". (Reprinted with permission from Semiconductor International Magazine, June 1989. Copyright 1989 by Cahners Publishing Co., Des Plaines, IL. USA)

Taiwan

Import barriers to be removed

Taiwan will end restrictive import inspection procedures for 156 telecommunications products and electrical household appliances, government officials said. This decision was made at a joint meeting of the Council for Economic Planning and Development, the Ministry of National Defense and the Ministry of Communications.

Existing regulations require that applications for imports of electrical household appliances and telecommunications equipment be submitted to the Taiwan Garrison General Headquarters, which issues special licences authorizing the import of such items.

Important items removed from the inspection list include video systems, radios, amplifiers, parts of videotape recorders, digital switching systems, telexes, electrical typewriters, colour TVs, integrated circuits, microprocessors and electronic eyes. (Source: Asia Electronic Union Journal, No. 2/1989)

Taiwan computer parts become more important

Taiwan is becoming an increasingly important source of parts for foreign computer firms. For many US companies like IBM, Taiwan is now second only to Japan as an Asian parts source. "Cheaper prices aside, Taiwan also boasts substantial technical expertise enabling design-to-production lead times to be shortened by as much as one third," according to one industry official.

Taiwan's exports of information processing products - including micro-computers, disk drives, printers, terminals, keyboards, and other peripherals and components - reached $US 3.7 billion in 1988, roughly 96 per cent of the local industry's output. (Source: Asia Electronic Union Journal, No. 2/1989)

United Kingdom

UK supports compound IC technology

The UK Government's Department of Trade and Industry (DTI) and the Science and Engineering Research Council (SERC) have combined their interests in compound semiconductor technology research by establishing the Compound Semiconductor Technology Subcommittee - a single organization responsible for basic, strategic and applied research.

This new subcommittee will primarily oversee three programmes. The first, a $23 million Advanced Technology Programme - funded under DTI's research

and technology initiative is concerned with research on all aspects of gallium arsenide technology.

The second programme, the $21 million LINK Advanced Semiconductor Materials Programme - jointly funded by DTI and by SERC - focuses on device-oriented research for non-silicon semiconductor materials. The third - the Low Dimensional Structures and Devices Programme - receives annual funding of over $8.75 million from SERC to investigate the physics of ultra-thin multi-layer structures and how to exploit such structures in novel devices. (Reprinted with permission from Semiconductor International Magazine, June 1989. Copyright 1989 by Cahners Publishing Co., Des Plaines, Il. USA)

Alvey programme leads to successful processes

New VLSI processes have been successfully developed under the five-year Alvey collaborative programme that ended in 1988. This programme was a joint information technology venture in pre-competitive research in response to increasing overseas competition. It involved government, industry and academic institutions, and cost some £650 million, including $165 million for VLSI technology. Over 40 silicon VLSI projects formed an important part of Alvey, but III-V work, optoelectronics, and microwave devices were specifically excluded.

The technology development of the VLSI 061 ultra-high-speed 1 μm bipolar process has been completed by Plessey Caswell in collaboration with the Universities of Southampton and Oxford. A divide-by-8 circuit has operated at 10.7 GHz, a world best for silicon, and similar to the best in any other technology. It employs advanced features, including trench isolation, and is now being transferred to Plessey Semiconductors (Swindon) for production. A second bipolar process, project VLSI 062 involving Plessey and Ferranti, uses a simple, low-cost, 1.2 μm CDI (Collector Diffusion Isolation) technology developed by Ferranti before the company was acquired by Plessey. Alternative technology options being explored include thermal annealing, polysilicon emitters and silicided contacts. Production is at Plessey Semiconductors in Oldham. This process is claimed to be very successfully filling the niche for fairly high performance at low cost.

A CMOS silicon-on-sapphire radiation tolerant technology has been developed under the VLSI 058 project by GEC, Marconi Electronic Devices Ltd., Lincoln) and the British Ministry of Defence's Royal Signals and Radar Establishment (Malvern). It is being implemented in production at Lincoln. A radiation hard 64K SRAM achieves an access time of <55 nsec over the -55°C to +125°C range. Work at the Royal Signals and Radar Establishment (Malvern) has shown that CMOS-SOS processing is viable below the 1 μm level.

GEC has withdrawn from the bulk CMOS project VLSI 059, leaving Plessey Caswell as the sole participant. It includes trench isolation, shallow silicided source drains, and multi-layer metalization on a 3 μm pitch for high packing densities. Most aspects of the technology have been successfully demonstrated. It is claimed that this 1 μm trench isolation process shows a sevenfold improvement in packing density and a threefold increase in speed over the pre-Alvey state-of-the-art. Pilot production at Plessey Semiconductors (Plymouth) is expected in 1989 (table 1).

The technology from this project has been applied to analog applications by Plessey Caswell under the 1.5 μm VLSI 050 project for which production began in September 1988 at Plessey Semiconductors (Plymouth). Such digital-analog combinations are especially important in telecommunications applications.

The 1.25 μm VLSI 071 CMOS project was less ambitious in technology than VLSI 059, but was the first process to achieve all of its goals with full process characterization by November 1987. It has been installed both at STC (Footscray) and British Aerospace (Stevenage). The technology with double layer metalization is complete and in production.

The Alvey VLSI technologies are claimed to be roughly in line with the US VHSIC programme and with the rest of the world on the basis of throughput (a combined measure of density and speed expressed as gate Hz/mm^2). These competitive VLSI technologies have been established with very modest resources. The extent of industrial exploitation is unclear. (Reprinted with permission from Semiconductor International Magazine, April 1989, Copyright 1989 by Cahners Publishing Co., Des Plaines, Il. USA)

United States of America

America pools its industrial strength in superconductors

Three giants of the American scientific establishment have joined forces to pursue applications of high-temperature superconductivity. IBM, AT&T Bell Laboratories and the Massachusetts Institute of Technology announced that they will form a consortium.

Table 1. Performance of Alvey Digital Full-process Technologies

Technology type	VLSI 061 ultra fast bipolar	VLSI 059 digital bulk CMOS	VLSI 062 CDI bipolar	VLSI 058 CMOS-SOS	VLSI 071 bulk CMOS/ BiCMOS
Min. feature size (μm)	1.0	1.0	1.2	1.5	1.25
Project cost ($ million)	5.6	20	13	15.8	11.7
Max Op Freq (GHz)	2.2	0.73	0.51	0.35	0.2
Toggle Freq. (GHz)	11	0.9	0.65	0.41	0.165
Density (SRAM bits/cm^2)	160 × 10^3	560 × 10^3	88 × 10^3	600 × 10^3	250 × 10^3
Circuit density (gates/cm^2)	3.6 × 10^4	4.8 × 10^5	5 × 10^4	2.25 × 10^5	8 × 10^4
Figure of merit (gate, Hz/cm^2 max)	7.9 × 10^{13}	4.5 × 10^{14}	3.2 × 10^{13}	5.8 × 10^{14}	1.6 × 10^{13}
Radiation sensitivity (neutron/cm^2 MeV)	10^{15}	10^{15}	1.5 × 10^{13}	10^{15}	5 × 10^{14}
Power figure (μW/MHz/gate NAND + metal)	0.1	6.7	9	2.6	1.75
Scheduled production	Oct. 88	April 89	Dec 88 1.0 μm Dec 89	March 89 1.0 μm Mar 91	July 87 1.0 μm June 90

Twenty five researchers will pool their efforts in four areas of electronics. They include work on networks, junction devices, integrated circuits and new materials to enhance superconductivity at room temperature. The new group, the Consortium for Superconducting Electronics, will request $4 million to $6 million from the Defense Applied Research Projects Agency (DARPA).

IBM, AT&T, and other companies interested in joining would contribute similar amounts to a start-up fund of about $15 million. It will be run from MIT and is planned to last up to 10 years. Several scientists, including former president Ronald Reagan's former science adviser, George Keyworth, have urged the Government to encourage companies and universities to co-ordinate efforts to apply superconductivity to electronics.

DARPA is interested in military uses, such as sensors for surveillance and microcircuitry for high-speed computing. In January, a committee set up by Reagan advised the White House that no single company has the resources to exploit high-temperature conductivity.

Ralph Gomory, the chief scientist at IBM, chaired that committee. On 2 May 1989, scientists at MIT announced the results of a two-year study of eight American industries, including semiconductors and consumer electronics. The study, called Made in America: Regaining the Productive Edge, stated that lack of industrial and academic co-operation threatened America's share of technological advances. (This first appeared in New Scientist, 3 June 1989, London, the weekly review of science and technology.)

Union of Soviet Socialist Republics

'Mailbox' venture with FRG firms

The first joint venture between Soviet communications authorities and foreign companies is off the ground. Called Interlink USSR, the $3.8 million venture with two FRG firms aims to set up a mailbox communications network that, using the country's phone lines, will eventually extend to all major cities in the Soviet Union. Supplying the mailbox computer and system know-how is Deutsche Mailbox GmbH of Hamburg. Profin GmbH of Freiburg will supply peripheral equipment such as personal computers, modems and acoustic couplers. In its first phase, the mailbox net will cover the Greater Moscow region; subsequent phases will extend it to other metropolitan areas. The Soviet Ministry for Communications owns 51 per cent of Interlink USSR, with each of the FRG firms holding a 24.5 per cent share. (Source: Electronics, June 1989)

Soviet software coming

The first two software products to come out of a major East/West joint venture hit the European and US market last March. UK PC-based computer-aided design company AutoDesk, and Soviet software co-operative Infograf have set up a joint venture company in Moscow called Parallel to sell AutoDesk products in the USSR and provide the UK company with Soviet-developed software for sale in the West. The first Soviet products are an AutoLisp compiler and a parametric data base. Expert systems products are now under development at Parallel, which is regarded as a blueprint venture for Soviet organizations wanting to get their hands on hard currency to buy Western IS products. AutoDesk, meanwhile, is joining up with Microsoft, IBM, Lotus, Apple, and Ashton Tate in a bid to stage a major seminar on copyright and legal issues in East/West trade outside Moscow at the end of June. (Reprinted with permission of DATAMATION[r] magazine[c], 15 April 1989, copyright by Technical Publishing Company, a Dunn and Bradstreet Company - all rights reserved)

Curtain raised on trade barriers

Political liberalization in the Soviet Union has finally opened the way for high-tech companies to clinch deals which would have been unthinkable a few years ago. Both computer maker ICL and the GEC Plessey Telecommunications (GPT) company announced major collaborative deals at the Moscow Trade Fair and the potential for success is immense.

The Soviets need Western technology to update industry and commerce. At the same time companies from the capitalist States are looking for big new markets into which they can expand. Russia wants to treble its base of personal computers to one million machines by the end of next year, while the country is reckoned to have the second-largest global telecoms market, according to the Telecommunications Research Centre, with a total expenditure of $6,400 million in 1986.

Technology exports to the USSR have been strictly controlled in the past and although shipments have been licensed, the advent of glasnost has significantly boosted Western confidence in the country's intentions. The USSR appears less a political and military rival than a great untapped marketplace.

Restrictions drawn up under the CoCom organization, which vets sensitive exports to communist states, remain in place, but the mood is changing towards a more liberal commercial approach to sales and now joint ventures.

ICL has permission to set up a joint venture company in Leningrad, the USSR's second city, to supply safety systems for Russian merchant ships, port administration systems and municipal services. Called Marine Computer Systems (MCS) the Soviet operation will be run with the Central Scientific Research and Planning Design Institute of the USSR merchant marine ministry, as well as the Civic Domestic Service Board of Leningrad city council.

Computers will eventually be assembled in Leningrad, based on ICL's DRS line of machines which feature both 8-bit and 16-bit technologies. This takes ICL's licence right up to the CoCom limit for sensitive exports. Up to 10,000 boxes per year is the manufacturing target and ICL has not ruled out the possibility of constructing more advanced computers at the site if CoCom relaxes its restraints.

Software development and the establishment of a service centre network throughout the USSR are planned, spreading from city to city as business grows. The MCS venture will be purely commercial, as ICL does not envisage any major technology feedback from the deal.

The GPT deal sees the company linking with the MGTS Moscow telecoms authority in a venture called Comstar. The immediate charter for the venture will be to supply modern telecoms for the Moscow area, which will start with pay phones and the shipment of 100 units as a minimum by the end of the year. Installations will start in July.

Like ICL's step by step plans, Comstar will extend its operation to other Soviet cities. If required, local manufacture will be initiated.

One benefit the Russians will gain from Comstar is foreign currency from the credit card pay phones to go into hotels and airports for overseas visitors. GPT and other UK firms can equally expect spillover business in other Eastern bloc States. GPT's protracted negotiations to sell System X to Bulgaria could be vivified by the Moscow deal. (Source: Electronics Weekly, 26 April 1989)

VIII. FACTORY AUTOMATION

Macintosh PC to be modified for the shop floor

Except for a brief time in the early 1980s, Apple Computer Inc.'s impact on the factory floor has been minimal. Now, however, as part of its development agreement with Digital Equipment Corp., the Macintosh is being examined for a shop floor position. Digital is testing a Macintosh PC that has been modified for the factory floor by Automatix Inc. of Billerica, Mass., to determine how well data and files can be shifted from minicomputers to the PC in industrial applications. Moreover, Apple is enlisting several manufacturing software vendors to develop applications for the Macintosh. If Apple begins to make its presence known in manufacturing environments, it will mark a return of sorts for the company, whose Apple II products were among the first PCs used in a factory floor environment. (Reprinted with permission of DATAMATION[r] magazine[c], 15 May 1989, copyright by Technical Publishing Company, a Dunn and Bradstreet Company - all rights reserved.

Sewing robot

Matsushita Electric Industrial (Osaka, Japan) has introduced a manoeuvrable sewing robot. Developed as part of the Japanese Government's R&D project for an automatic sewing system the robot is a two-armed articulated robot fit with seven joints, a 3D vision and six axis pressure sensors. The Government will start up a pilot plant for the automatic sewing system in 1990. The initial commercial model of the robot is expected to be offered by 1992. Matsushita, under a government contract to develop the technology needed to work with such flexible objects as fabric, developed a multilayer computer architecture with an Intel 80286 CPU at the top control layer, an NEC digital signal processor and five Intel 80186 CPUs at the secondary computation layer. Matsushita said it will develop various robots based on the technology. A possible use may be an assembly line robot to take on screws, solder wire and other complicated assembly work. (Extracted from Metalworking News, 3 April 1989)

Minature robot to assist in medical treatment

Scientists at Tokyo University are developing a small robot to go inside the human body and remove or otherwise treat diseased tissue. According to researcher I. Fujimasa, the robot would be less than 0.04 inches in size, small enough for it to move through blood veins and venture inside the body's organs. It would also have the ability to signal its location and communicate its findings to the attending medical team. The Ministry for International Trade and Industry (MITI) has been contributing financially to the project since September 1988. The researchers hope to get MITI money for an $80 million International Micro machine Center, plus additional support of $1.6 million/year. (Extracted from The Asian Wall Street Journal, 20 February 1989)

Automation marketing program created jointly

A workstation based plant floor automation marketing program has been jointly created by Apollo Computer, AUDRE (San Diego, CA), CAD CAM Integration (Woburn, MA), DocuGraphix (Cupertino, CA), INTERMEC (Lynnwood, WA), Optimation (Las Cruces, NM), Gyrex Gates (Wrentham, MA) and Westinghouse Electric's Automation Division (Pittsburgh, PA). The FactoryView program is targeted at supplying manufacturers with an open and integrated group of shop solutions as document management, and bar coding and quality control for various jobs. A program will include an "electronic traveler" that substitutes for paper-based shop-floor documentation with an automated technique of speeding data flow through plants. Apollo said FactoryView is oriented to practical solutions that enhance quality and throughput now, while creating an open computing environment that sets up firms for total computer-integrated manufacturing solutions. (Extracted from Metalworking News, 1 May 1989)

Computerization in welding controls

Computerization appears to be the chief trend in welding controls. This includes a trend towards controlling welding systems with standard computers instead of proprietary units. Various factors are helping bring about controls for automated welding systems via computerization. A more vital factor is ease of use, with the target being to simplify the job of programming and running automated systems so that a wider range of workers can use them. (Extracted from Metalworking News, 3 April 1989)

Welding robot

Lincoln Electric (Cleveland, OH) will launch a welding robot that will be interfaced with the Mig-Trak laser guidance system that Lincoln bought in 1988 from General Electric Robotic & Vision Systems (Orlando, FL). Nachi (Japan) is producing the not yet named robot to Lincoln particulars. Lincoln said a possible use is automotive. Lincoln believes it has given the guidance system the shop environment dependability necessary to function in industry. (Extracted from Metalworking News, 3 April 1989)

Software progress has improved automation

Recent progress in software technology has made computer simulation an improved tool for automated plants. As software packages become more user friendly and computer capacities rise, simulation will be used in everyday modelling, according to K. Rommelaere of Litton Industrial Automation. Real time plant floor data will be united into the model as system diagnostics and data gathering techniques become more sophisticated. This will allow the updating of the model with altering techniques and also permit for future events diagnostics. The future is expected to bring less expensive computers with capacities large enough to support more advanced simulations. Those simulations will be tied directly to on-line plant floor data for utilization in production upgrades and ongoing output fine tuning. (Extracted from Material Handling, May 1989)

Machine or process specific software

High Tech Research's (Chicago, IL) series of machine or process specific rule based expert system software can direct a machine operator so

that the machine makes almost zero defect parts. With the software, the In-process Stat Advisor program makes direct and immediate suggestions concerning minimum sample size and the need to compensate for a drift in the process. It differs from the majority of statistical-process-control software in that it does not bother the operator if a process is operating steadily above or below norm unless it decides that that trend is hurting quality needs. Responding to process variation, Stat Advisor re-estimates the best sample size after each data entry by the operator. If a machining process gets away from the norm, the program tells the operator to raise the frequency of inspection and/or the sample size to sustain control. It advises the operator to stop the machine if the process variability for process centring is near the quality acceptance limits or if the short-run capacity indices are near the targeted values. (Extracted from American Machinery, April 1989)

IX. STANDARDIZATION AND LEGISLATION

Standardization

Networking standards

Japan is helping to develop international computer networking standards that will be submitted for acceptance by the MAP/TOP World Federation at its meeting in Vienna, Austria. The standards would ascertain global recognition for tests and tested particulars for manufacturing automation protocol (MAP) and technical and office protocol (TOP). The "Factory Automation Interconnection System" project called "Mini-MAP" is presently in the third year of research by the International Robotics and Factory Automation Centre (Tokyo, Japan). The interconnection system allows integrated and efficient linkage of such plant automation equipment as robots and machine tools. The centre said characteristics include fast responsiveness, strong durability under strict work needs and environments, and inexpensive networking systems. More research will be carried out at a MAP/TOP conformance test centre in Higashi Kurume, Japan, which is expected to be set up in October 1989. The centre, which will be built by the Technical Research Institute of the Japan Society for the Promotion of Machine Industry, will have systems to be bought from the Corporation for Open Systems in the United States and the Standards Promotion and Application Group in Europe. (Extracted from Metalworking News, 29 May 1989)

The initial national codes put on compact disc-ROM memory in late 1989 will be standards for boilers and pressure vessels, which are presently found in a 24-volume set of codes published by the American Society of Mechanical Engineers. Information Handling Services (Englewood, CO), a data management firm, will compress the standards and related reference documents to one CD made and indexed for fast computer access for the ASME. The data can be read on an IBM AT-compatible personal computer that includes a high-resolution graphics monitor. ASME said 1,300 sets per year of the published code are sold, mainly to technical libraries. Ultimately the CD ROM technology may cut the code's price and expand the code's availability to more engineering users. (Extracted from Engineering News, 1 May 1989)

A voice for standards

The proliferation of voice messaging systems in the past two years has created its own problems. Many companies have already installed incompatible systems at various locations, with little chance of interoperability. Some system vendors offer networking, but only for their own machines.

Users and vendors have not been blind to the problem, however. A grass-roots effort is under way to establish a set of standards that can be presented to an existing standards body to facilitate formal industry guidelines.

The effort, led by the Audio Messaging Interchange Specification (AMIS) group, includes 10 users, 12 vendors, and eight service providers. After holding its first formal meeting last autumn, the group has moved full speed ahead to set a specification for the interworking of various voice mail systems within one year.

Recently, the group made a crucial decision in its approach to the future standard - whether it will be analog or digital. By a narrow margin, it voted to proceed with the development of a digital protocol only. However, the group will attempt to reconcile the concerns of those who voted against the digital protocol due to its costs, complexity, and lengthy development time. Once those concerns have been addressed, the effort will move forward more quickly.

Many in the industry consider a digital approach the way of the future, but most of the voice messaging vendors still offer only analog systems, so a move to digital could mean a longer standard effort. (Extracted from DATAMATION, 1 April 1989)

ISO gets Lisp draft

A draft proposal for a Common Lisp programming language standard will be presented to the International Standards Organization (ISO) for action. Prepared under the auspices of the American National Standards Institute, the draft standard could be voted on by the ISO before the end of this year, according to X3J13 Common Lisp committee member Richard P. Gabriel. The draft proposal does not include standardized language interfaces for mixing Common Lisp and other languages. Gabriel predicts that current efforts by developers to create language interfaces will spur wider acceptance of Lisp. (Reprinted with permission of DATAMATION® magazine©, 1 July 1989, copyright by Technical Publishing Company, a Dunn and Bradstreet Company - all rights reserved)

Credit-card sized ICs

Standardization of credit-card-sized integrated circuit (IC) cards has not yet been achieved. IC cards come in ROM versions, which hold applications, and RAM versions. However, major manufacturers failed to come up with an industry standard in a 1988 effort, according to A. Seybold, who conducted the negotiations. The manufacturers thought standardization would hinder innovation. However, standardization would probably lead to lower prices due to competition. Higher prices will keep out smaller software vendors, who cannot afford to produce IC cards for many standards, according to Seybold. Machines running on IC cards include Ultralite by NEC Home Electronics; Wizard PC by Sharp Electronics; and computers by Poget Computer and Agilis. Lotus will probably introduce IC cards for Lotus 1 2 3 (version 2.01), Agenda, and a combined Metro and Express program in July 1989, according to J. Prelack, technical marketing manager, Lotus. Standardization of IC cards will probably boost sales of notebook sized and cheque book sized laptop computers. (Extracted from PC Weekly, 12 June 1989)

Sparc International takes over in directing Sparc standard

The Sparc Vendor Council has created a not-for-profit organization open to hardware and software vendors of Sparc products. Sparc International will further development and industry understanding of the Sparc standard, according to SVC spokesmen, and supercedes the SVC.

Sun Microsystems introduced Sparc (scalable processor architecture) in 1987. The company was a major supporter of the SVC and now actively supports SI with its technical expertise.

Key SI charter items include:

- Ensuring development and open availability of hardware and software technology needed to build Sparc systems;
- Publishing binary compatibility specifications and instituting conformance testing;
- Directing evolution of the Sparc architecture;
- Promoting and supporting third-party systems and applications;
- Providing a demonstration centre for Sparc vendors.

An SI spokesman said that the organization considers itself a proponent of a truly open RISC standard because of the existence of multiple sources for Sparc chips and software development tools. More than 400 applications software packages are available as well.

SI and AT&T's Unix Sofware Operation will jointly develop the Unix System V Release 4.0 Applications Binary Interface for the Sparc architecture. AT&T and Sun Microsystems began this development project in October 1987.

SI was interviewing for a permanent chief executive officer at press time. Greg Leonard of Fujitsu Microelectronics served as the interim CEO for SI. The board of directors consists of representatives of the five SVC members (Bipolar Integrated Technology, Fujitsu Microelectronics, LSI Logic, Cypress Semiconductor, and Texas Instruments).

At its meeting on 7 April, the board finalized classes of membership, which will allow Sun and other interested companies and individuals to join SI. Executive membership for $100,000 gives a company the right to seat a member on the board of directors and on the architecture committee. Associate membership for $25,000 allows a company to participate in all committees and seat a member on the board. Affiliate membership for $100 permits students, teachers, consultants, and other interested individuals to receive SI's publications.

Funding from the original five members and new members will support the new CEO and staff. According to Leonard, the first step is to put together a strategic plan. Once the basic steps have been taken, SI hopes to organize a Sparc conference.

For more information, contact Sparc International at its mailing address, 1 W. El Camino Real, Suite 167, Mountain View, CA 94040, phone (415) 960 8718. (Source: Computer, May 1989)

CAD data get new standard

Federal Republic of Germany companies have joined forces to back a standard for the exchange of computer-aided design (CAD) documentation developed by the Deutsche Elektrotechnische Komission, Siemens AG, Asea Brown Boveri and GEI Software Technik. Based on standard graphics symbols and a so-called neutral interface for circuit diagram data, the standard now has the backing of another eight industrial companies and institutes in the country. (Reprinted with permission of DATAMATION® magazine©, 15 May 1989, copyright by Technical Publishing Company, a Dunn and Bradstreet Company - all rights reserved)

Users fear standards impotence

Computer users are in danger of losing all influence over the development of international standards because governments are refusing to fund user representatives at standards meetings.

Standards work is now dominated by system suppliers, who have vested interests in the results because they affect existing and future products and markets.

International standards bodies are growing concerned about the falling numbers of users taking part in their work. The European Telecommunications Standards Institute (ETSI), for example, has just cut its annual subscription for users and entire users associations to 1,000 pounds sterling.

Almost all Governments in Europe are ignoring a European Commission recommendation that they should "provide basic funding to enable consumers to play an effective role in standardization without loss of earnings".

The United Kingdom Government is thought to be the only one paying even lip service to this recommendation, and its support falls short in practice.

The funding issue has just caused the Information Technology Users' Standards Association (ITUSA), which represents the United Kingdom's biggest users, to resign from ETSI.

ETSI says the number of users' associations among its 160 members has dropped to around 15. (Source: Computer Weekly, 25 May 1989)

Europe lays down ISDN standards

Europe's PTTs have finally agreed the standards for a pan-European integrated digital network service.

The specification for full integration of European ISDN systems will be published before the end of 1989, freeing users to invest in equipment with no chance of redundancy.

A memorandum was signed in London by 18 PTTs members of the European Conference of Posts and Telecommunications (CEPT).

A BT spokesman says that as far as the general public is concerned there are not likely to be applications of ISDN before the end of the century.

ISDN will be of most benefit in the corporate sector, providing large companies with the means to transfer very large amounts of data quickly to anywhere on the network.

High resolution colour graphics, for instance, require huge amounts of data and need to be sent digitally over high bandwidth media.

More frequently, ISDN accommodates a wide range of services over the same line. Voice, data, videotex, fax and video telephony can all be integrated.

BT already provides these services in major United Kingdom commercial centres.

The Memorandum of Understanding includes three requirements. The first is that all signatories will provide a common range of services, along with a list of optional services that will meet the common standards.

Second, it will support common standards for customer equipment, so that for instance any terminal made to the agreed standards will work in any country in which the operator has signed the memorandum.

The third requirement is to interconnect the national systems to make an international set of services.

The United Kingdom, France and the Federal Republic of Germany all provide ISDN services, but there are several differences in approach.

The Memorandum of Understanding, which is now in force, is signed by 18 countries covering over 350 million people.

Standards for customer equipment will be handled by the European Telecommunications Standards Institute, set up last year by CEPT.

The institute includes national telecommunications administration operators, industrial representatives, users and research bodies. (Source: Computer Weekly, 20 April 1989)

Safety standard on the way

A United Kingdom-led international standard for safety-critical systems will be published this June. Developers and procurers of the systems are at present bereft of standards to work to, even though computers are used increasingly to control anything from civil aircraft to medical equipment.

Representatives from the USSR, the United States and Japan are among the members of the International Electrotechnical Commission (IEC) group which has developed the 184-page standard.

As of June the standard can be used as a reference in courts of law.

Users say the present United Kingdom "standard" in the form of the Health and Safety Executive's set of documents called Electronic Systems in Safety and Related Applications, are inadequate for complex safety critical systems.

The IEC standard which has been four years in the making is intended for all non-defence and non nuclear applications, but it has "85-90 per cent commonality" with the emerging United Kingdom defence standard 00-55.

It stipulates that developers have to have the quality assurance system ISO 9001 in place, and covers procedures for areas including specification, project management, validation and verification and maintenance.

It lists appropriate techniques depending on how potentially hazardous the application is.

Once industry comments have been processed, it will take until March 1990 to achieve the full standard. Meanwhile systems to run chemical plant production, and control car brakes continue to appear, written to insubstantial, ad hoc standards. (Source: Computer Weekly, 4 May 1989)

Data exchange standards used today

IGES: The most widely used data exchange standard among United Kingdom manufacturers is Initial Graphics Exchange Specification, developed by the United States National Bureau of Standards. Version 1 of IGES appeared in 1980 and one CAD/CAM consultant describes it as being based on "punch-card thinking".

Soon after it appeared, both the French and Germans produced their own versions to overcome what they saw as the drawbacks of IGES.

SET: The French version of IGES, called SET, was developed by the aerospace inudstry and is now widely used in France.

VDA-FS: The name of the version produced by the West German car industry. It is widely used in both the Federal Republic of Germany and the United Kingdom. (Source: Computing, 29 June 1989)

Steering a path in a standards maze

As manufacturers rely more and more on suppliers to collaborate in the design process, the need to exchange data between CAD systems is growing. And with it, all the headaches of sending data between incompatible systems are on the increase. Given that much of the data CAD users need to exchange is in the form of complex two and three dimensional models, the difficulties are magnified.

One way of overcoming this problem is for big manufacturers to insist that all their suppliers have identical CAD systems to their own. However, for suppliers who deal with more than one manufacturer, this is not feasible.

Another option is to use direct translators, which convert the data files from one system to the format required by the other. Although fast and effective they are expensive and specific to a single pair of systems.

The third solution - and the one most fashionable at the moment - is to use standard data exchange formats. These are neutral formats into which the data from the sender's machine is translated, and from which the receiving system reads the data. But even with these there are problems.

First, different CAD systems have different functions, so one may have 24 types of lines and the other may have only three. To send a diagram from the system with 24 line types to the other would mean reducing the number of line types used to three.

Another problem is that because the data exchange standard most often used, Initial Graphics Exchange Specification, covers so much ground, no one supplier has implemented the whole of the IGES specification - instead they have all implemented subsets of it. This means that while two suppliers

may both claim to have IGES systems, their systems may have little in common. To add to these difficulties, the IGES specification itself is written in such a way that it can be interpreted differently by different people.

Given the shortcomings in existing data formats, the whole business of data exchange is costly and time consuming, with plenty of room for error.

In a bid to overcome these problems, the International Standards Organization is developing another standard, known as Standard for the Exchange of Product Data, to replace existing ones. This is being heralded by some as a knight in shining armour, coming to the rescue of distressed CAD/CAM users.

However, it is still only at draft proposal stage, which means it is being assessed by all the countries involved. Under the painfully slow international standards process, their views will be incorporated into another draft proposal and the whole cycle will be repeated until a consensus is reached.

Dr. Charles Clarke, director of the European Industrial Automation group at Dataquest, thinks this will take a long time: "Any standard which depends heavily on the co-operation of people in a committee takes forever. Meanwhile users tend to take short cuts."

But Howard Mason, chairman of the United Kingdom committee involved with STEP, is optimistic about the impact the new standard will make: "In a couple of years' time STEP will offer equivalent functions to IGES, but unlike IGES it will be able to move forward with CAD technology."

Supporters of STEP say that because it is being developed with the help of CAD/CAM suppliers they will be able to implement it far more quickly than they have done with IGES. Another factor in STEP's favour is that the United States Department of Defense has said it will make the United States version of the standard, Product Data Exchange Specification, mandatory for all defence contractors.

In order to boost STEP's progress further, the CAD/CAM Data Exchange Centre is planning to have validation and testing ready for when STEP is published. Fowler says that because of these factors, the move from existing standards to STEP will be much easier for users and suppliers than trying to keep up with with IGES, SET and VDA-FS.

In a bid to get to grips with the practical problems of using IGES, the Society of Motor Manufacturers and Traders ran a project, completed last January, involving six pairs of companies with a commercial need to exchange CAD/CAM data on incompatible systems. Each pair exchanged data and reported bugs to the suppliers involved.

The CAD/CAM systems they used were IBM's Cadam, Computervision's CADDS4X, GE Calma's DDM, Intergraph's IGDS and McDonnell Douglas' Unigraphics.

One of the aims of the project was to set up a methodology to guide users on how to prepare for data exchange, how to perform the exchange itself and how to identify errors in the translation of data and report them to the supplier. This methodology was set up with the help of the CAD/CAM Data Exchange Centre, and SMMT is encouraging manufacturers to use it.

Meanwhile, the Data Exchange Centre is being funded by the Department of Trade and Industry to set up testing and validation services for CAD/CAM systems conforming to IGES. It is also working on a European Commission funded project to harmonize conformance testing for IGES with testing for SET in France and for VDA-FS in the Federal Republic of Germany to be completed by the end of 1991.

As manufacturing industry becomes more dependent on CAD/CAM, so its reliance on data exchange will increase. Pressure on systems suppliers to tighten up their adherence to standards may grow to the point where it can no longer be ignored. (Source: Computing, 29 June 1989)

Legislation

Programmes may retain copyrights

The United States Supreme Court has unanimously decided that such independent contractors as computer programmers can retain the copyrights to their works. Intended to be a clarification of the Copyright Act of 1976's work-for-hire doctrine, the decision specifies that the independent contractor retains the right to the work he/she does under commission unless otherwise specified in a contract. The paucity of skilled programmers and the high cost of employee benefits are expected to cause continued use of independent programmers, according to E.R. Schacter, computer-law expert (New York, NY) and other sources. The Computer and Business Equipment Manufacturers Association had opposed the ruling, stating that the decision is against industry practice. The decision will result in "more prolonged and complicated" contract negotiations, according to R.J. Palenski, general counsel, ADAPSO. (Extracted from Computerworld, 12 June 1989)

California acts on privacy protection

California is considering radical laws protecting the individual against powerful information technologies that could become models for similar legislation in the rest of the United States and other countries.

More than a dozen bills are being debated which aim to increase individual privacy, prevent the illegal collection and distribution of personal information, stop the sending of junk mail via fax or electronic mail, and regulate organizations that collect information on individuals.

Bill AB539 would designate personal information as an individual property right. It would severely limit the collection of personal data by organizations and the distribution of that data over computer networks.

It would also set rules for the organizations involved in such collections and give individuals the right to see any information about them in data bases.

Another bill proposes the creation of a data base of people who do not want unsolicited phone calls from telemarketers.

Bill 576 would stop the transmission of junk mail to people's faxes and electronic mail boxes.

There are also several bills dealing with computer security issues in the wake of widespread publicity about computer viruses and computer crime.

Computer criminals would be required to register with the Justice Department and this could lead to their deportation. (Source: Computing, 4 May 1989)

United States threatens pirates with trade sanctions weapons

Software pirates across the world are under fire from new United States Government legislation which is also expected to benefit United Kingdom and European software producers.

Five developing countries face the threat of trade sanctions under the new Trade and Competitiveness Act if they do not take steps to protect software copyright in the next six months.

Italy, one of the top four industrial nations in Europe, has also been singled out for special attention and only escaped being put on the priority list because of its positive response to recent legal action against Italian companies by the United States Business Software Association.

The association says software piracy in Italy is costing software firms $500 million a year.

Italy is instead being put on a list of 20 countries which will be approached by the United States Government for talks on intellectual property protection.

This list also includes European Community countries Spain, Portugal and Greece.

The five countries on the priority list are Taiwan, China, Brazil, Mexico and Thailand. These are costing United States firms around $700 million a year in piracy of software, films, music and books, with China the worst offender at £418 million. (Source: Computer Weekly, 1 June 1989)

European Community copyright move under fire

United Kingdom software houses are up in arms about a clause slipped into the draft directive on copyright from the European Commission which threatens to cripple smaller suppliers.

The clause, which was added without consultation with United Kingdom representatives, states that when software is commissioned under contract the supplier's client has automatic rights of ownership.

This directly contradicts the current United Kingdom law on copyright, which assures that ownership of software rests with the author except in special cases where companies agree special terms with their clients.

The Department of Trade and Industry says it will push the United Kingdom case in Europe. (Source: Computing, 8 June 1989)

X. RECENT PUBLICATIONS

Directory of US companies

United Nations managers who are looking for "inside information" on potential consulting companies based in the USA may be interested in Gale's business directory of US private and public companies 1989. Over 90 per cent of the approximately 90,000 businesses listed in the directory are private companies which do not reveal their financial status to the public, and the publishers, Gale Research Inc., boast that information on each company has been individually verified.

Entries include: company name, address, chief executive officer, sales volume, number of employees, and other details. The three volumes which make up the Directory are available as a set, for $US 845. Any two volumes are available at a price of $US 745, while Volumes 1 and 2 cost $US 395, and Volume 3 $US 595. For further details, please contact: Gale Research Inc., Book Tower, Dept. 77748, Detroit, MI 48277-0748. (Source: ACCIS Newsletter, May 1989)

The influence of optical disc media on the distribution, packaging and storage of information

A research report prepared for the European Association of Information Services (EUSIDIC) by The Information Partnership in association with CIMTECH, the UK National Centre for Information Media and Technology, looks at the influence of optical disc media, in particular Compact Disc, Read-Only Memory (CD-ROM) and Write Once, Read Many (WORM) discs, on the distribution, packaging and storage of information.

The two-year EUSIDIC project, of which this is the final report, was started at a time when the key optical disc medium appeared to be CD-ROM, but as the project progressed it became evident that, while read-only discs would have a major influence on the way in which information would be packaged and distributed, they would have little impact on storage and archive applications. In the second half of the project, therefore, considerable effort was devoted to an investigation of the potential of WORM discs.

To EUSIDIC member organizations, the study is available for 500 pounds sterling; otherwise the price is £750. Additional copies will be made available for £150. Further details are available from: EUSIDIC, 9a High Street, Calne, Wilts., UK SN11 0BS. (TP +44 249/814 584; FAX +44 249/813 656). (Source: ACCIS Newsletter, May 1989)

New directions in telecommunications policy

Communications policy has been a fertile arena for testing theories of regulation, subsidy and incentives, free speech, political participation and the public interest. The capacities of new communications technology have changed markedly since much of the governing legislation in the communications field was written. Such change is likely to continue, with considerable impact on specific communications sectors and in communications policy.

A two-volume set of essays entitled New directions in telecommunications policy will be published in June 1989 by the Duke University Press, as a review of telecommunications policy in transition. They analyse public policy problems of concept, scope and judgement in communications policy, problems in specific media industries, and wider public policy concerns intersecting with communications.

Edited by Paula R. Newberg, the first volume in the set looks at Regulatory policy: telephony and mass media. The second deals with Information policy and economic policy. Prices are as follows: (hardback) Set: $US 99.50; Volume One: $US 50; Volume Two: $US 50; (softback) Set: $US 37.50;

Volume One: $US 19.95; Volume Two: $US 19.95. For information and orders contact: Duke University Press, 6697 College Station, Durham, North Carolina 27708, USA. (TP +1 919 684 2174; TX 802829). (Source: ACCIS Newsletter, May 1989)

Surface mount packages

A report published by The Information Network, San Francisco, Calif., predicts that surface mount packages will increase from 17.5 per cent of the world-wide market in 1988 to 51.7 per cent in 1993. This represents a compound annual growth rate (CAGR) of 36.5 per cent. The report - titled "VLSI Packages and PCB Markets" - also predicts that unit shipments of through-hole packages will exhibit a CAGR of -1.5 per cent within the same time frame.

In 1988 the world-wide market for plastic packages was $3,468.2 million and is expected to grow to $2,849.4 million in 1993 due to decreases in the costs of packages. The report says that the average selling price of all plastic packages will decrease from 13 cents to 6 cents.

The ceramic package market will grow from $5,324.2 million in 1988 to $14,569.6 in 1993. The average selling price of ceramic packages is expected to grow from $1.32 in 1988 to $2.38 in 1993. The report also forecasts that the shipment of packages containing over 100 pins will increase from 0.4 per cent of total packages in 1988 to 1.8 per cent in 1993. (Reprinted with permission from Semiconductor International Magazine, June 1989. Copyright 1989 by Cahners Publishing Co., Des Plaines, IL. USA)

CDS surveys pest control data bases

International Development Services has carried out a survey in collaboration with the UK based specialist consultancy company, Vital Information Limited, on crop protection data bases and their accessibility. Funding for the data bases survey came primarily from FAO and CTA, the Technical Centre for Agricultural and Rural Co-operation.

They found that the field is dominated by a few, large, online, life science, agricultural or pesticide information data bases. There are many lists of pests and crops usually generated and held in personal computer files. With few exceptions, direct access to these smaller data bases is difficult for outsiders. Access to data bases by researchers and information scientists in the developing world is difficult, despite the fact that at least a quarter of the data bases surveyed contain material mainly from those areas.

Several software packages for "expert" or "knowledge" systems for crop protection exist but developments are at an early stage. These systems take the inquirer step by step through, say, a pest identification exercise. When they become available they will be important diagnostic tools for extension services, for trainers and researchers.

The CDS survey ranged widely covering:

Crop protection and environmental data bases available to anyone;

Data bases available only to closed user groups;

UK and government sources;

Videotext and expert systems;

Software sources available to the public.

CDS identified 89 agricultural data bases, of which 26 related to pesticides and their use. A further 21 were general data bases but with a useful crop protection content. Others covered pest and crop lists, quarantine and expert systems or crop management programs.

Pesticides are well served by data bases and the majority are available to the public online. Both national and regional data bases are well developed, indicating the level of interest among commercial companies, legislators and the general public.

Pest and crop lists are less accessible. Most have been developed by organizations and university departments for their own purposes. And no quarantine information is available, though FAO is developing a data base which may change that.

There are no obvious gaps in the coverage of the literature on crop protection. But accessibility is a barrier, particularly for developing countries. Few of the crop protection data bases surveyed can be described as user friendly, says CDS. But it is optimistic that more in-house systems will become accessible. However, authors are ambivalent about allowing access to information until there is a better relationship between the selling price of online services and printed copies of directories and other publications.

Draft copies of the report, entitled A Survey of Electronic Databases in Crop Protection, were included in the information pack of all delegates at the International Crop Protection Information Workshop. The final version of the report is to be included in the proceedings.

XI. SPECIAL ARTICLE

Impact of technological change on software development: implications for the LDCs and NICs
by Dr. Robert Schware* - April 1989

1. Introduction

The world-wide computer industry has been characterized since its inception by continuous innovation, improvement and rapid change. These developments have resulted in the growing importance of software - the programs that run computers and allow them to communicate with each other through data networks. Developing (LDCs) and newly industrializing countries (NICs) seeking a share in the burgeoning global information industry are promoting the development of their software industries through a variety of policy and institutional measures. At the same time, a growing number of US and Western European software firms and non-software firms (such as aircraft and financial service providers) are beginning to develop software overseas, often for foreign as well as domestic markets.

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The world wide software industry is still very much an industrie nouveau. Any assessment of the world wide software market has to rely on scanty, inconsistent and unreliable data. This makes projections of future software products and services an exceedingly risky undertaking. Nevertheless, such projections have been made, and they range from $US 70 billion to $US 180 billion by 1990. 1/

Five major forces are now promoting rapid changes in the world-wide software industry: (a) a productivity bottleneck in programming, with software and software-related support activities now accounting for the overwhelming percentage of total system costs; (b) the global battle for operating system standards; (c) the move away from single vendor solutions as the typical way for organizations to meet their information systems needs towards customized, integrated, multi-vendor hardware and software solutions; (d) the increasing emphasis on software production and sales by hardware vendors, leading to increasing concentration by large- and medium-sized firms; and at the same time (e) an expansion and fragmentation of the industry resulting in a large number of independent software vendors.

Technology, defined broadly as procedural methods, organizational modes and technological knowledge used to transform inputs into outputs, is becoming an increasingly important element in international competitiveness for software firms. This paper examines the importance of organization and management of the software production process for firms. It reviews some new software management practices being introduced by firms to control costs and improve the quality of both the final products and the process of developing software. Some new technologies that will affect the entire software production process and that will require a reorientation in thinking about investment and technological options are also examined.

2. Software development management

Software firms in developing countries and NICs alike are still struggling with inappropriate tools and methods in the software development process. This problem is due to: (a) lack of experience; (b) lack of knowledge or discipline; (c) difficulty of measuring the development effort accurately; (d) implementation of designs whose poor quality does not surface until the finished product is either tested or installed for operation; and (e) high life-cycle costs resulting from a system that was not designed for reusability or maintainability. Without established process methods and techniques, firms often solve the same problems over and over again. The average large software project continues to cost twice as much as its initial budget and is completed a year or more behind schedule; approximately 25 per cent of such projects are never completed and the remaining 75 per cent require inordinate amounts of maintenance.

A major premise in software development management is that the quality of a piece of software is governed largely by the quality of the process used to develop and maintain it. In a "mature" process, the methods, techniques and technology are used effectively and produce reasonably consistent results. Improvements in quality and productivity occur in part from automation. But in an immature software development process, unpredictable results occur: formal procedures, cost estimates and project plans are lacking; and technology is used on an ad hoc basis. The prospects for the NICs in software development will depend increasingly on the processes carried out in the software life cycle.

There is considerable middle ground between these two organizational extremes. An ideal maturity model (illustrated in figure 1) by which firms and organizations can judge the effectiveness of their software development process has five maturity levels: (1) initial, (2) repeatable, (3) defined, (4) managed, and (5) optimized. 2/

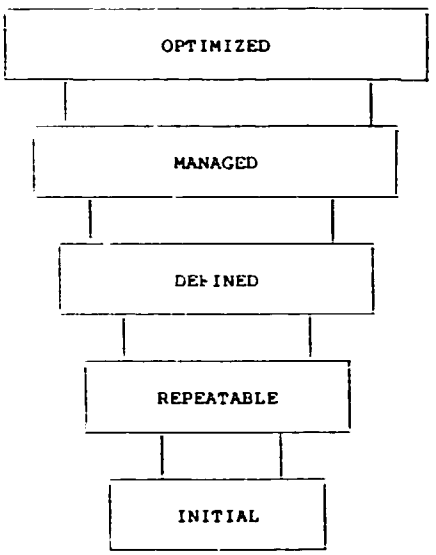

Figure 1. Software Maturity Model

The initial process level. A firm has ill-defined procedures and controls. Typically, it operates without project controls and does not integrate tools and techniques with the process. Coding and testing are dominant activities. Established procedures, if they exist, are usually abandoned in a crisis.

The repeatable process level. A firm has established basic project controls, such as project scheduling, coding standards, product assurance and change control. Mechanisms are in place for ensuring that the design team understands each software requirement. Statistics may be gathered on software code and test errors. The strength of the firm may also stem from its prior experience at doing similar work, but it may face major risks when presented with new challenges.

The defined process level. Standards and methods for technical and management activities required for software development are established at this level. These specifically include design and code reviews, training programmes and increased organizational focus on software engineering, including measuring specific tasks in the process. Some uncertainties remain about the value of the measurements, the best ones to use and the appropriate response to reviews.

1/ See Schware (1989) for some of the implications of basing policy decisions on overly optimistic market projections.

2/ Humphrey and Sweet (1987), pp. 5-6.

The managed process level. A firm typically has a minimum set of process measurements for each stage in the software life cycle, and it conducts extensive analyses of the data gathered during reviews and tests. Automated tools and techniques are used increasingly to control and manage the development process, as well as to support data collection and analysis.

The optimized process level. Firms at this level have achieved a high degree of control over their process, have automated data gathering and typically have a method for improving and optimizing these operations. This includes identifying and replacing obsolete technologies, more sophisticated analysis of the error and cost data and the introduction of error cause analysis and prevention studies. 3/

Some firms and organizations, particularly in the United States, are beginning to use the maturity model to assess their software development process and software management. The importance of such assessments is to indicate the maturity and technological levels at which a firm is operating. More importantly, it may indicate the strong and weak areas of a firm's software development capabilities, thus identifying immediate improvement priorities, interim improvement goals and progress measures.

One implication of the maturity process model for software producers in developing countries and NICs is clear: technology and managing the process of engineering tangible products will become increasingly important. An understanding of the maturity model and how it might be of practical benefit should be a clear research priority for software firms and for various government sponsored research programmes.

2.1 Software assessment standards

Standards for software engineering will take a long time to develop. But with the rapid technological change and increasing competitiveness characteristic of the software industry, government agencies and other large purchasers of software are using new techniques to evaluate contractors' abilities to develop software according to "modern" software engineering methods. Corporations, also mostly in the United States, are using the new evaluation techniques to assess their own ability to create "critical" projects and to assess their overall competitiveness. One methodology, developed by the Software Engineering Institute of Carnegie-Mellon University for the US Air Force, examines a contractor's capabilities in: (a) organization and resource management, including software engineering training and the adequacy of support facilities; (b) software engineering process and management, which includes the scope and use of conventions, formats, procedures and documentation during the various software development phases, software quality control and data management; and (c) the tools and technologies a contractor may use in the software engineering process.

Since this new methodology has become only one additional part of the criteria for procurement, it is unlikely that it will create a radical change in the contractors who are selected for software development projects. But the evaluations will probably lead major software companies to manage their software development process more closely. An awareness of software producers of these evaluation methodologies is important to future software development.

Raising some of the questions presented in various methodologies 4/ may improve the software development process in software firms and to some degree enhance their competitiveness in international export markets. These methodologies are usually concerned with standards and practices of software firms in the following areas:

- Organization and resource management, including quality assurance, process management, configuration control and the quality and quantity of resources;
- Software engineering process and its management, including the scope, depth and completeness of the process and how it is measured, managed and improved; and
- Tools and technologies used in the software engineering process, e.g., computer tools to measure test coverage, to analyse cross-references between modules and to design and debug code.

2.2 Software metrics

The state of software metrics, or measurement, is still somewhat immature and imprecisely defined. None the less, measuring software and software development can lead to substantial benefits for reasonable costs. Short-term productivity improvements, as well as the establishment of a common development environment, have been reported by companies that use software metrics. To many project managers in software companies, software metrics are a means for more accurate estimation of project milestones, as well as a useful mechanism for monitoring progress. 5/

Basically, software metrics are a way of measuring the various attributes of the software development process. Attributes include the size of a program, its cost, the number of programming errors or defects, the level of difficulty or complexity of the project and the method of communications required between members of a project.

Figure 2 shows an example of using software metrics in software development in what is usually an ignored activity: documentation. Documentation

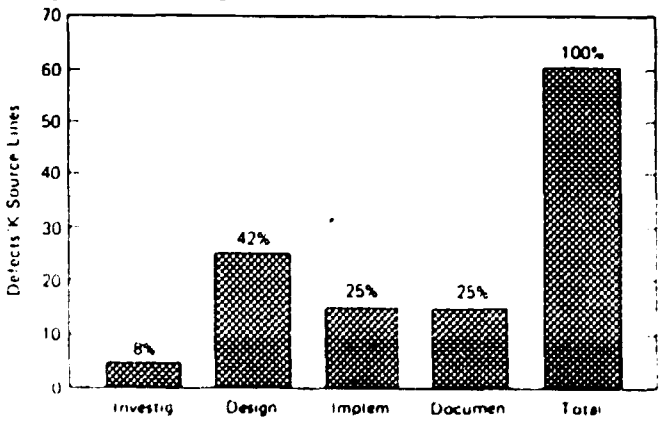

Figure 2. Introduction of Software Defects (from IBM and TRW studies)

3/ Humphrey and Sweet (1987), pp. 24-30.

4/ See, for example, Humphrey and Sweet (1987) and Kellner and Hansen (1988).

5/ Caswell and Grady (1987).

is frequently a low priority activity in software development. Yet in two studies at IBM and TRW, the overall quality of software is very much a function of documentation. As the figure suggests, 25 per cent of all software defects in the two studies were in documentation delivered to customers. 6/

Many tools are available - some in the public domain - to assist in collecting and examining measurable results during the various development stages. An earlier issue of the Microelectronics Monitor (number 24, 1987/IV) describes some of the available public domain software. For example, the US National Aeronautics and Space Administration (NASA) offers more than 1,100 computer programs through its Computer Software Management and Information Center (COSMIC). A program called SOFTCOST estimates software size, implementation productivity, recommended staff level, probable location, amount of computer resources required and amount and cost of software documentation. SOFTCOST is designed to provide project managers with a comparison between their expectations of a project's development and industry-based statistical expectations of that project. The software metrics data provides an additional basis for budgeting time and effort to a project.

A complete integrated set of tools does not exist. Figure 3 illustrates what Hewlett-Packard considers an ideal software development environment, which is reinforced by tools and metrics. The central data base provides a common control mechanism for all important parts of a project. 7/

"Successful" integration of collection and use of software metrics into the software development process is the main objective of firms using such tools. The time factor involved in learning tools and incorporating them into the entire development process has been the primary obstacle of their implementation. For example, the history of the Hewlett Packard Software Metrics Council shows that it took roughly three years of collecting and analysing data using software metrics before there were sufficient data available to show measurable trends for the entire organization. 8/

2.3 Software risk management

Several years ago, an error in the avionics software for the F 16 jet fighter instructed the plane to flip upside down whenever it crossed the equator. In separate incidents, software "bugs" have been responsible for the deaths of patients when an irradiation unit for cancer therapy generated "inappropriate" doses. More recently (1988), American Airlines lost an estimated $US 50 million in ticket revenues because its passenger reservation system indicated that aircraft had sold out of discount fares when such seats were, in fact, still available. The list goes on and on.

Like many fields in their early stages, software engineering has had and continues to have its share of disasters. Most assessments of projects with large, critical and complex software systems that "failed", particularly in banking, air traffic control, nuclear reactors, chemical plants, medical technology and defence and aerospace systems, have indicated that software-related problems would have been avoided or at least significantly reduced if there had been an explicit early concern with identifying and resolving high-risk elements. Frequently, these projects were swept along by a tide of optimistic enthusiasm during their early phases, or by enthusiasm for new software capabilities.

Risk management is an emerging discipline that provides techniques both for risk assessment (risk

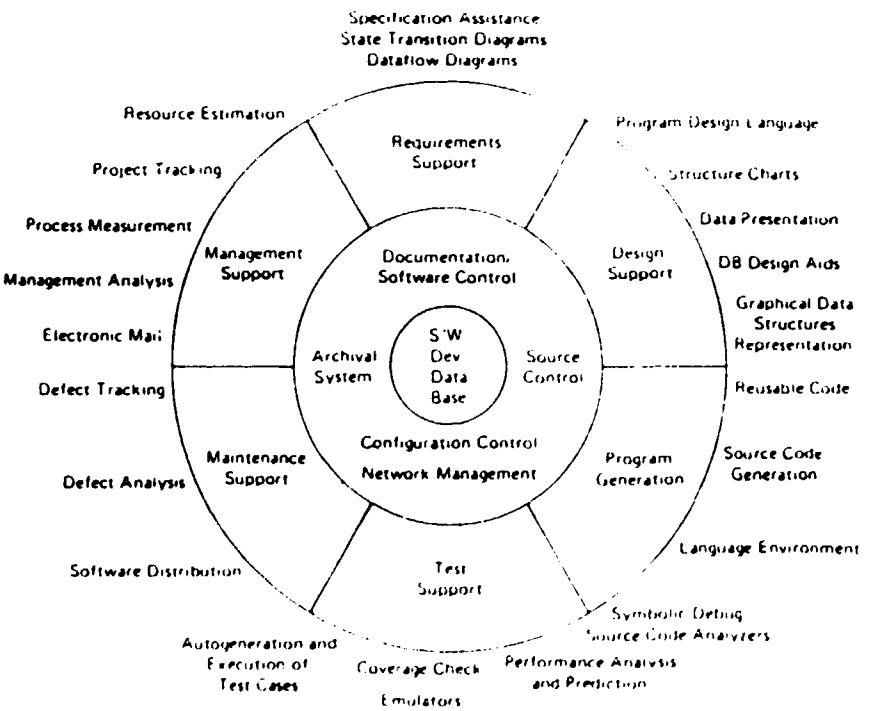

Figure 3. Hewlett Packard Software Engineering Productivity Environment

6/ Caswell and Grady (1987), p. 25.

7/ Caswell and Grady (1987), p. 199.

8/ Caswell and Grady (1987), p. 1.

identification, analysis and prioritization) and risk control (risk management, planning, resolution and monitoring). To ameliorate the potential problems caused by the relative unreliability of software systems, the US Government is increasingly requiring risk management plans of software contractors (for example, the Federal Aviation Administration's Advanced Automation System and the software for the US Airforce Small Missile System). Software risk management is also being instituted within US industry.

Table 1 provides a list of risk items in software projects and techniques in the software life cycle that have helped software projects avoid disasters. 9/ It is theoretically conceivable that a project could face all of these risks. Some of the software risk management techniques may appear familiar to software developers, although they are usually applied in an ad hoc fashion. Provisions for risk management should be made in the planning process by software firms, particularly those designing large systems with a number of independently modifiable subsystems and interfaces with other systems.

3. The impact of new technologies

Research and development efforts in software engineering have produced new methods that show promise for improving programmer productivity and software reliability. As the software industry gradually becomes less labour-intensive over time, the quality and availability of skilled labour will become more important than labour costs. Pressures on the quality of software labour markets will increase competition among NICs, as well as between NICs and developed countries, for skilled labour in software production. But the introduction and adoption of these new techniques is difficult and expensive, and they are thus adopted bit by bit as project budgets allow. 10/

Table 1. Top ten software risk items

RISK ITEM	RISK MANAGEMENT TECHNIQUES
1. Personnel shortfalls	Staffing with top talent; job matching; team building; morale building; cross-training; prescheduling key people
2. Unrealistic schedules and budgets	Detailed, multi-source cost and schedule estimation; design to cost; incremental development; software reuse; outside reviews
3. Developing the wrong software functions	Organization analysis; user surveys; prototyping; early users' manual
4. Developing the wrong user interface	Prototyping; scenarios; user characterization (functionality, style, workload)
5. Gold plating	Requirements scrubbing; prototyping; cost-benefit analysis; design to cost
6. Continuing stream of requirements changes	High change threshold; information hiding; incremental development (defer changes to later increments)
7. Shortfalls in externally-furnished components	Benchmarking; inspections; reference checking; compatibility analysis
8. Shortfalls in externally-performed tasks	Refe ence checking; pre-award audits; award-fee contracts; competitive design or prototyping; team-building
9. Real-time performance shortfalls	Simulation; benchmarking; modelling; prototyping; instrumentation; tuning
10. Straining computer science capabilities	Technical analysis; cost-benefit analysis; prototyping; reference checking

9/ Boehm (1988), pp. 10-11.

10/ OTA (1985), p. 76.

3.1 Automated software development aids

The conventional "waterfall" software life cycle has been stretched, shrunk and otherwise modified since its inception in the early 1970s. The major stages of software production - specification, design, coding, testing and maintenance - remain, but efforts are under way to alter and automate many aspects of the software life cycle. 11/ Lower development and life cycle costs are being realized through better structured and documented software, program support library procedures, diagnostic aids, environmental simulators, test data management systems and applications generators. Such tools and techniques support different phases of the life cycle. Some tools support the early phases in the form of automated diagram drawing, screen painting and error checking. Others give assistance by automating code generation and documentation.

Sizeable applications programs can now be generated using a very small number of user-language directives, which means that developing software with applications generators can be a far more cost-effective pursuit than hiring programmers to develop software one instruction at a time. Applications generators are also valuable for their ability to develop quick prototypes of a desired software capability.

The emergence of applications generators oriented around a data base management system and report-generation capability has created an attractive approach for both software productivity gains and for software customization. Some US and European firms using these tools have improved productivity by factors of two to as much as 20 across various phases of the software life cycle. 12/

The facilities in three different tools - one for complex, real-time computer systems, the others for business applications ("Auto-G", "Excelerator", and the "Cortex Application Factory") - now in use are listed below to illustrate the variety of ways in which software automation currently increases the productivity of software of all sizes and types.

Auto-G, produced by a small UK company, Advanced System Architectures (ASA), is so far the only non-American system design tool that has been evaluated and supported financially by the US Strategic Defense Initiative (SDI). 13/ The company focuses its operations on high reliability, high security real-time computer systems for telecommunications, aerospace or defence applications.

11/ The "US Defense Science Board Task Force on Software" Report (1987), for example, recommends the removal of "an, remaining dependence on the assumptions of the 'waterfall' model, and to institutionalize rapid prototyping and incremental development". A number of alternative software life cycle models have evolved over several years. However, although each of these alternative approaches deals with some of the difficulties of the waterfall approach, especially the fact that the model does not adequately address automatic programming capabilities and "knowledge-based software assistance capabilities", each has its own set of challenges and difficulties to resolve.

12/ Business Software Review (1987), pp. 29-30.

13/ Advanced System Architectures, Ltd.

Auto-G uses a formal graphical notation, G, to enable software engineers to build a system on a workstation in stages, from requirements specification to code generation. When the design is complete, the Auto-G toolset provides a code generator that converts detailed design automatically into a variety of programming languages, including, for example, C and Ada.

The facilities Auto-G provides include:

- Menu-driven, on-screen selection of design symbols;
- On-screen editing;
- Full graphic manipulation;
- Hard copy output to low-cost graphics plotters;
- Automatic checking of logical consistency of design.

Excelerator has four basic facilities for automating systems analysis and design tasks:

- Automatic diagramming tool for drawing structured diagrams, such as data flow diagrams, structure charts, data models and control flow diagrams;
- Screen and report painters for prototyping user interfaces;
- Integrated dictionary for storing and cross-referencing all systems analysis and design information;
- Automatic checking and reporting the completeness and consistency of structured diagrams.

The Cortex Application Factory is used by systems analysts and programmers to develop and maintain medium-to-large information systems. It is used to lead a developer through the steps of software development and includes features similar to those of the Excelerator, including:

- Screen and report painters for prototyping user interfaces;
- A dictionary for storing documentation about a system;
- Automatic checking for completeness and consistency of program specifications;
- A code generator capable of automatically generating 95 per cent of the program code from program specifications;
- Automatic program documentation generator.

Once completed, the applications are translated into machine code by an optimizing compiler for fast computer run time and greater machine efficiency. Applications developed with the Cortex Application Factory range from such bread and butter applications as sales tracking, order entry, accounting, inventory and payroll to more esoteric applications, such as regional price trend tracking for commodities and orders for materials monitoring in bulk fibre manufacturing plants. Applications range in size from a few files, screens and less than 50 data base fields to those with several

hundred files and screens and thousands of fileds. 14/ The "Factory" is illustrated in figure 4.

Engineered applications generators can produce major benefits in productivity and ease of implementation, use and maintenance if accompanied with good training and providing unexpected problems do not occur. Quantitative benefits include reductions in system life cycle costs and rapid development of prototypes to ensure quick turnaround for end user assessment. Among the possible qualitative benefits are the generation of documentation directly from specifications rather than program code, rapid iterative prototyping and greater control over maintenance.

Automated software documentation management techniques are gradually being introduced to software engineering to improve the quality of both software and documentation. It takes an average of three hours to produce a page of software documentation. 15/ The cost of one employee's labour-year in the mid-1980s is approximately $US 100,000, so one hour is worth approximately $US 50. Thus, a 500-page software document that may be obsolete by the time it is finished can represent a cost of $US 50,000 to $80,000. Code and documentation management systems are particularly useful in very large software projects (more than 100,000 lines of code). These systems automate routing and distribution of documentation cross-referencing and status reporting for code and documentation changes. 16/

Some tools now link hardware and software design. For example, an integrated set of tools - C compiler, optimizer, assembler, linker, simulator and debugger - developed by Quantitative Technology Corp. allows engineers to evaluate design iterations of both hardware and software without waiting for a final version of either. A simulation informs the hardware team how design changes will affect software-execution speed before a prototype is built, and software engineers can see how code modifications will work on the proposed hardware. Such tools operate on mini- and mainframe computers. 17/

Automated tools alone are not sufficient to ensure a productive software environment. With no coherent methodology, standards and set of controls, automated tools sometimes merely help a software project "spin its wheels more quickly". They can also create an image of modern methods and high technology without substantively increasing productivity.

"Successful" use of automated tools requires a fit between the tool and the environment in which it will be used. The selection of tools can be a complicated and confusing process. Tools must in some ways be similar to what a firm already does and knows; they must operate on available hardware and operating systems; and they must be supported and maintained. Firms generally understand and use automated tools only gradually over time.

14 Picardi (1987), p. 3. CORTEX Corporation, 138 Technology Drive, Waltham, MA 02154, USA.

15/ Boehm (1981), p. 574.

16/ Singleton (1987), p. 54.

17/ Young (1988).

4. Conclusion

As noted above, one cannot ignore the key technological trends and changes that are now unfolding in software production. Large software firms, especially in Western Europe, Japan and the United States, are increasing their degree of software automation and improving their efficiency and performance by better software management practices. Those firms in developing countries and newly industrializing countries that are able to purchase, integrate and exploit software engineering tools will need to be able to provide their customers with working software prototypes and custom software, the latter perhaps at package prices. But this technological capability requires increasing capital, skilled employees (most crucial), access to foreign technology, and an organizational maturity, which does not yet exist in many software firms in both developed countries and in NICs.

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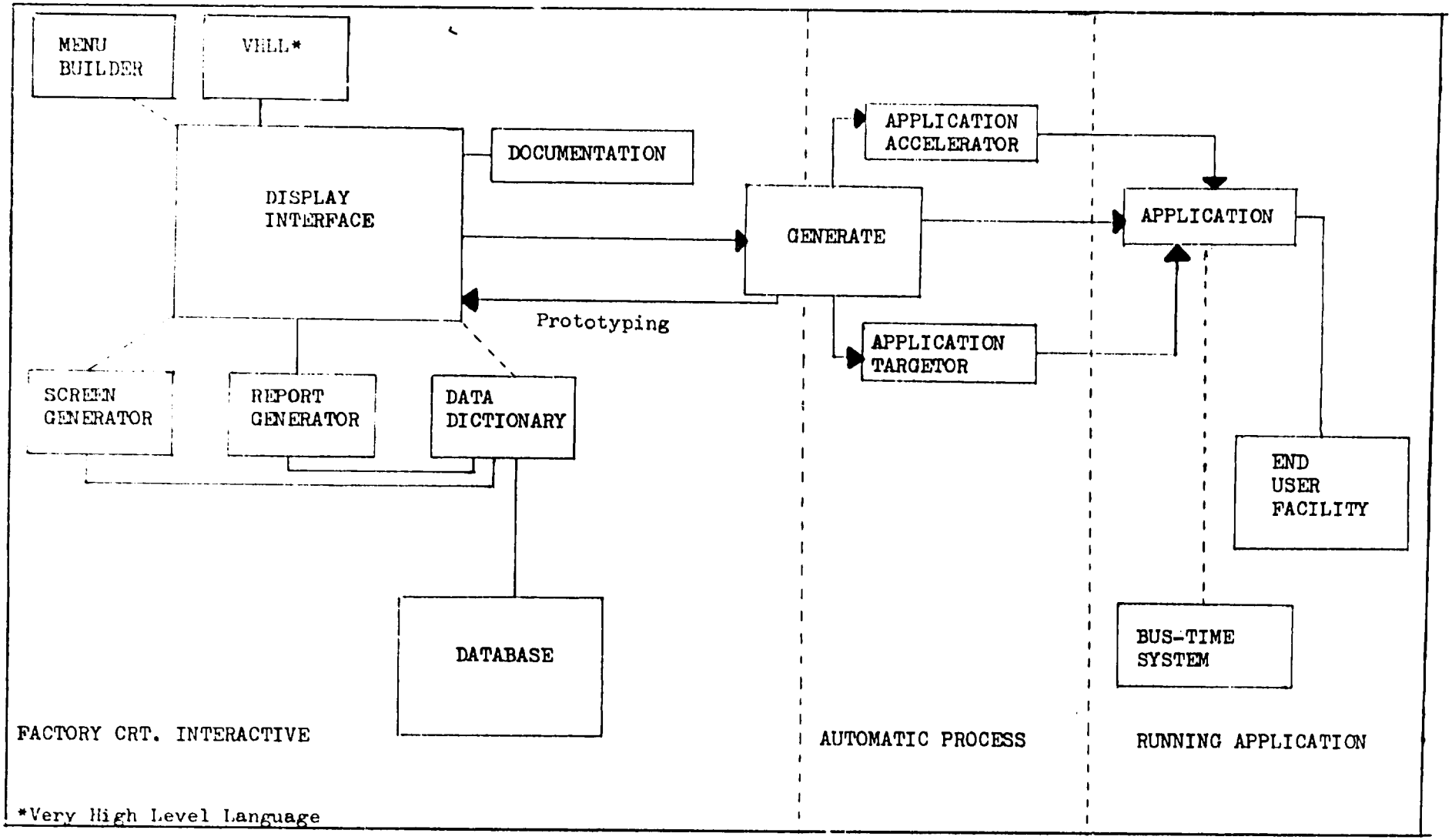

Figure 4. The Cortex Application Factory