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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

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I. NEWS AND EVENTS

UNIDO holds meeting on information technology

In an effort to coordinate the activities of organizations and professional groups active in the area of informatics technology for development, the UNIDO Secretariat convenes biannual meetings of the Consultative Group on Informatics Technology (COGIT). These meetings bring together professionals from the field of informatics, identify possible areas of cooperation and consider a mechanism for keeping mutually informed and for formulating joint programmes.

In the past years the UNIDO Secretariat has promoted the concept of software as an industry and the actions that developing countries could take to promote that industry. The concept has been elaborated through several studies dealing with software development and applications for developing countries, the approach to software production in those countries, and guidelines for organizing software houses. Further work in this area would include the promotion of software links to industry for specific applications of relevance to developing countries.

The software which can be developed and deployed is determining the speed with which computing systems penetrate industrial and service enterprises and transform them to increase the quality and quantity of their outputs.

Software technology is now being recognized as a new important sector deserving development in itself. However, in the context of UNIDO's activities not all the elements of the new sector necessarily deserve attention. The most important elements of informatics technology from UNIDO's point of view may include the following:

(a) Industrial software applications;

(b) Software as a small-scale industry;

(c) New production technologies for software;

(d) Standardization and legal aspects in both hardware and software;

(e) Monitoring development of software technology.

The formal objectives of a meeting of the Group held in Vienna from 26 to 28 November 1991 were:

(a) To review practical experience in software production and applications and to identify concrete measures of cooperation at the international level, including cooperation among developing countries, so as to promote such applications in a manner consistent with the requirements of the developing countries;

(b) To review UNIDO's past and planned activities in the field of software and suggest a programme of action.

Participants were from United Nations agencies, from selected developing countries, and experts from industrialized countries.

After reviewing current trends in software in the context of informatics technology as well as the needs of developing countries in that respect, a number of conclusions and recommendations relating to inputs to the UNIDO programme in this area were adopted.

Three major trends in the software field were recognized:

(i) **Increasing demand, particularly for software, in the wake of the most recent developments in microelectronic chips.** The availability of reasonably priced and powerful microelectronic chips is creating an increasing demand for system and application software based on those chips. Many urgent user needs could be satisfied most economically by taking advantage of these latest hardware developments. The demand is principally in the areas of distributed system software and applications software which supports easy-to-use man-machine interfaces and integrated hardware-software solutions.

(ii) **Globalization of the software market.** The standardization of computer hardware brough about by mass-produced microelectronic chips and the availability of a responsive gloabl communication infrastructure (computer networks such as Internet) has led to close transnational cooperation among software professionals. Information transfer achieved by these new means of communication ensures the global community comparable levels of know-how. Ultimately, a product either succeeds globally or disappears; even "niche" markets are being globalized.

(iii) **Optimal quality of product, documentation and development processes.** As a direct consequence of the globalization of the software market, only products of the highest quality succeed. Quality refers to absence of design faults, ease of use and detailed documentation. It is also accepted that software quality is determined by a rigorous development process and thus emphasis is now placed on structuring the development process accordingly. Many software users have already begun to demand full accreditation of the software development process.

(iv) **Increased cost of entry into the software market.** The globalization of the software market and the emphasis on assured software quality have led to a significant increase in the cost of entering the software market as a newcomer. In particular, the cost of global marketing can be prohibitive for a small company. Schemes, already promoted by UNIDO, for "joint venture" cooperation and risk-sharing between companies in industrialized and developing countries are of immediate relevance in this context and should thus be further encouraged.

The key issue in the development of software products is a demand for computer applications. Country-specific strategies for software industry development, including software applications in non-electronic industries and services, such as cement, fertilizers, agriculture, chemicals and transportation have to be developed to accommodate

the mix of infrastructure, policy-framework and manpower availability peculiar to each developing country.

In order to improve product quality and effectiveness in the small- and medium-scale industry sector, particular emphasis should be given to demonstration projects for that sector. Demonstration projects yielding tangible and measurable improvements in productivity in various sectors of the economy are of vital importance to opinion building among planners, economists and administrators in developing countries.

Developing countries should recognize "value-addition" as a valid objective for the software industry. Contract programming, custom design and implementation would help build up a critical mass of experience. It is also important for developing countries to acquire expertise in leading-edge aspects of software technology.

Developing countries should also consider adopting a coherent and cooperative strategy in the area of software protection along the lines already adopted for integrated circuits.

A large proportion of applications, especially in the small- and medium-scale industry sector, could be implemented using small computers. Every effort should then be made to ensure that industrial users in developing countries are fully aware.

Networking and centres

There is a clearly perceived need for centres of excellence in software production and applications. UNIDO was called on to encourage and support developing countries in setting up microprocessor and/or software applications development centres to address applications in domestic industry and develop new, intelligent products. UNIDO was also asked to lend infrastructural and related support to developing countries in setting up software development parks where professional entrepreneurs can set up operations serving both domestic and export markets. It was further suggested that UNIDO work out methods for effectively interfacing the research results and practical industrial use Both centres and networking could be so organized as to bring about the effective industrial application of research results.

The Group agreed that E-mail could contribute substantially to development. Developing countries should be made increasingly aware of the benefits offered by E-mail.

Building skills

The most critical input to software development is the quality of the human resource capabilities available. Consequently, in order to build up the software industry in developing countries, it would be necessary to build up human capabilities in the field of software technology in two specific groups:

(i) Training those about to enter the software development industry; and

(ii) Retraining and/or upgrading the skills of professionals already active in the industry.

It is recommended that for the first group, UNIDO should provide assistance to programmes designed to ensure the cost-effectiveness and relevance of training programmes to industry. With respect to the second group, UNIDO should support countries in setting up programmes designed to acquire, analyse, adapt and disseminate relevant technical information to software developers, as well as to analyse the structural or organizational implications of informatics in both an industrial and administrative environment.

Regional and international cooperation

The meeting emphasized the importance of supporting the growth of the software industry in developing countries and the pursuance of active policies to promote the diffusion of informatics, particularly among small- and medium-scale enterprises. The Group also recommended that drawing on the results and pilot experiences of the Regional Programme on Cooperation in Informatics and Microelectronics in Latin America and the Caribbean (REMLAC) project, the possibility of designing and implementing similar projects in Western Asia and other regions be explored. In the case of Western Asia, cooperation with the Economic and Social Commission for Western Asia (ESCWA) was recommended.

It was felt that lack of confidence in the quality of software products originating from developing countries was one of the major obstacles to the effective dissemination of those products. It was recommended that UNIDO should assist in the establishment of software accreditation bodies at the national and/or regional levels and should strengthen cooperation in the field of informatics between the International Centre for Science and High Technology at Trieste (Italy) and developing countries.

The meeting recommended that international cooperation in the field of informatics development be encouraged amongst international organizations, in particular between UNIDO, UNESCO and ITU, in such areas as networking, skill-building and software development centres. The meeting of the Group further recommended the consideration by the three organizations of a pilot project for one of the regions to be coordinated by UNIDO. The project would aim to study the possibility of establishing a regional network using a multimedia approach for education as well as upgrading industrial manpower in utilization of new technologies.

Businesses predict chaos over Europe's data rules

Buying an international airline ticket or using a credit card outside Europe could be illegal if a draft European law is implemented as it stands. The draft directive on data protection was attacked repeatedly at a conference in London for being unworkable, contradictory and so badly worded that even lawyers were uncertain of its meaning.

The proposed European legislation is supposed to safeguard the interests of individuals by controlling who can keep what information about whom. Its aim is to bring the safeguards up to the same standard throughout the European Community.

when the single European market comes into force at the end of this year, citizens will be encouraged to move between Member States and will consequently appear on computer records in more than one country. Businesses will want to use lists of existing and potential customers in several countries. When controls at national borders within the Community are removed, customs, immigration and police services will share data.

Britain's existing legislation allows most data to be transferred abroad, but the directive will prevent this unless there is a good reason, or the recipient is in a country with similar laws. This would hit any company doing business outside Europe - possibly even those which use only paper records, as the draft covers some of those too.

Lawyers are advising companies that from the end of this year it could be illegal to pass information on plane tickets out of Europe, making international bookings impossible. Credit-card and banking transactions could be illegal, as could direct marketing and mailshots beyond the Community's borders.

Companies in the third world which offer contract data processing are already suffering. NDL International is a London company which distributes and processes 3 million questionnaires a year on consumer preferences. Before the draft directive was published, all the answers were typed into computers in Barbados. But in the light of the draft, the operation has been moved to Barnsley.

Under the draft directive, criminal convictions, for instance, may not be held in private.

The European Parliament will discuss the directive later. It is supposed to be finalized by the end of the year. (Source: New Scientist, 1 February 1992)

US-Japan chip deal reaches boiling point

European anger about the eight-year old US-Japanese chip agreement is increasing and unless a satisfactory conclusion is reached it could well result in retaliation.

The European Commission has always found the agreement, giving US companies access to 20 per cent of the Japanese semiconductor market, unsatisfactory. The European Commission says that the agreement represents a cartel, and it plans to raise the subject in the next round of GATT talks.

The US-Japanese chip agreement has not gone smoothly since it was orginally signed in 1986. On several occasions the US Semiconductor Industry Association has accused the Japanese of failing to abide by the agreement. (Source: Electronics Weekly, 5 February 1992)

Europe regains autonomy in gallium arsenide production

European makers of gallium arsenide ICs are assured of their independence from Japanese suppliers, since a small firm in formerly East Germany has increased production of GaAs wafers. Wacker Chemitronic, in Burghausen, had been Europe's only native producer of high-purity GaAs crystals. Lobbying hard for autonomy were the German ministries for defence as well as research and technology, joined by the chip industry and the state of Saxony.

Wacker has transferred its GaAs production gear to Freiberger Elektronik Werkstoffe GmbH in Freiberg, which is already making and marketing the material. Its standards in GaAs crystal growing are said to match those demanded by Western firms. The company now wants to perfect its skills in cutting and polishing GaAs wafers and increase their size from the present 3- and 4-inch diameter.

Experts are counting on a boom in GaAs devices for mobile telephones and satellite receivers to drop prices. (Extracted from Electronics, December 1991)

CFC-free solution

The Hughes Aircraft Company in California is promoting the development of a CFC-free solution as a breakthrough for electronics production. It consists of a water and citric acid-based substance, called HF-1189, and new manufacturing processes that do not require environmentally damaging chlorofluorocarbon-based (CFC) chemicals. Hughes engineers say that the new solution and processes can remove up to two thirds of the CFC-based solvents required for the soldering of military electronics. The company solders approximately 300,000 pounds of these materials each year. HF1189 allows for a high quality bond during the soldering process, yet uses only water for cleaning, not solvents. The water substitutes for isopropyl alcohol, a volatile organic compound as the vehicle for the activator. (Source: Electronics Weekly, 29 January 1992)

"No clean" solder flux moves a step closer

Moves to allow printed circuit board (PCb) makers to comply with the Montreal Protocol, which aims to phase out harmful chlorofluorocarbons (CFCs) are heading in two directions.

An EC funded scheme commenced on 1 January under the BRITE Project. It will run for three years and its purpose is to produce an improved "no-clean" flux that will remove the need to clean residues from PCBs.

An alternative method was put forward by Dow Chemical, which has developed a flux-cleaning solvent, without ozone-depleting CFCs, that can be used in non-aqueous manufacturing processes.

Although Dow accepts that the majority of PCBs will soon be made using no-clean fluxes, it insists that a market will remain for flux cleaners in high-reliability areas such as military, avionics and some telecommunications systems.

The cleaner, called Dowanol PX-16, is an alkoxy alcohol compound. Unlike most alcohol-based cleaners, its flash point is 79°C, well above the recommended operating temperature of 60°C. Dow claims that this removes flammability problems common in other cleaners. (Source: Electronics Weekly, 22 January 1992)

New consortium formed

A group of international consumer electronics and computer companies - including a number of the biggest US workstation manufacturers - has formed a consortium to push for the adoption of CD-Recordable, a new optical-disk technology.

The group, called the Frankfurt Consortium, expects CD-R to have a dramatic impact on both readable and coming read-write compact-disk formats. Its intention is to allow faster-than-real-time recording of 650-Mbyte CD platters, which could accelerate the format's adoption by a border range of data users.

The group hopes to forward CD-R to the International Standards Organization (ISO) next summer and get it quickly adopted as an official standard. The US National Institute of Standards and Technology also has apparently indicated its interest in producing a Federal Information Processing Standard based on the consortium's proposal.

Founding members of the consortium include Meridian; Dutch giant Philips; Taiyo Yuden (a major Japanese chemical company, which codeveloped, with Sony Corp., the chemical processes that made CD technology possible); Ricoh Corp.; Victor Co. of Japan Ltd. (JVC); Sony Corp.; Teac Corp.; Sun Microsystems Inc.; Elektroson; Eastman Kodak Co.; the Jet Propulsion Labs; Optimage; Mammoth Microsystems; Microware; Hewlett-Packard Co.; and Digital Equipment Corp. (Extracted from Electronic Engineering Times, 21 October 1991)

Device makers cut chemical releases

In 1990, Silicon Valley device makers significantly reduced the amount of hazardous chemicals released to the environment.

The cuts were given in a report recently issued by the Santa Clara County Manufacturing Group (SCCMG). The association is composed of 25 companies, 12 that produce ICs. Participants in the study trimmed the use of toxic chemicals from 5.825 million pounds in 1987 to 1.512 million pounds in 1990. The companies that make ICs and participated under the Superfund Amendments and Reauthorization Act (SARA) are shown in table 1.

The largest chemical reductions, according to SCCMG, were represented by Freon 113, trichloroethane, acetone, hydrochloric acid and sulphuric acid.

The primary chemicals used in producing ICs, which require reporting, are dichlorobenzene (photoresist stripper), Freon 113 (cleaning solvent), glycol ethers (photolithography), hydrogen fluoride (etchant), phenol (stripper), phosphoric acid (metal cleaner) and 1,1,1-trichloro-ethane (solvent).

The two semiconductor equipment companies that reported, Applied Materials and Varian Associates, also showed large chemical reductions.

Table 1. Semiconductor Manufacturers Chemical Releases for 1987-1990

Company	1987	1988	1989	1990	'87-'90 change %
Advanced Micro Devices	29,300	32,500	37,891	14,203	-51.53
Analog Devices	39,814	42,048	44,990	26,242	-34.09
Cypress Semiconductor	0	0	14,047	11,649	NA
Digital Equipment	0	0	8,094	84,694	NA
Exar	15,877	14,710	7,012	7,241	-54.39
Hewlett-Packard	399,656	574,211	332,250	190,559	-52.32
IBM Corp	2,074,053	653,105	306,460	118,868	-94.27
Intel Corp	144,264	67,710	25,875	19,458	-86.52
Linear Technologies	1300	10	2000	60	-95.38
National Semiconductor	672,589	119,493	127,939	78,185	-88.38
Raytheon	75,934	83,996	100,490	27,688	-63.54
Signetics	48,282	51,469	48,375	26,740	-44.62

Note: Where '0' appears, the company's use of reportable chemicals was below the reporting requirement for that year. Source: "Environmental Releases for 1987-1990," SCCMG

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Toshiba sets an example of CFC elimination

Leading the way for expected similar announcements throughout the semiconductor industry, Toshiba Corp. says it has succeeded in eliminating chlorofluorocarbon (CFC) 112 and 113 from semiconductor cleaning processes. The world-wide manufacturing plants where this was done include Toshiba Corp. Microelectronic Centre - a development facility, Taketa Toshiba Electronics Corp. - a memories and microprocessor facility, Kaga Toshiba Electronics Corp. - a discrete-device facility, and Tohoku Semiconductor Corp. - a joint venture with Motorola Inc.

This effort, of course, is driven by international concern over the reported connection between CFCs and the earth's ozone layer and by the Montreal Protocol - an agreement that calls for 50 per cent reduction of CFCs by 1995 and 100 per cent reduction by the year 2000.

Toshiba's recent accomplishment is a result of its company-wide plan to cut CFC use in half by 1993 and eliminate its use entirely by 1995. Toshiba plans to be well ahead of environmental schedules proposed by national governments and international organizations.

Throughout Toshiba, engineers have also examined CFC use with three alternatives in mind: elimination of the CFC washing process altogether; use of a different cleaning method; or substituting the CFC-112 and CFC-113 with "Techno Care".

Setting an example for the entire industry (and perhaps third world countries not yet committed to CFC reduction), Toshiba is now requesting early elimination of CFC use from all its subcontractors, including manufacturers of wafers and packages. Toshiba officials are offering technical support to any interested subcontractors. (Extracted with permission from Semiconductor International Magazine, September 1991. Copyright 1991 by Cahners Publishing Co., Des Plaines, Illinois, USA)

UNESCO documentation and information centre on education

A documentation and information service covering the field of education has been set up at the headquarters of the United Nations Educational, Scientific and Cultural Organization (UNESCO).

The service makes available all UNESCO documents and publications on education that are produced at the organization's Paris headquarters, its Regional Offices and specialized institutions and centres. It also provides access to a number of specialized reference works produced by other sources.

A total of 1,300 UNESCO titles are available for distribution, while about 55,000 reference titles can be consulted by users of the service, the acronym for which is SDI.

The service operates, within the framework of the UNESCO Integrated Documentation Network, in close cooperation with the central UNESCO Library and with all other similar education services outside UNESCO headquarters, in particular the International Bureau of Education, regional offices, and specialized institutes and centres. It also has access to major education networks outside the organization.

Fields covered by the service include: literacy and adult education; training of educational personnel; science and technology teaching; higher education, etc. Among services provided to users are the annual dissemination of the catalogue of available UNESCO documents and publications related to education, and the preparation of specialized bibliographies and syntheses. Users range from national education institutions and international organizations to researchers, experts, consultants and students from all over the world.

For further information on the service, contact: Documentation and Computer-assisted Management Service of the Education Sector, Office 4.030, UNESCO, 7 place de Fontenoy, 75700 Paris, France. Tel.: +33-1-45/68-10-00; Telex: 204461 or 270602 Paris. (Source: ACCIS Newsletter, 9(3), September 1991)

UNU sets up institute for new technologies

The United Nations University (UNU), in collaboration with the Government of the Netherlands, has recently set up an Institute for New Technologies (UNU/INTECH) at Maastricht, the Netherlands.

The objective of the institute is to undertake policy-relevant research on the economic and social impacts of new technologies, especially - though not exclusively - on developing countries. To do so, UNU/INTECH seeks to set up a small, in-house team of researchers, composed of economists, political scientists, sociologists and technologists.

For further information, contact: Professor Charles Cooper, Director, UNU/INTECH, Kapoenstraat 23, 6211 KV Maastricht, the Netherlands. (Source: ACCIS Newsletter, 9(3), September 1991)

No escape from the global telephone

A new global telephone system, where users dial people rather than telephone terminals, could be into its first phase by 1995.

Raj Pandya, director of the University of Adelaide's Teletraffic Research Centre, says that the new system, known as universal personal telecommunications (UPT), would allow subscribers to dial direct to a personal telephone number. The global network would automatically divert the call to wherever that person was. By 2005, he said, 40 per cent of such calls would go to portable receivers.

Each UPT user would have a personal number which would allow them to place and receive calls anywhere in the world, using any type of receiver. Calls would be charged automatically to the personal number, rather than to a telephone or line. And the system would allow individuals to determine which calls to accept and which to have diverted to an answering service.

The International Telecommunications Union (ITU), the UN agency responsible for coordinating the global telephone network and its regulatory body, the International Consultative Committee for Telephones and Telegraph, has set up 18 working parties to hammer out the basic standards and form of the new system. For instance, the system would have to be able to verify who and where a user was, and then divert calls to them by the most efficient route.

Most of the basic technology to put together such a network already exists, but applying it requires more research. The most pressing area is development of the capability to allow verification of a caller. (Extracted from New Scientist, London, 19 October 1991, the weekly review of science and technology)

Green chips

A method for drying silicon wafers and glass plates, devised at Philips Research Laboratories in Eindhoven, could open the way for ultra-clean chips with no environmental effects. The method relies on the Marangoni effect where the flow along a liquid surface is induced by local variations in surface tensions, due to a gradient in either temperature or concentration along the surface. Generally the manufacture of products such as ICs, liquid crystal displays and printed circuit baords use wet processing which leaves a thin layer of contaminants on the product's surface. The Marangoni system of drying is of particular interest in IC production, where there are extreme demands for cleanliness. (Source: Electronics World and Wireless World, November 1991)

CFC substitute

ICI has developed a new hydrocarbon alcohol blend as a replacement for CFC 113 in cleaning printed circuit boards (PCBs) and other electronic components at a comparable cost.

ICI's product, Evolve, is claimed to have zero ozone-depletion potential and will be compatible with most materials used by the electronics industries. However, the new process may not be suitable for water-sensitive substrates because it employs a rinsing stage.

Laboratory tests have shown that the various formulations tested so far work at least as well as CFC 113 for cleaning PCBs. If the trials are successful, the product and multistage cleaning process will be introduced to the United Kingdom market during 1992. (Source: European Chemical News, 2 September 1991)

Panel to look at inter-library affairs

ACCIS has formed a new technical panel to provide a formal mechanism for United Nations system libraries to cooperate in ways that, it is hoped, will improve services to Member States and the United Nations system staff.

The Technical Panel on Inter-Library Cooperation, Standards and Management (TP/LIB) has come into existence following a Joint Inspection Unit (JIU) report that identified a need for cooperation and networking between the libraries of the system.

Among issues pinpointed by ACCIS for the panel's consideration were: the introduction of automated systems to libraries where this is lacking; development of a uniform catalogue as a preliminary stage for developing a central electronic library for the United Nations system; standards required for interconnectivity and interworking between libraries; and an inventory of current resources and problems in the United Nations library community.

The panel has been asked to prepare a catalogue of prioritized issues to be included in a plan of work for a two-year period. This will include activities and outputs, and be presented to the Steering Committee for approval.

Initial membership of the panel comprises: the United Nations, the United Nations Population Fund (UNFPA), the United Nations Institute for Training and Research (UNITAR), the International Trade Centre UNCTAD/GATT (ITC), the International Labour Organisation (ILO), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the World Health Organization (WHO), the Food and Agriculture Organization of the United Nations (FAO), the International Monetary Fund (IMF), the International Telecommunications Union (ITU) and the International Atomic Energy Agency (IAEA). (Source: ACCIS Newsletter, 9(4), November 1991)

INFOPROJECT

The Latin American and Caribbean Institute for Economic and Social Planning (ILPES), based at the headquarters of the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) in Santiago, Chile, has developed a computerized package to deal with all stages of a public investment project.

The package, called SLIPES/INFOPROJECT, is designed for collecting, organizing, handling and analysing information on projects at the national as well as sectoral and regional levels.

INFOPROJECT consists of seven data entry forms that record a project's life history. The forms capture: basic information; evaluation and impacts; financing and programming; external financing agreements; internal and external disbursements; programming of project implementation, and on-site follow-up.

The package is being used in various ways in a number of countries in the region through technical assistance projects, with the aid of the Inter-American Development Bank (IDB) and the United Nations Development Programme (UNDP). In conjunction with the World Bank's Economic Development Institute, ILPES conducts regional seminars for the purposes of promoting cooperation among the countries concerned, examing the progress being made, supplying information on achievements and providing an opportunity for the exchange of views on the package. Similar activities are planned for the purpose of analysing the work under way.

For further information, contact: ILPES, Office of Projects and Advisory Assistance, Casilla 1567, Santiago, Chile. Tel.: +56-2/485 051 to 485 061 or 2061519; Fax: +56-2/480 252; 481 946; Telex: 340295 UNSGO CK, 441054. (Source: ECLAC/CDCC Focus, Vol. 13, No. 1, 1991)

IEC/ISO information centre

The information centre located at the International Organization for Standarization (ISO) Central Secretariat is now acting as a joint ISO/International Electrotechnical Commission (IEC) Information Centre. It will also be the ISONET international node for both organizations (ISONET is ISO's information network).

Within ISONET, the Centre will be a focal point for information on international standards and normative documents. It will provide information on ISO and IEC standards to other international information systems such as AGRIS and INIS, coordinated by the Food and Agriculture Organization of the United Nations (FAO) and the International Atomic Energy Agency (IAEA) respectively.

The Centre will also be responsible for preparation of publications such as the KWIC index of international standards, and selective lists of ISO and IEC standards in given fields. The Centre can also put outsiders in touch with national standards bodies.

The Centre's library, containing, inter alia, full collections of ISO and IEC standards, is now used by staff and visitors of ISO and IEC central offices. For further information on the Centre, Tel.: +41-22/749-02-22. (Source: ISO Bulletin, March 1991)

Paperwork, paperwork, paperwork

The increased use of computers has caused a veritable paperwork explosion. As printers and photocopiers get cheaper and faster and offer full colour, we are going to run out of trees. For environmental reasons alone we should restrict the availability of printers and copiers and concentrate on reduction of paperwork rather than seek electronic help in its management.

If we truly believe in "paperless trading", "paperless offices", "E-mail", "networks", and

"multi-access data files" then surely we can accept a massive reduction in computer printers. And if we do not produce the paper in the first place, then we will not need to copy it.

The environmental damage caused by the oil spill during the war in Kuwait is as nothing compared to the uncontrolled paper wells pouring out paper in all organizations, both large and small, but particularly in the large monster corporations of the modern era. (Source: Management Accounting, October 1991)

II. NEW DEVELOPMENTS

IBM and Siemens announce 64 Mbit

The IBM/Siemens cooperation in the R&D of advanced DRAMs appears on-track with the announcement of a 64 Mbit device. The companies describe it as a "production prototype". The chip is made using 0.4-micron technology, but when it reaches the market it will be made using 0.3-micron technology. IBM is waiting for a special lithography machine for mass-manufacturing the chip from the US Government-backed R & D consortium, Sematech. Other companies around the world have announced 64 Mbit prototypes - the first from Hitachi in mid-1990 followed, in February 1991 by chips from Mitsubishi, Matsushita, Toshiba and Fujitsu. Market versions of the chip are expected in 1995. (Source: Electronics Weekly, 8 January 1992)

250 MHz microprocessor claim

Researchers at the North Carolina State University claim they have developed a prototype microprocessor that can run at 250 MHz. The high speed was achieved using a wave-pipelining process and fabricating the chip in 2-micron CMOS. The researchers say that their chip is more than eight times faster than other CMOS chips. They say that they have used conventional technologies and managed to boost their speed at a very small additional cost. The prototype chip was developed under the sponsorship of the US consortium Semiconductor Research. It has 60 members and is now exploring commercial applications for the new chip design. (Source: Electronics Weekly, 5 February 1992)

NEC claims record for computer speed

NEC Corp. has introduced a supercomputer it says is the world's fastest, slightly exceeding the speed of US-based Cray Research's top machine.

NEC's SX-3 44R has a sequential computation speed of 25.6 gigaflops, or 25.6 billion calculations per second, the company said. The Cray's peak speed is 24 gigaflops.

The machine is also 16 per cent faster than NEC's previous best, the company said. (Extracted from International Herald Tribune, 22 January 1992)

Molecular memory

Physicists in the US have used lasers to change the properties of single impurity molecules within a polymer. The work could lead to a method of optical data storage in which individual molecules store binary digits.

W. Moerner of the IBM Almaden Research Laboratory in San José and Thomas Basché, a visiting researcher from the University of Munich, carried out experiments on polyethylene films which contained about one part per million of the impurity molecule perylene.

Moerner says the technique is a sensitive probe for scientific research on the nature of solids. Single atoms and molecules had been studied before in liquids and gases, but not in solids. (Extracted from New Scientist, London, 15 February 1992, the weekly review of science and technology)

From star wars to chip wars

Researchers in innovative technology at the US Departments of Energy (DOE) and Defense are working on a new offensive called "Microtech 2000" to catapult US industry past foreign competitors in the microchip business by the end of the century.

Los Alamos and Sandia National Laboratories want to enter the free-electron laser, a spinoff from "star wars" research, as a candidate for funding under the new initiative.

The DOE has already agreed to spend $1.5 million to see if the weapons laser could be deployed as a credible chip production tool and advocates are hoping to obtain approximately another $35 million to move development into phase two.

The goal of "Microtech 2000" is to create short wavelength light sources that will enable US companies to produce ultra-dense, 1-gigabit memory chips by the year 2000 with 0.1 micron circuits. At this point, it would begin to be possible to put the equivalent of a supercomputer on a chip.

The DOE laser is attracting a lot of attention at Los Alamos and Sandia, but experts who have already been labouring in this area for years are sceptical. (Source: Science, 22 November 1991, p. 1099)

Brain's neurons modelled in silicon

A british and an American researcher have made a microelectronic circuit that closely mimics the behaviour of a neuron from the brain. Their "silicon neuron" could be a valuable tool for physiologists to test their theories of the brain and to computing researchers developing computer devices that interact with the world as the brain does.

Computer neural networks are normally made by programming a digital circuit to behave like a neuron. In contrast, Rodney Douglas of the University of Oxford and Misha Mahowald of the California Institute of Technology have built an analogue circuit with electrical properties very similar to a neuron from the neocortex of the brain from scratch.

The researchers built modular integrated circuits on a silicon chip that behave analogous to ion conductances. Two such circuits represent the conductance of the sodium ion and potassium ion currents which generate the impulses in a real neuron. Other circuits, representing other ion

currents, control the rate of the impulses. The various circuits can be assembled in compartments that reflect the anatomical structure of the neuron.

The researchers have squeezed all the circuits into an area less than 0.1 millimetres squared on a silicon chip. They are now working on a chip with many neurons to show that silicon neurons can operate together in circuits. (Extracted from New Scientist, London, 21/28 December 1991, the weekly review of science and technology)

Norwegians are winners in fast chip race

A Norwegian team has beaten US and Japanese rivals to develop a high-speed co-processor for non-numeric tasks.

The full-custom VLSI chip, called the MS160, implements parallelism on the processor to achieve a throughput of 160 Mbytes a second. The chip is divided into eight processing blocks, each of which is subdivided into 32 windows, so it can examine 256 data elements at once.

According to Jan Bakke, president of Microway Scandinavia, which will be manufacturing the chip, the chip will be 7 x 7 mm, but the pinouts are not finally decided. Microway is working with Nordic VLSI and Matra MHS on production versions.

The MS160 could be incorporated into a PC motherboard or add-in board or built into disk drives or other devices. It is aimed at applications such as searching text databases, pattern matching, signal processing and network monitoring. Its throughput rate means it could search for a sentence in 64,000 A4 pages of text in a second.

The chip was developed by a team at the Technical University of Trondheim, Norway, led by Professor Arne Halaas. It will be marketed in the UK by Microway Europe. (Source: Electronics Weekly, 15 January 1992)

Hitachi claims chip first

Hitachi Ltd. has claimed a breakthrough in semiconductor technology using tungsten instead of aluminium to manufacture a new generation of ultra-large-scale memory chips.

The company said the process was suited to 256-megabit dynamic random-access memory chips and other devices with circuitry as thin as 0.2 of a micron, or two ten-thousandths of a millimetre.

The circuits of four-megabit DRAMs, the biggest chip currently in commercial production, are 0.8 of a micron wide.

The company said it had already started using tungsten instead of aluminium to make 16-megabit DRAMs. (Source: International Herald Tribune, 28 August 1991)

Double-sided chip

SGS-Thomson has produced a semiconductor on which both sides of the wafer had been processed. The device provides protection from overvoltage for SLICs (subscriber line interface cards).

On one side of the die the device has the tyristor anodes, the diode cathodes and the collectors of the gate transistors and, on the other side of the die, the diode anodes, the transistor base and the emitter regions.

The programmable bipolar device protects SLICs from lightning-induced transient voltages, coupled power line surges and other potentially damaging over-voltages.

Designated LCP 150/1, the device is designed to be used between the ring relay and the SLIC IC and one device protects both the telephone wires by suppressing all voltage spikes. (Source: Electronics Weekly, 20 November 1991)

Inmos unveils graphics chip

Inmos has unveiled a device for use in MIPS workstations. The chip produces a video output at up to 135 MHz and can talk directly to 64-bit microprocessors.

Industry sources suggest that Inmos will sell the chip to DEC for use in workstations based on the MIPS microprocessor and built to the Advanced Computing Environment (ACE) specification. Inmos is already producing graphics chips on the production line built to make the much-delayed next generation transputer, the T9000. (Extracted from Electronics Weekly, 18 September 1991)

DEC claims RISC chip will last for 25 years

DEC has revealed details of its next-generation computer architecture, a technology the company says will last for 25 years.

The Massachusetts-based computer supplier says its reduced instruction set computing (RISC) processor, codenamed Alpha, will power everything from palmtops to massively parallel super-computers, and far surpasses anything on the market now in terms of performance.

First implementations of the 64-bit Alpha (the first 64-bit RISC chip from a major computer vendor) are claimed to be three to four times more powerful than the existing top-end Vax 6000-600. The advanced CMOS-based chip runs at 200 MHz.

Alpha will initially run VMS and the Open Software Foundation's OSF/1 version of Unix and will be made available to software developers during the middle of this year. Alpha also supports popular programming languages. (Extracted from Computer Weekly, 23 January 1992)

Computer code makes images crystal clear

Images showing features as small as 3 Angstroms across (3×10^{-10} metres) can be obtained with high-resolution transmission electron microscopes (HRTEMs). However, researchers find the pictures very hard to interpret. They are reduced to guessing the structure of their samples, simulating the image that a HRTEM would produce of them, then comparing this with the actual image.

Cambridge Molecular Design simulated images from a crystal of $YBa_2Cu_3O_7$, a high-temperature superconductor, which conducts

electricity without any resistance when cooled. The 2D images show slices of the crystal of different thickness.

Nick Austin, who wrote the computer code, says interpreting the images was difficult partly because electron microscopes do not focus very well. Also, the electrons, which "illuminate" a sample tend to bounce around in the sample several times instead of simply being transmitted or reflected, further complicating the images. (This first appeared in New Scientist, London, 21 September 1991, the weekly review of science and technology)

Prototype supercomputers

Several manufacturers are now developing prototypes of supercomputers that harness thousands of processors in parallel, in efforts to attain teraflops performance. Thinking Machines (Cambridge, Massachusetts) said that it is on target for a 1995 unveiling of the world's initial computer having teraflops speed. The Defense Advanced Research Projects Agency (DARPA) has provided funding to support the effort. Meanwhile Intel said its Touchstone Program, financed from Intel and DARPA, will make its fourth and last prototype, Touchstone Sigma. Touchstone Sigma is expected to have an aggregate performance of more than 150 gigaflops. The teraflops-level performance will come after that. (Extracted from Mechanical Engineering, August 1991)

Computer control with a flick of the eye

After the keyboard and the computer mouse, researchers wanting to speed up the interaction between people and computers are now focusing on the eye. Researchers have demonstrated a system which uses the movement of the eye to control anything from a word processor for the disabled to the weapons systems in a fighter aircraft.

Another group of researchers described work on a display technique that does away with a screen. Instead it projects its image straight on to the retina with low-power lasers.

The eye-tracking system, called EyeGaze, consists of a video camera fitted below the computer screen. A small low-powered light emitting diode (LED) that produces infrared light is attached to the centre of the video camera lens.

The beam from the LED creates a reflection on the cornea of the eye. It also makes the pupil appear as a bright spot, similar to the red eye effect caused by a flash attached to a camera.

The system will work with people wearing glasses or contact lenses. EyeGaze is being used by a disabled teenager in the US to drive a word processor, voice synthesizer and to play computer games. Other applications include analysing the effectiveness of screen information for air traffic controllers or pilots, diagnosing reading problems in children and market research. The technology has been tested for firing weapons in fighter aircraft.

Meanwhile, researchers at the Human Interface Technology Laboratory at the University of Washington in Seattle are investigating using fine laser beams to scan computer images directly onto the retina of the eye.

So far the project has scanned simple line shapes such as "X", but only in monochrome – in this case red. Full colour scanning will only become possible when blue semiconductor lasers are available. Only very low intensity beams are used which are said to be completely safe.

The aim of the laser microscanner project is to incorporate the system into light-weight spectacles. Semiconductor lasers are very small and light and no screen would be needed. This would overcome the limitation of present virtual reality systems: the encumbrance and poor resolution of current head-mounted displays based on liquid-crystal displays or small cathode-ray tubes. (This first appeared in New Scientist, London, 8 February 1991, the weekly review of science and technology)

Fast semiconductor switch

Researchers at the Department of Electronics and Electrical Engineering at Glasgow University (UK) have developed a semiconductor switch they claim is the fastest in the world. Operated by intense pulses of laser light lasting just 10 picoseconds, the switch could open the way to handling 1.2 million simultaneous phone conversations or 2,000 television channels. Researchers say the switch could be speeded up to operate at 10 femtoseconds. (Extracted from Financial Times, 25 October 1991)

New superconductor contains gallium

Researchers at Northwestern University and Argonne National Laboratory have discovered a new family of high-temperature superconductors that may lend themselves more readily to practical applications. The new materials are layered copper oxides that contain gallium, an element new to ceramic superconductors. They were synthesized by Kenneth R. Poeppelmeier's group at Northwestern and have the general formula $LnSr_2Cu_2GaO_7$, where Ln stands for yttrium or any of 14 lanthanide elements. Superconductivity has been observed at 30 K and 73 K only in samples of $YSr_2Cu_2GaO_7$ that were doped with calcium and annealed in high-pressure oxygen at 910°C. The new materials are structurally similar to the 93 K superconductor $YBa_2Cu_3O_7$, except that the square-planar copper chains separating the double Cu-O layers are replaced by chains of Ga-O tetrahedra. These gallium layers apparently make the structure more thermally and mechanically stable. For instance, tests show this superconductor, unlike others, does not lose oxygen when heated in air. The new material is the first in which only the Cu-O planes, separated by nonconducting chains, carry the supercurrent. (Source: Chemical and Engineering News, 29 July 1991)

Hypres does superconducting-IC milestone

Probably not a threat to silicon or gallium arsenide technologies at this point, nevertheless Hypres of Elmsford, New York, has shown "record speed with a superconducting digital logic circuit". Specifically it is a 4-bit shift

register chip that operates at 9.6 GHz and dissipates only 40 - W. In general, semiconductor circuits at similar speeds dissipate three orders of magnitude more power.

Interestingly, in a world where we associate major jumps in IC performance to jumps in process technology, Hypres engineers fabricate this high-speed circuit with 3.0 - m geometries, compared to the 0.5 - m geometries typically used with gallium arsenide to attain similar performance.

Edwin Hill, director of operations at Hypres, said that the processing for fabricating superconducting circuits uses rather ordinary wafer processing equipment and techniques, those that you commonly use for Si and GaAs manufacturing.

Hypres uses Josephson-junction devices to build its superconducting logic; the Josephson tunnel-junction uses a vertically stacked structure with a 10-15 Å barrier.

The Hypres process is a low-temperature 150°C process that produces devices in five working days. Defects are a concern, but unlike silicon processing, sodium contamination is not.

The Hypres 4-bit shift register is a test bed for the company's edge-triggered circuit designs for logic devices; this uses a two-phase rather than a three-phase clock.

Hypres engineers have also fabricated shift registers of up to 700 bits consisting of 4200 Josephson junctions. These circuits operate close to 10 GHz and are suitable for building ultra-highspeed digital signal processors operating at 10 Gsamples/s. Such circuits will have application in secure communications systems and low-probability-of-intercept radar, for example.

Also significant for future applications of superconducting circuit, Hypres engineers have demonstrated "the world's first" 4-bit shift register fabricated with niobium nitride. This superconducting compound operates at 8-10 K temperatures, rather than the 4 K required for circuit fabricated from pure niobium. (Reprinted with permission from Semiconductor International Magazine, November 1991. Copyright 1991 by Cahners Publishing Co., Des Plaines, Illinois, USA)

Superconducting motor sets new milestone

The first superconducting motor to achieve a practical power output at liquid nitrogen temperature was announced by American Superconductor Corp. of Watertown, Massachusetts. The motor, developed by Cleveland-based Reliance Electric Co., incorporates high-temperature superconducting electric coils made by American Superconductor. The demonstration direct-current motor produced 25 watts of power, with a current of 0.5 amp in the superconducting field coil. The motor's power output is about the same as that of a cooling fan in a desktop computer. The motor's ability to run at the power level it was designed for "shows how the major scientific obstacles to commercializing superconducting technology are rapidly falling away", says Gregory Yurek, president and chief executive officer of American Superconductor. "What remain are largely engineering hurdles." Superconducting motors are expected to be more efficient than conventional motors, and this would yield significant energy savings. Funding for the joint effort was provided by the Electric Power Research Institute. (Source: Chemical and Engineering News, 12 August 1991)

Superconducting generator

A totally superconducting generator has been developed by two laboratories in Grenoble, France. The generator includes typical layout, increased specific power ratings in terms of mass and volume, and a rise in efficiency as there is no need for electromagnetic screens. The device's original characteristic is the utilization of superconductors, which contain low losses at 50-60 Hz frequencies and are created from superconducting NbTi filaments placed in a very resistive CuNi matrix. (Extracted from Ceramic Industries, August 1991)

Tape from superconductors

A high-current tape made from high-temperature superconductors has been produced by scientists at Los Alamos National Laboratory and the American Superconductor Corp.

Powder from the superconductors is packed into a silver tube, which is then pressed or rolled, and then heated. Los Alamos has produced a continuous 130-foot length of tape, short sections of which showed a critical current density of 9,300 amps/cm^2 at 35 K in an external magnetic field of 2 tesla.

The researchers have built an electro-magnetic coil from a five-foot section of the tape that initially produced an estimated 200-gauss magnetic field.

Pressing the tape flat creates cracks along its length, while rolling the tape flat produces cracks across its width. A pressed tape can carry much higher current, but pressing is not technically feasible for long lengths of tape. Los Alamos said it has produced rolled tapes with critical densities of 4,500 A/cm^2. (Extracted from Electronic Engineering Times, 30 September 1991)

New technique for growing superconducting films

AT&T Bell Laboratories (Murray Hill, New Jersey) workers have devised a novel molecular beam epitaxy technique for growing superconducting films of complex materials. The process involves in-situ oxide growth resulting from reactions on the substrate surface at high temperature, of a metal flux with uncharged radicals, for the most part atomic oxygen and molecular oxygen in an excited state. The group has achieved smooth surface films of yttrium-barium-copper oxides with the critical temperature for superconductivity at 92 K and critical current density of 500,000 A/sq cm. The process also eliminates the need for an external oxygen anneal. The goal of the researchers is to control the deposition process to grow a single atomic layer at a time. They have also made hybrid devices with high-Tc film on one side of a planar structure and low Tc superconductor on the other side. (Extracted from Research and Development, November 1991)

Toshiba motors

Toshiba says it has achieved a breakthrough in nanotechnology by constructing a microscopic electrical motor less than .01 in. in diameter. Toshiba says it is the smallest electric motor ever made and includes all the components of an electric motor, magnet, bearings and coil. The tiny motor also includes a microchip to control it. It was built by using chip-making techniques and by very precise micro-machining techniques. Toshiba says the motor needs just 3 V to operate and predicts that it will be used in microscopic machines that will enter the human body for medical tasks. (Source: Electronics Weekly, 13 November 1991)

Prospects of nanotechnology

Scientists are working on the ability to manipulate individual atoms to make incredibly tiny circuits or machines. Possibilities vary from invisible supercomputers to tiny robots that could travel through the bloodstream to repair tissues. Dr. John Armstrong of IBM, while doubting that entire computers could be built on this scale, agrees that it will soon be possible to build electronic and mechanical devices atom by atom. Nanotechnology (a nanometer is 1 billionth of a metre, and is the size of about 3 atoms) draws on advances in physics, chemistry, biology and computer science. Micromechanics produces gears, motors, etc., that are measured by the micron - so small that they could accidentally be inhaled. But nanotechnology aims to make machines and circuits that are even smaller.
Dr. Nadrian Seeman of New York University points out that nanotechnology is partly a new way to describe very advanced chemistry. Ribosomes assemble amino acids according to instructions in the genetic code.

Nanotechnology has been largely shaped by Dr. K. Eric Drexler of MIT, now a visiting scholar at Stanford (Palo Alto, California). He envisions nanomachines being assembled by molecular assemblers, which would be able to replicate themselves as well as assembling needed atoms into useful machines. Some critics dispute the possibility of nanotechnology, saying that quantum mechanical effects and radiation would prevent the precise positioning of atoms. (Extracted from New York Times, 26 November 1991)

Co-opting nature's own nano-electronics

Investigators in the field of molecular electronics, which seeks to harness single molecules as switches, transducers and the like, are finding that nature has done much of their work for them. Molecular electronics researchers are concentrating efforts on ways to put biological molecules to work in simple electronic and optical devices - a first step, they hope, towards smaller and faster computers, denser memories and higher-capacity communications systems.

Bacteriorhodopsin, a membrane-bound protein that harvests light energy to fuel the metabolic activity of certain photosynthetic bacteria, was one of the featured bio-molecules.
Robert R. Birge, director of the Center for Molecular Electronics at Syracuse University, reported that he and his colleagues had embedded the molecules, whose purple colour changes to yellow on exposure to certain wavelengths of light, within cubes of plastic to create a data-storage medium. By using criss-crossed laser beams, they hope to read and record densely packed data - encoded in the colour of the rhodopsin molecules - in specific micro-regions in the cube. A one-inch cube theoretically could host several billion bits of data, enough to store entire libraries.

Elias Greenbaum of Oak Ridge National Laboratory is seeking to harness another piece of nature's molecular machinery: the photosynthetic reaction centre, a complex of molecules that enables green plants to capture sunlight for making food in the form of carbon compounds. The reaction centre actually performs only the first phase of the process, turning photons of light into a flow of energetic electrons. By turning optical signals into electronic ones, transducers based on the reaction centre might play a role in future computers or communications systems, Greenbaum speculates.

Molecular electronics may be commonplace in nature, but even the enthusiasts agree it will be a while before, say, desktop computers start sporting bacteriorhodopsin memories. (Extracted from Science, Vol. 253, p. 1215, 13 September 1991)

Taking the measure of tiny objects

Two engineers from the University of Cambridge have found a way of using an electron microscope to measure the height of minute objects that can be as small as three hundred atoms high. Because they use a microscope, the researchers can see clearly where they are making measurements. Such accuracy is essential in the design and testing of advanced semiconductor chips.

Electron microscopes are well known for the beautiful images they produce of insects' heads, crystals and other tiny objects. The pictures from the scanning electron microscope (SEM), look just like ordinary photographs because the electrons behave like light does in an optical microscope, but the pictures are normally two-dimensional, and do not reflect the height of objects. Researchers can make three-dimensional images with an SEM by taking one picture, then tilting the sample and taking another. With this pair of stereo images they can create the illusion of three dimensions.

John Thong and Bernie Breton from the department of engineering at Cambridge have now combined the information from such stereo images with a simple height-measuring technique taken from optical microscopy. Their system profiles the surfaces of silicon microcircuits.

Researchers would like to measure heights as small as nanometres, thousandths of a micrometre. Thong and Breton say they can measure less than 10 nanometres. Using a computer, they compare two three-dimensional images to detect exactly where the electron beam is in focus.

Instead of tilting the sample, they tilt the electron beam. They have arranged it so that the beam tilts about a point which is in focus. This means that all the parts of the specimen which are exactly in focus will coincide when one of the

stereo images is superimposed on the other. Areas above or below the focal plane are shifted to the left or right. So to get a particular part of the specimen in focus, the computer adjusts the focus until the images of that part coincide. To measure something like the height of a wire in a silicon microcircuit, the electron beam simply scans across the wire, recording the changes in focus. (Extracted from New Scientist, London, 23 November 1991, the weekly review of science and technology)

Micromechanical breakthrough

US researchers have developed a process they believe will make it easier to make reliable micromechanical devices. The team at the Sandia National Laboratories in Albuquerque in the US have produced uniform miniature moving parts with a new silicon etching technique. Micromechanical devices are made from silicon wafers using silicon etching techniques. The new process uses electrolysis to produce a porous layer on the surface of the silicon wafer and the devices are etched into this layer, rather than into the bare silicon. This makes it easier to etch repeatedly to the accuracy needed to make micromechanical devices. A spokesman for the laboratories claims that they can duplicate the etching process with no more than 0.3 per cent variation. (Source: Electronics Weekly, 8 January 1992)

Analog Devices combines micromachining and BiCMOS

Using standard BiCMOS processing, Analog Devices, Norwood, Massachusetts, has produced what it is calling "the first commercially available surface micromachined device - the ADXL-50 accelerometer". The ADXL-50 represents a milestone in semiconductor processing; experts expect it to play a significant role in automotive electronics.

However Analog Devices officials make a clear distinction between surface and bulk micromachining. Until now, all commercial micromachined devices have used a bulk manufacturing process to produce piezo-resistance based accelerometers. Bulk micromachined devices typically have 10 μm minimum features.

Surface micromachining, on the other hand, involves more intricate silicon processing using advanced IC processing techniques to make a precisely patterned mechanical structure - thin beams and masses - close to the surface of a silicon substrate. The feature dimensions of surface micromachined devices are typically 1-2 μm. In addition, these devices are immune to changes in operating temperature, unlike their bulk-machined counterparts.

Of considerable significance is that surface micromachining adopts conventional IC manufacturing techniques so designers can put electronic circuitry on the same chip as the mechanical structure.

Engineers at Analog Devices were able to take established IC BiCMOS technology and integrate within it steps to fabricate free-to-move 2 μm thick films of polysilicon, suspended 1-1.5 μm off the IC using a 4 μm BiCMOS process, where the steps needed to make the micromachined components were interleaved with those of the IC.

The micromachined sensor of the ADXL-50 measures 500 μm by 625 μm. Measurement accuracy is 5 per cent over a ±50 g range. Analog Devices designers have targeted automotive applications, such as collision detection, active suspension and antiskid braking systems. However, the company plans other devices for machine monitoring, smart munitions and inertial guidance. (Extracted with permission from Semiconductor International Magazine, October 1991. Copyright 1991 by Cahners Publishing Co., Des Plaines, Illinois, USA)

Chip makers unmask yet smaller circuits

Microchip researchers have been surprised to find that they can make the features on chips one third of their current size by refining existing techniques which were thought to be at their limits of miniaturization. They have made columns and troughs measuring just 0.3 micrometres - a hundredth of the thickness of a human hair.

Chip makers had assumed that it would be necessary to use X-rays rather than the usual ultraviolet light to make chips much smaller, and some have spent millions developing compact synchrotrons to generate the necessary X-rays. But by fine-tuning the conventional ultraviolet process, some European companies have made features which could be the smallest made in this way.

Frits van Hout of ASM, the Dutch company which made the mask exposing equipment, says, "X-rays are expected to be used for 0.2 to 0.1 micrometre features. We can do 0.15. Will X-rays be pushed out?". (Extracted from New Scientist, London, 7 November 1991, the weekly review of science and technology)

Small IC structures obtained via optical technique

Using a two-layer resist system, researchers in the corporate laboratories of Siemens A.G. believe they have developed a technique that will allow IC structures with dimensions of less than 0.3 micron to be fabricated using an optical technique.

In contrast to standard methods, the approach developed in the Siemens laboratories in Erlangen and Munich requires only a very thin uniform film to be exposed. The pattern obtained is then transferred to a second underlying resist film by means of anisotropic dry etching.

The second film is significantly thicker than the first and is stable enough for subsequent etching.

To achieve the required etching resistance, the thin resist is subjected to simple chemical after-treatment. This process permits controlled expansion of the optically transferred structure and, thus, a controllable miniaturization of the free interstices exposed to the etching agent.

This chemical expansion of resist lines, known as Carl, lets vias and isolation troughs be produced with dimensions of 0.15 micron, despite using exposure equipment with an optical resolution of only 0.4 micron.

Siemens' Perlach Laboratories has already demonstrated the Carl lithographic process for

0.3-micron test structures on silicon wafers, and occasional samples of 0.25 micron were attained. In conjunction with the improved high-aperture KrF laser exposure devices now being developed, the Carl technique also will be applicable for 0.25-micron technology. The resist system can also be restructured for 193-nm ArF laser exposure. A resolution of below 0.20 micron would then be attainable.

Siemens also believes that by using phase-shifting, optical techniques will be practical down to structural dimensions of 0.1 micron, corresponding to the requirements of gigabit chips. (Extracted from Electronic Engineering Times, 11 November 1991)

New precision milling method for microstructures

A new method for precision milling of microstructures is letting device researchers explore the role that geometry plays in the behaviour of semiconductor lasers. By carving triangular lasers from a gallium arsenide superlattice, researchers at IBM Corp.'s East Fishkill facility at Hopewell Junction, New York have demonstrated that lasers can be tuned solely by varying their geometric form. Previously, laser performance could be modified only by changing basic physical parameters of the materials from which the lasers are made.

The recently demonstrated triangular laser, called a "trilaser", is just the first step in a family of devices that could result from a new dry-etch ion-beam milling technique being developed by the IBM researchers in conjunction with other groups at Cornell University (Ithaca, New York) and Stanford University (California). The technique is giving device researchers a new freedom to build refined structures independently of the underlying crystal structure of compound semiconductors. Normally, high-quality edges and surfaces can only be cut parallel to atomic planes in a crystal.

Solid-state lasers are strictly linear in their operation. Typically, photons are trapped in a linear segment of a crystal, where they travel back and forth between two mirrored surfaces.

The ability to cut high-quality surfaces at any angle means that engineers will be able to tune laser performance by adjusting the angle of incidence at the corners of novel polygonal lasers. (Extracted from Electronic Engineering Times, 4 November 1991)

Solar cell conversion

A team from Imperial College in London has developed a new kind of solar cell which converts light to electricity three times as efficiently as today's panels. Dr. Keith Barnham's group has built and tested a cell based on quantum wells rather than the commonly used bandgap techniques.

Quantum wells have been used by researchers building optical computers. They consist of very small areas of impurities doped into a semiconductor whose atoms have slightly different energy absorption characteristics to the dopant. When light falls into the quantum well, an electron is knocked out. If a stream of electrons is displaced, a current begins to flow. Dr. Barnham has built a test cell consisting of 30 quantum wells and believes that the process has an efficiency of about 40 per cent. Commercial solar cells have efficiencies between 5 and 25 per cent. (Source. Electronics Weekly, 23 October 1991)

Optical neural processing development

Japanese researchers have developed a type of optical neural processor that has the unique ability of solving problems simultaneously and storing the answers. Researchers at Japanese electronics company Mitsubishi say that they developed the device by combining eight optical arithmetic elements and 64 optoelectronic memory storage elements on a gallium arsenide substrate. The Mitsubishi device uses optoelectronics in which light pulses process data instead of electricity. (Source: Electronics Weekly, 25 September 1991)

New optical disk system

Hitachi (Tokyo, Japan) has devised an erasable magneto-optical disk system based on a newly developed high output green laser. A semiconductor laser emitting red light stimulates a YVO crystal for lasing output at 1.06 micron that is directed to a KTP crystal to halve the wavelength to 530 nm, with power of 15 mW. The green laser light is used to record on a new platinum-cobalt double layer film disk, enabling achievement of 0.3 micron domains and a disk with three times the recording capacity of conventional disks. Available magneto-optical disk systems using low power lasers have read-only functionality. The new system will be marketed as a computer external memory product. (Extracted from New Technology Japan, September 1991).

Laser-based memory storage device

A tiny laser-based memory storage device no bigger than a sugar cube that can store 6.5 trillion bits of information has been invented by a University of California (Irvine) chemistry professor. The amount of information that the device can store is equivalent to the content of 1 million novels or 2,000 times more data than the amount that the best personal computers can store on hard disks. The device consists of a plastic cube only 1 cm on each side. It is sensitive to laser light, which is used to record and read the information contained within the cube. Access time is only several nanoseconds, many thousands of times faster than that required by computers. The device has been patented and a prototype is being used at a laboratory at the University of California, but the inventor has no further plans to commercialize the device. A major drawback is that the device can only retain information for several hours at room temperature. Even when liquid nitrogen is used to cool the device, it can only hold information for several months. The device stores information within the molecules of a light-sensitive organic compound inside a polystyrene cube. The device splits a laser beam in two to store the data. Lenses and mirrors direct the two beams so they meet at right angles at a single molecule within the cube. The molecule is physically altered and undergoes a colour change. Molecules in which data is not stored remain clear. When the stored information is to be read, a laser beam of a different colour is transmitted through the cube. Photo detectors

connected to a computer processor read the light emitted from the molecules in which data is stored and compile them into bits. (Extracted from New York Times, 2 September 1991)

Green laser wobbles

Green laser light wobbles chaotically, according to a group of researchers at the Georgia Institute of Technology in the US. The light beam can be stabilized if the crystals used are lined up very carefully. The work could have an impact on the search for blue lasers needed to increase the storage capacity of compact discs and the speed of fibre optic switches. Today's blue lasers work with the same frequency doubling techniques as the US group, led by Dr. Raj Roy, used to make its green lasers.

Green light is produced using a lasing crystal operating at infra-red frequencies. A frequency- doubling neodymium-YAG crystal then halves the wavelength to 530 nanometres. The Georgia team has discovered that the two crystals produce a chaotic interference pattern, scattering the laser's energy and reducing the efficiency of the doubling process. Roy's group discovered that turning the crystals around made the chaos go away. (Source: Electronics Weekly, 23 October 1991)

First blue-green laser diode

3M is said to have developed the first blue-green laser diode. The prototype has the potential to boost by 3 or 4 times the volume of data able to be stored on compact and optical discs. The company reports the development as providing new possibilities for laser applications in such areas as communications, printing and imaging. On a cautionary note, the firm said two years would be needed to work out technical obstacles. (Extracted from Wall Street Journal, 28 August 1991)

Laser-scanning apparatus

A new laser-scanning apparatus at the Research Corp. of Japan's Kyoto Research Park may bring atomic-scale micromanipulation closer to practical application. The new approach resembles the raster-scan technique used in cathode-ray-tube displays. In place of the CRT's electron gun, the micro-manipulation device uses a laser that assembles individual particles two microns in diameter into patterns by repeated scanning.

The technique builds on past research in which optical fields generated by lasers trap and move small particles. Since the atoms are trapped only at vibrational nodes in the optical field, only repetitive patterns have been achieved with this method.

Another approach to atomic manipulation was devised by electron microscopists who discovered that the scanning tunneling electron microscope tip could drag individual atoms into any desired configuration. While this manipulation technique represents the ultimate in both size and control, it is too slow for practical applications.

The new method uses electronically controlled mirrors and precision optics to focus a moving laser beam on a microscope slide containing a solution of polystyrene spheres two microns in diameter. Radiation pressure in front of the moving beam generates forces on the particles. Repeated scanning with on/off control by a computer allows the researchers to arrange the particles in any predetermined pattern. As a demonstration, they arranged the 2-micron spheres in the shape of the Chinese character for light. (Extracted from Electronic Engineering Times, 18 November 1991)

Tiny wire could make molecular electronics a reality

Chemists in Australia have designed and synthesized a molecule that could be used as a "molecular wire". Such a wire might link tiny electronic devices, making molecular-scale electronics a reality.

Max Crossley and Paul Burn of the University of Sydney joined together four so-called porphyrin units to make a conducting strand, 6.5 nanometres long.

Porphyrin molecules are common in nature, where they are generally involved in biochemical processes that require the transfer of electrons. An example is chlorophyll in green plants, which is a porphyrin-based pigment. Porphyrins are also at the heart of haemoglobin, the molecule that carries oxygen in the blood, and vitamin B_{12}.

Crossley says that it was seeing porphyrins in so many different but loosely related natural systems that gave him and his colleagues the idea of joining them together to make a molecular wire.

Crossley and his team are now working on what they call molecular "alligator clips". As the name implies, these would join the ends of the wire to the support material. The chemists have also developed a wire with a 90° bend in it. They say it will be quite useful for connecting devices round corners.

Jean-Marie Lehn of the Institut le Bel at the Louis Pasteur University, Strasbourg, and his colleagues are working on molecular wires of a different sort. They have designed a charged molecule, called caroviologen, which resembles a naturally occurring compound called carotene. The researchers have used this molecule to mediate electron transfer across a bilayer membrane. The membrane, made of spherical globules known as vesicles, is reducing (electron giving) on the outside and oxidizing (electron withdrawing) on the inside.

Lehn believes that it might be possible to make a "molecular rectifier" with the caroviologen wire and the right functional groups. A diode rectifies an alternating current, and will be vital in molecular electronics. (Extracted from New Scientist, London, 30 November 1991, the weekly review of science and technology)

VLSI technology in 3-D

Using a three-dimensional CMOS design approach, scientists at the Institute for Microelectronics Stuttgart (IMS) in Germany have slashed VLSI circuit size two to five times beyond the limits attainable with the two-dimensional CMOS techniques used today. Seven years in

development, the Stuttgart-based institute's vertically integrated Epilog technology has now reached a point where the industry could take it over to build commercial 3-D VLSI devices.

For all their advantages of high functionality, low cost per function and high speed, today's 2-D VLSI circuits suffer from a number of drawbacks. With transistors closely spaced side by side, the interaction of these devices can cause catastrophic latchup. The large area that the interconnections occupy can also lead to high load capacitance, diminished speed, increased power dissipation and electromigration (whereby the ions in the aluminium interconnections can produce disastrous short-circuits).

A way out of his dilemma is 3-D, or stacked, CMOS technology. Pursued for about 12 years, such schemes have been based mainly on polycrystalline silicon films on oxide.

In all likelihood the technology will first be used to fabricate static RAMs, since Epilog lends itself to getting the high density that the six-transistor cells of such devices require. It could also be used on logic circuits, where avoiding latchup and electromigration is crucial. (Extracted from Electronics, November 1991)

Hitachi develops advanced pattern technology

Hitachi has announced the development of a new patterning technology for 256 Mb DRAM devices. The new technology uses tungsten (W) with a very high melting point in multilayer wiring with a new gas called silane fluoride and can handle ultrafine contact holes down to 0.2 µm in diameter. Hitachi claims that the new process can be used on conventional process equipment with only minor changes, and positions it as a key technology for 256 Mb DRAM production.

The new technology came from a total review of the reaction mechanism of the reduction method. The conventional mechanism was explained through the formation of SiF_4 and hydrogen in addition to the W film during film formation, but control was extremely difficult and analysis of the reaction mechanism with an IR spectrophotometer showed a large amount of $SiHF_3$ generated in the reaction, instead of SiF_4. There was no large generation of SiF_4 in selective growth, and in fact selectivity was impaired as a result. This led Hitachi to develop a new system where SiF_4 was introduced into the reaction. In their consideration of $SiHF_3$ they also dtermined that SiH_2F_2 was more suited to full-surface CVD than hydrogen. (Extracted with permission from Semiconductor International Magazine, November 1991. Copyright 1991 by Cahners Publishing Co., Des Plaines, Illinois, USA)

New BiCMOS process

An unusual 3-D integrated BiCMOS process involving selective epitaxial growth and epitaxial lateral overgrowth methods has been devised by Rashid Bashir, Suresh Venkatesan and Prof. Gerold Neudeck of the School of Electrical Engineering of Purdue University (W. Lafayette, Indiana). The process, involving 12 masking steps, results in a structure with a decrease of active area by 25 per cent or more, because of the contact to the buried layer through polysilicon doped with arsenic. The design also features a self-aligned seed hole. (Extracted from Semiconductor International, August 1991)

New method of forming thin films

A method of forming thin films without disrupting the surface of the underlying substrate has been developed by researchers at the University of Minnesota (Minneapolis, Minnesota). The cluster assembly technique involves cooling the substrate to around 50 K and condensing a layer of Xe about 30-Å thick to act as a buffer, then depositing an atomic film by means of a conventional thermal source method. The atoms coalesce to form clusters, then the Xe is desorbed, so that the overlayer is deposited on the substrate with a big decrease in interfacial reaction. (Extracted from Research and Development, August 1991)

Aluminium under pressure

Researchers at Philips' laboratories in Eindhoven have developed computer models of the behaviour of a material which is set to replace aluminium as the main metal in chips. Metal silicides are likely to be used to wire together transistors in the next generation chips because aluminium wears out if very high speed signals pass through it.

Dr. Corrie Bulle-Lieuwma has recently completed a thesis using transmission electron microscopy to study the growth of cobalt silicide on silicon chips. "Our ultimate aim is to make effect semiconductor interfaces." (Source: Electronics Weekly, 23 October 1991)

Xenon atom controls electrical current

IBM has developed a method of controlling electrical current using a single xenon atom. The single xenon atom is moved back and forth to control the current, according to physicists at IBM's Almaden Research Center, San José, California. The manufacture of potentially faster and smaller microelectronic chips would be possible if a practical device is developed which incorporates the switch. IBM made the discovery using a scanning tunnelling microscope. IBM researchers have shown that a single atom can be moved to any desired area on a flat surface by using the tip of the microscope. A single xenon atom can jump from the tungsten microscope probe and a flat nickel crystal by creating a brief electrical potential, or difference, between the probe and the crystal. The xenon atom jumps back to the probe following the application of a pulse of the reversed polarity. (Extracted from New York Times, 15 August 1991)

New diamond process developed

Engineers at the Research Triangle Institute in North Carolina have developed a new process that makes diamond films out of water and alcohol. It also operates at much lower temperatures (300-400°C) than existing processes. Using its new process, RTI has produced diamond films that equal, and often surpass, the quality of those made with processes that use hydrogen gas.

While the researchers have used the new process to fabricate single crystal diamond films - the diamond material of most interest to the electronics industry - they have only been able to do so using natural diamond films as the substrate. This, says Dr. Ron Rudder of RTI, is the biggest problem blocking progress in developing a viable diamond technology for electronics applications.

The reason that a diamond technology is of such interest is that diamond films perform well where other materials fail. Their most notable properties include their hardness, transparency, thermal conductivity, high-temperature stability, chemical inertness and electrical and optical characteristics.

In the electronics industry, diamond substrates could find applications where high-temperature operation (500-700°C) is required. Already, researchers have proven that they can dope diamond to form a p-type material. Also, the thermal conductivity of diamond films make them an ideal heat sinking material and could conceivably be used to help cool devices like III-V lasers. Another potential application is in X-ray lithography, as a mask material: since it is transparent, optical alignment techniques could be used.

The new process developed at RTI is a major step towards a viable diamond process for these and other applications, although a true production process probably remains far in the future. (Extracted with permission from Semiconductor International Magazine, October 199[illegible]. Copyright 1991 by Cahners Publishing Co., Des Plaines, Illinois, USA)

New polymer inhibits ESD, corrosion in plastics

A new polymer process said to make plastic packaging material anti-corrosive and anti-static may eventually be used in chip assembly.

Inverted by John Franey, a chemist at AT&T Bell Laboratories (Berkeley Heights, New Jersey), the patented technology has been licensed to Baxter International (Deerfield, Illinois).

Bell says the process uses additives to convert common plastics into reactive polymers. These polymers conduct electricity that prevents static buildup. They also react with corrosive gases to inhibit corrosion.

The polymer, known as State Intercept, will make its first appearance in bags used to transport electronic devices. Cost of the bags "will be competitive" with the company's other static bags. The polymer will be sold to AT&T directly, and to others world-wide through distributors. The resinous material is also suitable for use in moulded plastic parts, such as IC packages. It can be mixed with conventional polymer compounds such as polyethylene, polypropylene, ABS or PVC. Additionally, it can be used in IC package moulding systems without any equipment changes. (Extracted with permission from Semiconductor International Magazine, October 1991, Copyright 1991 by Cahners Publishing Co., Des Plaines, Illinois, USA)

Magnet technology

Scientists in Japan will carry out an experiment which, if successful, will appear to bring perpetual motion closer to reality.

The scientists based at the superconductivity research laboratory of Japan's Ministry of International Trade and Industry will combine the latest developments in superconductivity and permanent magnets to levitate and spin an aluminium disc 3 metres in diameter at high speed.

It is not perpetual motion of course, since the superconducting components require supplies of liquid nitrogen to keep them at the optimum operating conditions, but even so, the virtually friction-free device should be capable of storing vast amounts of energy that can, in theory at least, be tapped to run machines.

The experiment will also mark a turning point in the fortunes of magnet technology. The scientists will be using the latest in high-power permanent magnets, the so-called rare-earth magnets made of exotic metals such as neodymium-iron-boron (NdFeB) and samarium-cobalt (SmCo).

NdFeB magnets could shake loose the strangle-hold that traditional ferrite and aluminium-nickel-cobalt-iron magnets have had on the mass production magnet market.

The magnet market is said to currently be worth over £1 billion world-wide and is set to more than double by the year 2000. The market is currently growing by more than 10 per cent per annum with NdFeB sales growing by 25 per cent.

The attraction of these magnets could eventually be felt in virtually all manufacturing sectors including the automotive, white goods and aerospace industries, although ferrite magnets will still maintain a substantial share of the market for low-cost low-performance applications. (Extracted from Engineer, 5 September 1991)

Porous silicon can glow

In 1990 two European research groups, at the UK's Defence Research Agency in Malvern and at the Central Reserach Laboratories of Germany's Siemens AG in Munich, showed that rather cheap silicon can also be made photoluminescent. Now scientists at the Fraunhofer Institute for Solid State Technology in Munich have discovered that porous silicon emits light not only under UV radiation but also when a voltage is applied to it. This means that silicon is electroluminescent as well. The discovery could lead to a new world of component and system applications.

The big advantage of voltage-induced light emission is that it is easy to change electrical signals into optical signals. Cheap and easy to process, silicon could replace the expensive and difficult-to-handle GaAs and other compound semiconductors in optical applications. With detectors already made of silicon, a light emitter that also uses silicon would mean a much higher level of integration than is possible when using different materials for the detector and emitter.

Silicon light sources on silicon chips could even trigger a revolution in optical signal transmission, the Fraunhofer researchers declare. Replacing metal connections between chips with light paths could considerably increase a system's data-transmission speed.

Furthermore, flat displays and monitors could be combined with ICs on a silicon basis, and the integration of optical and electronic technology on silicon would open new perspectives for computer architectures. A system could be built that uses electrons for computing and photons for data transmission.

However, before light-emitting silicon finds such applications, much work lies still ahead.

AT&T Co. in the US and a team in Grenoble, France, confirmed the findings of Leigh T. Canham of the UK's Defence Research Agency.

Since 1990, researchers have been trying to get silicon to emit light also under voltage application. Researchers at the Frauenhofer Institute have achieved it and as far as they know, they are the first to make silicon electroluminescent.

The Munich institute became involved because of its know-how in sensors using porous silicon, a form of the material that is a prerequisite for light emission, but just why porous silicon becomes photoluminescent is not fully understood.

In addition to raising efficieny and brightness, continued work at the Munich institute is aimed at determining the spectral distribution and the device response time as well as gaining a better understandi..g of what is going on in the silicon. (Extracted from Electronics, November 1991)

New type of LCD

Canon has developed a new type of liquid crystal diplay, which retains its picture even when the power is turned off. The new LCD could be used in flat screen TVs. One prototype also has been developed to offer colour pictures. The new ferroelectric LCD (FLCD) has 960 x 1312 pixels in a 38 cm diagonal monochrome screen. The firm expects to make screens with 1280 x 1024 pixels (the same quality as high definition TV) in five years or less. The new FLCD twists light through a birefringent crystal. A voltage applied to the crystal switches the crystal between two positions (on or off). The two positions are stable, so there is no need for a constant source of power to maintain the display. The FLCD thus requires much less power. Beatrice Nicholas of GEC Marconi says that a battery that could power a twisted nematic LCD for four months could power an FLCD for seven years. FLCDs are also faster, since each pixel is changed by applying a voltage, not by waiting for the TN crystal to revert back to its original configuration. Also, since pixels that do not need to be changed retain their position, not all the pixels have to be refreshed for each image. These two characteristics make FLCDs suitable for use in TVs. (Extracted from New Scientist, London, 26 October 1991, the weekly review of science and technology)

New power storage technology

Tohoku Electric Power Co. and Hitachi Ltd. of Tokyo, Japan have developed a new power storage technology known as superconducting magnetic energy storage (SMES).

The new system, connected to an experimental power transmission system, is being tested and evaluated at Tohoku's research centre in Sendai City, consists of a magnet composed of a superconducting metal coil and liquid helium coolant. The coil is cooled to a temperature of 269°C and an electric current is switched on. The coil is then separated from the outside circuits so that the electric power is transformed into magnetic energy.

The prototype system can store one megajoule at 1,000 amperes, which equals approximately 280 watts, or enough electricity to light a 100-watt light-bulb for about three hours, the Tohoku spokesman explained.

A full-scale research project will be conducted after the interim testing and evaluation, the spokesman said, adding that Tohoku and Hitachi already have spent approximately 1 billion yen in the past three years on the project.

Tohoku was one of the first companies to join the International Superconductivity Centre when it was established in 1988. In December 1989 the Sendai-based electric utility formed a research group with some universities. (Extracted from American Metal Market, 29 October 1991)

Flash evaporation technique

The University of Chile (Santiago) is developing a flash evaporation technique for deposition of thin films of barium titanate ($BaTiO_3$), a ferroelectric with high dielectric constant and excellent thermal stability, getting increasing interest for use as thin films in sensors. Researchers at the university have developed a feeding technique regulating the rate of deposition by the chamber pressure.

Capacitors have been made to examine the properties of the resulting films, in particular the feasibility of their use as dielectric layers in metal-insulation semiconductors. Changes in capacitance upon exposure to humidity, attributed to water molecule physisorption and/or chemisorption, imply applicability for humidity sensing. (Extracted from Industrial Ceramics, September 1991)

First optical neural network IC

Mitsubishi claims to have developed the first optical neural network IC with built-in analogue memory. The prototype device is an eight neuron chip made by the three dimensional integration of eight light-emitting elements and an 8 by 8 memory array of light-receiving elements on a 5 mm by 6 mm GaAs substrate. The light-receiving elements within the array can modify their sensitivity to light detection while learned knowledge is stored in the form of the detection sensitivities of the array. Memories are written in parallel, optically, and have a storage time of about 20 minutes. (Extracted from Electronics Times, 24 October 1991)

Six-bonded silicon surprises the chemists

Chemists in the US have discovered a cheap and easy way of making silicon compounds in which the silicon is bonded to five or six oxygen atoms. The new materials can be used to make conducting polymers, glasses and ceramics. Usually silicon bonds to only four oxygen atoms.

Richard Laine of the University of Michigan and his colleagues have discovered a way of activating silicon dioxide which, rather than removing oxygen atoms, involves adding an oxygen atom. Surprisingly, they used nothing more sophisticated than the common industrial solvent, ethylene glycol. This produced a so-called five-coordinate silicate, a structure previously made only with difficulty in the laboratory. Five-coordinate silicon derivatives are highly reactive. The new silicate has a yield of more than 80 per cent. The reaction even works with sand, although the sand dissolves only after heating for more than a week.

If the five-coordinate silicate is dissolved in methanol, adding acetonitrile will recrystallize the silicate. X-ray analysis of the colourless crystals reveals five oxygen atoms bonded to silicon. Laine also found that when the silicate is dissolved in methanol, the solvent molecules change places with the ethylene glycols surrounding the silicon. This process is reversible.

Laine believes that this "exchangeability" is the key to the boosted chemical reactivity of the new compound.

Laine has also shown that his reaction can produce a six-coordinate silicate. Martin Hoppe, a member of Laine's team, recently made six-coordinate silicate from ethylene glycol. He found it to be reactive just like the five-coordinate silicate. It can also be turned into silicate polymers, glasses and ceramics. (Extracted from New Scientist, London, 18 January 1992, the weekly review of science and technology)

Will flat colour TVs glow organically?

A team of polymer scientists from Austria have succeeded in obtaining blue light from light-emitting diodes made from an organic polymer. LEDs, the familiar red lights on stereos and other devices, are the building blocks of large flat displays. This, combined with the work of researchers at the University of Cambridge who obtained yellow-green light from a similar polymer in 1990, makes full-colour polymer displays possible.

The group of researchers, working at the Technical University of Graz in Austria and led by Günther Leising, made its blue LED from the semiconduting organic polymer poly(p-phenylene), or PPP.

The Austrian group made their LED by drawing out strands of a precursor to PPP from solution, spinning it into a thin layer and depositing it onto a glass substrate coated with a conducting layer of indium tin oxide. They then convert the precursor to PPP by heating it in a vacuum at 340°C. Finally, they deposit an aluminium electrode onto the surface of the PPP film so that the polymer is sandwiched between two conductive layers. When they apply a voltage of 12 volts between the conducting layers, blue light emerges out of the side of the sandwich.

The structure of the LED is similar to the polymer LED reported by the Cambridge researchers, led by Richard Friend, which was based on the polymer poly(p-phenylene vinylene), or PPV. Both PPP and PPV belong to the class of materials known as conjugated polymer molecules which behave like semiconductors in one direction only because electrons from double bonds in the polymer have some freedom of movement along the polymer chains.

The advantage of polymer LEDs over present devices is that they can be easily coated onto a cheap substrate material, and processed using only moderate temperatures. In contrast, the manufacture of blue LEDs based on silicon carbide is costly and time-consuming.

The efficiency of polymer LEDs, in terms of light produced from electrical input, is low, at 0.01 per cent, when compared to recently developed inorganic LEDs. (Extracted from New Scientist, London, 11 January 1992, the weekly review of science and technology)

How flipping enzymes could create a chemical computer

A simple computer made from human enzymes is only a year away, according to scientists in the US. John Ross of Stanford University in California and his colleagues have designed a computer which calculates by changing the concentration of enzymes in a chemical situation.

Ross claims that in the body such calculating enzymes might even control biological processes, such as cell cycles.

Ross's hypothetical computer consists of several compartments, each of which contains a soup of five enzymes. The compartments sit in a common bath of the same five enzymes. In this way, the compartments are connected to each other.

In the arrangement, each compartment is equivalent to a single neuron in the brain. When the concentration of a particular enzyme in a compartment is high - that is, above a certain threshold - this corresponds to a neuron firing. On the other hand, when the concentration of an enzyme is low - that is, below a defined level - this corresponds to a neuron remaining silent.

In normal circumstances, enzymes in a soup would react with each other and diffuse through the mixture until their concentrations became fixed throughout. However, a series of recent discoveries in Japan and the US have shown that some enzymes can be kept at artificially high or low concentrations by mixing them with other enzymes.

In Ross's hypothetical computer, cycles of reactions, powered by adenosine triphosphate (ATP) keep the concentrations of an enzyme in each compartment either high or low, the two states corresponding to a neuron firing and a neuron remaining silent. Nicotine adenine dehydrogenase (NADH) will probably be a suitable enzyme for

this, says Ross. He has devised several different chains of reactions between enzymes which in theory could enable compartments to communicate with each other, and so imitate the effect of neurons firing and setting off neighbouring neurons.

Ross believes it will also be possible to construct a computer in which the enzymes do not have to be distributed between compartments. Instead, they could be mixed freely together.

Ross is now beginning experiments to test his proposed enzyme reactions, before going on to build a working computer. He is also testing natural systems of enzymes to identify those which are capable of computing. (Extracted from New Scientist, London, 7 December 1991, the weekly review of science and technology)

Plant power inspires molecular battery

Chemists in the US have constructed a molecule that mimics photosynthesis, the process by which plants utilize energy from the sun's rays. This brings closer the prospect of molecular batteries charged directly by sunlight. The molecule generates 1.5 volts, just like the ordinary dry batteries such as those in personal stereos.

Michael Wasielewski and colleagues at the Chemistry Division of the Agronne National Laboratory in Illinois have spent five years evaluating dozens of articifical versions of chlorophyll, the compound which enables plants to make their food by absorbing sunlight. With the help of computer simulations, they worked out the required shape of the new molecule.

They then custom built the molecule, siting the three "working parts" of the battery at preselected sites on a hydrocarbon skeleton. Like an ordinary battery, the molecule has two charge-storing poles, one at each end.

Wasielewski and his colleagues are now looking at ways of hooking up the molecule to an electrical circuit. One option is to arrange the molecules in thin films of conductive polymer which would feed electric current into wires when exposed to sunlight.

Wasielewski expects the earliest application of the molecule to be as a catalyst. By building suitably tailored molecules, chemists may be able to direct trapped charge selectively into oxidation or reduction reactions, whichever is needed. (Extracted from New Scientist, London, 14 September 1991, the weekly review of science and technology)

III. MARKET TRENDS AND COMPANY NEWS

Market trends

Electronics exports to Eastern Europe slump

Exports of electronics production equipment, instruments and ATE to Eastern Europe, which reached £400 million in the late 1980s, are now measured in tens of millions of pounds, as a result of a break-up of the East European bloc.

British electronics companies exporting to central and Eastern Europe and the former Soviet republics have been badly hit by the slump in business caused by the disappearance of the former central buying agencies in the Communist countries.

Companies of all sizes have been forced to reduce the scale of their operations, and lay off staff in order to stay in business.

The only countries actively purchasing electronics equipment at present are Poland, Hungary and Czechoslovakia. The situation in the former Soviet Union, Yugoslavia and Bulgaria remains poor while political uncertainty continues. (Source: Electronics Weekly, 29 January 1992)

European VSAT market moves too slowly for BT

Liberalization of Europe's satellite communications market is moving too slowly for customers and operators according to BT.

The company claims the demand for pan-European two-way data services using economic very small satellite (VSAT) systems is being stifled by the reluctance of some European countries to open up their markets to outside competitors.

The competition proposals contained in the satellite services Green Paper published by the EC in 1990 are no nearer forming European directives which would compel countries to open their markets.

In the absence of a European directive BT has signed separate VSAT interconnection deals with seven European public operators. It has also set up a network of European distributors for the 1.8 m and smaller 90 cm VSAT dishes.

Last year an EC directive allowing private companies to set up VSATs limited to one-way services was challenged by a number of countries, including France and Spain. (Extracted from Electronics Weekly, 8 January 1992)

Experts: GaAs applications booming

The British advisory group, BIS Strategic Decisions, is forecasting a 39 per cent growth for gallium arsenide (GaAs) ICs; its analysts see today's $142 million world-wide market for merchant GaAs ICs reaching $740 million by 1995.

Military applications have traditionally driven the GaAs industry in the USA and Europe; BIS data shows military applications accounting for 53 per cent of GaAs IC merchant revenues in 1990. However, experts now see a rapidly increasing demand in commercial applications especially for high performance computers, communications and some consumer products.

The demand for digital GaAs ICs is being driven by the computer industry where the successful implementation of digital GaAs in high-end supercomputers has led to its increased use among workstation and general-purpose computer manufacturers. The combination of the high speed and low power dissipation offered by digital GaAs, at prices and levels of integration that are now comparable with leading edge silicon devices, has spurred these developments.

Many OEMs are implementing GaAs in equipment that conforms to the new high speed SONET (synchronous optical network) and FIDDI (fibre distributed data) standards.

Military applications, communications and consumer electronics will support the demand for analog-microwave GaAs ICs. For example, GaAs MMICs (monolithic microwave ICs) are finding applications in second-generation digitally-based personal communications systems because they save space, weight and power consumption. GaAs MMICs are also widely used in satellite communications such as GPS (global positioning system) receivers, VSATs (very small aperture terminals) and DBS (direct broadcast by satellite) TV receivers.

GaAs technologists see next generation devices coming from heterojunction technology, especially epitaxially dependent heterojunction bipolar transistors (HBTs).

Among the strides made recently in HBT technology, breakthroughs in carbon doped MOCVD, OMVPE and VPE-grown material are now supplementing beryllium doped MBE-grown wafers, with high base doping levels for carbon at $>4 \times 10^{19}$ cm^{-3} now available. Thus, materials issues should no longer dominate manufacturing costs and yields.

Device performance in many of these structures depends critically upon epitaxial thickness, doping, compositional and uniformity control. Growth abruptness is approaching the dimensions of lattice constants, and doping and compositional uniformities less than 2 per cent are fast becoming requirements for large volumes of complex epitaxial structures.

Another significant stride, development engineers have scaled emitter dimensions to below 2 m with good current gain. (Extracted from Semiconductor International, October 1991)

Race for RISC-based computing

Recent moves to form alliances among computer makers and operating system writers have caused the battle lines to be drawn in the fight to establish the next generation of desktop computers. It seems likely that machines based on RISC (Reduced Instruction Set Computing) microprocessors will in a few short years be as ubiquitous in business as the humble IBM AT and its millions of clones are today.

At the moment RISCs, which essentially perform less complex instructions than traditional processors but at much greater speeds, are found in expensive engineering workstations and file servers running Unix operating systems.

The main groups of protagonists in the RISC market are: Hewlett-Packard; Sun Microsystems and others making SPARC-based machines; the ACE consortium; and the joint venture between IBM and its erstwhile rival Apple Computer.

Hewlett-Packard is established as a manufacturer of high-end engineering workstations and low-end network servers built around proprietary RISC microprocessors and standard IBM compatible PCs.

All four groups will adopt architectures based on RISC processors. The Apple/IBM alliance is likely to use a proprietary IBM RISC processor. HP uses a proprietary RISC device, and the others will use processors based on architects developed by MIPS and Sun.

There are similarities between Sun and MIPS, leading lights respectively of the SPARC and ACE camps. Both are computer makers, not chip makers; both have to some extent designed RISC microprocessors; and both have licensed the manufacture of their chips to others. There are subtle differences in strategies, however. (Extracted from Electronics Weekly, 18 September 1991)

Joint effort to develop multimedia computer

Sony (Japan) consumer electronics company, and Apple Computer, the US personal computer maker, are together to develop a multimedia computer. Sony is acquiring a stake, believed to be between 5 and 10 per cent, in General Magic of California, which was formed in July by former Apple employees. Apple has a minority interest. The aim of the cooperation is to produce a palm-size, wireless personal communication device with digital audio and visual functions in about two years. Multi-media computers are still being developed. They could reproduce text or numbers as well as video pictures, sound and telecommunications. Electronic products such as video recorders and colour televisions are reaching market saturation; multimedia computers are seen as the key to a surge of growth.

Sony is manufacturing Apple's Powerbook 100 portable computer, launched in November 1991. Both companies collaborated on the development of the machine. Sony could play a key role in this latest project because of its skills in miniaturization and manufacturing, and its expertise in audio-visual technology.

Sony has launched its latest successful product from Japan, the Data Discman, a hand-held electronic book device with audio and simple video functions in the US and Germany. It will be launched in the UK in the spring. (Extracted from Financial Times, London, 29 November 1991)

World cell net gathers pace

The company behind the development of the first world-wide cellular voice data network says it is on target to meet its early 1997 launch date.

Iridium, an offshoot of electronics giant Motorola, also says it is close to finalizing agreements with national telecommunictions bodies and cell phone operators that would make Iridium an extension to local services.

Iridium was announced nearly two years ago to launch 77 satellites circling 400 miles above the earth, providing seamless cellular telephony handling voice, data, fax, broadcast and television.

Among the major changes to the original concept is the creation of a lightweight transceiver which can link into the Iridium system directly or the local cell network.

Charges, billing and general administration will be handled by the present systems used by local and national networks.

This will provide cellular network suppliers with an opportunity to build their own transceivers. (Source: Computer Weekly, 23 January 1992)

Industrial evolution

In the 1940s, the famous Austrian philosopher Joseph Schumpeter pointed out that information, not capital, had become the lifeblood of western economies. No one listened to him. It took another 40 years before academics talked of an information age.

At about the same time that Schumpeter made this remark, the information technology industry was born when a breakthrough in microelectronics made possible the first electronic processor.

Today, information technology is the third biggest industry in the world. In the UK alone, in the past 10 years, the IT industry has grown at a rate almost twice that of the total economy.

But although immune to previous recessions, the industry has been knocked by the current slump in the world economy. This is because the recession has coincided with more profound changes in the industry.

What is happening to the IT industry is a reflection of what is happening to the western world's economy as a whole. There is a slow but irreversible movement from an economy based on production towards one based on service. It is estimated that roughly 70 per cent of the US gross national product is derived from service industries.

This shift has occurred just as computer hardware markets mature. Once sold as a proprietary solution with enormous profitability, hardware is now bought and sold like household appliances.

This happened first in the personal computer market and now the same is happening to mid-range machines: in both the lion's share is held by a group called "others".

Even the mainframe market has been affected, though indirectly. IBM still retains control of more than half the market, but downsizing, the advent of high-powered desktop machines and the open systems movement have all contributed to a marked drop in the prices of mainframes.

In a commodity market where one maker's product is indistinguishable from another's, a company strives for competitive edge either by slashing prices or providing additional services. Traders and agents are in a better position to do this than manufacturers. Consequently, the profit margins of the manufacturers are squeezed hard.

Falling margins have driven manufacturers to cut costs, and the highest cost is manpower. Most of the main players have announced large-scale redundancy programmes in the past 18 months. In the past four years IBM has cut over 40,000 jobs world-wide, while Apple Computer announced this summer that it was looking for a 10 per cent reduction in its workforce. Olivetti, ICL, DEC and others have reported similar plans.

Given that hardware is no longer such a huge money-spinner, the major vendors are tilting the balance of their business away from sales of equipment to the value-added side of the industry: software and services. World-wide, between 1984 and 1989, software and services income grew at a rate of 30 per cent a year - roughly twice as fast as the industry as a whole.

Both ICL and DEC Europe say that less than half their income is now derived from sales of hardware. Even IBM has grown its service business and there is plenty of evidence to suggest that software will follow the way of hardware - towards a commodity market. Most programming will be done by people in India and China at rock-bottom prices.

This is already beginning to happen - London Underground and Citibank have both farmed out programming work to Indian software houses. What prevents more companies following their lead is the intrinsic nature of software, at least the way it has been developed to date. With the advent of object-oriented programming and faster processor speeds the task of development will become much simpler.

Mass manufacture of code has been inhibited by the nature of software development which has traditionally comprised a lone engineer writing rule after rule of code. Factory processes, by contrast, are modular and multi-tasked. Since object-oriented programming has been conceived as a modular process, it is suitable for mass production.

If, as the trend suggests, the production of program code is diverted to software factories in the developing world, competition between developed nations in the service section will become even more intense.

Most pundits agree, therefore, that there is a bright future for systems integrators and consultancies. Since communication is at a premium here, Japan is at a significant disadvantage.

Facilities management looks particularly well favoured, as more and more organizations spare their MIS staff the headache of running an increasingly complex set of systems. International Data Corporation predicts that the FM market in the UK will grow from its current worth of £310 million to £790 million in 1996 - the market will more than double in value in the next five years. But new technologies are sure to emerge, bringing with them new markets.

In the shorter term, two technologies will gain in importance: communications and multimedia. The first is already reshaping organizations and creating new markets, while the second may significantly alter the way business is done.

Many computer companies have already forged strategic alliances in both areas: AT&T has acquired NCR, while IBM and BT have resurrected a telecoms agreement; IBM and Apple, Olivetti and Cambridge University are combining resources in

multimedia. Indeed, the distinction between telecoms and computer companies may become blurred, while organizations not usually associated with IT, the likes of Sony and Toshiba, will be accepted into the fold.

But for every solution there is an additional problem. The increased deployment of systems will generate new obstacles for suppliers and users alike. These will be both technical and human, and the onus will be on the industry to correct them - perhaps in a profitable manner.

Most urgent will be the escalating need for better methods of verification.

There are two enormous impediments to verification. The first is the size of the system. Today's systems are relatively small, with thousands, rather than millions, of lines of code. The second stumbling block is a lack of available manpower.

A second complication is the area of intellectual property rights.

Macroeconomic changes in the industry are also reflected in the role of the information systems manager, which will change radically in the next 10 years.

As hardware has evolved into a commodity item, so the buying habits of IS managers have changed. For a start, they no longer deal with just one supplier, and since it is possible to drive a hard bargain in a competitive market, IS managers are spending more of their time simply finding out what is on offer and who is offering it.

Second, with the increased automation of both office and operations, the IS manager has a great opportunity to spot new markets. Perhaps most significant for IS managers, however, is the rise of the FM markets. Many IS departments live under the threat of being outsourced. (Extracted from Computing, 7 November 1991)

Bigger and better - some disk drives

Today's average desktop computer comes with the capacity to store an Encyclopedia Britannica's worth of information. Yet most are already overflowing with last year's financial results, letters to the boss, computer games and some stuff in the back that nobody can remember the purpose of - but that nobody wants to throw away lest the memories come back to haunt them. Making ever more room for information-age pack-rats requires increasingly amazing engineering. Some predict that disk drives will become at least ten times, and quite possibly 100 times, more capacious over the next decade or two. That would put the equivalent of a good-sized library into the average desktop computer - 800 megabytes to 8 gigabytes of storage, to put it in tech-speak, with each megabyte holding roughly the same amount of text as six inches (15 cm) of bookshelf. Such success would make things even harder for those seeking to replace disks with other storage media. (Source: The Economist, 9 November 1991)

Semis market set to pick up in 1992

The European semiconductor market is emerging from its mid-1991 trough and it will start growing again through 1992 and 1993.

"The drop is stopping", said Jean-Phillipe Dauvin, chief economist at SGS-Thomson Microelectronics (STM) who is also vice-president (Europe) for the World Semiconductor Trade Statistics (WSTS) organization.

The WSTS forecast is for an $11.14 billion European semiconductor market in 1992, a growth rate of 9.6 per cent. The following year will see further acceleration to $12.4 billion, a growth rate of 11.4 per cent, while 1994 sees growth decelerating to 8 per cent at $13.4 billion.

In world terms Europe is losing ground. In 1991 it will represent 18 per cent of the world semiconductor market. Through 1992 this percentage will be eroded, mostly by the rapid growth in Asia and the Pacific which by 1993 will represent 16.3 per cent against Europe's 17.4 per cent.

In 1992 the world market will grow by 14.5 per cent to $63.3 billion, says WSTS. (Source: Electronics Weekly, 30 October 1991)

Explosive growth predicted for EDA

Competitive pressure to cut time-to-market for complex electronic devices will cause explosive growth in the US electronics design automation (EDA) market over the next five years, says the latest Frost and Sullivan report.

US EDA sales are forecast to jump from $2.08 billion in 1991 to $4.92 billion in 1995, with hardware revenue growing from $518 million to $1.24 billion and software sales climbing to $3.69 billion from $1.56 billion today. Frost and Sullivan says designers will be wooed by new, easy-to-use front-end tools and swish integrated top-down design packages.

In a separate report, Frost and Sullivan predicts the US market for multimedia hardware and software will grow nearly sixfold over the same period, reaching $25.4 billion by 1995.

Entertainment will remain the main application driving the technology, the report says, although its share will fall from 30 per cent to 23 per cent by the middle of the decade. (Source: Electronics Weekly, 23 October 1991)

Slow growth for US PC market

The US PC market will grow slowly in 1992 according to market research company International Data Corporation (IDC). 1991 will be a flat year for the US PC industry, with US market shipments growing just 1.5 per cent compared with the previous year, and only a 0.3 per cent rise in the dollar value of the market. 1992 sales are predicted to be slightly better with 6 per cent growth in US market shipments and 4.3 per cent in dollar growth. (Source: Electronics Weekly, 25 September 1991)

European Submicron Centre

Europe's major chip makers, undaunted by a recently aborted attempt to merge their operations into a single European semiconductor company, have devised another way to rally cooperation. Plans are afoot to create the European Submicron Centre, which will pool the R&D resources of companies, develop advanced IC technology and build major silicon foundries for the participants.

The centre is being likened to an electronics-industry version of the successful Airbus Industries consortium formed by European aircraft manufacturers. The cost of the proposed venture could total $10 billion over the next 10 years.

The initial concept for the submicron cooperative was launched earlier in the year at a high-level meeting of the top executives from Philips, Siemens and Thomson with Jacques Delors, the European Commission president, and Filippo Maria Pandolfi, EC vice-president. The proposal was then delayed for several months as SGS-Thomson Microelectronics - partly owned by Thomson - campaigned for the creation of a single European semiconductor company.

The German Ministry of Research and Technology would also like to get at least one of the plants located in the former East Germany to build up the region's infrastructure and employment, according to sources. (Extracted from Electronic Engineering Times, 4 November 1991)

Company news

Toshiba predicts shortage of memories next year

Japanese semiconductor manufacturer Toshiba is predicting that there will be a major shortage of memory chips by the middle of 1992.

Hideharu Egawa, senior vice-president of Toshiba, believes that large cutbacks in manufacture of 4 Mbit DRAMs by major Japanese memory chip manufacturers will result in a large shortage of chips when an upturn comes next year.

Some US analysts have agreed with Egawa's predictions. Market research firm VLSI Technology expects the chip shortage to begin in the latter part of 1992 and last well into 1993. Market research firm Dataquest also expects a shortage in 1992.

In 1990, 4 Mbit DRAMs sold for as much as $60 compared to recent prices of as low as $15.

Japanese memory chip manufacturers say that they are barely making a profit on DRAM sales and are investing money in the manufacture of other more profitable semiconductors.

Toshiba, Hitachi and NEC say that they are cutting back production of 4 Mbit DRAMs.

Computer manufacturers fear that when the upturn in business comes, there will not be enough production capacity to supply the demand. (Source: Electronics Weekly, 23 October 1991)

Toshiba and Siemens agree to develop and market RISC microprocessors

Toshiba (Japan) and Siemens (Germany) have announced an agreement that will provide a basis for cooperating in developing and marketing RISC (reduced instruction set computing) microprocessors based on technology developed by MIPS Computer Systems of the US. The accord will boost the growing interest in RISC-type microprocessors, which could eventually erode the overwhelming market share that Intel, the US microprocessor company, has had in the world-wide personal computer market. Toshiba said it expected the share of RISC devices in the 32-bit microprocessor market to rise from 11 per cent today to 30 per cent in 1995. The agreement outlines a framework for cooperation that could include areas such as joint development of MIPS's R3000 and R4000 series of RISC processors, mutual supply of these products to assure availability to customers, and supply of RISC silicon wafers to each other. Toshiba said the most significant part of the agreement was that it would allow the companies to assure supply stability for each other. (Extracted from Financial Times London, 19 November 1991)

Toshiba cuts forecast

Flagging demand in Japan combined with the slowdown in the US computer market has forced Toshiba Corp. to cut its profit forecast for the current financial year.

Toshiba, Japan's second-largest maker of electrical and electronic machinery, said non-consolidated pre-tax profit would be 70 billion yen ($546 million) in the financial year ending 31 March, around half its October forecast of 130 billion. The new level represents an even steeper drop from the non-consolidated pre-tax profit of 175 billion yen that Toshiba actually posted for 1990-1991.

Toshiba attributed the downward revision to the world-wide recession in the markets for semi-conductors, computers and other information and communications systems.

A large proportion of Toshiba's integrated circuits are exported to US computer makers, but with the persistent US recession eating into corporations' capital investment, the computer market there has been sluggish for some time.

Adding to Toshiba's misery, Japan's domestic market has turned sour in recent months and ceased to provide the supporting role it used to when exports were down.

Toshiba said consolidated net earnings would reach 40 billion yen, one third of the 121 billion yen recorded for 1990-1991. Toshiba's initial forecasts had called for 90 billion yen in consolidated net earnings. (Extracted from International Herald Tribune, 21 February 1992)

Apple signs major development contract

Apple Computer Inc. has signed its first major technology development contract and royalty licensing agreement with Soviet technologists from ParaGraph International. Apple is licensing ParaGraph's advanced cursive-handwriting-recognition technology to speed its implementation of pen-based computing on forthcoming pentops.

ParaGraph's technology is the first system which has demonstrated the ability to recognize cursive (connected letters) handwriting at a practical speed. Many researchers working on isolated block-character recognition believed such a technology was years away.

The Soviet programmers who developed the technology have accomplished what American companies have been trying to do for more than 20 years. ParaGraph employs 80 programmers and computer researchers in both the US and the Soviet Union, investigating written, printed and fax-character recognition and voice-recognition systems. ParaGraph International has the exclusive rights to market technology and products developed by ParaGraph JV, a Soviet-American partnership formed two years ago. (Extracted from Electronic Engineering Times, 21 October 1991)

IBM and Intel build centre to develop one-chip PC

IBM and Intel are building a microprocessor development centre in Boca Raton, Florida, as part of a 10-year programme to develop a PC on one silicon chip.

The Robert Noyce Development Center, named after the co-founder of Intel who died last year, will release its first silicon products in 1993. The centre will employ 100 engineers from IBM and Intel.

By 1994, it says it will release a single piece of silicon - a generic version of Intel's 32-bit i486 microprocessor - that will have all the components needed to build an IBM PC on it. Standard IBM compatible PCs not only require a microprocessor but an I/O control chip, a graphics controller and a memory controller chip.

The 10-year agreement will also give IBM the rights to build its own i486 chips for internal use. This will also allow IBM to manufacture P5 - Intel's i586 chip due for release in 1992 - for internal use.

Although many analysts see the IBM/Intel Noyce Centre as beneficial, some believe the move, further cementing the two companies' relationship, will drive rival IBM computer makers into the arms of another chip-maker, Advanced Micro Devices. (Source: Computer Weekly, 14 November 1991)

Joint effort to reduce waste

Motorola Inc.'s Government Electronics Group, Los Alamos National Laboratory, and Sandia National Laboratories will research new technologies to reduce waste and hazardous materials in the manufacture of printed-circuit boards and other electronic components.

The three are working on a new wave-soldering process that could greatly reduce the use of chlorofluorocarbons in the cleaning of circuit boards and other parts.

In the wave-soldering machines commonly used in the electronics industry, circuit boards travel through a pool of solder, and areas that oxidize are usually cleansed with a CFC-based solvent. Los Alamos, Sandia, and Motorola are investigating a vacuum wave-soldering technique which would prevent any oxidation from occurring in the first place.

The partners will test the effectiveness of alternate cleaning methods and try to determine whether the wave-soldering and cleaning processes have affected how well the circuits function or the materials from which they are made.

Under an international agreement known as the Montreal Protocols, many uses of CFCs are already illegal. The protocols call for a total ban on CFCs by 1996. Cleaning printed-circuit boards and other electronic equipment accounts for roughly one fifth of world-wide CFC consumption. (Extracted from Electronic Engineering Times, 7 October 1991)

Bell Labs tests its luck

Researchers at AT&T Bell Laboratories Inc. have built a high-capacity wide area research network to determine the viability of doing business electronically at speeds in the gigabit-per-second range.

The network, called LuckyNet, in honour of Bell Labs executive director Robert Lucky, comprises three nodes, located at Bell Labs facilities in New Jersey. It will ultimately extend to other AT&T locations and to universities and will interwork with the US National Research and Education Network gigabit-per-second (gbps) test beds.

LuckyNet can carry a billion bits of information per second. A "world class" research prototype radio is being used on the microwave link, enabling information to be sent across the network at up to 2.5 gbps, Bell Labs said. Commercial systems top out at about 100 megabits per second. (Source: Communications Week International, 20 January 1992)

IBM posts net loss for 1991

IBM has said that its revenues have fallen 6.1 per cent in 1991, marking the first time in 45 years that the world's largest computer maker's growth had faltered.

IBM had a loss for the year of $564 million, the first in its history. In 1990, it had reported a profit of $6.0 billion.

Sales for the year fell 6.1 per cent to $64.8 billion from a record of $69 billion in 1990. For the fourth quarter, which is usually the company's strongest, IBM's revenue declined 4.2 per cent to $22.1 billion from $23.1 billion.

The company said that the year had been "disappointing" and that it had been affected by a declining world economy, increased competition and the difficulties associated with introducing new product lines.

For the fourth quarter, IBM's results included a $3.4 billion special charge as part of a sweeping decentralization and planned job cutback. As a result, the company reported a loss of $1.4 billion for the quarter, compared with a $2.5 billion profit in the year-earlier period.

Including the special charge, earnings per share represented a loss of $2.42 for the quarter compared to a $4.30 profit a year ago. The company said the cost of the restructuring charge was approximately $4.68 per share. (Extracted from International Herald Tribune, 18-19 January 1992)

Digital audio heads for the pool

The proliferation of techniques for compressing sound signals in digital form, so that they can be fitted onto smaller optical discs or cassette tapes, has forced the electronics industry to pool all the patents together. Otherwise, companies fear that lawsuits would stop anyone launching new formats.

Philips' digital compact cassette (DCC) and Sony's mini disc, both due to be launched in 1992, rely on data compression because sound converted into digital form takes up far more recording space than in its original analogue form. Digital radio, which is still under development, relies on compression to fit digital signals into narrow transmission bands.

All of the compression systems are derived from a technique called masking-pattern adaptive sub-band coding and multiplexing, or MASCAM, developed in the 1980s by Germany's radio research centre in Munich. The digital encoder splits the sound into narrow frequency bands and ignores sounds in any of the bands which it judges are inaudible to the human ear. This drastically reduces the number of bits of information needed for recording or transmission. MASCAM has spawned many other techniques, such as France's MUSICAM, and a US/German/French collaboration called ASPEC. Working from MUSICAM, Philips developed PASC for its DCC. Sony's mini disc uses ATRAC, derived from ASPEC.

Everyone filed their own patents and these are all now in a pool. Licensing deals struck between Philips, Matsushita and Sony effectively bring Japan into the pool as well. (Source: New Scientist, 30 November 1991)

Siemens puts plan to EC

Siemens has drawn up a new plan for a collaborative scheme to safeguard the future of the European semiconductor industry.

The plan has been presented to EC vice-president Fillipo Pandolfi despite Siemens' rejection of five proposals from Pandolfi.

The Siemens plan involves the EC funding wafer fabrication plants for each new generation of DRAM - the 64 Mbit, the 256 Mbit, and the 1 Gigabit.

The effort of having the fab would be to bring the technology to Europe for cost-effective semiconductor manufacturing. Competitiveness in microelectronics depends on competitiveness in costs. (Extracted from Electronics Weekly, 27 November 1991)

Cautious optimism reigns at Philips

The cure that Philips Electronics NV in the Netherlands has ordered for itself to recover from its financial woes is starting to show results. For the first half of 1991, the Dutch electronics giant reported a net income of approximately $340 million on sales of $26 billion. For the first half of 1990, net was $186 million on sales of $13.17 billion.

The positive result comes after a painful year of restructuring during which Philips got rid of loss-producing activities, slashed its product portfolio, and started to drastically cut its workforce. By the end of 1991, it will be down from 286,000 workers to 230,000.

Now that the worst is over, the period of divestiture appears to have ended, industry analysts say. The core businesses - lighting, consumer electronics, components, and professional systems - will essentially stay as they are now, although some portfolio moves may be made to reduce or strengthen some product categories. (Source: Electronics, October 1991)

Siemens will expand in the US with automation gear

Siemens Industrial Automation Inc., the German electronics giant, is poised to become a leader in the American market for automation systems and equipment. The Atlanta firm, which marries TI's industrial control activities to Siemens' former US automation equipment business, is already the fourth largest supplier of industrial automation gear to the $12 billion US market.

Siemens expects an annual growth rate between 10 and 15 per cent, double the amount predicted for the overall US market for electrical equipment.

Siemens did about $2 billion worth of business around the world in automation technology in 1990. In programmable controls, it is the world's leader. (Extracted from Electronics, December 1991)

IBM-Intel processor chip deal

Strategic alliances was one of the more important implications of last November's IBM-Intel chip accord, in which they agreed to cooperate for the next decade in the design of central processors. The deal's potential synergy promises both parties a big advantage over their adversaries.

The work will be done by about 100 engineers from both companies at a facility to be established in Boca Raton, Florida - which is where IBM Corp. designs and builds its PCs - called the Robert N. Noyce Development Center. According to the terms, both companies will have the right to make the microprocessors and Intel will have exclusive rights to sell them to other computer manufacturers.

For Intel and IBM, the arrangement means, among other things, that the staggering cost of developing chips and computers will be halved. Also, it gives IBM a head start on use of the newest Intel chips.

In a business where it is becoming difficult to tell one manufacturer's product from all the others, IBM now has the opportunity to differentiate itself more strongly from the rest. (Extracted from Electronics, December 1991)

IBM restructures

IBM Chairman John Akers believes his company's 20,000 staff reductions will save it

$1 billion in 1992 and $2 billion in 1993. It brings the workforce down from 373,000 at the start of this year, and down from 407,000 at its peak in 1986.

The company will take a $3 billion restructuring charge against fourth quarter earnings to cover the costs of voluntary redundancies and the reorganization.

The charge will produce a loss for the fourth quarter, but the company's stock price rose 2.9 per cent on the New York stock exchange after the announcement. Profits fell 77 per cent from $3.6 billion to $800 million in the first nine months, while turnover dropped by 7 per cent.

Some analysts believe IBM might have formed its business units into wholly owned subsidiary companies, with IBM Corporation as a holding company, but it has stopped short of this.

IBM began increasing its software and service offerings in the mid-1980s, when its profit margins on hardware began to decline. In April this year Akers told shareholders that software revenue had risen by 18 per cent and generated $18 billion, making IBM the leading software company in the world. But some are worried about the effect such fundamental changes will have on users. (Extracted from Computer Weekly, 5 December 1991)

IV. APPLICATIONS

Teraflops computing

Thinking Machines Corp. has ushered in the era of teraflops computing when it introduced a new generation of massively parallel Connection Machines. But perhaps more important than the CM-5's raw performance is its attempt to remove the major roadblock to wider acceptance of parallel machines, i.e. software.

The CM-5 is built on off-the-shelf RISC micro-processors, rather than the proprietary chips of the company's earlier machines, and it runs on a UNIX-compatible operating system. CMOST, as the system is called, combines SunOS with NFS and transparent parallel-processing extensions.

The CM-5 also reports a new, more flexible architecture that is dynamically configurable to accommodate SIMD (single-instruction, multiple-data- processing), like the firm's earlier machines, or MIMD (multiple-instruction, multiple-data) processing. The machine's "universality" means that no restrictions are imposed on programming methodology. It accommodates -loop style, array style, data parallel, message style, tightly coordinated, loosely coordinated, coarse or fine-grain programming, delivered within a familiar, standard UNIX environment, and the operating system never needs to know what style of execution an individual task is using.

The machine scales from 32 to 16,000 processing nodes, each consisting of a 22 Mips, 33 MHz Sparc; a small supervisory kernel; 32 Mbytes of memory; four optional 32 Mflops, 64-bit vector pipes; and interfaces to the machine's control, data and diagnostic networks. Four processing nodes reside on a single printed-circuit board, and 32 such boards fit a single backplane. (Extracted from Electronic Engineering Times, 4 November 1991)

Two new demonstration ICs

As the next stage of its research into fuzzy logic, SGS-Thomson Microelectronics will produce two demonstration ICs, one a hybrid coprocessor and the other a fully digital device. The two chips will represent alternative architectures for fuzzy-logic hardware, but both will be based on the design of a fuzzy inference engine that SGS-Thomson believes to be radically different from work by others.

First silicon for the digital device is planned for the fourth quarter of 1992, and the hybrid coprocessor will follow in the first quarter of 1993. Gianguido Rizzotto, SGS-Thomson's director of corporate advanced systems architectures, said that both chips will be R&D demonstrators, not commercial devices.

The company has yet to decide whether to market chips targeting fuzzy-logic applications, but if Rizzotto's research is successful, such a move would hardly be surprising. The devices could represent a valuable expansion of SGS-Thomson's micro-controller business: according to some forecasts, the world-wide market for fuzzy-logic semiconductors may total $10 billion to $13 billion by the year 2000. (Extracted from Electronic Engineering Times, 11 November 1991)

Digital fuzzy IC

Olympus Optical (Tokyo, Japan) has devised a digital fuzzy integrated circuit. A majority of fuzzy logic functions, used in consumer electric and electronic products, are software-based. The LM2136 fuzzy logic chip however, has internal random access memory (RAM) for rule storage and an architecture that allows weighting in time sequence. The chip features reduced circuit size due to parameterizing simplified membership functions and rules. It can perform inference in time division, giving conclusions in 4-micros from two inputs and 10 rules. Multiple chips can be used to carry out parallel inference. The company is accepting custom orders based on the chip and provides a program for writing fuzzy rules. (Extracted from New Technology Japan, September 1991)

New chip mounting technique

Over the course of the IC industry's history, designers have been trying to make chip packages smaller. The J-leaded DIPs and flat-packs used today are examples of the shrinking package, but perhaps the ultimate will come when all ICs can be mounted without packages at all.

One recently announced technology is at least a step in that direction. Called Flip-On-Flex by its developers - Cherry Semiconductor Corp., East Greenwich, Rhode Island, and Sheldahl Inc., Northfield, Minnesota - the new concept allows chips to be mounted upside down on flexible

printed circuits. Indexing marks printed on the bottom of the chip make proper orientation easier. The flex circuits can then be wrapped around support structures of the final electronic system, making for a very small package indeed.

Although the ability to solder IC packages to flex circuits has been around for a while, this joint development resulted in a way to mount the bare, unpackaged IC die on a flex circuit. Sheldhal's flex circuit looks like a standard item, but the substrate is made of a proprietary material called Novaclad, an adhesiveless polyimide copper laminate. The copper is deposited directly on the substrate instead of being glued down with an adhesive layer, making it able to withstand high temperatures. To attach an IC die, the company uses a standard solder-mask technique to place solder paste on the flexible substrate on contact pads. The pattern of these pads is a direct match with the pattern of solder dots on the die. Then the die is mounted on the flex circuit, with the active side of the die facing the circuit. (Extracted from Electronic Business News, 28 October 1991)

Samsung builds 64-Mbit DRAM chips

Samsung Electronics Co. of Korea has announced that it will be the second supplier in the world to build pilot 64-Mbit DRAM chips. The Korean company said it has overcome the technical hurdles to building a DRAM cell for the next-generation device.

The announcement follows Hitachi Ltd.'s statement that it had produced 64 Mbit parts in the laboratory. To date, there are no US-made 64 Mbit parts, and all domestic vendors except IBM Corp. are believed to be either ignorning the devices or working with a Japanese partner in their development efforts.

The technical breakthrough is a major triumph for Samsung. Although it is a major player in all types of static and dynamic RAMs, the company has always lagged about half a generation behind its Japanese competitors in devclopment. Early in 1991 Samsung stated its intention to catch up and, eventually, to overtake the Japanese with its own Korean-based development efforts. If the 64-Mbit devices stay on schedule, that goal is within reach. (Extracted from Electronic Engineering Times, 21 October 1991)

Chip revolution no flash in the pan

A personal computer 1.3 centimetres thick, 250 grams in weight and £100 in price is one of the goals of a trans-Pacific partnership forged to exploit the latest thing in memory chips. The chips are called "flash memories" and advocates say they will soon replace disc drives as well as conventional memory chips for storing data in electronic equipment.

The advantage of flash memories is that, unlike the dynamic random-access memory (DRAM) chips, which are the storehouses in today's computers, they do not need a constant supply of electricity.

Flash memories are variations on the read-only memory (ROM) chips that contain instructions preprogrammed by manufacturers of electronic equipment. Manufacturers sometimes want to alter these instructions, so EPROMs, erasable programmable ROMs, were developed, which can be erased then reprogrammed with new instructions.

Some EPPOMs are erased by illuminating them with ultraviolet light for up to 20 minutes, then reprogrammed electrically bit by bit. Others, called E^2PROMs can be erased electricaily bit by bit, then reprggrammed in the same way. Flash memories are E^2PROMs that can be entirely erased by a single electrical pulse, then reprogrammed bit by bit. Flash memories are considered to be the best candidate for future electronic devices because they are cheap, long lasting, and pack more bits into a smaller area.

US semiconductor firm Intel has joined forces with the Japanese electronics company Sharp to produce flash chips on a huge scale. The companies agreed to work together to manufacture flash memories capable of storing the same density of information as DRAMs (the largest capacity DRAMs now on the market can store four megabits of data). They say that production in large quantities will begin in 1993.

By the end of 1995, Intel said, a flash memory will be cheaper than a magnetic hard disc, opening the way for a new generation of more rugged portable electronic equipment, such as musical instruments and cameras. (Extracted from New Scientist, London, 15 February 1992, the weekly review of science and technology)

Disposable PCs

The era of the disposable personal computer may be just around the corner. The introduction of a "single chip personal computer" by Chips and Technologies, a leading Silicon Valley supplier of semiconductor components for personal computers, promises to drive the cost and size of personal computers down to calculator proportions. The device that could make this possible is the "PC/Chip", a semiconductor circuit containing all the electronic logic functions of a personal computer. It replaces half a dozen of the semiconductor chips used in today's most highly-integrated personal computer designs. Add a keyboard, a display, data storage peripherals and some memory chips and you have a complete personal computer system. Chips and Technologies' first PC/Chip provides the computing power of an 8086 low-end desktop personal computer. In about 18 months, the company aims to introduce a higher performance version equivalent to today's most popular "386" PC models. Total material costs will be about US$ 100, says Mr. Gordon Campbell, Chips and Technologies Chairman and Chief Executive.

That should translate into introductory retail prices as low as US$ 250. Over the next few years the price could fall to well under US$100. Chips and Technologies is to demonstrate its PC/Chip in a prototype "pocket-sized" personal computer. (Extracted from Financial Times, London, 30 September 1991)

Speedy computers hit the price barrier

"Teraflop" computers, which can work out a thousand billion sums a second, could now be

built, but they would be so big, power-hungry and expensive - at around £170 million - that nobody would buy them. They are needed to crack today's toughest computing problems, such as weather forecasting and mapping the human genome. But in up to three years, the price could fall to a tenth of what it is today.

Cray Research, the world's first and most famous supercomputer maker, and Intel, the world's best-known chip maker, both announced their latest supercomputers in November 1991. Cray's Y-MP C90 has 16 processing chips which can do up to 16 billion calculations a second (16 gigaflops). Intel's Paragon XP/S can have up to 2,000 processors, working at between 5 and 300 gigaflops.

Earlier, Thinking Machines of Cambridge, Massachusetts, claimed to have developed the first supercomputer that could reach teraflop speed, known as the CM-5. If it were built with its full complement of 16,000 processors, in theory it would run at 2 teraflops. But computers never work that fast. When a real program runs, it has to wait for data to be loaded from memory, or to be calculated in another part of the program. Programs seldom run at more than half their maximum speed, and then only if they have been written carefully.

All the manufacturers acknowledge that organizing the flow of information around the computer is the biggest challenge. Half the processing power of both the Paragon and the C90 is devoted to organizing this.

Information travels from the C90's memory to its processors at 250 billion words a second. This is so fast that the wires which carry them begin to act as an aerial and emit microwaves. Cray prevents this by encasing the wires in Goreply, a material which speeds up the electrical signals. (This first appeared in New Scientist, London, 30 November 1991, the weekly review of science and technology)

1.8 inch hard drives

Integral Peripherals Inc.'s 1.8 inch hard drives look like a good bet to usher in a new generation of subminiature computer and communications products.

The Boulder, Colorado company's 20- and 40 Mbyte models need one fourth the volume of a low-profile 3.5 inch drive. They deliver significant systems-design advantages, including low profile, ruggedness and low power.

The drives consume less than 1 W overall. A sleep mode allows them to be "spun down" to a speed where they consume .015 W. Since the read/write heads do not touch the media during spin down, there is no danger of wear or data loss. The drives recover from sleep mode in about one second. The drives can withstand 200-G shock force in non-operating mode. (Source: Electronics, September 1991)

New battery

Ovonic Battery has devised a metal-hydride battery that it claims requires only 15 minutes to be be recharged. The sealed battery, with a metal-hydride material developed by the company acting as the negative electrode, is seen as a possible replacement for nickel-cadmium batteries, as manufacturers seek to avoid use of the hazardous cadmium. The firm melts together vanadium, titanium, zirconium and nickel chromium, as well as other materials in a patented process, to form a powder from which a sintered electrode is made. The battery, being studied by Chrysler for use in an electric car, offers almost twice the energy density of nickel-cadmium batteries. Further development with mass-production manufacture in mind is planned. (Extracted from Design News, 4 November 1991)

New data compression technique

A new data compression technique called wavelets has been developed. The method is similar to the method used by the ear and the eye to process data. Dr. Ronald Coifman of Yale University says that the eye looks for sharp edges between blurry objects, while the ear splits sounds into octaves. The wavelet method does the same for data processing. Dr. Victor Wickerhauser of Washington University says that wavelets can be used for a wide variety of problems. Aware, Inc. makes a wavelet computer chip, although the method is not yet in wide commercial use. Wavelets could be used to compress speech, according to researchers at AT&T Bell Laboratories.

Some applications that could use data compression, such as weather photographs from satellites, have not compressed the data, because existing compression techniques either require too much computing power, take too long, or eliminate some useful data. The FBI still stores fingerprints in a catalogue room that already has 25 million fingerprints. Storing just a few fingerprint cards would require all the hard disc storage of a personal computer and transmitting data on a single fingerprint card by phone would take 18.5 hours. Wavelets might be used to store X-rays in hospitals.

Wavelets were first developed by Dr. Jean Morlet of Elf Aquitaine, in an effort to help interpret geological data. Fourier analysis is usually used for this task, but it is complex. Wavelets, according to Dr. Yves Meyer of Paris Dauphine University realized that wavelets are part of harmonic analysis, which is a well-studied branch of pure mathematics. Dr. Ingrid Daubechies of AT&T Bell Laboratories developed a proof that the wavelets were most efficient for data storage. Dr. Stephen Mallat of New York University realized that the wavelet idea was similar to those in image processing. Daubechies showed that wavelets can store images with 1/40th the amount of data needed for other systems, such as fourier analysis. (Extracted from New York Times, 12 November 1991)

Design technique that mimics natural selection

Design engineers could soon benefit from computer design techniques that mimic the process of natural selection. These will be developed by an engineering design research centre being set up at Polytechnic Southwest in Plymouth, United Kingdom, to exploit the potential of genetic algorithms.

These allow a designer to breed from the successful elements and properties of a design to create new generations which perform more efficiently than their parents.

Companies including Rolls-Royce and Plessey Semiconductors have already started collaborative work with the centre.

Using the genetic algorithm technique, computer models of a potential design are evaluated, then elements of it are slightly changed at random. This is similar to the process of genetic mutation that occurs in nature. If the change is successful, the new design is retained. Failures are disregarded.

Modern computing power means that a process that takes nature many thousands of years can be compressed into a few hours, with only the strongest designs surviving. The random element of the process means that innovatory breakthroughs are thrown up by chance. (Extracted from Engineer, 7 November 1991)

New voice-processing system

Wang Information Services Corp. (WISC) has developed a new voice-processing platform targeted at small organizations and remote locations. The system, called PhoNETix, will incorporate voice messaging, call processing, interactive voice response (IVR) and facsimile technologies on a personal computer platform. The initial version will support from four to 24 ports.

PhoNETix consists of a voice-messaging architecture, a menu-based applications generator, and IVR applications which include fax response, forms, a locator and order entry. Though WISC will package the software on Wang's IBM-compatible personal computers, the company said users and value-added resellers can install applications on any Intel Corp. 80386-based, Unix-based PC. PhoNETix offers callers simple access to different applications. For example, after getting pricing information using IVR, a caller can leave a voice message without having to call back. (Extracted from Communications Week, 11 November 1991)

Notebook competitor

A new class of portable computer is coming that could compete with the current generation of notebook computers. Called the "companion" personal computer, the new format will offer built-in application software and cost only a third as much as today's notebooks.

An alliance led by Phoenix Technologies Ltd. announced a reference design for the new portables. Phoenix will offer the design to office equipment manufacturers, which would use it to build machines incorporating a highly integrated CPU from Chips and Technologies, systems software from Microsoft Corp., and applications software from Lotus Development Corporation.

Within four years, according to Dataquest, sales of companion PCs will rival those of two other classes of portables, laptops and pen-based systems, and start closing in on notebooks. Dataquest projects shipments of companion PCs will reach 4.4 million units by 1995, compared with shipments of 4.7 million laptops, 4.4 million pen-based systems, and 7.2 million notebooks.

The software reference design includes ROM-based versions of the Phoenix BIOS, Microsoft MS-DOS 5.0, Lotus System Manager and nine application programs, and a non-DOS shell that provides a common user interface for value-added custom-software configurations. In addition, Phoenix will be providing a series of software options. Initial options include Microsoft Works and the Lotus Connectivity Pack. (Extracted from Electronic Engineering Times, 4 November 1991)

The rise of the superfloppy

There is a quiet revolution brewing in backup and storage for single-user machines. The lowly 3 1/2 inch floppy disk is taking on a new life with higher capacities.

In summer 1990 IBM announced a 2.8 megabyte drive developed by Toshiba Corp. San Jose-based Insite Peripherals Inc. is slated to introduce its 20 MB Floptical drive. Brier Technology Inc., another San Jose start-up, has been shipping its Flextra 20MB 3 1/2 inch drive since early 1991.

Most analysts agree that IBM's 2.8 MB device is an evolutionary development. Like the 1.4 MB 3 1/2 inch disk before it, the 2.8 MB doubles the capacity of its predecessor. The drive, which uses new barium ferrite disks, is widely considered the next logical step in 3 1/2 inch disk drives. Introduced in June 1991, the IBM drive is standard on the PS/2 model 57 and optional on models 35 and 40.

The 3 1/2 inch, 20 MB floppies are more revolutionary than evolutionary. Because of their high storage capacity, they allow users to file away large quantities of data much more efficiently than ordinary floppies do. While they probably will not replace hard drives, the new superfloppies could slow the upward spiral towards ever-larger hard disk sizes in single-user machines and help save money in the process.

The two major players in 20 MB floppies, Insite Peripherals and Brier Technology, are both marketing their drives through original equipment manufacturers (OEMs). Retail prices run from $400 to $1,000.

Since IBM introduced its 2.8 MB drive, several companies have announced support for it. Both Sony Corp. and Toshiba, for example, make drives and disks that use the new format. Other companies are beginning to produce everything from backup software to disk controllers for the IBM devices. Insite and Brier also seem to be gaining support for their more exotic 20 MB formats.

The Insite drive has an access time of about 80 milliseconds - about as fast as a first-generation PC hard drive. Brier's drives do best - they can access data at around 35 milliseconds - close to the 25 milliseconds or so performance clocked by most modern hard drives.

Although analysts expect high-capacity floppy drives to show up in laptop computers, MIS managers today are likely to recommend the units as tape drive replacements on desktop machines.

Of course, backing up an entire hard drive onto floppies - even 20 MB floppies - is not as convenient as backing up to tape. However, most users will always need at least one floppy drive on their PCs, whereas tape drives are likely to remain a luxury for years to come. If that one drive can double for backup purposes, then the savings in cost and complexity over tape are obvious.

The other use for high-capacity floppies is for long-term storage of infrequently used data and program files. In this scenario, users can save entire subdirectories to floppies, where they remain safely out of the way until required. When a user wants to run a particular program, he or she can either copy the files from the floppy over to a hard drive or run it directly off the floppy.

IBM's 2.8 MB drives are cost-effective replacements today for 1.4 MB drives. The drive is only slightly more expensive than 1.4 MB models, and disk costs are similar, considering the extra capacity they offer. These drives are also fully compatible with other 3 1/2 inch formats.

The 20 MB models cost much more than existing floppy drives, and the disks, at $20 to $25 apiece, are not cheap, either. Still, they do carry their own economic rationale - chiefly, that in some circumstances they can replace both the conventional floppy disk drive and a backup device (such as a tape unit) in a single PC. For this argument to hold water, of course, the drives must be compatible with conventional 720 kilobyte and 1.4 MB floppies. Insite and Brier have taken different approaches to downward compatibility.

Insite's Floptical drive can read and write 720 KB and 1.4 MB floppies, but not IBM's 2.8 MB disks. Brier's drives are not read and write compatible with earlier formats and must be used along with a standard floppy drive. Analysts expect Brier to announce a downward-compatible drive sometime in 1992 - perhaps with 50 MB capability.

Because all these floppy drives use MS-DOS, they are all supported in one form or another by most makers of backup software. A few backup packages go beyond DOS and support the new drives directly using their own - usually faster - native format. (Extracted with permission of DATAMATION® magazine©, 1 October 1991, copyright by Technical Publishing Company. A Dunn and Bradstreet Company, all rights reserved)

Single-chip sensor gives cushion to car drivers

Analog Devices believes that it has developed the world's first single-chip acceleration sensor made by micromachining the silicon surface. The device should allow companies making the airbags which stop car drivers hitting the steering wheels during accidents to manufacture versions of their products suitable for fitting in old cars.

The technology of silicon micromachining is not new and a number of companies and universities have been refining the technique in recent years to try to make acceleration sensors, or accelerometers. But to make a commercial device and integrate signal conditioning onto the die as well is a step forward.

The devices will not only be used in cars. But legislation in the United States requiring all new cars to have airbags fitted by 1994 has provided a market driving the technology towards exploitation.

The idea is to have a bag mounted on the steering wheel which fills with air very quickly if the car is stopped very suddenly by other cars, trees, walls and the like. The bag expands out to meet the driver as he or she continues to move towards the steering wheel or windscreen.

Current airbag systems use a number of sensors in different parts of the car. The reason for this is the need to distinguish between a crash and normal sudden braking. The sensors need to detect the sequence of events which go along with a crash.

In contrast, a single chip sensor can be mounted anywhere, removing the need for expensive harnesses and the work on the assembly line to wire them up. There is no real reason not to mount the sensors with the airbag itself.

This will make it possible to develop self-contained airbag units which can be fitted to existing cars. Lutz May, the manager of automotive products at Analog Devices, believes his company's device will allow car makers to reduce the cost of the whole airbag system from $500 to about $50.

The device is made using a standard Analog Devices BiMOS process. When all the logic has been deposited, a 1 μm thick layer of oxide is deposited over the sensor area, leaving just the holes needed to anchor the tethers to the substrate.

A 2 μm thick layer of polysilicon is then deposited on top of the oxide. An etching process is then used to remove the oxide under the beam, leaving it free-floating. Holes are left in the beam to ensure that the etchant takes away the oxide right underneath the beam.

The whole chip measures 3 mm by 3 mm, with the sensor beam itself weighing 0.1 μg. It detects motion in the plane of the substrate only.

The sensors will also be used in ABS control, active suspension systems, body level control and the like. They could also be used in non-automotive applications; for vibration analysis in industrial systems, computer disk drives and military systems. (Extracted from Electronics Weekly, 18 September 1991)

A micromachine that cuts air-bag costs

Analog Devices Inc., a Norwood, Massachusetts chipmaker, has passed the experimental stage and put the world's first micromachine on the market.

The company designed an air-bag trigger with a comb-like gauge machined from pure silicon. The gauge works by measuring minute changes in an electrical current that holds the 48 microscopic teeth of the comb rigid. The force of the collision acting on the teeth causes the current to change, triggering the air bag.

By making its sensors in a high-volume process, Analog Devices expects to sell the chips for just $5 each, a fraction of the $20 to $50 cost of mechanical switches now used in auto air-bag systems. The first cars to employ the microchip triggers could appear in 1994. Analog Devices is working on other micromachined sensors for controlling automobile suspensions. (Source: Business Week, 4 November 1991)

Intelligent vehicle/highway systems

The Massachusetts Institute of Technology is heading a joint project to develop intelligent vehicle/highway systems, joined by Motorola and Sumitomo (Japan). Professor Moishe Ben-Akiva, director of the project, expects up to 20 other companies to make commitments to provide $75,000/year for three years to support the research. Commercialization - initially in cars and eventually in highways - will be over 10 years. The Department of Transportation estimates that traffic congestion causes over 2 billion vehicles hours/year of delays, rising fourfold by the year 2000. Texas A&M Unversity's Texas Transporation Institute study found that traffic costs over $40 billion/year in lost productivity.

The highway automation project will include auto makers, electronics manufacturers, transportation companies and other businesses to produce dashboard computers with electronic links to roadways and highway control centres to provide accurate, instantaneous traffic information, indicate the best available routes, support accident-avoidance systems and enhance urban traffic management. Currently, most motorists receive traffic information via intermittent updates on local radio stations. These updates rely largely on anecdotal, highly subjective and sometimes conflicting observations. New approaches could involve two-way communications between drivers and highway operations centres, giving drivers data via dashboard computer screens on immediate road conditions, traffic congestion and alternate routes; automated vehicle-control systems that could sense objects around the vehicle, warn of impending collisions and brake to avoid them; and commercial vehicle operation systems that would provide specialized functions for commercial vehicles, such as fleet monitoring, truck weighing and toll paying. (Extracted from New York Times, 20 November 1991)

More efficient LCD screen

Canon will offer LCD screens that use a new technology that could make them less costly, less energy-hungry, and bigger. The ferroelectric liquid crystal (FLC) display technology features materials with built-in memory capabilities. When an image is produced, the FLC memorizes it until a new one is made. Because a diode or transistor does not have to be fixed to each pixel, bigger screens can be built. However, spacing between plates must be very small for a uniform picture. Also, the displays do not have the gray scale needed for desktop publishing and colour programs. (Extracted from Information World, 4 November 1991)

New method to scan luggage at airports

Several companies are developing computer-based systems that can detect currently unnoticed bombs in airports. Scan-Tech Security (Northvale, New Jersey) is working with Rutgers University to use electromagnetism to examine the contents of luggage. Data is evaluated using a neural network computer. Such systems have numerous processors whose degree of influence on each other can be varied. If a bomb slips through in a practice run, the system can alter its own logic as many times as needed to produce a mistake-free system. Scan-Tech says its equipment can detect the specific molecule that identifies each type of explosive, as opposed to many other devices which only examine bags for concentrations of nitrogen. Imatron Industrial Products (San Francisco, California) uses technology similar to that in CAT scans. The system produces a detailed image of the contents of luggage and evaluates X-ray images to detect the specific patterns caused by known explosives. (Extracted from Wall Street Journal, 4 November 1991)

Flat screens - the race is on

Japan's major electronics firms are engaged in a battle for a slice of the flat-screen computer market, expected to be worth 1 trillion yen (almost US$ 8 billion) by 1995.

Slick graphics on lightweight portable computers and movie-style viewing in the home with television sets that hang on the wall promise to be big business in the 1990s.

In December 1991 one Japanese company announced plans to build a 30 billion yen factory to produce up to 50,000 active-matrix liquid-crystal displays a month. Expected to account for up to half of the total LCD market by 1995, active-matrix displays provide sharper images and faster reactions than the passive models found on watches and many existing personal computers. Competition for this lucrative market is currently a wholly Japanese affair; no US company can at present supply the screens in large enough numbers.

The new displays will cater for the growing number of people who want computers they can carry around easily. At the moment, however, this is computing for the rich. What was advertised as the world's first notebook-sized PC to feature an active-matrix liquid crystal display recently went on sale - at almost 600,000 yen (nearly US$ 4,700).

Meanwhile, Japanese companies are racing to develop another type of LCD, which achieves high picture resolution on a flat screen by using thin film transistors to switch dots of light off and on. Jostling for position in the market, these companies have poured billions of yen into development and production, but the complex structure of the display makes manufacturing extremely difficult, and keeps prices high.

A third type of LCD, promoted as a low-cost alternative to thin-film transistor displays, is also expected to hit the marketplace soon. This is the ferroelectric LCD, said to be much easier to produce than the others. The makers say they will start mass production in 1993. (Source: International Herald Tribune, 10 December 1991)

Chip speeds laser printers

Adobe Systems has announced a new chip that will help improve the performance of laser

printers and computer displays by helping to generate postcript characters. The Adobe Type 1 Coprocessor is a VLSI circuit that takes over from software in rendering characters from Adobe's library of 10,000 Type 1 outline fonts. The chip can process 2,000 characters per second, which is 25 times faster than Risc-based printer controllers. The Adobe coprocessor can also be used for computer displays in which Adobe fonts are used and precise what-you-see-is-what-you-get representations are required. Adobe claims that its new chip can support the printing of documents at more than 100 pages per minute. (Source: Electronics Weekly, 23 October 1991)

Electronically inclined to stay on the level

Spirit levels may soon be pushed out by a microprocessor-controlled rival that can set a true horizontal, a vertical or any angle in between, to one tenth of a degree.

The heart of the SmartLevel, produced by Wedge Innovations in San José, California, is a device called a liquid-filled inclinometer. A sealed capsule contains two parallel conducting discs with a space partially filled with liquid between them. Both the discs are divided into three pie-shaped segments. The liquid moves around between the discs and depending on what angle the plates are inclined at there will always be two of the pairs of segments with some liquid between them while the third pair is above the level of the fluid. Any pair of parallel conductors acts as a store of electric charge. Its ability to store charge, its capacitance, is influenced by what is between the conductors.

The quantity of liquid between each pair of segments of the SmartLevel inclinometer depends on the device's angle from the horizontal. So by measuring the capacitance of the three pairs of segments, the angle of the inclinometer can be calculated.

In the SmartLevel, a microprocessor converts capacitance measurements into the angle of the inclinometer and sends this to the tool's liquid crystal display. The level can display any angle in degrees, as the percentage slope of a surface, or as the pitch in inches per foot or rise. Alternatively it can mimic the bubble in a standard level.

If the SmartLevel goes out of kilter, perhaps because it has been dropped or jarred, it can quickly be reset on any flat surface, even if it is not level. Just place the tool on the surface, press the reset button, and wait for about a minute. Then rotate the tool through 180°, reset it again, and it will recalibrate itself.

Bosch, the German tool firm, will soon produce a version of the SmartLevel for the European market. (This first appeared in New Scientist, London, 1 February 1992, the weekly review of science and technology)

Computers to be worn

NEC says that by the year 2000, computers will be portable enough to be worn like an article of clothing. The technology to make the computers already exists, but they would be prohibitively expensive, and battery technology must be improved to make them practical. The body computers would be for use where even laptops are inconvenient. The Lapbody computer would hang from the shoulder, and a screen and keyboard would fold down. The Wearable Data Terminal would have a unit worn over the shoulder and another unit worn on the forearm. The arm unit would have a bar code scanner and touch sensors for loading data. Such units could be used for taking inventory. The Porta-Office would combine phone, keyboard, handwriting notepad and fax machine. All the electronics would be in a tube on the user's back. Tender Loving Care would be a computer worn on the should by paramedics. It would have sensors to monitor a patient's pulse, temperature, blood pressure, etc., and a camera. A computer would diagnose problems and make treatment recommendations. Meanwhile, Haruo Tsuji of Sharp says that LCDs will continue to improve as chip technology improves. (Extracted from New Scientist, 28 September 1991)

Latest weapon in crime fight

The most sophisticated police computer installed in Britain should improve efficiency in all aspects of police work, including catching criminals, finding missing persons and foiling hoax 999 callers. At the heart of the computer is a geographic information system which, when an incident is reported, can instantly display a map showing streets, buildings and the incident's location. The map also shows the locations of police vehicles and officers. If, for instance, there is an urban riot, and streets have been blocked off, the system would automatically compute the next best route to get into and out of the area. The system is also able to turn two-dimensional plans of buildings into three-dimensional drawings. Thus officers can walk through a building on the screen to study potentially dangerous areas such as recesses on staircases. The facility's main use would be during sieges or during chemical factory accidents. (Source: The Times, 20 September 1991)

IBM produces 1 Gbyte drive

IBM Corporation has set a new technology target for its competitors: a disk drive boasting 1 gigabyte of storage in a 3.5 inch form factor.

The drive is the industry's first application of magnetoresistive recording. This technology delivers an areal density of 132 million bits per sqare inch, a 25 per cent advantage over competing drives.

Developed at IBM's Storage Systems Products Division in San Jose, California, the drive's read/write head is about one-sixth the size of conventional heads. It also contains separate read and write elements, instead of a single dual-purpose element.

Smaller geometries mean that more sliders, the devices that carry the read/write head, can be produced on a wafer. Separate read and write elements provide faster data transfer.

The drive is available with 9.8 ms and 11 ms access times. A 8650 Mbyte model is also available. Both drives integrate read-ahead catching and automatic sector allocation. They are rated at 400,000 hours meantime between failure. (Source: Electronics, October 1991)

Social technology

Everybody knows computers are going to change people's lives, but nobody knows how. Which means that computer researchers face a double uncertainty: not only are they still unsure about what the technology can do, they are also unsure about what people will want it to do. So computer researchers at the DEC/Olivetti research laboratory in Cambridge, UK are conducting social experiments alongside technical ones - with intriguing results. The idea is to build new ideas into real systems and then to play with them. Two of today's toys are the Active Badge, a name-tag which tracks its wearers' every move, and Pandora, a system that turns desktop computers into a desktop video-conferencing system. Both have provided surprises.

Using an infrared beam similar to that of a television remote control, the Active Badge talks to transceivers placed about the walls of the laboratory. One of the things the badge constantly transmits is a signal saying who the wearer is. This enables a central computer system to track people as they go about their jobs.

Leaving aside the question of privacy, constant surveillance can be remarkably convenient. Security doors open automatically. Telephone calls are transferred automatically. With a tap to the keyboard, a researcher can discover the whereabouts of any colleague. With the badge, a researcher can have work follow him or her routinely from computer to computer. As he walks away from one terminal, he will be automatically logged off; as he approaches another, the network can automatically log him on and bring his work, as he left it, to the screen.

Badge-wearers have arrived at a variety of social conventions to make the technology less intrusive than it might seem. Someone who wants to be left alone can place the badge face-down on a table; this will block the signal and he or she will disappear from the computer system. When more than three badge-wearers are gathered in a room, they are assumed to be in a meeting and are not disturbed. As in everyday life, one protector of privacy is politeness. It is considered terribly rude to try to make a record of somebody's movements; to help that convention enforce itself, the technology enables badge-wearers to know who is monitoring their whereabouts.

But the most popular service is video mail. Video mail is electronic mail with sound and moving pictures. Pandora enables any researcher to record a message - which can be attached to some supporting text - and send it to a colleague. People use this technology as they would talking post-it notes. The vast majority of video-mail messages sent over Pandora are about 30 seconds long. Each contains just one or two simple items. But the great advantage of video is that, unlike electronic mail or old-fashioned memos, it conveys the facial expressions, tone of voice and gestures that can help the recipient to understand a message. The words "Where is the report?" might mean anything from casual puzzlement to tight-lipped anger - and, whatever tone is meant, something completely different can be inferred by the recipient. Video provides a quick and easy way of ensuring that the right message is sent. (Extracted from The Economist, 23 November 1991)

Electronic ear keeps eye on ailing hearts

Doctors will soon be able to see as well as hear the heartbeats of their patients, a development that could allow them to detect serious cardiac disorders much earlier than at present.

Heart ailments such as failing valves, holes and narrowing of arteries are all potentially fatal. They also create characteristic noises as the blood moves past obstructions or through holes. These subtle differences take years of training to identify by listening through a stethoscope and even then do not always betray the nature and extent of the disorder.

A device known as a dynamic spectral phono-cardiograph (DSP) uses a sensitive microphone to pick up heart sounds, which are then broken down into their constituent frequencies and displayed on a screen. The frequency spectrum from patients' hearts can then be compared with that produced by a healthy heart.

The DSP gives doctors an immediate visual display of heartbeats as they hear them. "The combination of eye and ear is pretty good for recognizing patterns", says William Bennett, professor of applied physics at Yale University, who invented the machine with Jean Bennett, his daughter.

Bennett believes that once it is proven, DSP will be useful for screening and, because a printed copy of the heartbeat can be generated, for following the progress of disease. He says DSP may also predict when an artificial heart valve is going to fail. (Extracted from New Scientist, London, 2 November 1991, the weekly review of science and technology)

Rapid screening for dental X-rays

Visits to the dentist could be speeded up and made safer by an electronic X-ray system which provides images of your teeth on a computer screen. The system, developed by researchers in the US, uses an electronic sensor instead of photographic film and can reduce the amount of radiation used to make an image to a half or a third of that needed by conventional X-rays.

Hans Roehrig, research professor of radiology and optical sciences at the University of Arizona in Tucson, explains that the system displays a picture on a computer screen within a few seconds of taking the X-ray. Normal dental film must be taken out of the patient's mouth and developed.

"This potentially eliminates the need to retake X-rays that are under- or overexposed", Roehrig says. "With our system, the dentist can immediately manipulate the images to get a better view."

The prototype is now at the University of Arizona, where Roehrig expects to begin trials on patients soon. The development work was by Electro-Optics Corporation, a consultancy based in Laguna Beach, California, with funding from the US Army Office of Dental Research. Roehrig says one objective was to develop a portable apparatus for examining battle injuries.

Negotiations are under way with potential manufacturers, but Roehrig says that further

development is needed to improve the spatial resolution of the picture. He believes that within two years the system could be installed in dental surgeries. It can be adapted to fit most existing X-ray equipment. (Extracted from New Scientist, London, 4 January 1992, the weekly reivew of science and technology)

Fibre-optic probe offers instant blood tests

Chemists at Tufts University near Boston have developed a fibre-optic probe that will simultaneously measure several different chemicals in blood. The system could allow immediate clinical analyses of blood chemistry. At present there is a delay while blood samples are sent away to a laboratory. Other multiple sensors exist but they need much larger probes, which are difficult to insert into blood vessels.

Fibre-optic chemical sensors work by sending light down a fibre, and monitoring the fluorescence of a dye probe at the far end of the fibre. The amount of fluorescence depends on the concentration of the chemical being monitored. But until now, the responses of multiple dye probes used with the same fibre have been difficult to isolate.

Steven Barnard and David Walt have made two crucial innovations. First, a probe is made by fusing together 1,500 fibres, then drawing the bundle down to an overall diameter of 400 micrometres. Each fibre retains a distinct light-carrying core, but reduced to just a few micrometres across. Secondly, dye-sensing regions are fabricated on selected parts of the probe surface, so that each fibre in the bundle collects light separately.

In this way, Barnard and Walt could separate the response of the different dye probes by using a charge coupled device camera to monitor the fluorescence transmitted by different fibres in the bundle.

Barnard and Walt used their device to measure acidity and carbon dioxide concentratation with three separate sensors on one fibre probe. Walt says that different dye probes could measure other substances, such as oxygen or glucose concentrations, which are important in clinical blood analysis. (This first appeared in New Scientist, London, 5 October 1991, the weekly review of science and technology.)

Computers keep watch at the bedside

Critically ill patients at Southampton General Hospital are helping to test a computer program which could make nurses' lives less stressful. The Equipment Monitor program monitors the equipment connected to the patient by means of a neural network. Equipment Monitor is a neural network program which, like the human brain, takes "decisions" by weighing up information it receives, in this case from the equipment.

Patients in the intensive care unit at the hospital are connected to conventional equipment which monitors their heart rate, blood pressure, respiration rate and other functions. While the nurses watch the equipment as usual, Equipment Monitor is watching too. If the program proves a success, it could eventually take over this task completely, freeing the nurses to look after patients in other ways.

The program was specially developed for medical monitoring and runs on an ordinary personal computer. It won a small business award from the UK Department of Trade and Industry in 1990. Neural Solutions also hopes to apply the program to environmental monitoring. (Extracted from New Scientist, London, 5 October 1991, the weekly review of science and technology)

Versatile inexpensive colour printer

Hewlett-Packard has developed a new inexpensive colour ink-jet printer. The Deskwriter C comes with both a black-ink and colour cartridge, which can be held in a special container that comes with the printer. The printer functions with an AppleTalk network, or can be hooked up to a stand-alone Mac. Plain paper (both letter-size and legal-size), transparencies, coated paper, labels, and envelopes can all be used in the printer. (Extracted from Information World, 11 November 1991)

Artful copier

Toshiba has developed a colour photocopier that uses a clever mix of analogue and digital technology to produce more subtle gradation of colour and contrast than existing machines. In addition, Toshiba's machine is roughly half the price of the cheapest conventional colour copiers, at a cost of 1.2 million yen (about £5,000).

Toshiba uses a new technique which is currently being incorporated into printers to make stills from video images. It transfers ink from dye sheets onto paper using heat, and Toshiba has refined the heating method to give better copies.

Toshiba's copier scans a colour original by moving it past a strip of tiny solid-state light sensors, closely spaced to give a resolution of 16 dots per millimetre. The signal from the sensors is converted into digital code so that the operator can make changes, for instance to highlight selected areas in chosen colours or ring areas with computer-generated shapes.

Toshiba claims that the system can be made for half the price of a xerographic printer. The first of its copiers are now on sale in Japan. Toshiba has not yet announced plans to sell them in Europe. (Extracted from New Scientist, London, 14 December 1991, the weekly review of science and technology)

Electronic tags for $1

Electronic tags can be made for as little as $1 using a new chip-bonding technique. ISD, the company which has pioneered the method, believes that the new tags will be cheap enough for use as baggage labels by the world's airlines. ISD's tags are part of a system which reads the chip's identities using a 27 MHz international band allocated for industrial, scientific and medical applications. This means that the frequencies are free from interference everywhere in the world. The new chips can be programmed on-site with up to

10 digits and a number of tags can be read simultaneously. ISD also believes that its chip can be packaged in an inert bolus which can survive and be detected in a cow's stomach, making it suitable for tracing cattle. More conventional cow tags can break and result in glass ending up in human food. (Source: Electronics Weekly, 8 January 1992)

The news on the radio gets itself out of a tangle

A digital radio editing system developed by the Australian Broadcasting Company that will free producers from tangles of recording tape looks set to spread to newsrooms around the world. ABC has sold its system to the American Broadcasting Company. The US network will install the system in its New York radio newsroom, with links to bureaux in Los Angeles, Washington, DC and London.

The system virtually eliminates recording tape from the newsroom. Tape is expensive, loses sound quality every time it is copied, and can be damaged during editing or playback. With D-Cart recordings on tape are converted straight into digital code and stored on the system's hard disc drive, which is capable of holding 2.4 gigabytes of data. Interviews and other sound material can also be recorded directly onto D-Cart via telephone or studio lines.

Because D-Cart stores sound digitally, many people can access the same original source simultaneously.

The system is controlled by a mini-computer and can sample the sound it is to store at different rates to achieve different sound qualities. It can sample at a frequency of 32 kilohertz for FM studio quality and at 44.1 and 48 kilohertz for compact disc quality. (Extracted from New Scientist, London, 15 February 1992, the weekly review of science and technology)

Cheap hologram printer steps into focus

A hologram printer developed in the US could give designers of laser-driven devices the chance to use holographic optical components in place of standard ones. Until now the use of such components has been limited by the cost of the equipment used to produce them.

Computer-generated holograms can bend light in ways that are impossible for optical lenses, but their potential has not been fully exploited because the holograms are too difficult and expensive to make. There are only two ways of making computer-generated holograms: by using a laser writer or by electron beam writer. Laser writers focus light to a small point to draw the hologram, but they produce an image no bigger than 25 millimetres square and are expensive. Electron beam writers have the same disadvantages but produce images with ten times better resolution (the number of lines per millimetre).

Silhouette Technology of New Jersey has designed a desk-top hologram printer that beats both of these methods. Not only is it cheap, but it produces computer-generated holograms measuring as much as 100 millimetres by 125 millimetres. The resolution at this size is 1-2 micrometres, as good as is produced by existing laser writers. By adding the further step of photo reduction, a standard method for increasing the resolution of an image by reducing its size, the resolution can be improved to match that of electron beam devices.

The device should provide researchers with a cheap means of designing their own optical systems. It can also be used to make photomasks for microlithography, the process used to manufacture semiconductor chips. (Extracted from New Scientist, London, 12 October 1991, the weekly review of science and technology)

Turning a scanner into a speed-reader

Less than one per cent of the world's information is stored on computer, with 4 per cent on microfilm or magnetic tape. This leaves an astonishing - in the face of the explosion in the number of computers in recent years - 95 per cent still kept on good old paper.

Optical scanners can "read" pages into computers, but they have remained far too slow and inaccurate to be the panacea for a paperless society.

Until now? A company from Virginia, USA claims to have a system that can read and index more than 1,000 pages an hour. That is about 10 times faster than most of its current rivals. The breakthrough is thanks to the use of multiple processors to scan more quickly and accurately. What is more, the makers, Infinite Images International Inc., claim that their Parallax system cuts the cost of a scanned page from around 50 cents (US) to just a few cents.

The new system, which runs software from Californian company Calera Recognition Systems Inc., costs from US$ 80,000 to US$ 750,000, depending on the number of processors in the computer. (Source: Business Week, 3 June 1991)

Dutch border guard is a computer

Amsterdam's Schiphol airport, one of Europe's busiest, has introduced a computer that can read fingerprints to speed Dutch travellers through immigration checks.

The computer compares personal data electronically encoded on a special pass with the traveller's fingerprints, and automatically opens a barrier after the person's identity is confirmed. The process takes 20 seconds. The passes are available to citizens who travel abroad more than five times a year. The airport expects to issue 7,000 passes this year. (Source: International Herald Tribune, 17 February 1992)

Hi-fi makers break CD recording barriers

Compact disc recorders are now a consumer product. People will be able to use the new recorders to make their own CDs and then play them on any player.

Until now CD recorders have been confined largely to the music business. Recording studios use them to provide pop musicians with a CD copy of their day's work. But recent agreements between the record and electronics industries to tax blank recording media and build copy-restricting circuitry into all domestic digital recorders has cleared the way for domestic CD-R.

The electronics industry has also solved several technical problems which previously stood in its way. Philips and Sony have agreed a new "Orange Book" standard - an extension of the Red Book standard which they drafted 10 years ago - that will make new recordable CDs compatible with existing CD audio players.

The CD recorders look like an ordinary CD player. The blank CD is a 12-centimetre disc, made by the Japanese chemical company Taiyo Yuden, which has a coating of polymeric blue-green dye over a gold reflective layer. The recorder focuses an infrared laser beam onto a spot on the disc surface. The beam is absorbed by the dye, which heats up and deforms to create a permanent mark. This mark stops the gold beneath it reflecting a laser beam, so to a conventional CD player the marks look the same as the pits of a prerecorded CD.

The surface of the blank disc is engraved with a spiral groove of the same 1.6-micrometre pitch as the track of pits on a prerecorded CD. The spiral provides optical guidance for the recording laser. It also undulates slightly, and the frequency of the undulation acts as a code which denotes running time from the start of the disc. This code is used by the recorder to log the start and finish time of each recording it makes. (Extracted from New Scientist, London, 5 October 1991, the weekly review of science and technology)

V. COMPUTER EDUCATION

The global classroom

Campus 2000 is an electronic network service catering for the information and communications needs of education and is aimed at all levels from primary to further education. It provides rapid communication with educationalists around the world, electronic mail and conferencing, specialist subject and project information and access to a wide variety of public information databases. Campus 2000 will shortly be offering schools the opportunity to participate in an international project called Worldtour. Starting in January 1992, schools will be able to travel via the telephone wires from the UK to northern Europe and across the world, stopping off in places such as Moscow, Jumamoto in Japan, Cairns in Australia, Hong Kong and New York and back to the UK again, all in the comfort of their own classrooms. (Source: Times Educational Supplement, 25 October 1991)

Back to basics with new computer system

Adults throughout the USA will be able to review basic learning skills more effectively and at their own pace thanks to a new computer system for remedial education developed at St. Philip's College in San Antonio in cooperation with IBM. More sophisticated in its content compared to the basic skills computer programs designed for younger children that are now available, the new system includes seven work stations and is loaded with ten programs designed to help adults with maths, reading and writing. Schools may also customize the system by adding additional programs for other courses. The college is develcping additional computer learning systems in its Instructional Technology Transfer Center opened by IBM at the school earlier this year - one of nine centres in the USA and Canada. (Source: BioBytes, San Antonio Biotechnology News & Information produced by Dublin-McCarter & Associates, September 1991)

VI. SOFTWARE

Diagnosis by computer

Programs that help doctors spot disease are being examined in the US to diagnose faults and test reliability and accuracy. Many of these expert systems are commercially available, but doctors have been slow to put their trust in them.

According to Randolph Miller of the University of Pittsburgh, there are no regulations in the US covering computer programs that help to diagnose illnesses. He says the success or failure of software written for doctors is determined solely by whether they are willing to buy them. Except for occasional reports about the products in peer-reviewed journals, there are no good measures of whether a program is reliable. Miller says that the reliability studies now under way are being conducted only on a few well-known software packages. However, they can act as quick reference guides to remind doctors of little-known medical conditions that may match an odd combination of symptoms.

Future court cases may hold the key to whether computer diagnosis will have a place in most doctors' surgeries. Diagnostic programs could disappear if their manufacturers are held liable when the software suggests the wrong treatment.

Doctors may reject the programs for similar reasons: they may be liable for damages if they accept wrong advice from a computer or if they reject advice that turns out to be correct. On the other hand, doctors in the US have been sued for not having the right equipment available to treat certain ilinesses. If a court ever holds a doctor liable for damages because he did not use computerized diagnostic tools, there would be a rush to buy them. (Extracted from New Scientist, London, 15 February 1992, the weekly review of science and technology)

Commercialization of object-oriented programming

For object-oriented programming to become a commercial reality, there must be a standard software framework based on a way to make requests within the object-oriented environment - that is, a software road or bus enabling objects to interact over a network of different systems.

Now there is such a bus. Announced at the end of October 1991 and called the Object Request Broker (ORB), the bus is the first of three elements that will make up the Object Management Architecture being assembled by companies in the 180-member Object Management Group, which was started in 1989 to promote object technology. By making it easy for application software from different vendors to work together, ORB is a gateway to the goal of open distributed computing.

The other elements in the Object Management Architecture are promised for 1992. The Object Model (which is the "language" for conversing among objects) is due in the first quarter, and the Object Services (the common "topics") by the third quarter. (Extracted from Electronics, December 1991)

Software development

Software productivity is improving at a modest rate of 4 per cent a year compared with hardware, which is doubling in performance every four years. To identify and promote best practice in software metrics, an ESPRIT project has brought together nine companies who have pioneered the use of metrics in Europe.

Called Pyramid, the project includes software house Data Logic and management consultancy training company Brameur from the UK, as well as representatives from France, Germany, Italy and Greece.

The group has significant collective experience to offer and the results from Pyramid's initial efforts will be available shortly in the group's interim report* which describes an approach to metrics using current best practice.

Metrics will not take hold in a company unless they are supported at the top, says Pyramid. Senior management must understand the benefits and campaign on their behalf, supporting middle management who can otherwise find themselves in an awkward position. But as well as this top level support, metrics needs a champion or a sponsor group. Pyramid recommends that someone is allocated full-time to the task of promoting metrics and overseeing their collection.

The Pyramid approach recognizes the importance of existing quality standards such as BS5750/ISO9001 and the UK Department of Trade and Industry's Tickit programme. These provide the guidelines for procedures which can then be quantified using metrics techniques.

The group has set itself several goals. It aims to approach 1,000 IT managers and 10,000 technical staff across a number of business sectors by the end of 1992. It also wants to approach managers and technical staff on the IT supplier side. It also aims to teach by example - Pyramid has observed quality improvements of up to 35 per cent a year.

Measuring something and expressing it in numbers is the way to advance knowledge towards a science, said Lord Kelvin. By way of emphasis the Pyramid group is promoting the use of the term "quantitive software management" over metrics.

The group believes quantitive management "takes away some of the mystery and wizardry of software development. It makes it more understandable through its similarity to other development processes". (Extracted from Computer Weekly, 7 November 1991)

* Quantitix Software Management - Get a Better Grip on Software: The Esprit Pyramid Project, available from Data Logic. Tel.: 081 863 0383.

Common serial test-vector format

Texas Instruments Inc. has proposed a common serial test-vector format and language that, if standardized, would allow vendor-independent transfer of JTAG/IEEE 1149.1 boundary-scan test information between design and test tools and equipment.

The lack of such a standard has compelled designers incorporating boundary-scan test structures to develop their own formats for transferring information. For example, vectors generated by conventional, parallel-oriented tools, such as simulators, must be converted to the serial form required by 1149.1.

With a portable standard such as SVF, engineers will be able to implement testability throughout a product's life cycle, in chips, subsystems and systems. The vectors would not depend on the 1149.1 controller used or on the tools applied in design, production test or field diagnostics. (Extracted from Electronic Engineering Times, 28 October 1991)

IT can help predict and prevent disaster

Averting disasters, be they sudden or gradual and cumulative, is the key to an environmentally friendly world. Aware as we are, for instance, of global warming, monitoring and research is concentrated as much on adapting to new conditions as on prevention and cure.

The cure is often obvious, although it is also often impractical, and so IT is being used to analyse climatic changes and model future scenarios and thus prepare agriculture for changes in weather patterns, for instance.

The Bracknell-based Hadley Centre for Climatic Prediction and Research is looking at the long-term climatic effects of global warming. Research coordinator David Bennetts points out that while there is no doubt about climatic warming, it cannot be absolutely proven that the cause is the emission of so-called greenhouse gases. None the less, he stressed there was sufficient evidence of the effects of pollution to persuade governments to take note. "The biggest problem is carbon dioxide", he says, "and we can only stop that by stopping the burning of fossil fuels".

Bennetts recognizes, however, that the solution is not especially practical, noting that apart from the West's massive consumption, vast areas of China and India are only just coming to their own industrial revolution and are unlikely to take kindly to massive restrictions.

The Centre has been running the climate prediction model on supercomputers. The major use of the systems is to develop the models to predict future changes in climate. They are also used to record observations and analyse data, contributing to predictions of what is likely to happen if at least some changes in the current situation are not made.

The Forestry Commission is another UK Government body looking at the effects of climatic change, as well as man-made pollution. It conducts a major tree-health survey, analysing the condition of trees throughout the country and collecting data in the field using hand-held

micropalms. The Commission is also conducting experimental work in controlling pollution levels in the field, as well as extensive research work on water quality.

The Warren Spring Laboratory, a government executive agency, part of the Department of Trade & Industry, but working on a consultancy basis for both the private and public sectors, is carrying out work on pollution monitoring. Established in 1959 by the former Department of Scientific and Industrial Research, the laboratory is reputed to have built up international recognition as a centre of excellence in both industrial processing and environmental pollution monitoring and abatement.

As at the Met Office and Forestry Commission, the major current use of computer technology at Warren Spring is made in data acquisition, analysis and modelling across a range of divisions, including air pollution, pollution abatement, biological treatment and marine pollution. In the area of air pollution, for example, the laboratory has a constant record of the country's air pollution levels, supplied via a national telemetry system. This system has been further developed and streamlined over the past year, allowing data to be accessed more efficiently and quickly.

At the same time Warren Spring has applied numerical modelling techniques on a range of spatial scales to assess the contributions to air quality from different sources, the effects of future control scenarios, and to provide an integrated interpretation and assessment of measured data.

Just as in the private sector, modelling techniques at the laboratory are also used to help in the control of oil production. With European Commission funding, an oil and chemical spill simulation model has been developed for the north-west European Continental Shelf, western Mediterranean and Adriatic Seas. The model uses a particle-tracking technique to supply information about the spreading, advection and distribution of thicker patches of oil or chemicals following a spill.

Nevertheless, accidents happen and IT can help minimize damage to the environment.

Quick response is undoubtedly a significant contribution to damage limitation, and Bristol-based Datacall Systems has come up with Speechcentre, a PC-based warning system that telephones appropriate personnel and delivers a spoken message detailing the nature and location of an alarm. Connected to data collection systems monitoring, for instance levels of pollution in the water supply, Speechcentre allows for continuous response, even when the control centre is unmanned. (Extracted from Computing, 6 February 1992)

Computer-aided modelling expands downstream

Use of computer-aided design in the chemical industry has enabled great strides to be taken in recent years in terms of design accuracy and reduced design time for chemical plant. Chemical contractors, and companies that perform their own plant engineering in-house, have reaped the rewards of better project definition and management, fewer design faults reaching the construction stage, and more on-schedule start-ups.

One of the most visible advances has been the ability to generate on-screen 3D models of the plant during the design stage. These allow the design team to visualize the plant at an early stage, and to ensure that the design is physically correct, with no clashes of piping and process equipment with other parts of the plant such as steel support work, the heating and ventilation system and cable trays. It has been estimated that avoidance of on-site re-working to correct design mistakes can save some 2-5 per cent of overall costs.

Computer modelling also allows the client to be kept up to date during the design process, and eliminates the production of a costly, and inflexible, physical scale model of the final design for customer-contractor review.

The latest versions of these powerful 3D visualization software packages incorporate a "walk through" capability whereby the viewer can be moved through the computer model of the design, so that he can see what the plant will look like from any internal viewpoint. This capability enables engineering companies and plant operators to carry out design model reviews and perform logistical studies for construction, operator training and plant maintenance.

The information used to generate the computer model is held in a relational database, and can be used for other purposes than "conjuring up" what the plant will look like. The database is essentially a complete record of the plant, built up during the front-end engineering definition of the plant and enhanced and brought to completion during the detailed engineering stage of the design process.

This information can potentially be used in many downstream engineering areas, such as during plant erection, commissioning and testing, and afterwards for plant maintenance, modifications and revamps.

Benefits to the plant operator could extend even further over the next two years or so, thanks to developments in "open systems" compatibility. The computer industry as a whole has been developing standards so that software packages from different suppliers can be linked together to form integrated systems running on their own hardware.

In the chemical engineering/CAD field this will enable the design database for a plant to communicate with other databases and software programs.

Another advantage to the plant operator of having an on-site computer design capability is that it gives him the ability to keep a complete and up-to-date record of the plant as-built. Not as it was originally designed, but as it is at the present time, and if at any time the plant is scheduled for a major modification involving an outside contractor, the computerized plant description can be returned to the contractor, eliminating much error and work in reassessing the current status of the plant. The computer plant

model can also be used by the plant owner in hazard and operability (hazop) type studies, to assess the efferts of any modifications on the plant. Open systems should in fact enable integration across the whole plant design process.

Full integration would allow the designer to link other packages, from other suppliers, into the system. These could include pipe stress analysis packages, process simulation packages, and the like. Such a possibility has been talked about for a number of years but recently the work to make it possible has been accelerating. The next 2-3 years could see the possibility of assembling a fully integrated design system come to fruition.

If integration of software products is the leading development today, a close second must be the dramatic increase in speed and power of the hardware available on which to run the programs. The late 1980s saw a shift in emphasis away from mini- or mainframe computers to powerful, high-speed workstations with their own processing power.

These have brought the advantage of a lowering in cost/seat to the user, and given greater flexibility in the configuration of systems in the large contracting engineering operations. Such lowering of costs will make it more attractive for plant operators to make the leap to using computers to keep plant design records. (Extracted from European Chemical News, 16 December 1991)

Ancient tongue teaches new tricks

Computers capable of flawlessly translating books, documents and scientific papers from one language into another could soon be rolling off the production lines, courtesy of an ancient language that was first spoken 5,000 years ago by the Aymara Indians of South America. The rigid, logical and unambiguous structure of the Aymara language is a natural bridge between the world's Indo-European tongues. The system developed will translate English, French, Dutch, Spanish, Italian, German and Swedish, using Aymara to decode the text of one language and instantly recode it into the new one. If the system is good it might end some of the more sparkling errors which occur when machines are asked to try to translate meanings from one language to another and which have limited their use. The most classic example of such errors is when "out of sight, out of mind" is translated from English into Russian and then back into English to come out as "invisible idiot". The dream of flawless computer translation has attracted huge investment over recent decades. The European Community spent several million dollars on an unsuccessful computer translation project. People saw it (translation) as a linguistic problem. But it is a problem of language engineering, how to translate grammar into logarithms which work in a machine. (Source: The Times, 28 September 1991)

Computer cryptography

Public-key cryptography could become one of the most common technologies of the information age, underpinning all sorts of routine transactions. Not only does it promise to provide the digital equivalent of a signature, it could also give users an electronic envelope to keep private messages from prying eyes. The idea is to create codes that have two related keys. In conventional cryptography the sender and receiver share a single secret key; the sender uses it to encode the message, the receiver to decode it. In public-key techniques, each person has a pair of keys: a disclosed public key and a secret private key. Messages encoded with the private key can only be decoded with the corresponding public key, and vice versa. The public keys are published like telephone numbers. The private keys are secret. With this technology, digital signatures are simple.

The heart of any system of public-key cryptography is a mathematical function which takes in a message and a key, and puts out a code. This function must be fairly quick and easy to use, so that putting things into code does not take forever. It must be very hard to undo, so that getting things out of code does take forever, unless the decoder has the decoding key. Obviously, there must be no easy way to deduce the private key from the public key.

The greatest successes in finding functions that meet these criteria so far are those using functions called prime factorization algorithms. A variety of schemes have been worked out which use this insight as the basis for a workable public-key code. Most popular of these is the so-called RSA algorithm, named after the three MIT professors who created it. It has been patented and is sold by a Silicon Valley company, called RSA. RSA has attracted both academic praise and a range of commercial customers: Microsoft, Sun Microsystems, Digital Equipment and Lotus Development. (Extracted from The Economist, 21 September 1991)

Hackers fail

Difficult times for hackers: neither ingenuity nor luck will help them very much once the new Kryptosystem package becomes available. The system protects peripheral computers against unauthorized access. Texts and tables are transformed into an apparently unintelligible mass of data that can be read by no one but the original user. Conventional hacker techniques, such as analysing the frequency of individual letters, will no longer work. Even a super computer would have to work for roughly 19 million years to decode the data. The system was developed by researchers at the University of Bochum (Germany) in cooperation with the Dortmund-based Hoesch company. (Source: Scala, January-February 1992)

UNIDO Commodity Balance Statistics Database available on tape and diskette

Since 1984, UNIDO has been developing a database of statistics on domestic production, imports, exports and apparent consumption of selected manufactured products at the most detailed product specification possible. The database, which is available to researchers, policy makers and project personnel outside UNIDO upon request, is briefly described below.

The database contains annual time-series data on production, imports, exports and apparent consumption, all in physical units (metric tons, cubic metres, number etc.), of selected manufactured products. The data are arranged according to the International Standard Industrial Classification of All Economic Activities (ISIC) at the six-digit level, and are presented by product, country and year. The coverage in the 1991 version of the database is summarized as follows:

Number of countries and areas covered	161
Number of products covered	133
Period covered	1970-1988

The primary sources of data were the United Nations trade and commodity production tapes. Supplementary data were drawn from various sources, including the supply and utilization account tapes of the Food and Agriculture Organization of the United Nations, United Nations world energy tapes, a number of statistical and industrial publications, national data compiled by statisticians engaged by UNIDO to work in specific countries, and estimates made by UNIDO.

The Industrial Statistics and Sectoral Surveys Branch maintains and updates the data annually as part of its responsibility to provide continuing service to UNIDO users.

Tapes will use blocked fixed-length record format. Users may, however, specify a maximum block size and choose from the following physical characteristics:

Labels: No label/IBM OS standard

Code: EBCDIC/ASCII

Density: 1600/6250 BPI 9 tracks

On diskette, the commodity balance database is also available as a subset covering a selected number of products and countries. Data are stored on 5 1/4 or 3 1/2 inch IBM PC or compatible diskettes as "flat" ASCII files, following PC-DOS and MS-DOS conventions.

Price

The data are sold on magnetic tape or diskettes at the rates shown below.

All buyers, except secondary disseminators, are enjoined to refrain from transferring copies of the tape to users outside their respective institutions or firms. Payment should be made through bank draft or cheque in favour of UNIDO, or through a direct bank deposit to UNIDO, Creditanstalt-Bankverein US dollar account No. 29-05115. Payments should be forwarded to the Industrial Statistics and Sectoral Surveys Branch, UNIDO, P.O. Box 300, A-1400 Vienna, Austria. Purpose of payment and account code number RB-7310000 should be indicated.

Database costs

(United States dollars)

Item	Secondary disseminators, commercial firms	Universities, research institutions, government agencies
Tape (entire database)		
First buyer	1 600	400
Subsequent yearly updates a/	500	200
Diskettes		
First buyer (entire database)	1 900	500
Subsets of database		
Per single product	80	30
Per single country	80	30

Notes. On request, the data can be dispatched by special courier at the following rates:

Tape: Europe $38; United States of America and Canada $51; all other destinations $65.
Diskette: Europe $32; United States of America and Canada $39; all other destinations $48.

a/ Reduced rates apply to buyers of entire database.

UNIDO Industrial Statistics Database available on tape and diskette

Since 1984 UNIDO has been making available to researchers outside the United Nations system its database of industrial statistics. The database is briefly described below.

In the development of the database, which was set up in 1979 to facilitate the work of UNIDO economists and researchers, the first priority has been to satisfy the data requirements of multinational, or intercountry, studies. Much of the work has thus consisted in developing a set of data that are comparable and consistent, both between countries and over time. Statisticians have given particular attention to the need to reconcile differences in national statistical practices, as reflected in the use of different classifications and definitions and in variations in the scope and coverage of data.

The International Standard Industrial Classification of All Economic Activities (ISIC) has been employed throughout the project. The concepts and definitions associated with that classification have been preferred and country data adjusted to meet those standards to the extent possible. The data relate to the period 1963-1989 inclusive, and are arranged according to the ISIC at the three-digit level, which provides for the inclusion

of 28 industries in the manufacturing sector.* Information is presented by country, year and industry, and each of the following items is covered: value added, gross output, wages and salaries, employment and production indexes. The following table shows the extent of coverage in the 1991 version of the database.

The methods used and the extent to which comparability and consistency have been achieved to date are described elsewhere.**

Database coverage in 1991

Item	Number of units or time range
Number of countries	151
Period covered	1963-1989
Number of observations	
Value added	64 911
Gross output	65 889
Wages and salaries	66 311
Employment	71 870
Production indexes	75 078
Total	344 059

Four major sources have been used in compiling and cleaning the data contained in the UNIDO database.*** First, industry data reported in country questionnaires are included. National publications - industrial censuses, annual surveys and input-output tables - are the second. Over 1,000 such publications have been collected by UNIDO during the project. Thirdly, international sources, both published and unpublished, have been used. Finally, a fourth source has been national data compiled by statisticians engaged by UNIDO to work in specific countries.

The Industrial Statistics and Sectoral Surveys Branch maintains and updates the data annually as part of its responsibility to provide continuing service to UNIDO users. Future tapes and diskettes will contain data for an additional year, as well as revisions, corrections and extensions in coverage that may include observations for earlier years dating back as far as 1963.

Tapes will use blocked fixed-length record format, one record per country, table, year and ISIC code. Users may, however, specify a maximum block size and choose from the following physical characteristics:

Labels: No label'IBM OS standard

Code: EBCDIC/ASCII

Density: 1600/6250 BPI 9 tracks

On diskette, the Industrial Statistics Database is also available as a subset covering a selected number of industrial branches and countries.

Data are stored on 5 1/4 or 3 1/2 inch IBM PC or compatible diskettes as "flat" ASCII files, following PC-DOS and MS-DOS conventions.

The data are sold on magnetic tape or diskettes at the rates shown below.

All buyers, except secondary disseminators, are enjoined to refrain from transferring copies of the tape to users outside their respective institutions or firms. Payment should be made through bank draft or cheque in favour of UNIDO, or through a direct bank deposit to UNIDO, Creditanstalt-Bankverein US dollar account No. 29-05115. Payments should be forwarded to the Industrial Statistics and Sectoral Surveys Branch, UNIDO, P.O. Box 300, A-1400 Vienna, Austria. Purpose of payment and account code number RB-7310000 should be indicated.

Database costs

(United States dollars)

Item	Secondary disseminators, commercial firms	Universities, research institutions, government agencies
Tape (entire database)		
First buyer	2 000	500
Subsequent yearly updates a/	600	250
Diskettes		
First buyer (entire database)	2 400	600
Subsequent yearly updates a/	600	200
Subsets of database		
Per single industry	100	35
Per single country	100	35

Notes. On request, the data can be dispatched by special courier at the following rates:

Tape: Europe $38; United States of America and Canada $51; all other destinations $65.
Diskette: Europe $32; United States of America and Canada $39; all other destinations $48.

a/ Reduced rates apply to buyers of entire database.

* The status and coverage of the database is documented in "An inventory of industrial statistics: UNIDO database, 1991" (PPD.186).

** See "Industrial statistics for research purposes" (PPD.192).

*** More detailed information can be found in "UNIDO database: primary sources and database design" (UNIDO/IS.463).

Viruses - a remedy at last?

Experts have identified around 500 computer viruses - codes that can cause PCs to go haywire, with self-evidently dreadful consequences. Programs exist to immunize PCs against known viruses - but new ones are appearing every week, against which microcomputer users are totally unprotected.

A Californian company has now produced a package which it claims can help. XTree's ViruSafe has a database of all known viruses. From that, the program can eliminate recognized viruses residing in a computer's memory or hard disk and spot suspicious-looking codes that could be a new virus.

To determine whether a code is in fact a virus, ViruSafe creates a temporary file and monitors what the code does to it. If it proves harmful to the test file ViruSafe adds the new virus to its database and removes it from the PC.

ViruSafe itself is intended to be immune: it is composed of six overlapping modules, so if the program becomes infected the damaged portion is deleted and rebuilt from the unaffected five automatically. (Source: Business Week, 26 August 1991)

INIS database released on CD-ROM

The INIS database is now available on CD-ROM. Produced by the International Atomic Energy Agency (IAEA), in collaboration with participating countries and other international organizations, INIS covers the peaceful uses of nuclear science and technology.

INIS provides extensive coverage of all aspects of nuclear science and its peaceful applications, with emphasis on physics, chemistry, earth sciences, life sciences, isotopes and radio applications, and engineering.

Information contained in the INIS database comes from such sources as: journal articles, research reports, monographs, proceedings, theses, conference papers, and patents. Coverage dates back to 1976 with approximately 1.2 million records, the majority of which have lengthy and detailed abstracts. INIS is an English-language database, but some titles, abstracts and source materials appear in their original languages.

The complete database will be published on four disks and updated quarterly. For further information, contact INIS, Vienna International Centre, A-1400 Vienna, Austria.

New compression record

Scientists at Iterated Systems Inc. (USA) have achieved a record-setting compression ratio of 2,456:1 in reducing the data needed to describe a raster computer image. The company is pitting its technology against a wave of image-compression techniques based on discreet consine transforms.

The most prevalent commercial version of DCT is the evolving Joint Photographic Experts Group (JPEG) standard, now proceeding through ANSI and ISO committees for industry adoption. While DCT image-compression techniques are grounded in decades of mathematical foundation, fractal image analysis (compression) and deconvolution (decompression) constitute a much newer science. Though Iterated Systems has just received patents on some of its basic fractal methodology, much of its process remains proprietary.

Fractal-mathematics pioneers Michael Barnsley and Alan Sloan - the co-founders and co-presidents of Iterated - are beginning to offer algorithm tools that they believe can unseat DCT as the computer-industry standard for image compression and reconstruction. In September 1991 the researchers announced a suite of hardware and software fractal toolkit products that allow engineers to explore fractal data-reduction solutions to the storage problems created by multi-megapixel computer-graphics images.

DCT-based systems reduce data by throwing out what are believed to be redundant image-data elements. Barnsley contended that DCT's "decimation" technique often eliminates or blurs important data regions of a picture, whereas fractal mathematics reduces an image to a series of tightly compacted mathematical formulas that describe all picture elements, with minimal reduction or blurring of image detail. (Extracted from Electronic Engineering Times, 30 September 1991)

New software tool makes best designs better and increases productivity

An engineer at the GE Research and Development Center at Schenectady, N.Y., has developed a software tool that can take a human designer's best work and - using the same computerized design programs employed by the human - make it even better.

The new software tool, called ENGINEOUS, is speeding the design of tomorrow's jet engines, electric motors, and other complex machines at GE plants across the US.

In putting computerized design programs through their paces, ENGINEOUS substitutes an expert system for a highly skilled human designer, according to developer Dr. Siu S. Tong, a GE aeronautical engineer.

GE's software program already has helped to improve gas turbine designs that have resulted in increased fuel efficiency for jet aircraft engines manufactured by the company and has reduced the time to design an industrial DC electric motor from 120 hours to less than four.

Over the past decade, the development of computer-aided design and engineering tools has brought new levels of efficiency to the process of converting an idea in someone's head into an actual product. But when the human expert manipulating those tools departs for the evening or for the weekend, work comes to a standstill. With ENGINEOUS at the controls, by contrast, computerized design tools are tirelessly manipulated day and night with the skill of a human expert - while hundreds of thousands of design possibilities are tried out. The expert system earlier has received instructions as to which results are desirable and which should be discarded.

ENGINEOUS was developed to focus on such complex design problems as those associated with jet aircraft engines - some of which are built with as many as 12,000 parts - where even a small change in the design of a single component can have a disproportionately large effect on overall engine performance.

ENGINEOUS addresses complex design problems using artificial intelligence-based computational techniques, including expert systems and genetic algorithms. Conventional numerical optimization methods also are employed when appropriate.

Expert systems, today's most widely used form of artificial intelligence, are special software programs that enable computers to mimic the reasoning process of human authorities on a given subject. With ENGINEOUS, design engineers are able to input their accumulated knowledge and experience into the computer.

The design engineer tells ENGINEOUS what parameters and sequence of analysis codes to employ in the design, what criterion should be optimized (e.g., maximize efficiency), which constraints apply, and what rules of thumb a human engineer might use. ENGINEOUS then incorporates these rules along with its search techniques to vary the input parameters of each analysis code. It analyses each variation to see if it has improved the criterion and then adjusts the design accordingly. ENGINEOUS' use of genetic algorithms to solve design problems is analogous to the principles of natural selection. Starting with a population, or a set of designs, it evaluates each design using a "survival of the fittest" scheme: good designs will propagate from one generation to the next. Bad ones will not. After a propagation, it combines the good features of the different designs - just as nature combines different chromosomes to come up with a better chromosome.

Over a number of generations and a number of designs, the best solution will normally evolve. To make certain that the optimum level of design is achieved, ENGINEOUS will occasionally introduce a "mutation" into its calculations by randomly picking design parameters and randomly changing their values, much as cosmic rays may cause genetic changes in life forms.

As for the future, Dr. Tong would like to see ENGINEOUS move from engineering design to other disciplines. For example, the Power Systems Engineering Department at GE currently is engaged in a research project aimed at applying ENGINEOUS to electric utility planning problems, such as reducing the cost of power generation by alleviating transmission bottlenecks. "Longer term, it might also be used for financial analysis or as a research tool, aiding stock and security analysts as well as chemists, physicists, and engineers", Dr. Tong added. (Source: News Release, 11 December 1991)

VII. COUNTRY REPORTS

Austria

BiCMOS processes developed for ASIC fabrication

Austria Mikro Systems International GmbH (AMS), Unterpremstätten, Austria, is developing 1.2 µm and 1.0 µm double-metal BiCMOS processes from their single-poly processes primarily to meet the increasing demand for mixed analog-digital ASIC circuits. Additional mask and process steps are required to produce BiCMOS devices (which include both bipolar and CMOS devices on the same chip). The AMS process incorporates high-performance vertical NPN transistors and parasitic PNP transistors.

AMS believes its BiCMOS products will be used mainly in the fields of telecommunications (both voice and data systems), in the automotive segment where the inherent high processing speeds are of vital importance in such fields as safety and overall vehicle electronics management, and in the industrial field where high-performance mixed analog and digital cells make it possible to implement enhanced robotics, sensor, remote control encoders/decoders, and advanced instrumentation. (Extracted with permission from Semiconductor International Magazine, November 1991. Copyright 1991 by Cahners Publishing Co., Des Plaines, Ilinois, USA)

Bulgaria

Bulgaria coming on line

Bulgaria's largest electronic data-processing company has launched a series of business databases on tape or diskette, with an on-line service to follow next year.

The core database offered by the Sofia-based Information Service Corporation (ISC) is DELFI, which contains data on all domestic Bulgarian companies, including name, address, registered number, manager, activities and nominal capital. The source is the Bulgarian Law Report for Companies Registration, a compilation of data supplied from regional courts.

The database is updated weekly, has over 155,000 records, and can be searched by company name, location and activity.

More detailed information is provided by DELFI Fin, which contains annual balance sheets; DELFI Pro, giving prices, output quantities and production capacities; and DELFI Serv, containing information about prices, terms and conditions.

Data is also available in the form of a hard-copy directory, the companies, products and services catalogue. This includes a list of the leading 1,000 Bulgarian companies, arranged by trade and activity, with a company profile and a list of available products and services with prices and terms. It also contains general business information about Bulgaria, such as financial conditions and legal guarantees.

ISC is also looking at the possibility of sending printed reports by fax or mail. For further information, telephone +359-2/467-193. (Source: Information World Review, September 1991)

Canada

Description of integrated circuit designs

Design descriptions are requested from universities for each integrated circuit design submitted to the Canadian Microelectronics Corporation (CMC). These descriptions are intended to provide information regarding the IC design activities within the university community. The following are selected descriptions of the designs received by CMC in January, February, and March 1991. Further information about specific designs or the integrated circuit technology interests of the universities sponsoring the design activities can be obtained by contacting the people listed below.

Member Organization	Representative	Telephone Number
University of Alberta	Dr. J. T. Mowchenko	(403) 492-3827
University of British Colombia	Dr. D. Camporese	(604) 228-4623
University of Calgary	Dr. J. Haslett	(403) 220-5806
Carleton University	Dr. M. Lefebvre	(613) 788-2600
Concordia University	Dr. A. Al-Khalili	(514) 848-3119
Lakehead University	Prof. J. Coolen	(807) 343-8597
Université Laval	Dr. U. S. Ganguly	(418) 656-7943
Univeristy of Manitoba	Dr. R. D. McLeod	(204) 474-8886
McGill University	Dr. N. Rumin	(514) 398-7113
McMaster University	Dr. J. P. Reilly	(416) 525-9140 ex2895
Memorial University of Newfoundland	Prof. M. Bruce-Lockhart	(709) 737-8937
École Polytechnique de Montréal	Prof. B. Lanctôt	(514) 340-4233
Université de Montréal	Dr. E. Cerny	(514) 343-7472
University of New Brunswick	Dr. C. Diduch	(506) 453-4561
Technical University of Nova Scotia	Dr. A. Jost	(902) 420-7777
University of Ottawa	Dr. D. Gibbons	(613) 546-2495
Université du Québec à Montréal	Dr. J. Davidson	(514) 987-3323
Queen's University	Dr. A. R. Eastham	(613) 545-6081
University of Regina	Prof. B. Misskey	(306) 585-4161
Royal Military College	Dr. D. Al-Khalili	(613) 541-6401
University of Saskatchewan	Dr. R. Muir	(306) 966-8576
Université de Sherbrooke	Dr. S. Richard	(819) 821-7141
Simon Fraser University	Dr. R. Hobson	(604) 291-4454
University of Toronto	Dr. A. Salama	(416) 978-8658 ex6992
University of Victoria	Prof. D.M. Miller	(604) 721-7220
University of Waterloo	Dr. M. I. Elmasry	(519) 885-1211 ex3753
University of Western Ontario	Dr. Z. Kucerovsky	(519) 679-2111 ex8309
University of Windsor	Dr. G. Jullien	(519) 253-4232 ex2574

Université Laval - Microcontrolled processor for the integrated MAR vision system
(Marc Tremblay)

This chip is the controller for the Multiple Array Receptor (MAR) system. It is the integration of previous subsystems named as LVCT1, LVCT2 and several TTL chips (87) which are presently implemented on a wire wrap board (14" by 8") and functional. This entire controller is designed to be installed within the camera with two external PAL20L8 for host busses buffering and arbitration. This controller includes three large PLAs that implement 158 lines of microcode for 18 inputs and 24 outputs. The standard cell part of the chip includes an instruction register and specific logic for defining the direction signals of the pixel of interest into the special sensor. It also includes a data bus controller for visual information management and several counters designed for microcode looping and external memory address generator. This chip is part of a novel sensor with integrated processing capabilities for computer vision applications.

Smart sensor for real time focal plane image processing
(Marc Tremblay)

This design implements a 300 by 300 pixel sensor for focal plane image processing. An array of photodiodes is accessed through a multiport memory with local interconnect. This final version of the sensor will be mounted in a single camera box with local analog computing (LVNEU) and the camera controller (ICALVMRC) for defining a new concept of sensing device for robot vision and image understanding. Plans of mechanical parts of the camera are in progress, host board for PC-AT with local processor, LUT and dual-port memory is completed for interfacing the camera and for interrupt management. A post-graduate student works on a software emulator of the MAR system to design future software and general routines for the camera. This work is an integrated part of the IRIS programme of the centre of excellence.

University of Windsor - A modified architecture for multi-layer neural networks (Aria Nosratinia)

This chip contains a modified architecture for free-forward multi-layer neural networks. Most of the system is implemented in current mode analog CMOS. However, the weights are stored in a POM. To avoid the interconnection congestion problem, a multiplexing scheme is used.

Simon Fraser University - Test chip (Glenn Chapman)

This test chip contains four designs of a micromachined specific gravity sensor. The special pattern is calculated to compensate for the post fabrication etching through the entire wafer, creating the correct size and shape of buoyancy float needed. Several designs of poly piezoresistive stress sensors and sections of the Wheatstone bridge are also being tested. Information from these mechanical and electrical tests on this design will feed back into the etching calculations and the design of the sense circuitry for the next version. This work is being done in collaboration with the micro-machining and sensors group at Simon Fraser University.

Concordia University - Digital neuron (Firoz Kharrazi Hasani)

A digital neuron which incorporates a 5-bit hardwired multiplier, an 8-bit adder, and memory along with control unit, selectors and registers. The design can be called a specialized processor.

Université de Sherbrooke - A new multichannel cochlear implant (Jaouhar Mouine, Soheyl Pourmehdi, Mohamad Sawan)

This neural stimulator translates the serially transmitted Manchester coded data via an inductive link through the skin into analog signals to provide stimulations. It uses an array of 16 totally independent 8-bit D/A converters and permits monopolar and bipolar type of stimulation. The system's operation is regulated by means of an elaborately testable PLA.

The four-channel pain relief stimulator (Maoxin Wei)

This is the implantable pain relief stimulating system. The instruction is transmitted transdermally to the implant. The stimulator is designed with four channels, and every channel can be programmed independently. The stimulating current polarity can be both positive and negative.

Several blocks for pain controller (Maoxin Wei)

The design contains several constructing blocks for the pain controller which is the nerve electrical stimulator in medicine. The blocks include the output stage, the logic interface and the reference voltage generation circuit. A 5-bit synchronous counter is also included to allow easy testing of the chip. The chip is under a research project.

Czechoslovakia

Data net to speed economic reform in Czechoslovakia

Digital Equipment GmbH, the Munich-based subsidiary of the Maynard, Massachusetts, computer maker, will install a nationwide data network in Czechoslovakia to help that country privatize its Government-run industry. Under the programme, Czech citizens will be permitted to purchase coupons entitling them to shares in formerly State-owned enterprises. The DEC network's job is to administer, expedite, and monitor this economic-reform process on a county and district level, and in addition to handle supervisory chores at the computer centres located at Prague and Bratislava.

The network of information systems will be installed as part of a contract that Germany's Software AG has won from the Prague finance ministry. The network is a multi-stage, modular arrangement based on the communications software DECnet/OSI. It ties together some 80 VAX computers distributed over the whole country into a wide-area net.

At the lower level - that is, at the computer sites - are local-area networks to which personal computers can be connected according to the client/server principle. (Source: Electronics, October 1991)

European Community

EC selects research projects

The European Commission has selected the 250 projects which will be funded in the next phases of the RACE and Telematics collaborative research programmes. The RACE programme is concerned with the introduction of broad-band communications in Europe and the EC has agreed ECU 489 million funding for 84 new projects which will run to 1994. The Telematics programme, which includes the DRIVE transport technology programme will receive 380 million ECUs of funding. (Source: Electronics Weekly, 15 January 1992)

EC plan frees high-tech cash

Money will be available to high technology innovators more easily and more quickly if changes to the "financial environment" proposed by the European Commission are accepted.

The Council of Ministers passed a resolution on 18 November which Commission officials believe will make it easier for small companies to start up in electronics.

The Commission has studied the difference between the way high tech companies are financed in Europe and Japan. According to officials, companies in Japan can effectively borrow money for 10 years, paying 1 per cent interest.

The Commission officials are concerned that there is money available from ESPRIT to help research and that banks will lend money to companies already producing products, but that there is a gap in between when nothing is available.

One high-ranking official said that around 70 per cent of the ESPRIT work was carried out by small companies which might have problems exploiting their work.

The Commission has been trying to establish a mechanism for providing venture capital, supplied by banks but guaranteed by the Commission. It is now working with the European Investment Bank to encourage venture capitalists to get involved in electronics. Officials admit they are unlikely to offer money at one per cent for ten years, but believe that any system is better than none at all.

The Commission is concerned that Europe does not produce small high tech companies as quickly as the United States. The United States Government has also been studying ESPRIT and similar programmes with a view to similar public intervention in research. (Extracted from Electronics Weekly, 4 December 1991)

JESSI in jeopardy?

The 1992 budget for JESSI, the European initiative on semiconductor research, has been cut by 30 per cent. The European Commission has paid only a third of its contribution to the programme, amid signs that it wants to withdraw from JESSI.

In 1989, the Commission promised to pay a quarter of the £2.3 billion JESSI was to cost between 1989 and 1996. Britain, Germany, Italy, France and the Netherlands jointly pledged another 25 per cent, and have paid their share so far. Siemens, Thomson and other European electronics firms promised to match the public funds. The Commission's shortfall means the companies' contributions have also been cut. (This first appeared in New Scientist, London, 2 November 1991, the weekly review of science and technology.)

Europe aims to build its own supercomputers

Sixteen European companies and research agencies have launched a programme to expand the use and production of supercomputers in Europe. The plan is a response to a warning earlier this year that European industry must stop depending on foreign supercomputers.

The programme is called European Industry Initiative, or Ei3. The third "i" stands for imagination. The companies will ask the European Commission to help fund Ei3 through ESPRIT, its research programme for information technology.

European scientists lead research into parallel processing, the computer architecture which will form the next generation of supercomputers. Ei3 aims to turn this "technological edge" into "an industrial advantage", by bringing developers of parallel processing technology together with industrial users, so that machines can be designed to meet specific needs.

This echoes a report to the Commission earlier in 1991 by a panel of scientists and computer users. The panel warned that European industry would suffer if it continued to rely on foreign supercomputers.

Members of the panel complained at the time that European computer companies expressed little interest in developing supercomputers. The German company Siemens, for example, considered supercomputers unprofitable. No big computer companies were present at the launch of Ei3. The only prospective suppliers of machines were Inmos, a British firm developing the transputers required for parallel processing, and Parsytec, a small German firm which plans to use Inmos transputers.

Besides research agencies such as the Dutch research agency TNO and the German Fraunhofer Society, the remaining members of Ei3 are industrial users of supercomputers. They include the large German companies Daimler-Benz, Telefunken, AEG and Dornier, which are interested in applications ranging from medical equipment to traffic control; CAP Gemini, a leading French software producer; Casa, a Spanish maker of flight simulators; and Piraiki-Patraiki, a large Greek textile maker interested in using supercomputers for quality control. (This first appeared in New Scientist, London, 23 November 1991, the weekly review of science and technology.)

Framework programme receives extra funding

The European Commission is planning to inject an extra £1.5 billion into the beleaguered pan-European Framework research programme, but will delay its successor programme by a year.

The cash boost and programme extension are needed because of embarrassing delays on some of Framework's 15 projects. Several are running over a year late.

The delays have been caused by political in-fighting between the Council of Ministers and the European Commission over control of the programme. With the help of the European Parliament, the Commission is seeking to break the Council's stranglehold on setting up and running of Framework.

The current programme is the third in a series and is scheduled to run over the period 1990-1994, including a two-year overlap with the next Framework programme. (Extracted from Engineer, 17 October 1991)

Users urge pan-European pricing

Users and resellers are putting pressure on PC software developers to adopt a consistent pricing policy across Europe.

International Software, the United Kingdom's largest independent PC software reseller, said the price of identical packages could vary enormously in different European countries.

According to the company's calculations, the price of Microsoft Word version 5.5 costs almost £60 more in the United Kingdom than in Germany and Microsoft Windows Project 1.0 about £200 more in France than in the United Kingdom.

Users are also calling for consistent pricing across Europe. Du Pont, a manufacturer of industrial machinery, is rationalizing all its European IT procurement under a single division in order to save money. (Extracted from Computing, 24 October 1991)

Infonet to document operations

The European Commission's year-and-a-half investigation into whether Infonet's structure violates European Community competition law is drawing to a close, with the Commission disposed to letting Infonet operate as is.

In a official notice, the Commission said the organization of Infonet, which is owned by MCI Communications Corporation, seven European public telecoms operators and three Asian operators, "presented some problems from the point of view of competition policy". The main issue is the risk that the European owners of Infonet will cross-subsidize the value-added services company to the detriment of other service providers.

Infonet has agreed to record-keeping responsibilities and to file a detailed annual report to the Commission, to assure the Commission that no violations have occurred. On the basis of those promises, the Commission will allow Infonet to continue operating. Interested parties have one month to comment before the final verdict. (Source: Communications Week International, 20 January 1992)

Japanese proposal for research into CIM

A feasibility study to consider a Japanese proposal for a world-wide R&D project into computerized integrated manufacturing (CIM) was announced in Brussels last November. CIM combines computers and robotics with traditional manufacturing techniques. The Intelligent Manufacturing System initiative (IMS) will bring together researchers from Japan, Europe, United States, Canada and Australia. An official attending the European Strategic Programme for Research and Development in Information Technology (ESPRIT) conference said that discussions about the Japanese proposal began in May last year in Brussels. A second meeting took place in Tokyo. Detailed proposals, including US-prepared terms of reference for setting up the feasibility study were discussed by officials in Switzerland on 9 and 10 December and were likely to be formally endorsed in February. (Extracted from Financial Times, London, 29 November 1991)

Low-cost DIALOG access for Europe

DIALOG, the database host, has announced low-cost access to its service from eight European nodes via Sprintnet. Access is available for a fixed cost of US$ 10 per hour, with direct dial from major European cities including London, Brussels and Paris. The cost of using the database is extra.

Access speeds of 9,600 baud, superior error correction and improved line quality are also said to be offered by the network, which began carrying DIALOG in the summer of 1991. (Source: Information World Review, September 1991)

France

France in the 1980s on CD-ROM

A new CD-ROM provides a wide-ranging view of French politics and society in the 1980s. It contains over 180,000 key documents on current affairs in France between 1981 and 1988.

Published by La documentation Française, and developed by ACT Informatique, the disk contains all presidential declarations and official communiqués, from the Council of Ministers, the President's Office, the Prime Minister's Office and the Foreign Office. It also includes résumés of declaration and programmes of ministers and other political leaders, as well as those of trade unions and employers' federations.

Over 95,000 national press articles and 20,000 documents published by the French Administration (books, periodicals, studies and reports) are stored on the disk, which provides a day-by-day account of current affairs, ministerial changes in successive governments, as well as practical information concerning political parties, trade unions and employers' federations. Priced at FF 3,500, the CD-ROM is distributed by: Chadwyck-Healey France, 3, rue de Marivaux, 75002 Paris, France. Tel.: 33-1-42-86-80-20; Fax: 33-1-42-61-33-87.

India

India's top IT company arrives in United Kingdom

India's largest hardware manufacturer is setting up in the United Kingdom offering software consultancy services.

HCL was founded in New Delhi in 1977 as a hardware manufacturer and computer services supplier. It is now India's largest indigenous manufacturer, with a US subsidiary.

The company set up HCL Europe to offer software consultancy to European vendors and users. HCL will target projects using relational database systems from Oracle, Ingres and Sybase, and will move into the object-oriented market in 1992. (Extracted from Computing, 6 February 1992)

Multinationals to test new machinery

International Business Machines (IBM) (US) and Mitsubishi of Japan are expected to be the first two multinationals to test the new machinery set up by the Indian Government to process foreign investment proposals. IBM, which left India in the 1970s after refusing to dilute the equity of its wholly-owned Indian subsidiary, is to set up a joint venture with Tatas, the Indian conglomerate. The new company, in which IBM and Tatas will each hold 50 per cent of the equity, will manufacture microcomputer systems, PCs and export software. The IBM proposal, along with another joint venture proposal by Mitsubishi, the Japanese vehicle and engineering group, will be the first projects to be taken up by a new high-level foreign investment committee set up to accelerate clearance of major investment proposals by large multinationals. The Government's aim is to attract several prestigious investments by multinationals as a way of enhancing the credibility of new economic reforms aimed at opening up the economy. Several other US electronics groups - including Texas Instruments, Hewlett Packard, and Digital Equipment (DEC) - are already taking advantage of India's low-cost software engineering skills to export software development. (Extracted from Financial Times London, 30 August 1991)

Italy

Photovoltaic power plant

The Italian National Agency for Electricity (ENEL) has announced the construction of a 3 MW photovoltaic power plant in the Naples region. The new power plant, expected to cost 42 billion lire (about $35 million), should be ready by 1992 and will satisfy the energy needs of a community of 7,500 inhabitants. The project will be carried out jointly with Pacific Gas and Electric with relative exchange of information, results, and projects for the diffusion of solar plants. The power plant will employ modules made of polycrystalline silicon manufactured by Italian companies such as Ansaldo, Italsolar, and Hellos, but will also compare features and efficiency with modules acquired from the Photowatt (France), Solarek (US), and Kyocera (Japan). (Source: European Science News, April 1991)

Portici Centre for Photovoltaic Research

At Portici, near Naples, ENEA is managing a centre for photovoltaic research. The activities of the centre are presently focused on three technology branches: (1) photovoltaic cells based on amorphous silicon and its alloys; (2) photovoltaic cells based on polycrystalline composite semiconductors; and (3) photovoltaic cells based on high-efficiency gallium arsenide. In the first case, the centre is producing modules of amorphous silicon with a 5 per cent efficiency output with a future output of 10 per cent. The ultimate goal is at least 15 per cent. Concerning photovoltaic cells based on polycrystalline thin films of indium and copper diselenie and cadmium ditelluride, a 14 per cent efficiency rate has obtained at low cost and at considerable time duration.

Beginning with these results, scientists are studying the possibility of selecting a sedimenting technique especially suited for industrial production. For the third case concerning thin-film cells based on composite polycrystalline semiconductors, they are studying various aspects of the sedimenting of transparent and conductor oxides with the method of spray pyrolisis obtaining a conversion efficiency of over 30 per cent. (Source: European Science News, April 1991)

Japan

Computer production projections for 1992

The Japan Electronic Industry Development Association (JEIDA) has announced its projections for computer production in 1992 based on MITI's Dynamic Statistic Survey of Production.

In the economic environments of computer-related industries, streamlining and information equipment investments by companies has remained steady despite the fear of an economic slump in Japan, the failure of the banking industry to invest in information equipment, and diminishing computer demand in the United States and Europe. Technically, the development of open systems and networking and downsizing processes are stimulating demand for personal computers and workstations, raising firm demand expectations for general-purpose computers as database and management machines. Overall computer production is expected to steadily increase, reaching ¥6.110 trillion in 1991, up 5.1 per cent over the preceding year, and ¥6.544 trillion in 1992, up 7.1 per cent.

Computer production is projected to be ¥2.898 trillion in 1991, up 8.7 per cent over the preceding year, and Y3.161 trillion in 1992, up 9 per cent. Production of general-purpose computers in 1991 will be nearly equal to that of 1989 and will steadily increase in 1992, fulfilling new roles in the fields of database servers and system management.

Production of pheripheral and terminal equipment is predicted to reach Y3.212 trillion in 1991, up 2 per cent over the preceding year, and ¥3.383 trillion in 1992, up 5.3 per cent. Production of peripheral equipment, which has been stagnant due partly to low demand for general-purpose computers over the years, is expected to increase steadily in 1991 and 1992. (Extracted from The Telecom Tribune, December 1991 and January 1992)

Japanese hit by consumer drop

Japanese electronics majors are seeing reduced profits as the recession hits spending on consumer products, on personal computer and on the new generation of DRAM - the 4 Mbit.

Hitachi, NEC, Toshiba and Mitsubishi reported declines in first-half profits of -27 per cent, -6.8 per cent, -62.6 per cent and -24.5 per cent respectively, although only Toshiba out of the four showed any decline in revenues (-3 per cent).

All four companies have cut back on their plans for semiconductor investment and all four are expecting declines in profits for the year-end: NEC -4 per cent, Hitachi -27 per cent, Toshiba -25.9 per cent and Mitsubishi -19 per cent. (Source: Electronics Weekly, 30 October 1991)

Japan forces shortage of DRAM chips

A severe memory chip shortage is looming as Japanese manufacturers cut back on production in a bid to raise depressed prices.

European and US computer companies, struggling to climb out of an economic recession, will be extremely vulnerable and are likely to be the hardest hit during a chip shortage. The shortage will affect supplies of the increasingly popular 4 megabit dynamic random access memory (DRAM) chips.

A senior executive at DRAM manufacturer Toshiba warned that a chip shortage is likely to make an impact by the middle of 1992. Hideharu Egawa, senior vice president at Toshiba, said computer companies would find it very difficult to get enough memory chips in the second half of 1992 and the shortage was likely to last well into 1993.

US market research companies Dataquest and VLSI Research also believe a shortage will begin

in mid-1992. They say the cause is production cut-backs by the major Japanese producers who are shifting production resources to more profitable chips.

Chip manufacturers Toshiba, Hitachi, NEC and others have all cut back production of 4 megabit DRAMS. The Japanese produce over 80 per cent of world supplies. (Source: Computing, 24 October 1991)

Sixth generation computer possibility

A feasibility study into the possibility of developing a sixth generation computer capable of making judgements by intuition and inference will be launched by MITI. If the study yields promising results, a sixth generation computer project will begin in April 1992. It will run for ten years and cost ¥100 billion. The current fifth generation computer project will run through 1991. The proposed sixth generation computer will feature "distributed and parallel systems" connected by central processing units. It will combine neural network technology, optical computer technology and processing systems based on fuzzy theory. It will not require programs to operate. MITI plans to make the sixth generation project an international effort including companies, universities and government agencies in the United States and Europe as well as Japan. (Extracted from Journal of Japanese Technology, June 1991)

Romania

IBM signs Romanian PC contract

The Romanian Government has signed a deal with IBM for PCs for its education and science department. The order is the largest ever signed by IBM with a customer in Romania, and comes only a year after the company set up business in the country.

The PC order is part of a crash course in IT for the country. Romania plans to equip its colleges with PS2s, networking hardware and software, and peripherals in an effort to catch up with the rest of the world. (Extracted from Computer Weekly, 3 October 1991)

Russian Federation

Semiconductor technology in the Russian Federation

The former Soviet Union opened its doors to the West and allowed a series of visits to major research and production centres in Moscow, Zelenograd and Minsk during 1991.

The First Soviet Trade Mission was organized by US semiconductor trade body SEMI in conjunction with the now defunct USSR Ministry of Electronics.

In Moscow the Vacuummashpriborg factory showed the advanced stage of development of Soviet vacuum technology and is applying its vaccum experience and technology to semiconductor and materials technology including ion implantation, plasma deposition and etch, X-ray technology (cyclotron), sputtering and ion beam lithography.

Vacuumashpriborg is a scientific and industrial association (NPO); it builds only the first prototypes here, production models are built elsewhere.

Planar in Minsk concentrates on IC photo-lithography production gear. It is the main Russian Federation factory for stepper and pattern generator production. Planar also manufactures back-end equipment (wafer saws, probers and assembly equipment).

Another Minsk company, Integral, is one of the most advanced IC production factories in the Russian Federation. It is also the biggest, producing around 23 per cent of the total Russian Federation micro-electronics production.

As well as making some of the most advanced Russian Federation ICs (64 k/256 k DRAM in production; 1 M DRAM in development) it is also one of the largest producers of agricultural machinery in the Russian Federation.

Integral is currently equipping a new class 10, 150 mm clean room capable of building 4 Mbit DRAMs (theoretically). Three such modules are planned to be built eventually. The prime limitation is lack of appropriate equipment and materials.

The Researach Institute of Physical Problems in Zelenograd, founded in 1964, is unique in that it belongs to the industrial electronics branch of the Russian Federation micro-electronics industry rather than being part of the Russian Federation Academy of Sciences.

Its work concentrates on the design and development of silicon technology (VLSI/ULSI circuit elements) focused around its Sub-Micron 95 research initiative. This programme calls for the development of a 64 Mbit DRAM by 1995.

Much of the work centres around the study of molecular and nano-electronics. To this end a purpose-built cyclotron radiation centre is currently being constructed comprising a 100 mev linear accelerator, a 0.45 gev booster and a 2 gev storage ring. This, together with a pilot, sub-0.5 micron, X-ray photolithography mask-making centre will be operational by the end of 1992.

Angstrem in Zelenograd is one of the Russian Federation's top IC plants. Production is currently mostly on 100 mm wafers in class 100 clean rooms and two 150 mm production lines are currently being built. Though Angstrem is currently profitable, they are finding it difficult to make ends meet. Angstrem is one of the biggest producers of pocket calculators in the Russian Federation.

Elion in Zelenograd is a research institute for precision machine manufacturing and is the starting point for all IC production gear. Pilot production is also undertaken here, including equipment for epitaxy, vacuum evaporation (pvd), plasma etch and E-beam exposure, as well as some test and measurement gear.

Also in Zelenograd is Elma, the main Soviet silicon/materials institute. Elma currently produces over six million silicon wafers (100 mm,

125 mm and 150 mm diameter) annually. In addition, it produces III/V, II/VI, LCD active matrix displays and solar cells. Elma also produces around four million photo-mask blanks (glass and chrome) each year.

The Naunchy Centre in Zelenograd is a scientific industrial cooperation responsible for materials production (over 12,000 different types) plus equipment including thermal diffusion, ion implantation, epitaxy, plasma, ion, E-Beam, vacuum, sputtering and diffusion equipment.

It is the overseeing body within the Zelenograd complex comprising 41 separate enterprises plus ten other factories located elsewhere. These links were traditionally kept in place by government order but now are increasingly so by economic reality.

The Russian Federation remains the single largest semiconductor opportunity in Eastern Europe. (Extracted from Electronics Weekly, 20 November 1991)

Thailand

Thailand seen as next contract assembly centre

Thailand could be the next centre of Asian contract assembly.

There are now four subcontractors in Thailand - Alphatec Electronics, Chinteik, Hana and Thai Micro Systems. AT&T Microelectronics (the former Honeywell/Synertek facility) also offers some contract work in its otherwise captive operation. Advanced Micro Devices, Data General, National Semiconductor and Signetics operate assembly plants near Bangkok. The result of this concentration of assemblers is a potential powerhouse infrastructure.

Other advantages seen for Thailand are its favourable economic and political environment. Also, after many years of mostly sluggish efforts aimed at attracting offshore industry, the Thai Government seems, at last, eager to recruit energetically. (Extracted with permission from Semiconductor International Magazine, October 1991. Copyright 1991 by Cahners Publishing Co., Des Plaines, Illinois, USA)

United Kingdom

University consortium

Five London universities have set up a consortium to develop parallel processing systems as part of a government funded research programme. The group, called Elpac, will be led by Queen Mary Westfield College and will work with industrial partners to increase the use of parallel computer processing in the United Kingdom industry. According to project leader Dr. Peter Dzwig the group is actively seeking industrial partners and a number of sponsors have already joined the project. In July the Government allocated £34 million worth of funding for parallel processing projects in four university centres including London. (Source: Electronics Weekly, 27 November 1991)

United Kingdom components to grow in 1992

The United Kingdom components market will grow 5.5 per cent to £1.92 billion in 1992, according to a forecast by AFDEC, the component distribution industry's trade body.

In 1993 AFDEC predicts an 8.4 per cent rise to £2.08 billion. At the same time the distributors' share of the market will grow by 4.9 per cent in 1992 to £626 million and 8.1 per cent in 1993 to £677 million.

For distributors the forecasts are a little more disturbing. Figures show their share of the market eroding, albeit slowly, from 29.8 per cent in 1991 to 29.6 per cent in 1993.

Among the factors are a growth in custom chips, a not very fruitful area for distributors.

Taking component markets sector by sector AFDEC predicts the semiconductor market will grow 6.5 per cent in 1992 to £1.34 billion, the electromechanical component market will grow 2.9 per cent to £319 million and the passive components market will grow 3.9 per cent to £259.3 million. (Source: Electronics Weekly, 27 November 1991)

United States of America

US benefits from Japan trade deal

The US Government has signed a deal with Japan that makes it easier for US computer companies to bid for lucrative Japanese Government contracts.

The accord allows US suppliers to pitch for a share of the £5 billion a year the Japanese Government spends on IT.

Last year US companies took a 41 per cent share of Japan's private-sector mainframe market, but only 0.4 per cent of the Government's IT spend.

Under the deal the Japanese Government, which buys almost exclusively from the domestic market, will open up its bidding process to allow foreign manufacturers the same information and timetable it provides indigenous suppliers.

It will also stop Japanese companies from entering unreasonably low bids intended to prevent foreign suppliers from tendering and disqualify companies which help draft the tender specifications.

Unlike the voluntary targets announced on Japanese purchases of US cars and car parts, the computer agreement is binding.

The US computer industry estimates it can increase exports to between $3.5 billion and $5.5 billion a year compared to $500 million at the moment.

A spokesman for DEC in the United States said the company welcomed the move but remained cautious. (Source: Computing, 30 January 1992)

Joint US/EC initiative

Sematech and JESSI (Joint European Submicron Silicon Initiative), the US and European semiconductor research consortia, have agreed to cooperate on the development of advanced semiconductor process technology.

The accord, which was signed in Munich, however fails to identify any potential joint programmes in what is seen as a politically sensitive issue because of the US Government's funding of Sematech. Sematech is hoping to avoid a possible negative Congressional reaction to the export of process technology it develops.

The final formula, by which Sematech hopes to avoid jeopardizing its taxpayer-funded financial base, carefully predicates cooperative projects on Sematech's ability to obtain technology that it would not otherwise be able to acquire. The pact, which requires project-by-project approval for implementation specifies that cooperation within single projects must be well defined in separate agreements.

Shared activities are limited to relatively less sensitive areas, including projects regarding standards, competitive technology analysis, common users groups and common equipment qualification.

Also set out was a basic rationale for the agreement, with the consortia saying the agreement is designed "to maximize the effectiveness of capital and personnel and to achieve economies of scale, save critical time and avoid wasteful duplication of effort and repetition of error". (Extracted from Electronic News, 23 September 1991)

VIII. AUTOMATION

Intelligent machining workstation

Streamlining product planning time is being carried out at Carnegie Mellon University's Robotics Institute (Pittsburgh, Pennsylvania). The institute has finished a four-year US Air Force financed project planned to develop an intelligent machining workstation (IMW). Meanwhile, it has started a project targeted at the automated output of sheet metal parts. The aims of both projects are to reduce cutting enterprise time, and to automate the whole output technique, making it possible to feed a CAD design directly to an intelligent machine tool that will run unattended, automatically and repeatedly making an appropriately machined part or prototype. The USAF needs to reduce costs and is quite interested in fast output. Cincinnati Milacron (Cincinnati, Ohio) was the main contractor on the IMW project, and United Technologies' Pratt & Whitney unit supplied input as to what would be needed of this type of system on the output floor. The IMW will find out whether it can machine the planned part via utilizing expert systems. The IMW too will find out what characteristics ought to be machined initially and what kinds of tools ought to be utilized. (Extracted from Mechanical Engineering, November 1991)

Welding prototype

A research project at Nottingham University in the United Kingdom could allow component manufacturers to produce prototype metal parts in hours rather than weeks.

The university has combined a welding robot with a computer-aided design (CAD) package to produce a system that can manufacture prototype components straight from the screen "drawings".

The system uses a standard metal inert gas (MIG) welding system coupled to a robot to build up metal components layer by layer. Each layer represents a "slice" through the component. The dimensions of each slice are sent to the robot by the CAD system.

The welded prototypes have the same strength as wrought steel and with further development could be of high enough quality to be used directly in manufacturing, he says. As the components are built up layer by layer, metal oxides and impurities on the weld surface are melted and blasted away by the welding gun's shielding gas, giving sound components. (Extracted from Engineer, 7 November 1991)

Most advanced robotic arm yet

Sarcos (Salt Lake City, UT) has developed a robotic arm with 10 degrees of freedom (DOF), and includes a thumb, two fingers, a palm, wrist and elbow. Working in collaboration with workers at the University of Utah's Center for Engineering Design, the company devised what may be the most advanced robotic arm in the world. The Sarcos Dextrous Arm is based on hydraulics, with a redundant sealing system and hydraulic fluid lines made an integral part of the design to allow use in such environments as clean rooms. The equipment has a 3-DOF end effector which can accommodate standard tools and a variety of objects with dexterity like that of human movement. When paired with the 10-DOF Exoskeletal Master control system which fits over an operator's arm, the robotic arm will duplicate the desired motion of the master and provide feedback to the master so the operator can sense what the robotic part "feels". Applications for the device are seen in task performance in harzardous environments such as nuclear facilities or space, or in dealing with high-power lines or in clean-room operations. Now in limited production, the product can be teleoperated or configured for autonomous control, or a combination. (Extracted from Machine Design, 7 November 1991)

IX. STANDARDIZATION AND LEGISLATION

Standardization

New technical panel to look at standards

Information Management Strategies and Standards are to be the area of work for a new technical panel set up by ACCIS at its sixth session, which was held in Geneva from 17 to 20 September 1991.

Since the same standards were envisaged for use in different areas of activity of UN organizations, ACCIS decided to create the new panel in order to look at standards as part of a global approach to the management of information.

One of the main objectives of TP/IMSS is to look at the recommendations of, and needs identified by two other ACCIS bodies: the Working Group on Electronic Records Management (WG/ERMIS), and the Technical Panel on the UN Telecommunications Network (TP/NET), working in cooperation where appropriate.

The International Atomic Energy Agency (IAEA) is the new panel's lead agency. Other members are: the United Nations, the United Nations Children's Fund (UNICEF), the United Nations Development Programme (UNDP), the International Labour Organisation (ILO), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the World Health Organization (WHO), the International Monetary Fund (IMF), the International Telecommunication Union (ITU), the International Maritime Organization (IMO), and the International Fund for Agriculture and Development (IFAD). (Source: ACCIS Newsletter, 9(4), November 1991, page 6)

Partnership to standarize CAD/CAM technology

General Motors Corp., Ford Motor Corp., and Chrysler Corp. share a partnership to standarize CAD/CAM (computer-aided design/manufacturing) technologies and design processes across the board. Reducing time-to-market and overhead costs, they believe, will help them compete more effectively with their Japanese rivals.

The automakers' CAD/CAM Research and Development Partnership will also evaluate the feasibility of a uniform computer language in automotive engineering and design. Because of the billions invested in current CAD/CAM systems, observers expect the partnership to focus on a common language and set of interfaces rather than whole new systems. (Extracted from Information Week, 18 November 1991)

US group joins standards fray

A US industry group is trying to help software companies win business in the single European market by issuing them with quality certificates.

The American Society for Quality Control's Registrar Accreditation Board is the first US body to award the International Standards Organization's ISO9000 series of quality standards.

The European Commission will use ISO9000 as a quality benchmark in the post-1992 single market. Suppliers bidding for contracts will have an advantage if they possess the standard.

Among major UK corporations, British Telecom has already indicated it will insist that outside contractors are ISO certified from 1993 onwards. (Source: Computing, 24 October 1991)

Computer user groups

A happy by-product of the blows traded between the vendors' interest groups, consisting of the Open Software Foundation (OSF), UNIX International and X/Open, is the birth of user-led groups, created out of the frustration felt by users in putting forward their own open systems needs.

The past year has witnessed a host of computer user groups dedicated to open systems. First there was the User Alliance, then came the Group of Ten. The latest umbrella group, the World Forum of Open Systems Users, was launched with the aim of bringing together UNIX and open systems user groups throughout the world.

The World Forum is being led by US UNIX group Uniforum and European, the European forum for open systems. It intends to meet regularly and take a stance on issues related to the world-wide promotion of open systems.

Membership of user groups also helps where products based on a particular standard are not yet available. The user group can provide a forum for solving the practical problem of implementing a new technology in the interim. There is a cost attached to user group involvement and while a membership fee may present no problems, the expense of sending qualified personnel to meetings also has to be taken into account. It is usually the case that users are represented only on groups where specific members of staff have the appropriate expertise and enthusiasm.

Some of the vendor-dominated groups have responded to the rising tide of user pressure by strengthening the user voice within their organizations. X/Open in particular has done a lot of work to ensure that users have a positive role in setting and developing standards. (Extracted from Computer Weekly, 14 November 1991)

Bodies that influence standards

ANSI - The American National Standards Institute, the main US technical standards body.

BSI - The British Standards Institution, the main UK technical standards body.

CCTA - The UK Government IT purchasing consultancy, also responsible for the specification of the Government OSI Profile (Gosip), a guide to implementing open systems.

COS - The Corporation for Open Systems, a US supplier-led organization promoting inter-operability of products.

DISC - Has taken over the role of IT standards specifier from the BSI in the UK.

IEEE - The US Institute of Electrical and Electronic Engineers. Its networking standards committee 802 specified the local area network standards later adopted by ANSI and then ISO that now form the basis of most LANs - 802.3 (Token Ring), 802.4 (Token Bus) and 802.5 (Ethernet).

ISO - The International Organization for Standardization, a United Nations non-treaty organization charged with approving technical and safety product standards throughout the world.

Network Management Forum - a group to promote open systems network management.

NIST - The National Institute of Standards and Technology. A government agency which defines the US version of Gosip.

OSF - A software/technology development consortium comprising leading hardware vendors such as DEC, IBM and Hewlett-Packard. Established in May 1988 to produce a standard version of UNIX (OSF'1) to rival the "official" version, AT&T's UNIX System V Release 4.

SOS - The Standards and Open Systems Group (also known as the Group of Ten). Recently established as an informal group to specify user requirements in open systems.

SPAG - A European organization dedicated to promoting standards for interoperability.

Uniforum - An international organization of open systems suppliers and users which developed out of the UNIX user group known as USR/group.

Uniforum UK - The UK affiliate to Uniforum, originally USR/group/UK. The organization changed name and adopted the wider ambit of open systems.

UNIX International - Set up in 1988 as a reaction to OSF and to support AT&T's UNIX System V Release 4, now advises on all development of UNIX.

UNIX System Laboratories - The AT&T subsidiary which owns the rights to the UNIX operating systems and which now carries out developments of UNIX and related software technologies on the basis of advice from UNIX International.

X/Open - A vendor group committed to standards for portability. (Source: Computer Weekly, 14 November 1991)

legislation

Europe's Community Patent

When the Single Market becomes reality on 1 January 1993, it will also bring something new in the field of patents. The Community Patent, due for introduction also on 1 January 1993, will complement the existing European Patent, which has been around for the past 13 years. The Community Patent will be issued on the basis of a single application and unified grant procedure, yet it protects an invention or intellectual property in the 15 countries that are members of the European Patent Organization (EPO). It will be valid in EC countries and a few non-EC nations that are members of the organization and have ratified the Community Patent Convention.

US companies intent on doing business in the single-market Europe are likely to benefit from the Community Patent. Perhaps its prime advantage is in providing a solid basis for business decisions on investments and licensing. In addition, there is the lower cost stemming from a single application, a special boom to small and medium-sized firms with limited resources. For them, the Community Patent is a relatively inexpensive tool for gaining access to the potentially lucrative European market.

With the advent of the Community Patent, US and other non-European companies and inventors will have four options for getting their inventions patented outside their home market. First, they can apply for a national patent in any European country in which they want to do business. Second, companies can seek an international patent in any of the 49 countries (including European ones) that are members of the Patent Cooperation Treaty, which comes under the auspices of the Geneva-based World Intellectual Property Organization. Third, they can apply for the European Patent and, lastly, go after the new Community Patent.

The major difference between the European and the Community Patents is that the latter will be a truly supranational industrial property right, confering uniform protection in all member countries and transferrable or revocable only unitarily. The European Patent, on the other hand, is effectively a national patent in each country for which it is granted, and the protection it confers is limited to that country's territory.

The sole body to process applications and grant Community Patents will be the EPO in Munich, Germany, with its branch in The Hague, the Netherlands, and suboffices in Berlin and Vienna. This means that applicants will be dealing with a single authority instead of a number of national patent offices.

Legal safety enters the mix because the new patent is granted only after an extensive search of a data bank that now contains information on some 26 million documents.

The unitary patent information policy, as well as the EPO's enormous resources in data processing, will not only speed up patent searchers but also help reduce the industry's duplication of development efforts.

The issue of translating a patent into every language spoken in the EC is a political one; each country is eager to have patents published in its own language. The EPO is working to resolve this problem. It is also working on fees, which have yet to be determined. The agency wants to come up with a formula that takes into account the size of various countries and other factors. As regards patent protection in all countries, if a company objects to that, it still has the option of applying for the European Patent, which gives protection only in countries the company chooses.

The 15 member States of Europe's patent organization are Austria, Belgium, Denmark, France, Germany, Greece, Italy, Liechtenstein, Luxembourg, Monaco, the Netherlands, Spain, Sweden, Switzerland, and the United Kingdom.

These nations constitute a market with more than 350 million people, which makes it bigger than the Single Market with its 320 million consumers. Portugal will become the sixteenth member on 1 January 1992, and Ireland has agreed to join as well (its Government must still ratify the agreement). Finland, Cyprus and Yugoslavia have observer status and may also join, as may Iceland and Malta. Hungary, Poland and Czechoslovakia have expressed an interest. These nations, however, must first fulfill certain requirements: their patent legislation must be compatible with the EPO's, and they must have an open-market economy and a democratic form of government.

The procedure for drawing up and filing a Community Patent application is identical to that for the European Patent. First, however, the patent must meet three criteria. It must constitute a novelty (an invention is considered "new" only if it does not represent state of the art); reveal an inventive step or new principle (one that is not obvious to a skilled person); and be industrially applicable. Once granted, a patent is valid for 20 years.

The idea of a common European patent has been a long time coming. Plans date to 1949, when a proposal for establishing a European patent office was submitted to the Council of Europe. Years of meetings and conventions produced no concrete results until December 1975, when the EC, then numbering nine countries, agreed on a common patent. But political differences and certain flaws in the agreement prevented the accord from becoming effective. Renewed efforts at a conference in Luxembourg in December 1985 achieved only partial success. The final details were not hammered out until December 1989. (Extracted from Electronics, December 1991)

Can electronic property be protected?

Like many biotechnology products, software is difficult to define and even harder to protect as intellectual property. Many programmers rely on copyright law - originally intended to stop plagiarism and art fraud - to prevent illicit copying of their work. But they have also attempted to get patents for software "inventions", which range from small program subroutines to full-scale operating systems. Neither approach has worked very well, according to a recent report by the US National Research Council (NRC),* and some knowledgeable observers are deeply concerned about the possible implications of dragging intellectual property lawyers further into the digital world.

One of the worries is that the courts may have gone overboard in using copyright laws to protect the rights of software designers. Historically, courts have awarded narrower protection to literary works with "functional" aspects - that is, with practical uses - than to those with artistic purposes. (Narrow protection means that someone must copy a work almost exactly before infringing a copyright.) Software programs, which are clearly functional, should receive narrow protection under that principle. But a 1985 federal district court decision known as Whelan expanded the copyright protection software to include its "structure, sequence, and organization", thereby protecting program aspects such as file and data structures or sequences of screen displays as if they were art forms.

A different group of intellectual property experts who believe that patents offer a better way to protect the functional aspects of programs. A patent conveys 17 years of ownership rights in a "nonobvious, novel, and useful" invention in exchange for full disclosure of the working details, and many program writers are now seeking these rights. According to a recent estimate prepared for the State Bar of Texas, the Patent and Trademark Office now issues about 200 software patents each year. But this avenue is not without its own pitfalls. Many legal experts say that courts are inconsistent in applying the law, making it difficult to predict whether a given program infringes on a patent or not. For instance, while patents are not awarded for algorithms" which are considered "laws of nature", the Patent Office draws a firm distinction between "computer algorithms" (which are patentable) and "mathematical algorithms" (which are not). Furthermore, a proliferation of software patents further hinders the progress of software development by forcing innovators either to risk litigation or to engage in lengthy and expensive research to ensure that they have not independently created a patented design.

* Intellectual Property Issues in Software, National Research Council, May 1991

(Extracted from Science, Vol. 253, 5 July 1991, p. 23)

IBM opposes extension to EC law

IBM is opposing attempts to have a European directive on software copyright drafted into international law.

The EC is negotiating with the World Intellectucal Property Organization to have its controversial software directive adopted as a clause in the Berne Copyright Convention.

The EC directive was drawn up after a two-year battle which divided the IT industry into opposing camps. One camp wanted to relax the copyright laws, the other wanted them toughened up.

US supplier IBM was strongly in favour of tightening up European laws, but does not want them extended to non-European companies. (Source: Computing, 16 January 1992)

Legislation to improve the environment

The "greening" of the European Community is now seriously under way with emerging environmentally sound business practices being spearheaded by draft resolutions from the British Standards Institution (BSI). There are over 200 EC environomental measures in the pipeline, including the concept of the eco-audit. Each EC country is to establish an audit scheme by late 1993, under which organizations can apply to a regulatory body for a seal of approval, similar to BS5750, from accredited consultants who vet each company.

While this scheme is only voluntary, setting up the machinery within each country will be

mandatory, and it is hoped an eco-audit will be considered by industry as a prize worth winning. Pressure for environmental reform is increasing on a global scale. The Montreal Protocol aims to phase out stratospheric ozone-depleting substances by the year 2000, with EC regulations applying, in theory, even sooner.

This year Rio de Janeiro hosts the United Nations Conference on the Environment and Management, with the emphasis on partnerships between international companies and developing world organizations to solve environmental problems.

The implications for UK organizations are far-reaching - for example, many electronics companies will have to find substitute cleaning agents. More importantly, some software houses and consultancies are already promoting packages and solutions that will help businesses manage the environmental aspects of their business more successfully, thus helping them to live within the new "green" laws.

In June 1991, the BSI's technical committee EPC/50 published a four-part document Environmental Management Systems, inviting public comment on a draft standard. It recognizes that "the achievement and demonstration of sound environmental performance is a primary goal" of many organizations.

Of course, this is no coincidence - commerce is influenced by increasingly stringent legislation and regulation, a growing awareness of the importance of the environment by consumers, investors and the media and, perhaps most persuasively, government economic measures "to curb activities causing undesirable environmental effects and foster those less damaging". (Source: Computer Weekly, 30 January 1992)

X. RECENT PUBLICATIONS

TNCs bibliography published

The UN Centre on Transnational Corporations (UNCTC) has published the bilingual (English-French) Transnational Corporations: A Selective Bibliography 1988-1990. UNCTC's work is aimed at furthering the understanding of the nature of transnational corporations (TNCs); securing effective international agreements; and strengthening the negotiating capacity of host countries in dealing with TNCs.

Main topics covered in the bibliography are foreign direct investments; TNCs, their management and their impact on home and host countries; the economic, political and social issues that affect and are affected by TNCs; the international and national legal and policy framework against which TNCs operate; and the contractual arrangements that link TNCs and host governments. Works selected for inclusion treat issues in an international context. For example, works dealing with the banking system of just one country without reference to transnational activities were excluded.

This bibliography covers books and articles published from 1988 to 1990; it follows an earlier compilation published in 1988 that comprised works published from 1983 to 1987. Some citations reflect the literature in the Centre's Documentation Unit; others were taken from the UN Bibliographic Information System (UNBIS) database, and from major international indexes and catalogues. It represents a broad spectrum of world literature on the subject of TNCs; special efforts were made to cover works in many languages and from many parts of the world.

Transnational Corporations: a Selective Bibliography 1988-1990 carries ISBN 92-1-004032-5 and is available from UN Sales Offices in New York and Geneva (E.91.II.1.10).

Transnational business information

Transnational Business Information: A Manual of Needs and Sources is a manual produced by the United Nations Centre on Transnational Corporations, based on experience gained in providing information services to support the work of the Centre. UNCTC serves as focal point within the United Nations Secretariat on all matters related to transnational corporations.

The Manual discusses the needs of developing countries for information in all phases of their relations with transnational corporations, and suggests sources that can help to meet those needs. Its purpose is to help governments and enterprises in developing countries to establish their own collections of information sources and to use them to meet their present and future needs for information.

Chapters deal with: policy objectives of information; preparation for negotiations with transnational corporations: information sources on industry; selecting candidates for negotiation, and dealing with individual transnational corporations.

The Manual (UN Sales No. E.91.II.A.13; ISBN 92-1-104371-9) is priced at US$ 45, and can be purchased from United Nations Sales Sections in New York and Geneva.

Single-article distribution service established

A US firm, The Faxon Company, is to introduce a range of services which send individual articles to those who cannot afford to subscribe to journals.

Faxon claims that its methods will address the legitimate concerns of publishers more effectively than traditional, photocopying-based services. In fact, journal subscriptions will be stimulated, it says.

Details of the services are not yet known, but the company hints that they will involve its electronic network, linking over 30,000 publishers to more than 60,000 libraries world-wide.

A subsidiary company, Faxon Research Services, Inc., has been formed to provide these and other document delivery and current awareness services.

For further information, contact: The Faxon Company, 15 Southwest Park, Westwood, MA 02090, USA. Tel.: +1-617-329-3350.

IMF disc available

The International Monetary Fund (IMF) has launched its financial statistics database on CD-ROM.

Historical data are included which are absent from the monthly, printed version, and there is said to be greater precision than in the corresponding magnetic tapes.

International Financial Statistics, as the database is called, gives details for most countries in the world, including exchange rates, international liquidity, prices, production and national accounts.

It can be searched in English, French and Spanish, and data may be extracted and downloaded. The cost from the UK distributor, Microinfo, is £399. For further information on the database, contact: Mr. John B. McLenaghan, Bureau of Statistics, IMF, 700 19th Street, Washington, DC 20431, USA. Fax: +1-202-623-4661; or for details of the CD-ROM, Tel.: +44-420-86848.

CASE strategies

CASE strategies is a newsletter from Cutter Information Corp. that claims to be an objective, practical hands-on tool for information systems executives, MIS/DP managers, and anyone involved with the design, development or implementation of software systems. It aims to provide immediately useful solutions to CASE implementation problems.

The newsletter covers subjects such as: productivity and metrics; implementation strategies; tool reviews; news and trends; standards and reviews of resources such as books, reports, firms and services, as well as conferences and seminars. It will also contain practical details of actual CASE implementations, and keep readers abreast of the emerging synergy between artificial intelligence (AI) technology and software systems engineering.

A year's subscription to CASE strategies costs US$ 295 inside North America, US$ 345 anywhere else. Those interested should contact: Cutter Information Corp., 37 Broadway, Arlington, MA 02174-5539 USA. Tel.: 1-617-648-8700; Fax: +1-617-648-8707.

New thesaurus on information and communication

The Communication and Information Thesaurus has been prepared by Jane Aitchison under contract to the International Federation for Information and Documentation (FID), with financial support from the United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Programme for the Development of Communication and the Friedrich-Ebert-Stiftung. It will shortly be available in English, French and Spanish versions in both printed and electronic formats.

The thesaurus has been developed from the second edition of the UNESCO Mass Communication Thesaurus, by Jean Viet. Its coverage of communication and information technology has been expanded, and it includes library and information science.

The thesaurus was originally compiled for use by members of COMNET, an international network of documentation centres on communication research and policies, initiated by UNESCO.

Further information is available from: UNESCO CC/CDF, UNESCO, 7 place de Fontenoy, 75700 Paris, France. Tel.: +33-1-45-68-10-00; Fax: +33-1-45-67-16-90.

Directory of United Nations Documentary and Archival Sources

The Academic Council on the United Nations System (ACUNS), an international association set up to study the work of the United Nations system and other intergovernmental and non-governmental organizations, has prepared a Directory of United Nations Documentary and Archival Sources in cooperation with the United Nations Dag Hammarskjöld Library.

The Directory, co-published by ACUNS, the United Nations and Kraus International Publications, gives details of documentary and archival sources that cover the following subject areas: Structural and Instititional Issues; Peace and Security, Disarmament and Arms Control; Economic and Social Issues; International Law; Human Rights, the Environment and others.

Types of sources include document collections, statistics, archival resources, catalogues, indexes, guides and other bibliographic tools.

Compiled by Peter J. Hajnal, the Directory (UN Sales number: 91.1.14) can be purchased from UN Sales Offices in New York and Geneva. price US$ 20.

XI. SPECIAL ARTICLE

SOFTWARE - THE INDIAN SCENARIO

Dr. U.P. Phadke

Presented at the Meeting of the Consultative Group on Informatics Technology for Development (COGIT) 91 during 26-28 November 1991 at UNIDO, Vienna

I. Background

Software activities in India began in the early 1960s with the commissioning of computers for commercial usage. Until the late 1970s, only the relatively large sized companies could afford these machines owing to the high costs involved as well as the requirement of skilled professionals. The efforts in the 1970s resulted in the creation of a broad spectrum of software packages primarily for in-house use. These covered application in science, engineering, banking, manufacturing planning, census, etc. along with innovative applications in government departments for the collection, collation, processing and dissemination of data. The late 1970s and early 1980s witnessed the setting up of computer hardware manufacturing activities in the country along with continuing imports of mini-computers as well as mainframes. A major part of the Indian software effort over the years has been in

providing programming and software design inputs to foreign companies resulting in exports. This has been a combination of "body-shopping" as well as complete turnkey projects. The growth of Indian software exports from Rs. 30 million in 1980 to Rs. 2,000 million in 1990 is given in table 1. From around 50 companies exporting software in 1986, the number increased to about 150 in 1990. Presently, around 500 organizations in India are engaged in some form of software activity. The areas of expertise available include systems software development and conversion, MIS and decision support systems, financial control and accounting systems, production management and inventory control, project feasibility studies and monitoring systems, telecommunications software, CAD/CAM software, expert systems, microprocessor based software, government information systems, etc. The current level of Indian software exports is around Rs. 2,000 million, which is equivalent to about US$ 80 million and is a very small percentage of the world software market estimated at around US$ 45 billion in 1987 (table 2) and expected to grow to US$ 400 billion by 1994-1995.

The structure of the Indian software industry is highly concentrated with most of the production coming from a few companies. For example, the Tata Consultancy Services (TCS) alone exported software worth around Rs. 480 million in 1989, which constitutes over 30 per cent of the total software exports during that year. In the recent past, TCS have developed major software packages covering project management, local area networks, business management system, office automation tools, CASE tools, etc. Recently, TCS has developed and supplied software packages covering banking, office automation to the UK, material control and job costing system to Hong Kong, and a container and cargo control system to Holland. In the government sector, the Computer Maintenance Corporation (CMC) has developed a variety of software packages covering mining, oil, power, steel, railways, ports, sea, air and road transportation, etc. Some of the international customers of CMC include in the United Kingdom, the London Underground, Port & Harbours, and the Commonwealth Secretariat; Digitial Equipment (the Netherlands); Government of Mauritius, etc. In India, CMC has developed an on-line passenger reservation system to meet the specific requirements of the Indian Railways. The system, called IMPRES$, handles reservations, modifications, cancellations, inquiries, ticketing, refunds, etc. Features of this system include sophisticated application software to take care of the procedural complexities of the Indian Railways, a comprehensive message handling facility, bilingual printing of tickets and reservation charts. The train schedule system, which CMC developed for the London Underground, enables periodic revisions of the operational schedule and generates signalling data to cater to the existing heterogenous signaling technologies.

The Indian software scene is witnessing a rapid growth through the setting up of new companies by non-resident Indians (NRIs) as well as senior professionals of Indian companies who break away to form their own groups. A recent example is the formation of the International Informatics Solution (IIS), which was set up by a former CEO of Tata Unisys. In just two years, the company has grown to a strength of 100 professionals and recorded a turnover of around Rs. 20 million in 1990. This is a 100 per cent export-oriented unit and is handling a diversity of software packages for customers such as Merrill Lynch (a software package for credit worthiness evaluation), Britannia Building Society (mortgage-based loan system), and the European Parliament (video text information system). This company has a partnership with Third Wave Systems of the UK, which acts as a front-end in foreign markets and obtains orders for implementation by IIS. In the area of MIS in the government domain, the National Informatics Centre (NIC) of the Planning Commission has played a pioneering role. The primary objective of the NIC is to provide computer-based MIS services and related support facilities to the foreign ministries and departments and other offices of the Government of India. The computer network of NIC has expanded its reach to the district level. A variety of information systems have been developed covering central excise and customs, natural resources, construction and transport, commerce, network and communication, industry information, agriculture and water, finance, energy, trade and media, etc. In the recently concluded General Election in India, NIC mobilized their network to provide instant counting data and analysis on an on-line basis to the psephologists. This was a major achievement for informatics technology.

The Indian hardware and software companies and other related organizations covering academic institutions and R&D laboratories have formed professional and semi-professional bodies such as the Computer Society of India (CSI), the Manufacturers' Association for Informatics Technology (MAIT), the National Association of Software and Service Companies (NASSCOM), to provide suitable forums for the exchange of views and interaction with government organizations as well as international experts.

II. Policy framework

In December 1986, the Government of India announced its Policy for Software Export. The broad objectives of the policy were to promote software exports to take a quantum jump; to promote the integrated development of software in the country for domestic as well as export markets; to simplify the existing procedures to enable the software industry to grow at a faster pace; to establish a strong base of software industries in India; to promote the use of computers as a tool for decision-making and to increase work efficiency; and to promote appropriate applications which are of a development catalysing nature, with due regard to long-term benefits of computerization to the country as a whole. Further liberalization has taken place with the announcement of the New Industrial Policy by the Government in July 1991 and subsequent developments.

Software development for the domestic market can be carried out by wholly owned Indian companies as well as companies having foreign equity up to 51 per cent; the foreign equity was earlier limited to 40 per cent. Companies with foreign equity exceeding 51 per cent are permitted

only for 100 per cent export-oriented projects. Foreign collaboration and/or foreign investment are allowed as per provisions of the Foreign Exchange Regulation Act (FERA). The software industry has been exempted from the licensing provision of the Industries Development and Regulation (IDR) Act, 1951. This industry has also been exempt from any locational constraints.

Import of hardware and software

The import of computer systems and software can be undertaken under the following schemes:

Category	Export obligation to be met over a period of 4 years (per cent)	Custom duty to be paid (per cent)
A. Foreign exchange released by the Government of India	250 (Net)	65
B. 1. Through non-resident Indian participation	150 (Net)	65
2. With foreign exchange entitlement as a result of excess exports		
3. With foreign participation		
C. Foreign exchange released by the Exim Bank or Government of India	350 (Net)	35
D. Import of system on loan basis (for one year loan period only)	50	20
E. Hardware and accompanying software import under new scheme	300	25
F. Import of application software for systems already imported	300	NIL (Income tax will be paid)

Note: The exemption of duty on application software as indicated above is limited to a value limit of 30 per cent of the total CIF value of computer equipment, inclusive of accompanying software as specified in the above table, provided that the application software is imported on a date subsequent to the date of import of computer equipment under item E.

The minimum levels of cumulative export obligations to be met over the four-year period will be 20 per cent by the second year, 50 per cent by the third year and 100 per cent by the fourth year. The use of imported computer systems may be in any proportion for domestic and export activities. Thirty per cent of the excess software earnings over the export obligation can be used by the exporter for the import of new computer systems, hardware and software sub-systems and/or augmenting computer installations and office equipment and computer spare parts. This import will be aimed at taking up further software exports and would be subject to actual user condition and export obligations of 150 per cent of CIF value of import. The excess export benefit can be accumulated for a period of three years.

Any software, in any media, in any number of licensed copies, is permitted to be imported under the Open General Licence either by an actual user or by a computer manufacturer or by a software company registered with the Department of Electronics for stock and sale. Neither a Not Manufactured in India Certificate (NMIC) nor a DOE concessional duty certificate is required. Computer software allowed for import by computer manufacturers under this provision shall be restricted to the supply of one copy for each system along with hardware manufactured and supplied by them. If software is imported with permission to copy/duplicate without payment of royalty, the duty of 112 per cent is on this one time payment. If software is imported with permission to copy/duplicate up to a specified maximum number of copies, the duty of 112 per cent is levied in advance on the royalty payable on this maximum number in addition to an initial one time payment, if any. For software imported in source code on paper, Customs Duty of only 50 per cent is levied. As software is governed only by the Copyright Act, the royalty remittance rules and procedures are identical to those applicable to the licences for copyright/duplicating of copyright books. Software is protected in India under the Copyright Act (1957) as amended by an Amendment Act (1984).

The criteria for registration for stock and sale of imported software is given below:

Thirty per cent of excess software export earnings made over and above the export obligation, can be made use of by the software exporter for the import of computer software for 'Stock and Sale', importing new computer systems, software and hardware sub-systems and/or augmenting the existing computer installation and office equipment and computer spare parts.

OR

Software organizations will be permitted to import software for "Stock and Sale" limited to a value equivalent to 50 per cent of the Income Tax paid by the unit on software activities during the preceding assessment year.

Hundred per cent export units

The following options are available for setting up 100 per cent export projects:

- Export Processing Zones (EPZs)
- 100 per cent Export Oriented Unit Scheme (EOU)
- Software Technology Park (STP).

Export Processing Zones (EPZ) are enclaves separated from the domestic tariff area where export production is organized on an internationally competitive basis with the requisite infrastructure and duty free imports. The units approved by the Board of Approvals set up for this purpose by the Ministry of Commerce will be eligible for import of capital goods, etc. required by them for export production under the scheme. These zones are located at Kandla (Gujarat), Santacruz, Bombay (Maharashtra), New Okhla Industrial Development Authority (Uttar Pradesh), Madras (Tamil Nadu), Cochin (Kerala) and Falta (West Bengal). The following are the salient features and incentives given for such units:

- Exemption from basic, additional and countervailing Customs Duty on raw materials, components, consumables, spares, tooling and packaging materials, etc. imported into the Zone;

- No licence is required for import of capital goods (whether new or second-hand), raw materials, consumables, spares, tooling or packaging materials - import of these items has been liberalized under the Open General Licence (OGL);

- Exemption from Central Excise Duty and other levies on products manufactured within the Zone and also on goods brought into the EPZ from the Domestic Tariff Area (DTA) for use in production or in connection with the production of goods for export;

- All clearances relating to industrial licences, foreign collaborations, Monopoly and Restrictive Trade Practices (MRTP), etc. are accorded from a single window, viz., the concerned EPZ Board;

- Capital goods and all other inputs supplied to the Zone from the rest of the country are treated as deemed exports and suppliers are eligible for import benefits;

- Duty free import of capital goods and equipment from preferred sources;

- No restriction on foreign shareholdings in companies that set up units in the EPZ;

- Central Sales Tax paid by the units on purchase is reimbursed by the Zone;

- Exemption from restrictions under the Export Control Order on products manufactured and exported from the Zone, except textile items;

- Term finance at concessional rates of interest for fixed assets;

- Packing credit facility for a period of 180 days even in the absence of firm export orders or letters of credit;

- Products manufactured in the Zone are permitted to be sold within India against a valid import licence or under OGL;

- Remittance of profits and dividends earned by foreign investors in the Zone is allowed freely after payment of taxes;

- Liberalization of foreign exchange controls including permits for business visits abroad;

- Complete tax holiday for a period of five years. This could be any consecutive five years in the first eight years of operation;

- Priority release of telephone and telex connections; units can opt for cash assistance on export, which is 50 per cent of the normal rates - in such a case, reimbursement of CST on raw materials to the Zones units and cash incentives to the domestic supplier of raw materials will not be admissible; domestic sales of even those items whose import is not allowed (excluding certain sensitive items) can be permitted. The percentage of such sales is dependent upon the proportion of imported raw materials consumed; diesel oil is available to the exporting units and is supplied at subsidized prices.

The 100 per cent Export-Oriented Unit (EOU) Schemes offers the flexibility to the manufacturer to set up operation anywhere in the country. Most of the features and facilities available to the EPZs apply to the EOUs as well. The Software Technology Parks (STPs) are a major initiative launched by the Department of Electronics of the Government of India to boost software exports from the country. The DOE has set up six such parks at Bangalore, Bhubaneshwar, Gandhinagar, Hyderabad, Pune and Thiruvananthapuram. These STPs are under the technical supervision of the Department of Electronics, which provides a single window clearance mechanism through the Inter-Ministerial Standing Committee of the DOE for the setting up of projects in the STPs. No import licence is required for the import of equipment into the STPs. All imports are duty free as these are 100 per cent export-oriented projects. The export obligation on the STP units in net foreign exchange terms in US dollar value equals 1.5 times the CIF value of the hardware import for which foreign exchange is released by the Government of India plus 1.5 times the wage bill. The obligation for the hardware part is to be fulfilled over a four-year period, whereas the obligation for the wage bill is on an annual basis. Companies can set up their own STPs if they so desire.

Marketing

The Government releases foreign exchange to software exporters to enable them to pay commissions to foreign firms/distributors/ retailers for services rendered, to establish joint ventures and/or market subsidiaries and offices abroad, etc. to incur expenditure on foreign tours, recruiting experts from abroad, obtaining drawings, designs, etc. A foreign exchange allocation of 30 per cent of the net foreign exchange earnings in the previous year is permitted for this period.

Acquisition of software companies abroad

Indian companies can acquire software companies abroad out of 30 per cent of excess software export earnings made over and above the export obligations in addition to the other options already available. The release of foreign exchange for this purpose carries an export obligation of 150 per cent of the foreign exchange released, to be fulfilled over a period of four years. In case of companies which do not have excess import entitlement, the foreign exchange released will carry an export-obligation of 250 per cent to be fulfilled over a period of four years.

Financial aspects

Many financial institutions have been providing Venture Capital Fund assistance to new or existing industrial concerns towards: encouraging commercial application of indigenously developed technology; adapting imported technology to wider domestic application; and all matters connected with or incidental to the above. Assistance under the scheme is available for financing the cost of fixed assets (land, buildings, plant and machinery) as well as operating expenditure (including the cost of raw materials, salaries and wages, utilities and market development expenses) during the development period. Venture Capital Fund assistance is initially provided in the form of unsecured loans involving minimum legal formalities before disbursement. Various financing options, like equity participation, conditional loan and support services are provided under the scheme. These institutions provide capital as well as management support, technical guidance and information.

The General Insurance Corporation of India has introduced a scheme for liabilities arising out of errors, omissions and professional indemnities. The scope of cover and other terms are given below:

- Professional negligence, including unintentional breach of contract.
- Dishonesty/infidelity of employees of the insured (i.e. exporter/developer).
- Unintentional breach/infringement of intellectual property rights, such as unauthorized use of confidential information, trade secrets, patents, copyrights or the systems or program of others.
- Loss of or damage to documents such as agreements, plans, records, deeds, books, letters, certificates or computer programs or information stored, written or punched into cards, tapes or magnetic discs, etc. Documents, however, do not include bonds or coupons or stamps, bank or currency notes or other negotiable instruments.
- Defence costs for legal expenses to defend the insured in case of any claims lodged against him.

Recently, the earnings from software exports have been exempted from Income Tax under the newly introduced Section 80 HHE. Also, software exporters are entitled to Exim Scrip for an amount equal to 30 per cent of the net foreign exchange earnings. These scrips are tradable and can be utilized for import as per policy.

Data communication facilities

Data communication facilities in the country are being provided by Videsh Sanchar Nigam Ltd. (VSNL) through their Packet Switched Data Network or through the dedicated earth station installed by VSNL under the Software Technology Park scheme. VSNL has introduced the International Gateway Packet Switched Data Service from its Bombay Gateway office for data communication between computers and data terminals world wide. This service is known as GPSS Service. GPSS supports two main types of Data Terminal Equipments (DTEs):

- Synchronous Packet Mode X.25 DTEs
- Asynchronous Character Mode X.28 DTEs.

GPSS may be accessed by two methods:

- Dedicated access using voice grade circuits operating at speeds of 300, 600, 1200, 2400, 4800 and 9600 BPS. At present, 48 and 64 KBPS are being planned.
- Dial-up access over the Public Switched Telephone Network (PSTN) operating at speeds of 300, 600, 1200, and 2400 BPS. In the dial up access, the user is temporarily connected to GPSS if he has a Network User Identification (NUI) Code allotted by VSNL. Modems would be required to enable data transfer over these voice grade analog circuits. The modems will be provided at the data terminal end as well as at the exchange end.

The following additional terms and conditions will apply for use of dedicated earth station/ satellite links:

- Satellite links can be used only for 100 per cent export activities. All imports connected with this will be exempted from duty.
- Declaration of exports shall be made on a Special Export Declaration Form notified by RBI in lieu of the GR form.
- The party shall undertake to export the entire production (100 per cent) for a period of 10 years.
- All technology parks will be utilized for the development and 100 per cent export of software through physical media and/or satellite earth stations connected to computers/computer based equipment/ computer-related equipment linked through approved satellites.

- Regarding procurement, installation, commissioning and financing the earth station, the following two options shall be followed:

  (a) Videsh Sanchar Nigam Ltd. may procure, install, commission and finance the earth station after making sure that the specifications of the earth station meet the requirements of the users in the Park, keeping in view the standardization aspects.

  (b) Alternatively, the mother unit of the Technology Park may finance and procure the earth station after getting the specifications approved by VSNL. The Technology Park will then hand over the earth station on an ownership basis to VSNL for installation, operation and maintenance. Adjustments of the costs, paid by the Technology Parks towards the procurement of the earth station, will be adjusted against the annual rental charges to be paid by the technology parks to VSNL. This adjustment will be completed in a five-year period.

- The VSNL will run, maintain and control the earth station.

- The normal measures for ensuring security of data as applicable to other areas of communication like telephone, fax, etc. will also apply to data transfer.

III. Initiatives taken by the Department of Electronics

The Department of Electronics (Government of India) has accorded high priority to the area of software, with particular emphasis on software exports. The DOE has been continuously interacting with the indigenous software industry to obtain their points of view as well as monitoring international developments. Based on the initiative taken by the DOE, the Government announced a comprehensive policy for computers and software in 1986. The DOE has been continuously monitoring the requirements of the software industry and the policy framework described above and the strong pro-active approach of the DOE has resulted in concessions and incentives, such as Income Tax exemption of earnings from software exports, availability of Exim Scrip at 30 per cent, elimination of double taxation on software, etc. The DOE has also set up an Inter-Ministerial Standing Committee (IMSC) which provides a single window clearance mechanism for the setting up of units under the STP scheme, imports of hardware for software export projects, release of foreign exchange for marketing expenses, foreign collaboration approvals, acquisition of foreign companies and sale of software, etc. In addition to the interaction with the industry and concerned Government departments vis-a-vis improvements in the policy and procedural framework, the DOE has also initiated several activities in the area of software. These are briefly described below

Software Export Promotion Programme

The main objective of this programme is to boost software exports from India. The programme aims to identify markets, analyse market characteristics, develop strategies for different market schemes, project Indian capabilities to foreign customers, and create basic facilities for the development and export of software through data links. The programme has two elements. The first deals with organizing export promotion campaigns through conferences/seminars and participation in international trade shows to project Indian capabilities as well as carrying out market surveys and analyses. The second element deals with a major initiative launched by the DOE to create the infrastructural facilities through the creation of Software Technology Parks (STP). The STP is a 100 per cent export oriented scheme to develop the export of software using data communication links or in the form of physical exports. The objectives of the STP are: to establish and manage the infrastructural resources such as communication facilities, core computers, buildings, amenities, etc. and to provide services to users for development and export of software through a satellite and communication channel and charge for the service rendered; to carry out development and export of software and software services; to undertake export promotion activities such as technology assessments, market analyses, market segmentation, etc.; to train professionals in the field of software technology; and to undertake and encourage design and development in the field of computer software and software engineering. Other details of this scheme have been described under the heading Policy Framework.

Computer Integrated Manufacturing (CIM) Programme

The Government has accorded priority to the rapid industrialization and use of modern technologies for the achievement of social, industrial and economic objectives. Accordingly, a thrust has been given to the use of computers in Government and industry to improve the quality of decision-making and management. The DOE had earlier launched the Computer-Aided Management (CAM) and Computer-Aided Design (CAD) programmes to promote a fuller utilization of resources and manpower in organized sectors of the economy through improvements in management techniques and optimization of industrial design. These projects have been successfully completed. As a logical sequel, it is proposed to initiate the CIM programme. Under this programme, four centres would be established to undertake R&D in this area, professionals would be trained in CIM, software packages would be developed and technology transfer from academia to industry would be facilitated. A CIM software exchange system would also be established.

Indigenous development of software packages

With the growth of computerization in the country, the demand for computer software is increasing very rapidly. A large number of software packages are being imported to meet the growing demand. To reduce the outflow of foreign exchange, reduce Indian dependence for upgrading and to eliminate the piracy to some extent by

providing low cost indigenous software, the above software packages are proposed to be developed indigenously. The primary objective of this activity is therefore to develop generic software packages as an import substitution. The project would be implemented by the Department of Electronics in close cooperation with the Computer Maintenance Corporation (CMC). CMC proposes to coordinate the development, marketing, distribution, maintenance of the software and overall management of the project. The software packages will be developed by capable and interested professional organizations in the private and public sectors, education and training institutions, R&D organiz tions and societies, including NCST and CMC.

The Department of Electronics will oversee the project through an Apex Committee comprising a Secretary from the DOE and the Chairman and Managing Director of CMC Limited, a representative of the Software Development Division of the DOE and other senior staff. A Technical Advisory Committee comprised of eminent software professionals from R&D organizations and industries will also be set up to help in the execution of the project. It is expected that NCST will play a major role in the project through these committees. The software developed/procured will become the property of the Government of India and will be made available to users at a reasonable charge. Import of software in these areas is proposed to be discouraged so that protection is available for locally developed products in the initial years.

National Centre for Software Technology (NCST)

The National Centre for Software Technology (NCST) was set up in 1985 as a major R&D centre under the aegis of the DOE. The Centre has evolved from the National Centre for Software Development and Computing Techniques (NCSDCT) at the Tata Institute of Fundamental Research (TIFR), Bombay, into an autonomous centre of excellence in the area of software technology and related computer science. The long-term objectives of the NCST 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; offer consultancy for high technology projects and play the role of a referral agency; act as a central coordinator for software development activities, creating and leading task forces, stimulating activity where national groups require stimulation and help; participate in the development of specifications/standards for indigenous equipment and software and in testing or benchmarking these; and disseminate knowledge and know-how through publications, journals, newsletters and through specialized workshops, courses, lectures, etc.

Recently, the NCST has carried out work in the area of text processing tools, an interactive system for aircraft surface design, X.25 PAD technology, an electronic mail messaging system, an on-line transaction processing system, an intelligent shipping scheduling system, etc. The Bangalore centre of the NCST, the National Centre for Software Development, was inaugurated in October 1990. This centre conducted a one-week advanced course in software engineering in January 1991. The objectives of this centre are to: provide a window to significant software products world wide by establishing a software resource centre nationwide; accelerate the evolution of a national industry from its focus on relatively simple applications to large, complex and critical software projects; provide a variety of R&D and promotional support to the software industry; and set up a library of software packages for the benefit of the software industry.

Centre for Development of Advanced Computing (C-DAC)

The C-DAC works in the area of technology, applications and research in parallel processing. One of the VLSI design centres of the DOE is also run by the C-DAC. C-DAC is developing an advanced parallel programming environment (APEX), which is designed to be a portable environment for message passing multiple instruction multiple data (MIMD) machines designed for use as back-end computer engines attached to industry standard hosts. Development of several modules covering an algorithm prototyping tool, a load balanced resource allocator, libraries, advanced integrated debug environment, a performance evaluation tool and a graphics visualization package has been completed. Several applications driven parallel processing tools have also been developed. A comprehensive artificial neural network simulator package has also been developed and ported on the parallel machine developed by CDAC. A related activity has been the development of the graphics intelligence script technology (GIST-9000) chip, which provides the basis for a plug-in card for IBM-PC compatibles and allows all the existing packages to be used along with any script. Presently, GIST provides all the Indian, Perso-Arabic, Thai, as well as Cyrillic scripts.

Knowledge Based Computer Systems (KBCS) programme

The main objective of the KBCS programme is to apply the KBCS technology to Indian socio-economic problems. The activity is carried out by seven nodal centres. Some of the developments carried out recently include an intelligent case history taker as part of an expert system, an intelligent test abstraction and graphics help system, and a 40-word recognition system. The work carried out by C-DAC and NCST, which are two of the nodal centres under this programme, has been mentioned above.

Manpower development

The Department of Electronics recognizes that competent manpower is a key resource for the growth of computer industry. The Department has been supporting projects relating to manpower and skill development right from its inception. It is implementing a programme on the development of manpower for computers. The programme was launched in 1983. Since then, the number of institutions conducting computer courses at degree/diploma levels has increased

from about 35 in 1983 to over 400 in 1990. Out of these institutions, financial support to about 250 institutions was provided by the Department of Electronics for the purchase of computers, software, books, etc. The output of trained manpower at degree/diploma levels has increased from less than 1,000 in 1983 to about 12,000 in 1990. The Department of Electronics introduced three new courses at these levels, namely a Diploma in Computer Application (DCA), a Master in Computer Application (MCA) and a Diploma in Computer Engineering. In addition, the Department of Electronics has also introduced vocational courses in computers and supported 35 industrial training institutes (ITI).

In an effort to overcome the shortage of computer teachers, the Department of Electronics is implementing teachers' training programmes for DAC and MCA at about 15 centres. Another scheme towards reducing the shortage of computer teachers is the Cross Migration Scheme. Under this scheme, teachers of other disciplines are given full-time intensive training for 18 months. After the successful completion of training, the teachers are given M. Tech, or an equivalent degree, in computers. The scheme is being implemented in 10 institutions throughout the country. The Department of Electronics has also initiated a scheme whereby private sector training institutes would be recognized for computer training. This scheme will go a long way towards providing opportunities for academic growth to those desiring to pursue higher studies in computers. It is estimated that 200,000 professionals would be required in the area of software by 1994-1995. Keeping in mind the emerging opporturites in the Japanese market, the DOE has recommended to all institutions carrying out MCA/DCA programmes, as well as the State governments, to encourage the setting up of Japanese language classes. In addition to the Government efforts, the industry has also shown an initiative in this area. Tata Consultants have an excellent facility in Madras. The proposal of M/s IBM with Tata (which has recently been cleared by the Government) has a major element involving the setting up of a resource centre and providing for training.

Table 1

Software exports

(US$ 1 = 26 Rs.)

Year	Export (Millions of Rs.)
1980	30
1981	60
1982	130
1983	190
1984	210
1985	340
1986	490
1987	700
1988	1,000
1989	1,570
1990	2,000

Table 2

World software market

(US$ millions)

Domestic markets	Software* 1985	1987**
Australia***	500	737
Austria	188	275
Belgium	300	440
Canada	598	783
Denmark	209	316
Finland	186	282
France	2,159	3,157
Germany	1,864	2,730
Japan	2,861	3,999
Italy	1,071	1 677
Netherlands	575	833
Norway	188	300
Spain	305	518
Sweden	344	534
Switzerland	341	501
United Kingdom	1,831	2,771
United States	16,546	22,610
Total OECD	30,065	43,464
Total non-OCED****	860	1,652
Total	30,925	45,116

* Software data includes related consultancy and software bundled with hardware by hardware manufacturers.

** 1987 figures are estimated.

*** Australian figures reflect unbundled software only. Software values also include facilities management.

**** Brazil, South Africa, Israel, Mexico, Korea, Singapore, Taiwan, India.

Sources: OECD, based on information provided by International Data Corp. (IDC), IDC Australia, IDC Canada, IDC and IDC Europe for OECD countries: by the United States Department of Commerce for non-OECD countries; ADAPSO (1989).

List of abbreviations

CAD	Computer Aided Design
CAM	Computer Aided Management
CMC	Computer Maintenance Corporation
CSI	Computer Society of India
DCA	Diploma in Computer Applications
DTA	Domestic Tariff Area
DTE	Data Terminal Equipments
EOU	Export-Oriented Unit
EPZ	Export Processing Zone
FERA	Foreign Exchange Regulation Act
GIST	Graphics Intelligence Script Technology
IDR	Industries Development and Regulation Act
IIS	International Informatics Solution
IMSC	Inter-Ministerial Standing Committee
ITI	Indian Telephone Industries Ltd.
MAIT	Manufacturers Association for Informatics Technology
MCA	Masters in Computer Application
MIMD	Multiple Instruction Multiple Data
MRTP	Monopoly and Restrictive Trade Practices
NASSCOM	National Association on Software and Service Companies
NCST	National Centre for Software Technology
NIC	National Informatics Centre
NMIC	Not Manufactured in India Certificate
NSCDCT	National Centre for Software Development and Computing Techniques
OGL	Open General Licence
STP	Software Technology Park
TCS	Tata Consultancy Services
TIFR	Tata Institute of Fundamental Research
VSNL	Videsh Sanchar Nigam Ltd.