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For the interest of those of our readers who may be unaware that UNIDO also issues a Monitor on Advances in Materials Technology, the last issue, No. 11, covers the subject of high temperature superconductive materials. Copies may be obtained on request by writing to the Editor, Advances in Materials Technology Monitor.

The *Microelectronics Monitor* proposes to accept industry-related advertisements from companies interested in reaching planners and policy-makers as well as entrepreneurs and members of the scientific community in some sixty developing countries throughout the world and inform them about their products and services.

The *Monitor* is published four times a year and distributed free of charge to individuals and institutions on an approved mailing list which includes at the moment 1300 entries. The *Monitor* has been published since 1982 and has built up a sound reputation both in developed and developing countries.

Our activities in the field of advertising are directed towards helping to finance the preparation, publication and mailing of the *Monitor*, which will continue to be distributed free of charge.

Advertisements will be printed in black and white and in English only. Prices in Austrian Schillings or the equivalent in $US will be AS 5,000 for a full page; for half page advertisements, AS 3,700; and for a quarter page, AS 2,500. Requests for placing of advertisements, accompanied by a layout, illustrations and text, should be submitted to the Editor, *Microelectronics Monitor*.

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I. NEWS AND EVENTS

International Conference on the General Aspects of Software

The Intergovernmental Bureau for Informatics (IbI) is contributing to the event "Informatics 88", held in Havana, Cuba, in February by organizing an international conference on the general aspects of software. Its major points of interest are: the evaluation of the changes which have come about in the software industry over the last few years, the examination of the problems of software transfer, the analysis of the most recently adopted solutions for the production of software, the elaboration of general lines of action for the development of a software industry and for the structuring of a regional centre to solve the problems of the protection and transfer of software.

The analysis of the problems of the transfer of software will concern the technical and legal aspects inherent in the different purchasing modalities currently used: technical assistance, sales and leasing contracts, licences, marketing agreements, joint ventures, etc. The transfers from businesses to government will also be studied, considering the current national regulations, the problems of standardization, the role of transnationals and the jurisdictional problems.

The protection of the rights of software manufacturers will be studied taking into account the different norms applying to them: from copyright laws to patent protection laws. The role of the different international organizations involved in this field will be considered, as well as the different national positions on this problem taken by countries in Latin America, Africa, Arab countries, United States and Europe.

The conference was mainly geared to governmental officials and authorities, parliamentarians and politicians interested in informatics, specialists in the public, private, industrial and university sectors, representatives of international organizations active in this field and software manufacturers.

The acquisition of software is gaining increasing importance given that it is this part of informatics costs whose value is growing proportionally at an ever greater rate. It is even more important for technical reasons due to the fact that in certain specific cases an appropriate software can restore or prolong the life of hardware which is theoretically or commercially obsolete, while the need to support a specific software can lead to a premature renovation of modern equipment.

Informatics 88 was held at the International Conference Centre in Havana from 15 to 21 February and comprised the following events: the International Conference on Informatics, the International Conference on the General Aspects of Software, the 13th Meeting of Latin American Informatics and Communications Users, and the International Informatics Fair (Source: Bulletin IbIPRESS, No. 157/03 + 4)

IbI's Extraordinary General Assembly

The General Assembly of the Intergovernmental Bureau for Informatics (IbI), at its fourth extraordinary session, decided to conclude the work of the management committee which had managed the organization since March 1987 and to confirm its president, Professor S. Venceslai, as Director General A.I.

The Assembly decided that at the next session of the Executive Council a programme of informatics projects of interest in the short term for the Governments of the member countries will be presented. The programme will take into account the individual priorities outlined in the development programmes for each country and their available informatics capacity. These criteria will allow a precise definition of the priority criteria for the actions to be carried out at international, regional and national levels.

As regards the international market for information technologies, IbI will give support to the developing member countries so that they may acquire goods and services in the best technical and economic conditions. It will therefore reinforce the role of technology transfer, in particular using training as an instrument for making these transfers effective.

IbI's action will be in line with the financial means available in the short term and will take recourse to co-financing operations in order to obtain additional resources. It will look again at the problem of unpaid contributions taking into account the fact that the current financial difficulties of the organization stem from the rapid increase in the level of the obligatory contributions since 1983 (increases of up to 200 per cent in 1984).

It attributed great importance to collaboration with international bodies which act in favour of the developing countries. One of the types of co-operation foreseen is to offer appropriate informatics services which can facilitate the carrying out of its programmes. In addition, it will carry out a sensitization programme on the problems of IbI with international organizations and countries which are not members of IbI.

During its four days in session, the Assembly was informed on the activities carried out during 1987 and of the adjustments made to the 1987 programme and budget. Agreements made during the 1985-1986 biennium were ratified and the 1988 programme and budget was studied. (Source: Bulletin IbIPRESS, No. 157/02)

IbI-ASSINTEL co-operation agreement

A co-operation agreement was signed at the headquarters of the Intergovernmental Bureau for Informatics (IbI) between the said organization and the National Association of Utility Companies for Informatics, Telematics, Robotics and Eidomatics (ASSINTEL). The agreement was signed by the Director-General of IbI, Professor S. Venceslai and the President of ASSINTEL, Mr. V. Gervasio, accompanied by the Vice-Presidents of ASSINTEL, Messrs. M. Astuti and G. Tansini, the consultants E. Cortis and S. Martinelli and a large group of representatives of the associated companies of ASSINTEL.

Amongst the objectives of the agreement the following were considered: a joint study of the possibility to set up a reflection group, consisting of experts of sectors and of different geographical areas, to develop the theoretical aspects necessary to conceive new models of society in the non-industrialized countries - the promotion of contracts between ASSINTEL and the associations of utility companies of the developing countries so as to favour the exchange of experiences and the launching of common initiatives at an institutional level for a wider diffusion of information technologies - the elaboration of a co-operation programme with the participation of the associated companies of ASSINTEL to the IbI activities in member countries to be determined. This co-operation will be mainly channelled to the training and specialization in informatics, technical assistance and implementation of projects for the transfer of informatics technology.

The preparation and implementation, in one or more member countries, of specific programmes or projects in some of the contemplated sectors shall be the object of special agreements to be drawn in the future between IbI, ASSINTEL and the companies concerned.

The agreement is based on the consideration that, in the present situation, it is possible for the developing countries to grow without passing through the stages formerly covered by the industrialized countries, due to the possibility being offered by the information technologies which show new ways to arrive at the full development of the country.

ASSINTEL, established at the beginning of 1967, is made up of more than 170 companies specialized in software production - data capture and processing - distribution, installation and maintenance of package software and informatics devices - telematics, robotics and eidomatics. It differs from other sectoral associations in its interest to underline and promote the fact that the companies forming it play a fundamental role in favouring the presence of a modern and advanced tertiary sector in other countries. (Source: bulletin InIPRESS No. 155/05)

At the threshold of the year 2000: Automatic census by telephone

A project system for automatic census by telephone, using voice recognition and synthesis technology, was recently presented to the American Department of Commerce.

This project, in which the Census Bureau, the National Bureau of Standards and Mitre Corporation have taken part, will be operational by around the year 2000, once the various testing phases have been completed, and will reduce the necessary time for an interview from 45 minutes to 5 minutes. As regards the census, different methods will be possible. The first method is completely automatic and uses voice recognition and synthesis, thus enabling the system to verify the location and identity of the speaker and ensuring that he is competent to answer questions. If the speaker cannot or does not want to respond, the interview is made following a second method which is computer-assisted. In this case, an agent telephones and carries out the interview with the aid of a PC and a simple menu, along with a specially designed keyboard and a tactile screen. If the household does not have a telephone, the agent will go to the address with his portable PC. On the basis of the various surveys carried out, more than 90 per cent of the population is favourable to interviews carried out by computer. (Source: bulletin InIPRESS, No. 154/07)

TP/DbA concluded

The final report of the Technical Panel on Database Access came before the fourth session of ACCIS, which expressed its appreciation of the completion of the Panel's mandate. TP/DbA had been charged with preparing a compendium of existing United Nations system database policies and a recapitulative list of issues for consideration in framing access policies. Its report is now being edited and prepared for publication and general distribution.

Working Group on database access formed

Another new body to emerge from the fourth session of ACCIS was the Working Group on Database Access, which will give further consideration to issues raised by the work of the Technical Panel on Database Access (TP/DbA). The United Nations has agreed to chair the Working Group, other members of which are ILO and ICAO, and will be responsible for convening the Group and developing its work plan. (Source: ACCIS Newsletter, Vol. 5, No. 4, November 1987)

Demonstrations of United Nations systems

A number of United Nations organizations are now using electronic information networks for communication within their headquarters and between headquarters and field offices. ACCIS sponsored the demonstration of a number of these - the DIALCOM system used by UNICEF, the systems used by UNDRO and ITC which run on the ICC's central computers, and the Local and Wide Area Networks in use by WHO - on 22 September, before the start of the ACCIS meeting. Approximately 47 representatives of United Nations organizations attended. (Source: ACCIS Newsletter, Vol. 5, No. 4, November 1987)

Promotion of EEC information services

The Commission of the European Communities is currently developing a policy and plan of action for promoting the Community's information services market. A major aspect of the action plan will be the implementation of a restricted number of large-scale pilot or demonstration projects to be developed and executed in close collaboration with the information industry and users. The projects should aim to provide a breakthrough in the quality, performance and use of advanced information where the user is not an expert in information technology.

Earlier this year the Commission called for declarations of interest, to elicit ideas from industry and users. Interested parties were thus given the chance to make an impact on the Community's planning for pilot projects at an early stage.

Following intensive discussion with national officials, information service providers and users, key elements of the demonstration projects have been defined. They relate to widely based potential user groups and the ability for the projects to demonstrate commercial viability using existing infrastructures. Easy-to-use systems, with a multinational, multilingual approach, are deemed necessary for stimulating a Community-wide information market.

Further details were published in the Official Journal of the EEC on 17 July 1987, No. c.186. A copy can be obtained from: Commission of the European Communities, DG XIII-B, Attn. Mr. Siebeck, L-2920 Luxembourg. (TP+4301 4226; TX EURDOC LU2752). (Source: ACCIS Newsletter, Vol. 5, No. 4, November 1987)

INIS database on CD-ROM

The International Atomic Energy Agency is planning to present a CD-ROM of the INIS (International Nuclear Information System) database on nuclear information to the 8th INIS Advisory Committee Meeting, to be held in November 1987. The CD-ROM version of the database is expected to be in its final form by the time of the meeting, after which it will be sent to INIS Liaison Officers so that they can familiarize themselves with the new technology. (Source: INIS Newsletter, August 1987)

A historic first for United Nations system

At its meeting in October 1987, the Administrative Committee on Co-ordination (ACC) gave its approval to what is, to our knowledge, the first system-wide decision on the standardization of information-handling within the United Nations system. The decision (1987/23) means that from now on all serial publications produced by the United Nations system must be registered into the International Serials Data System (ISDS), and bear an International Standard Serial Number (ISSN). The inclusion of United Nations system serials in the ISDS will improve their accessibility to Member States, while ensuring more effective utilization within the United Nations system. (Source: ACCIS Newsletter, Vol. 5, No. 5, January 1988)

United Nations information systems on display at Online 87

ACCIS mounted an exhibit at the 11th International Online Information Meeting, which took place in London between 8-10 December 1987. The conference and

exhibition attracted information specialists from around the world to witness the latest developments in information technology and online databases. A considerable number visited the ACCIS booth to collect information and ask questions on databases and information systems available in the United Nations system. Information on ACCIS products, such as the ACCIS Guides to United Nations Information Sources, the Directory of United Nations Databases and Information Systems, the forthcoming Register of United Nations Development Activities, and the Register of United Nations Serial Publications, was also made available. Secretariat staff demonstrated the database of the Register of United Nations Serial Publications on a microcomputer, using UNESCO's CDS/ISIS (micro version) software package. In addition, a representative from the International Trade Centre UNCTAD/GATT (ITC) demonstrated software in use at ITC. A representative of the United Nations Information Centre in London helped to staff the ACCIS booth and to answer questions. (Source: ACCIS Newsletter, Vol. 5, No. 5, January 1988)

Strategy for Caribbean information systems

A project undertaken jointly by the Caribbean Community (CARICOM) Secretariat and the Office for the Caribbean of the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) has produced draft proposals for a regional information system strategy for the area until the year 2000.

The project, financially supported by the Canada-based International Development Research Centre (IDRC), examined factors influencing the development of regional information systems, resources available in the region, and the national policies and plans to be implemented within the next decade. Its recommendations cover the development of systems as well as their products and services.

The geographical scope of the study took in areas covered by the Caribbean Development and Co-operation Committee (CDCC), the Caribbean Community (CARICOM), the Caribbean Development Bank (CDB), and the Organization of Eastern Caribbean States (OECS). Priority sectors were: agriculture; industry; energy; trade; tourism; socio-economic planning; public health and preventive medicine; education; disaster preparedness and the environment.

The study proposes: the further development of human resources to manage the regional and national information systems; linkage of the systems with national and regional mass media to encourage wider dissemination of information, and the establishment of a Regional Network of Information Systems.

For further information on this project, please contact: United Nations Economic Commission for Latin America and the Caribbean, Subregional Headquarters for the Caribbean, PO Box 1113, Salvatori Bldg., Port-of-Spain, Trinidad and Tobago. (Source: ACCIS Newsletter, Vol. 5, No. 5, January 1988)

NIT skills needed

The traditional division between blue-collar and white-collar workers may in future be less important than the distinction between workers with NIT (new information technology) skills and those without, suggests a report prepared by the International Labour Organisation (ILO) for its Fourth European Regional Conference, held in September 1987. Entitled Training and retraining: implications of technological change, it identifies a bottleneck between demand and supply of specialists who can design, manage and operate new technologies. This is particularly acute in Europe, generally acknowledged to "lag behind" the USA and Japan in computerization and the diffusion of new technology.

The spread of numerically-controlled machines and the advent of the paperless office have important ramifications for education and training, which should foster creativity, flexibility and the ability to adjust, the report claims. It warns that in an epoch of rapid technological change, the interests and goals of firms and individuals may be contradictory, and concludes that a profound transformation in education and training in Europe is the only alternative to becoming largely irrelevant to the new opportunities of tomorrow.

The complete reference for this publication is as follows: ILO. European Regional Conference, 4th, Geneva, 1987. 65p. (Report III). Training and retraining: implications of technological change. Geneva, 1987. (Source: ILO Information, August 1987)

Forest products database on diskette

The forest products database of the UN Economic Commission for Europe/Food and Agriculture Organization (ECE/FAO) is now available on diskette. Collected, maintained and updated by the Timber Section, ECE/FAO Agriculture and Timber Division, in Geneva, which uses it in its own work on forest products, the database covers annual data from 1964 onwards. The data, gathered from official government sources, are the same as those published in the Timber bulletin (Nos. 5 and 10 of each volume), with the same definitions and units applied. They are presented at their most disaggregated, thus allowing users to make their own aggregations.

As data for recent years are frequently revised, users are offered two options: the complete database from 1964 to the most recent year (price $US 120); or data for the most recent five years. Diskettes are available in DIF (Data Interchange Format), which can be converted without difficulty for use with most major spreadsheet programs. Further information and order forms will be published in forthcoming issues of the Timber bulletin. Diskettes can be ordered from: United Nations Bookshop/Sales Unit, Palais des Nations, 1211 Geneva 10, Switzerland. (Source: ACCIS Newsletter, Vol. 5, No. 5, January 1988)

Management training - the implications of new technologies

Technological innovation in industry will have a profound impact on productivity, international competitiveness, economic growth, the structure of industry and employment patterns. To maximize the benefits of advanced technologies, new management approaches must be developed, and training will play a key role in this process.

On 17-19 November 1987, a symposium was held in Geneva on Management Training Programmes and Methods: Implications of New Technologies, organized jointly by the United Nations Economic Commission for Europe (ECE) and the International Labour Office (ILO).

Papers submitted covered a broad range of issues related to management training in private and State-owned industries, and the challenges presented by the rapid development of automation, and information and computer techniques.

The report of the symposium, and any further information required, can be obtained from: the Office of the Executive Secretary, ECE, Palais des Nations, 1211 Geneva 10 (TP+41 22 34 60 11, ext. 3254/3265). (Source: ACCIS Newsletter, Vol. 5, No. 5, January 1988)

New world-wide database links

A service linking chemical and engineering databases in Japan, the United States and the FRG has been inaugurated. The Japan Information Center of

Science and Technology, Chemical Abstracts (United States) and Fiz Karlsruhe (FRG) will provide 40 data bases including one for comprehensive scientific technology, 19 for chemistry and seven for engineering. The US National Science Foundation's new geometry supercomputer project will link researchers in the United States, United Kingdom and France through a telecommunications network. The effort, which will analyse 3-D shapes, could be useful in robotics and automatic object recognition. (Extracted from: Japan Chemicals, 24 December 1987 and Aviation weekly, 4 January 1988)

Forthcoming events

The following events may be of interest to some of our readers:

12-15 May 1988: Philadelphia, Pennsylvania, USA. Beyond Electronic Mail: People and Organizations at Work in A Global Economy. Conference sponsored by the Electronic Networking Association. For registration information: Nan Hanahue, ENA Conference, 2744 Washington Street, Allentown, PA 18104, (215) 821-7777.

Beyond Electronic Mail focuses on innovative and productive uses of computer-based communication. Designed for managers, organizers, teachers, journalists and networkers of all kinds, this conference features discussion of electronic communication in support of planning, project management and information exchange. For additional editorial information: Tom Sherman, ENA Conference, 224 South Chester Road, Swarthmore, PA 19081, (215) 328-9773.

25-29 July 1988: Lausanne, Switzerland. "ECCE 88", the European Conference on Computers in Education will take place at the Palais de Beaulieu in Lausanne. This Conference is organized by the Swiss Federation of Informatics on behalf of the International Federation for Information Processing (IFIP) and will bring together more than 1,000 people concerned with the increasing development of computers in education.

Deep philosophical questions about the role informatics in education are being debated, especially at the elementary and secondary level. ECCE 88 will be a time to pause and look back at what has been accomplished, to discuss new trends and the impact of new technologies, to exchange information between the most advanced and experienced members of our community and those in the early stages of development.

The conference will also be concerned with the use of informatics methods and computer applications designed to help in the solution of educational problems for those with special needs.

At the same time, an exhibition will be set up and all participants as well as the general public will be able to discover and appreciate the nature of products specialized in the field of computers in education (computer-aided learning and its associated disciplines), including specialized books and periodicals. Further information may be obtained from: Organizing Committee: Marc-Henri Cuendet, Case postale 104, CH-1000, Lausanne 9/Switzerland. Tel. (021) 43 62 50/52. Telex 455 757.

12 September - 21 October 1988: Brighton, UK: Study seminar 123: Restructuring industrialization strategies: Microelectronics and new work practices.

This seminar concerns the implications of emerging automation technologies and new work practices for industrialization strategies, particularly those in developing economies. Not only is this a policy issue of major importance, but one of the most important lessons is often missed - instead of recognizing that these emerging technologies offer both opportunities and constraints, prejudice more often leads to an uncritical pessimism or unfounded optimism. So that these issues may be explored in greater depth, the Seminar will take the following pattern:

- The nature of new technology and work practices - this will involve lectures by specialists, visits to advanced British factories, and visits to factories producing automation equipment.

- The selection of a sectoral case study, suitably chosen to reflect the industrial environments of countries from which participants come. In each of these sectors, participants will work in small groups, visiting a range of British enterprises, some of which make use of the most advanced automation technologies, and introducing the new work practices. This will enable participants to observe for themselves the effect of the new technology on inherited strategies of industrial and technological policy.

- After these visits, participants will be encouraged to present their conclusions to their colleagues at a small conference.

Further information on the course is available from: The Chairman, Teaching Area, Institute of Development Studies at the University of Sussex, Falmer, Brighton BN1 9RE, England. Cables Development Brighton. Telex 877997 IDSBTN G. Telephone Brighton (0273) 606261.

II. NEW DEVELOPMENTS

Superactivity in superconductivity

Developments in superconductivity continue to unfold at a stunning pace. In January, participants at a meeting in Boston heard of a new material that becomes superconducting at room temperature. Also, researchers at the University of Houston reported on a relatively high-temperature superconductor that, unlike the other new materials, does not require a comparatively expensive rare earth. Instead, it uses bismuth.

In Boston, 100 representatives from academia, industry and government gathered for the Cambridge Conference on Commercial Applications of Superconductivity, sponsored by World Tech Press (Cambridge, Mass.). So far, the highest confirmed temperature for superconductivity is near 95 K (-288°F) in an yttrium-barium-copper oxide material developed by Paul Chu and co-workers at the universities of Houston and Alabama (Huntsville). Several unconfirmed reports of superconductivity at higher temperatures have appeared. Some scientists even say that they have made materials that are superconductive at room temperature, but their work has met with widespread scepticism.

At the meeting in Boston, a material that is a superconductor at 320 K (117°F) was revealed by Stanley R. Rich, publisher of The Cambridge Report on Superconductivity. The material - lanthanum-strontium-niobate - was made by Tetsuya Ogushi of Kagoshima University (Kagoshima, Japan), who has submitted a paper covering the work to the Journal of Low-Temperature Physics. The Journal will publish a paper on a cruder version of the compound in March.

By definition, a superconductor cooled below its critical temperature, T_c, has zero resistance to electric current. It must also exhibit the Meissner effect, or expulsion of magnetic fields. The Cambridge Report says that Ogushi has detected between 35 per cent and 70 per cent of the Meissner effect found in pure low-temperature niobium alloy superconductors.

Studies at the Central Research and Development Department, E.I. du Pont de Nemours and Company, Experimental Station, Wilmington, DE, of a new high-temperature superconductor identify its formula as $Bi_2Sr_{3-x}Ca_xCu_2O_{8+y}$. M.A. Subramanian et al prepared the new materials and analysed their atomic structures and properties by X-ray diffraction and transmission electron microscopy. Like the two other classes of superconducting compounds (lanthanum and yttrium-barium copper oxides), the new materials have sheets of copper and oxygen; in the new superconducting phases, double copper-oxygen sheets alternate with double bismuth-oxygen sheets. In all of the copper oxide-based superconductors, the copper component is present in mixed oxidation states. The new materials and the lanthanum compounds differ from the yttrium-barium high-temperature superconductors in not having prominent copper-oxygen chains; such chains have previously been considered important for the mechanism of high-temperature superconductivity. The new material begins to undergo a transition to superconductivity (electric resistance drops) at about 116 K and is fully superconducting at 91 K.

The Houston work involves a new compound that exhibits stable superconductivity at temperatures as high as 114 K (-250°F). A team of University of Houston researchers, headed by Chu, says that the new compound, which requires liquid-nitrogen cooling, contains bismuth, aluminium, strontium, calcium, copper and oxygen. The group says that the cost of rare earth elements is about 10 times that of bismuth and that substitution of bismuth will make the material cheaper to produce than existing superconductive materials.

Japanese and French researchers have also reportedly used bismuth as a component in superconductors. The French compound, developed at the University of Caen, consists of bismuth, strontium, copper and oxygen, but it operates at a lower - and less useful - temperature: 22 K (-420°F).

A Japanese group at the National Research Institute for Metals (NRIM), in Tokyo, has developed a sample superconducting material from bismuth, strontium, calcium, copper and oxygen. The substance's electric resistance begins to fall at 120 K (-243°F) and becomes superconductive at 75 K (-322°F). The NRIM material contains none of the rare earth elements and requires simple sintering and other procedures for production, officials report.

Ogushi's work on the compound that becomes a superconductor at higher-than-room temperature is what has caught the scientists' attention. If it is confirmed, says Zafar Iqbal, Allied-Signal solid-state senior physicist, "We have a revolution on our hands". (Source: Chemical Week, 3 February 1988, and Science, 26 February 1988)

New superconducting compound

A compound of yttrium, barium and copper oxide that is superconducting at 300 K has been discovered by A. Erbil of Georgia Institute of Technology. Most researchers doubt that superconductivity can exist above 100 K. P. Chu of the University of Houston says the Georgia Institute of Technology results are probably the result of unstable anomalies. Erbil says his results are stable and reproducible, and that superconductivity has been verified by the 1000 times drop in resistance, the presence of diamagnetism and voltage current curves indicating a Josephson effect. Resistivity fell from 80,000 ohms/sq. cm at 350 K to 80 ohms at 250 K. If all the diamagnetism came from superconductivity, it would indicate that 0.03 per cent of the sample was superconducting. Other researchers doubt that diamagnetism was actually measured. Erbil has not observed the Meissner effect, which is a generally accepted test for superconductivity. Only a few researchers claim to have observed superconductivity at 100 K, let alone 300 K. Some slight increases in the temperature at which superconductivity occurs may be possible with 90 K superconductors after carefully-controlled heating and cooling of the material. (Extracted from "New Scientist", London, 7 January 1988, the weekly review of science and technology)

Breakthroughs for Japan in superconductor technology

Japan has announced another "breakthrough". Researchers at Sumitomo Electric Industries have developed a single-crystal thin film that can carry a maximum current of 2.5 million A/cm^2 at the temperature of liquid nitrogen; high current-carrying capacity is also maintained in a strong magnetic field.

The development breaks the previous record set by Nippon Telegraph and Telephone (NTT) (1.8 million $A\ cm^{-2}$ in July last week) and the technique to make the film differs from that of NTT.

Holmium-barium-copper oxide was sputtered epitaxially on the <100> crystal face of a monocrystal MgO substrate (as opposed to the <110> face of a $SrTiO_3$ substrate in the case of NTT). As a result, the a and b crystal axes of the ceramic lie perpendicular and parallel respectively, to the plane of the film and high current-carrying capacity is thus possible in both the vertical and horizontal directions in the film.

One major problem besetting the development of the new high-T_c superconductors has been their inability to carry high currents under a magnetic field, but Sumitomo's thin film maintains a critical current density of 1.5 million $A\ cm^{-2}$ under a magnetic field of 1 tesla. The current-carrying capacity of the film has remained stable for over a month. Meanwhile a group of Japanese scientists at the Science and Technology Agency's National Research Institute for Metals in Tsukuba has reported a new high-temperature superconductor composed of bismuth-strontium-calcium-copper oxide. The development is unusual in that the new oxide does not contain any rare earth elements.

The new oxide, $BiSrCaCu_2O_x$, when annealed for several hours at just under 900°C, shows an onset in reduction of resistance at 120 K and zero resistance at 75 K. But there is a very sharp drop to almost zero resistance between 107 and 105 K. Dr. Hiroshi Maeda of the institute, whose group made the oxide, suspects that the new ceramic is composed of two phases, one with a critical temperature of 75 K and the other about 105 K.

Magnetic susceptibility measurements show clear evidence of the Meissner effect. The oxide can be made to float in air when placed above a permanent magnet after soaking in liquid nitrogen, the oxide is black in colour but its crystal structure has not yet been determined.

All high T_c superconductors found so far contain rare earth elements, such as yttrium and lanthanum. Japan's Ministry of International Trade and Industry has been allotted ¥140 million (about $1 million) in its fiscal 1988 budget to assess world supplies of rare earth elements because of fears that Japan's supplies

of the elements might dry up when the new superconductors reach the applications stage. Some theorists suggest, however, that it is the presence of Cu-O planes or chains within the atomic lattice that is crucial for superconductivity.

The results of the present discovery will be published in the Japanese Journal of Applied Physics. (Source: Nature, Vol. 331, 14 January 1988 and 4 February 1988)

Superconductor spin-offs

A small research and development company in Sacramento in California has taken out patents on a process for turning high-temperature superconducting materials into commercially useful products.

The company, Ceracon, hopes to sign its first licensing agreement for the process with a firm in the US within the next two months. Ray Anderson, the company's chief executive, estimates that the market for such products is worth $800 million world wide. He wants to sign other licensing agreements in Europe and Japan. Robert Shelton, chairman of the physics department at the University of California, Davis, is taking on another researcher to test products made by the process.

Currently, several methods exist for compacting powdered compounds, like the superconducting ceramics, into industrial products. The difficulty is that these methods take place at high temperatures and pressures for up to 24 hours in some cases. The high temperatures affect the physical nature of the compound, which then loses its superconducting properties.

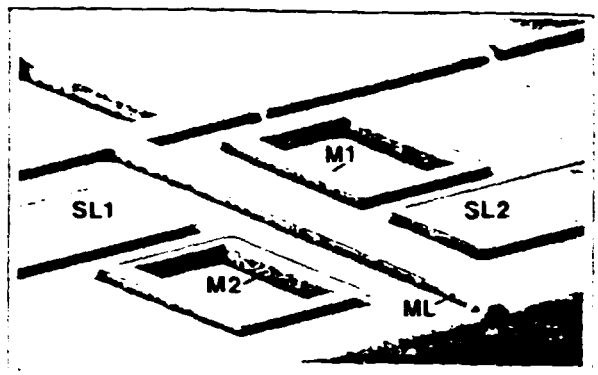
Ceracon has found a way to compact the superconducting ceramic into industrial products at very high pressures, typically, between 690 and 830 kilopascals compared with 240 to 280 kilopascals for today's processes. As a result, the process takes only a few seconds. The material is still exposed to high temperatures, but for a much shorter time, and the ceramic does not lose its superconductivity.

Shelton is providing Ceracon with the superconducting material yttrium-barium-copper oxide. Peter Klavin, a member of Shelton's group says that the preliminary results are very good. Besides retaining its ability to conduct electricity without resistance at temperatures up to 93 Kelvin, the material looks as though it will have a high critical current density. The critical current density is the point at which an increase in current density would make the material lose its superconductivity. (Extracted from: "New Scientist", London, 3 March 1988, the weekly review of science and technology)

Superconductor contact resistivity cut

Researchers have reduced contact resistance three to four times as against conventional contact of normal metallic wire to superconductors, and the connection was achieved under 200°C, which has important advantages over higher-temperature processes, according to J.W. Ekin of NBS and A.J. Panson and B.A. Blankenship of Westinghouse R&D Center. The process consists of minimizing the superconductor surface's exposure to air prior to contact, sputter etching the superconductor surface to remove the degraded surface layer and immediately depositing a thin layer of silver or gold to protect the surface and serve as a contact pad. Of the 14 contacts made using the new process, all have had consistently low resistivity during a four-month exposure to dry air and cycling between room temperature and 76 K. (Abstracted with permission from Chemical and Engineering News, 23 November 1987. Copyright (1987) American Chemical Society)

Optic in a flash



Future computers could be based on elements like the one shown above. This optical logic gate, built by W.J. Grande and C.L. Tang uses the "on" and "off" states of its semiconductor lasers as the raw material of its digital operations. Grande and Tang demonstrate that it can be used in continuous mode for the logic operations NOR, NAND and invert.

The inputs for the gate are the two side lasers consisting of an active medium (SL1, SL2) and a mirror (M1, M2). The output comes from the main laser (ML). The mechanism was first developed in the 1960s. The main laser is coupled to the two side lasers, because its active medium falls within their optical cavities. If either is on, it depletes the population inversion, necessary for laser action, in the crossing zone. For a NOR gate, either laser alone is sufficient to quench the main laser; for NAND, both need to be on. The main laser is continually powered up, and is always on unless quenched. This means that switching times depend primarily on the "cavity lifetime" of the main laser, and could eventually be as little as 10 ps. Other proposed optical logic devices use nonlinear optical effects, requiring high laser intensities and hence high powers. Others use changes of optical wavelength or polarization and require additional external components. Grande and Tang argue that their gate uses less power, is smaller (the micrograph above is about 60 μm across; individual lasers could be as little as 20 μm long) and does not require external components, and so could be used more readily in integrated monolithic chips using current technology. Each gate could be driven, and its output detected electronically; or an entire device could be based on optical logic and communication, with the output of one gate driving the input to one or several other gates. (Source: Nature, Vol. 331, 28 January 1988)

New gate array gets more density with antifuses

Actel Corp., the Sunnyvale, California, company has developed what it calls a user-configurable gate array incorporating an antifuse structure developed with a proprietary technique that combines the ease of programming of PLDs and the density and flexibility of traditional mask-programmable gate arrays.

Actel engineers have described a 2,000-equivalent-gate device built around a one-time-programmable, low-impedance, antifuse circuit fabricated using a 2-μm n-well double-layer-metal CMOS process.

To program an antifuse element, say Actel engineers, an 18-volt signal is applied across its terminals, while all other elements are subjected to no more than half that voltage. The result is a conversion of a high resistance barrier into a low resistance bidirectional connection between segments previously separated by the antifuse elements.

In current PLD technologies, programmability depends on blowing connections between gates in order to configure a function. That works fine in memory

devices, from which the technique was borrowed, where no more than 50 per cent of the elements must be programmed, but in a logic device, as many as 90 per cent of the gates are needed to implement a given logic function. To get around this problem, PLD manufacturers have limited density to no more than a few thousand gates and to a few predetermined logic types.

The antifuse array overcomes this density limitation by establishing the interconnections at predetermined locations in order to implement a particular function. The antifuse structure is at least an order of magnitude smaller than comparable bipolar fuses or most electrically programmable elements.

In the prototype device, the basic building block from which all logic functions are constructed is a configurable logic module. It has eight inputs and one output capable of implementing all two- and three-input variable functions and some four-input variable functions. The module, chosen for its efficiency in implementing both combinatorial and sequential logic, can also be connected to form latches and flip-flops.

The modules are organized like a gate array into rows and columns and separated by wiring channels, but unlike a gate array, the Actel device incorporates segmented horizontal metal interconnect tracks in the channel regions. The inputs and outputs of the logic modules are connected to dedicated vertical metal wire segments, between horizontal metal interconnect levels. Other vertical wire segments, not dedicated to any module output or input, are also provided for vertical interconnection. Antifuse elements are located at the intersection of the horizontal and vertical wire segments and between adjacent horizontal and vertical wire segments.

An antifuse is similar to the vias on a gate array, where large numbers of potential programming sites can be incorporated, with only a small fraction needing to be implemented in any one application. In the 2,000-equivalent-gate prototype developed by Actel, 295 modules containing 112,000 programming elements and 60,000 transistors are incorporated onto a 240-by-360-mil^2 die, equivalent in density to many gate arrays. Similar to a gate array and unlike PLDs, the Actel antifuse-based array needs no predetermined hardwired latches or flip-flops. They can be implemented anywhere in the array to suit the requirements of the application. Also unlike a PLD, the I/O structure can be quite flexible. Any I/O module can be configured as an input, output, or bidirectional I/O at the user's discretion, by simply programming the appropriate antifuse. (Reprinted from Electronics, 18 February 1988, copyright 1988, McGraw-Hill Inc., all rights reserved)

Laser micromachining brings quick prototypes

Elron Electronic Industries has introduced its Quick gate-array development system, which allows a sophisticated operator to produce a 2,500-gate array double-level-metal CMOS array in minutes. A 10,000-gate array can be generated in 90 minutes. The six feet long by four feet wide by five feet high Quick-array system incorporates a neodymium-yttrium-aluminium-garnet frequency-doubled laser that cuts the interconnects to any gates the design will not use. The laser is under the control of a host computer based on a Motorola 68020 microprocessor. Integral to the system are special blank arrays with a proprietary design that modifies the upper two metal layers. These modifications adapt the array to the company's micromachining process. Importantly, the Elron laser micromachining technique can be used only with base arrays that have been modified by the circuit companies in four vital areas - input/output cells, core logic array, core routing, and the core interface with the I/O cells. (Extracted from Electronics, 12 November 1987, copyright 1987, McGraw-Hill Inc., all rights reserved)

Mobile ASAC may do the job in minutes

Lasa Industries has developed its quick-turnaround gate array prototype system that features a laser-based direct-writing technique. The system will be available in the first quarter of 1988, and will be able to produce completely packaged, fully functional application-specific ICs in a few minutes, or for more complex ASICs, a few hours. The system can be operated by unsophisticated users, and it requires no special equipment or plant modifications, except for cabling and power requirements. Lasa's QT-GA system is based on the additive interconnection approach, in which metal lines are put in place by the laser. Specifically, Lasa's laser-initiated method is based on laying down interconnecting metal under computer control with the assistance of GDS-II, the standard formatted layout program implemented by most CAE work stations. Integral to the QT-GA system is a complex multiprocessor control system that fits a card cage above the laser-positioning and process chambers. Two 32-bit Motorola 68020 microprocessors, four 16-bit controllers, control electronics for each of four robotic-arm mechanisms, and eight Mbytes of DRAM for storing and reformatted data from the GDS-II tapes, form the core of the system. (Extracted from Electronics, 12 November 1987, copyright 1987, McGraw-Hill Inc., all rights reserved)

Fast logic gate array

Sony (Japan) has developed an emitter-coupled logic gate array that executes a command in only 80 trillionths of a second. It has several hundred gates, far fewer than slower gate arrays, which have several thousand. The new gate array can be used in minicomputers and supercomputers. (Extracted from Asian Wall Street Journal, 19 October 1987)

Motorola's 80 per cent gate utilization

Three levels of metal interconnection and a new power-bus routing scheme are helping Motorola Inc. redefine the meaning of high density in CMOS gate arrays. No longer must arrays hog huge amounts of real estate or boast a gargantuan gate count to deliver a lot of usable logic.

That is the message behind a new family of triple-metal, 1-μm CMOS arrays from Motorola. The new series promises up to 80 per cent utilization of logic on channelless master slices ranging from less than 6,000 total gates to over 100,000. Comparable 100,000-gate arrays from other companies deliver at most 50,000 usable gates.

The ability to program gates with all three metal layers and the use of a flexible power-bus routing scheme result in more efficient use of logic compared to competing channelless architectures using the third level of metal only for power distribution. This makes for more efficient use of chip real estate.

The new family sports typical internal gate speeds of 300 ps on fanouts of 2 pF at 25°C and 5 V. It also has a flexible bond-pad structure around the periphery that can accommodate either wire bonding or high-pin count tape-automated bonding. Wire bonding offers up to 300 input/output pads having a pitch of 5.6 mils. The current TAB will support a total of 460 ground, power, and I/O pads on a 4.0-mil pitch.

The new HDC family will consist of 10 master slices, spanning from 5,670 to 104,832 total gates. The total die size of the smallest HDC5000 array is 159 mils on a side, and the biggest family member measures only 483 mils on a side. Other channelless arrays in the 100,000-gate range are much larger - as much as 597 mils on a side.

Initially, Motorola's ASIC Division is offering three sea-of-gate master slices for 10,000-gate arrays. Joining those three family members in the

first quarter of 1988 will be arrays for gate implementations totalling 5,000, 8,000, 12,000, 25,000, 45,000, 62,000 and 80,000 gates.

Motorola product managers estimate per-unit prices will fall in a range between $0.003 and $0.008 per usable gate, depending upon package selection and array density. Nonrecurring engineering charges of between $35,000 and $250,000 will be placed on array designs ranging from 10,000 to 100,000 gates. Motorola is launching the series with 12-to-14-week turnaround cycles, from the time customers sign off on a design to the shipment of the first prototypes. The turnaround times are expected to shorten during the coming year.

The HDC series, also dubbed the "Max" family, are made from a process Motorola calls TRIM, which not only stands for triple-level metal technology but also refers to the process's ability to cut the silicon real estate usually associated with large semicustom logic arrays.

Like other channelless array architectures, the new Motorola HDC family uses oxide isolation to separate gates. A primary cell is made up of four n- and four p-channel transistors, which can implement two 2-input NAND gates or logic. The cell can also be used to create 1 bit of single-, dual-, or four-port random-access memory or 6 bits of read-only memory (one transistor per bit). The arrays will support 16-by-9-bit configurations of RAM in up to 16-Kbit densities, or 16-by-9-bit ROM configurations for up to 32 Kbits of storage. (Extracted from Electronics, 12 November 1987, copyright 1987, McGraw-Hill Inc., all rights reserved)

New long-term storage DRAMs

Research Corp. Technologies (Tucson, AZ) is patenting and licensing new gallium arsenide (GaAs) Dynamic Random Access Memories (D-RAMs) that offer long-term storage and nondestructive readout of binary data. The D-RAMs, which were invented by J.A. Cooper and his colleagues at Purdue University, are only slightly more complex to develop than a single transistor, need 20 per cent the chip space of multitransistor static RAMs, and can operate up to 120°C. Also, high-density dynamic memory is made available to GaAs designers through the D-RAMs. The "buried potential well", on which one of the D-RAMs is based, is a buried region of doped GaAs that, although not physically linked to the D-RAM's sole transistor, influences the flow of current through it.

Prototype GaAs D-RAMs can be read an infinite number of times, and can maintain a charge at room temperature for considerably long amounts of time without refreshing. The buried well concept is compatible with both GaAs MESFET and MODFET transistors. It includes an adjustable barrier that stays high for stable storage but can be lowered for simple punch-through information retrieval. The memory cells will incorporate all of the advantages of GaAs, including rapid speed switching, low power dissipation, and resistance to damage by radiation. (Extracted from Electronic Data Processing, 8 February 1988)

A RISC chip this spring

Motorola Semiconductor will offer a reduced-instruction-set-computer 3-chip set in the second quarter of 1988. It was generally known that Motorola was working on a RISC chip set, but the early planned introduction of the product was a surprise. The company will offer a 3-chip set based on the Harvard architecture, and will also offer a complete systems solution, including development software. In addition, Motorola has announced that some 24 customers have committed to its new 32-bit design, with 200 customers still evaluating it. The chip set features a central processing unit, and two cache/memory-management chips. The RISC chips are fabricated with a 1.5-micron double-metal double-polysilicon CMOS scalable process. Importantly, Motorola does not feel the RISC chip set will cannibalize the company's successful complex-instruction-set 68000 family. Motorola marketing director J. Browne sees three possible growth paths for the company: RISC for high-speed applications and new customers; the 68000 for existing users who need to maintain software compatibility; and 68000 users who will use the RISC chips if their market demands it. (Extracted from Electronics, 18 February 1988, copyright 1988, McGraw-Hill Inc., all rights reserved)

One-chip ADCs reach 2 GHz; others hit 18-bit accuracy

Driven by the needs of video and digital signal processing among other things, single-chip ADCs are rising to the occasion, reaching sampling rates of 2 GHz and resolutions of 18 bits, albeit not simultaneously. To stretch that far in performance, however, architectural design alone may not be enough. Indeed, advances in mortar and brick - in the form of advanced processing - are just as essential in some cases.

So, while some designers are busy describing monoliths wrought with such techniques as pipelining, error correction, sampling-and-holding, recursion and folding, others are revealing the biCMOS and leading-edge bipolar processes making possible the techniques or contributing to the speed of operation. One unusual converter, to be described by engineers from Analog Devices Inc., Wilmington, Mass., is highly representative of the new breed. Intended for audio-digital-signal processing and designed by both analog and digital experts, the 10-μs device converts its 14 bits in five successive (recursive) passes through a 4-bit flash subconverter, each time narrowing down its range. It accepts its ac input signal through an on-board sample-and-hold amplifier. To do all that, the chip's circuits are carved from biCMOS - CMOS for its complex logic and output registers, bipolar for its sample-and-hold and other amplifiers.

Another high riser, from Philips Research Laboratories in Sunnyvale, California, is an 8-bit, 100-MHz flash ADC with a twist - it folds its input signal eight times, interpolates some of the more significant bits, and uses the same comparators a number of times. The idea is to cut the number of comparators - to 80 from the 255 conventionally needed - and reduce die size so as to realize the stringent signal and clock timing distribution needed to achieve the high speed.

Still another way to get high resolution (above 8 bits) at the speed of flash ADCs - without the attendant hardware - is with pipelining. One chip that does just that comes from the Electronics Research Laboratory at the University of California, Berkeley. According to designers Senat Ray and Paul Gray, to maintain 13 bits of differential linearity, three stages of pipelining alone were not enough; they had to add a segmented DAC to correct errors. The resulting design could run at 1.5 million samples/s when fabricated in 3-μm CMOS. Instead, the designers chose to optimize for least area. The result: speeds of 250,000 samples/s and dimensions of 1.4 by 1.6 mm.

Pipelining appears again in two other CMOS ADCs. One exhibits high throughput (1 MHz) and linearity (12 bits) with relatively little circuitry. This is achieved by cascading 4-bit ADCs and using a capacitor averaging technique to correct crucial errors. The other strides at 20 MHz and resolves 8 bits by digitally correcting errors and autozeroing its differential comparator/sample-and-hold circuit. The first is a joint effort of the Department of Electrical and Computer Engineering at the University of Illinois in Champaign-Urbana and AT&T Bell Laboratories, Murray Hill, N.J.; the second hails from various groups at Hitachi Ltd. in Tokyo.

Top honours for speed go to Nippon Telegraph and Telephone LSI Laboratories' bipolar flash 6-bit ADC. It samples at a blazing 2 gigasamples/s. Another medal winner, this time for resolution, is an 18-bit performer from NEC Corp. with 105-dB signal-to-noise ratio and 0.003 per cent total harmonic distortion (Reprinted from Electronics, 18 February 1988, copyright 1988, McGraw-Hill Inc., all rights reserved)

How to measure a processor's performance in the real world

Most users of desktop computers are on the lookout for machines that offer more performance, but that desire must be tempered by the realities of a system's cost, size, power consumption, cooling requirements, and other factors. So the goal of computer makers is to design machines that deliver the high performance and still fit a user's budget, operating environment, and desk space. Figuring out the performance of any given system while taking into account all of these variables is hard to do. The Advanced Processor Division of Intergraph Corp. thinks it has come up with a way, using what it calls mips density.

Used alone, mips, or millions of instructions per second, provide only a rough measure of power. A better criterion is VAX mips, with a Digital Equipment Corp. VAX serving as the standard for comparison. The comparison is somewhat more precise in that case, since it provides a constant to measure against. But VAX mips still only measure sheer speed.

Mips density is a far more precise gauge than either raw mips or VAX mips. It accounts for performance, or efficiency, with respect to physical size, power consumption, and cost.

Obviously, the more computing power compressed into a given area, the more dense the machine. With the C300 module occupying just 12 square inches of board area, it delivers considerably more computing power than competing processors, which require more board area to accomplish the same functions. The size of the compute engine is critical because it affects the number of boards in the system. Too many boards devoted to the processor means fewer expansion slots in the machine.

The C300 also provides about 13 times more processing power than a 68020 for every watt of power consumed by the system processor. Excessive power dissipation can drastically alter a system's potential location in an office, its reliability, or its cooling requirements. Finally, the C300 outdoes its competitors at the basic level of cost. It is more cost-effective than the other computation engines by six times or more. (Reprinted from Electronics, 12 November 1987, copyright 1987, McGraw-Hill Inc., all rights reserved)

New chips for fast design

A company in the United States is taking a new approach to creating the computer graphics needed for anything from molecular models to designing and rotating teapots or cars on a screen.

Designing three-dimensional models and calculating, for example, shading and lighting effects as they rotate requires a lot of computer power, and systems that can do this usually contain special graphics chips added to standard microprocessors. But these have a limited number of functions. They can also take several hours to work out successive frames depicting rotating images.

Now AT&T has devised a way of building a powerful graphics system from combinations of many digital signal processor chips (DSPs), which are already widely used in telecommunications equipment.

The system, called the Pixel Machine, relies on two different sorts of parallel processing. One is pipelined parallelism, where each chip in a chain or pipe works on a different part of the same problem. The other form involves an array of processors, each doing the same job but working on different elements of a picture. This method can be used to calculate the shading and lighting effects on each element of a rotating image.

The pipeline of DSP chips has the advantage that users can change software instructions according to the task in hand, making it more flexible than machines based on chips dedicated to specific types of design. Using each chip in a pipe to carry out different parts of the same job is a good method for rotating the image, or for changing the textures on the surface of an image, claims AT&T.

The pipeline first processes information on each frame of a moving image and then passes the resulting data on to the array which can calculate shading effects for each version of the image.

AT&T says that designing new frames of an image of recursive spheres (spheres which are surrounded by smaller spheres which, in turn, are surrounded by smaller spheres) takes less than 30 seconds. (This first appeared in "New Scientist", London, 21 January 1988, the weekly review of science and technology)

Ixys postpones plans for smart-power chips

Last year, it looked as if Ixys Corp. would be the first chip maker to achieve smart-power capability - the combining of low-power logic devices and high-power output devices on the same chip substrate. The San José, California, company planned to put MirrorFET, its high-voltage power device, on the same substrate with one of two low-power pulse-width-modulator chips, resulting in greater integration and savings in board space. However, Ixys ran into problems packaging MirrorFET, and the device has yet to go into production. What is more, the company now believes customers will not buy a combined power and logic chip. So now Ixys has put its smart-power technology plans on hold. Instead it will add additional logic to the MirrorFET: temperature- and current-sensing circuitry.

The two control logic devices, the IXMS150 analog current-mode pulse-width modulator and the IXDP610 digital pulse-width modulator, are already on the market and doing well, but the MirrorFET amplifier has yet to roll off the production line. When it does, it will be sold separately, rather than on the same chip as one of the two pulse-width controllers.

MirrorFET, named for the current-sensing lead that produces a current drain 1/1000th of the actual drain current, ran into a packaging problem while under production. The device, now in preproduction, should be in production in the next few months. (Reprinted from Electronics, 12 November 1987, copyright 1987, McGraw-Hill Inc., all rights reserved)

New breed of bipolar chip being developed

IBM Laboratories (FRG) is working on a new breed of bipolar chip that may lead to the implementation of bipolar design into VLSICs for consumer products, which require low power, and for data processing, which requires high speed. The researchers are developing prototype chips with power dissipation of 50-micro-W and a speed of 800 ps, with even better specifications in the offing. IBM's new complementary-transistor-logic IC does not work on a well-defined base current like conventional bipolar logic ICs. Instead, it uses minority carrier charges to produce the currents for switching the output transistors. This is how it derives its name-charge-buffered logic (CbL). Since

only low dc currents flow in standby, the IBM device's average power consumption is reduced to CMOS levels. The basic CBL IC consists of three diodes and a pnp/npn transistor pair at the output. IBM achieved the 800 ps, 5G-micro-W specifications by using conventional 2.2-micron technology and a 200 Mhz switching transistor. IBM says that a 300 ps, and less than 10-micro-W level can be reached if 1.2-micron features and a 1.5 GHz pnp are used. (From Electronics, 17 December 1987, copyright 1987, McGraw-Hill Inc., all rights reserved)

New RISC processor

Advanced Micro Devices (AMD) will deliver test-site samples of a 25 Mhz Reduced Instruction Set Computer (RISC) processor as of December 1987. The AM29000 chip can operate at 25 mips peak performance, versus Sun Microsystems' new Sparc RISC chip and IBM's RISC chip used in the RT PC computer, which both operate at 10 mips. Also, the new chip can operate three to five times faster than Intel's 80386 microprocessor. It will be used by computer manufacturers as the core processor for low-end workstations, high-end workstations and super minicomputers, primarily in applications such as computer-aided design, manufacturing or engineering (CAD, CAM or CAE), graphics and desktop publishing. For high-end uses, the AM29000 chip can be designed into a workstation for engineers, rather than as general office computers, and best suited for very fast number-crunching and CAD, CAM, CAE and 3-D simulations. Full production of the AM29000 chip will begin in March 1988 and AM29000-based machines will be available in late 1988. A version of the Unix System V operating system, which will be used for the new chip, will be available in late summer 1988. (Extracted from PC Weekly, 24 November 1987)

New method for producing large-capacity memories

Japan Synthetic Rubber and UCB (Belgium) have jointly developed a high-resolution dry developing method and a new resist for producing large-capacity memories. Their so-called "diffusion enhanced silylating resist" technique can produce circuits as small as 0.5 microns. The new JSR Plasmask resist has only one layer but works like a multilayer resist, and maintains patterns even at 572°F. Using Plasmask it is possible to process more than thirty 8" wafers/hour, with better resolution than existing methods. (Extracted from Asian Wall Street Journal, 7 December 1987)

16M-bit DRAM developed and tested

Matsushita Electric Industrial (Japan) is developing a 16M-bit DRAM and has already begun tests. Other Japanese semiconductor producers are still working to commercialize 4M-bit DRAMs. Matsushita expects to begin shipping its new chip by mid-1991. The device uses a printing width of 0.5 micron and has a record access time of 65 ns. It measures 0.15 square inches. Matsushita Electric Industrial is the second company to come up with a 16M-bit DRAM. Nippon Telegraph and Telephone was the first. (Extracted from Asian Wall Street Journal, 4 January 1988)

Silicon sandwich for faster chips

The ultra-fast microprocessors needed for the computers of tomorrow may not consist of silicon, but of a combination of silicon and germanium. Evan Parker and Terry Whall at the University of Warwick are working on a chip that will operate up to 100 times as fast as conventional silicon chips. The new chips also look as though they could be made to emit light. If this proves true, they could be used as the basis for optical computers.

Parker's team has made a sandwich of alternating layers of silicon and germanium only a few atoms thick. They used a technique called molecular beam epitaxy, which enabled them to grow the thin layers in a carefully controlled way.

The addition of germanium results in a structure with properties different to either germanium or silicon. Parker calls it a "designer semiconductor". The silicon and germanium atoms, which have different lattice spacings, take up each other's atomic spacing. This, and the fact that the layers are so thin, creates a compression effect on the layers - comparable to 250 people standing on a tiny silicon chip. Under these conditions, the electrons can move much more quickly through the material. Growing the layers together also creates what is called a "superlattice" effect, where the electrons can be persuaded to move across the bandgap between the conduction and the valence band more easily than in either silicon or germanium.

This opens up the possibility of growing the structure so that the electrons emit light efficiently. The material could be used as a photodetector to receive light and convert it into electronic signals. Varying the amount of added germanium changes the structure and the properties of the chip.

Currently, gallium arsenide is regarded as a good prospect for faster chips. But it is difficult to manufacture and to handle. Parker's chips could take advantage of the highly developed manufacturing techniques for silicon chips. (This first appeared in "New Scientist", London, 7 January 1988, the weekly review of science and technology)

Microchips put themselves to the test

Failure of a chip in equipment for air traffic control or a nuclear power station could cause a disaster. Plessey, the British electronics firm, has now developed a way of designing chips that it says will be much safer for these applications. The chips can test themselves for faults in 0.6 seconds. These tests, according to Plessey, are far more exhaustive than checks currently carried out at the end of chip production lines. They also mean that the chip can be tested as frequently as needed, and is out of use only very briefly. Until now, chips have been tested by putting in signals called test vectors, and checking the output. This process has to be repeated many times to check for all possible faults.

Plessey believes that these chips - the first of which are being used for Navstar satellite receivers - are the only ones in the world to have autonomous self-testing circuits. The ability to self-test is due to a software package called SHADE, which calculates all the ways in which the chip could go wrong. Each fault is described by a digital word - a series of 1s and 0s - and stored on a floppy disc or other memory device. Customers buy the disc with the chip and install the fault library on a personal computer. Each chip has one spare output pin or terminal. To test a chip, users send a digital pulse into this pin. The signal that comes back, basically a string of 0s and 1s, is automatically compared with the library of words on the computer. There is only one word that indicates that the chip is working perfectly. All others tell the user that something is wrong and what it is.

William Gosling, the technical director of Plessey, says that the self-test chips are five per cent slower and 20 per cent bigger than their conventional counterparts. Bigger chips need more silicon and so cost more. But because the chips test themselves, there is no need for conventional testing

equipment (costing $20 million to $30 million) at the end of every production line. The advantages and disadvantages balance out.

Plessey specializes in application specific integrated circuits (ASICs), which are chips that are designed for particular tasks. These are becoming more popular than standard chips. However, each new customer's needs require new design. On average every gate, or collection of transistors, on a silicon chip adds another £2 to the cost of designing the chip. Today's complex chips can have 100,000 gates, and every 500 gates can take a week to design.

Plessey began developing the SHADE package four years ago to try to speed up the design of ASICs, and to make them cheaper. At the same time, the company carried out a study that showed that testing chips by conventional techniques would be so difficult with the very complex chips of the future that it would take the useful lifetime of the chip to do it. SHADE not only tests the chips very quickly, it has brought the cost of designing the chip down to 40 pence per gate. The aim is 20 pence.

Plessey and the UK Ministry of Defence are carrying out final tests of the self-testing chip. Next, Plessey will look for a partner to provide a back-up source of the technology for its customers, by licensing a chip manufacturer, or a software company. (This first appeared in "New Scientist", London, 28 January 1988, the weekly review of science and technology)

One million transistor chip

Intel is developing a one million transistor microprocessor chip, model 80486, a successor to its 275,000-transistor model 80386, and is trying to reduce the average time it takes to design a logic chip to under one year, although critics note that such a deadline could lead to errors that could mean multimillion-dollar delays and embarassment, and compete against firms such as Motorola.

To help hasten the design process, Intel has adopted some basic principles from makers of autos, air conditioners and rifles, who know the merits of building new products from old parts. Intel indexes and stores each feature its designers develop, so a proven feature of the 80386 can be lifted from the electronic library and used for the 80486, even if modified for its new use. However, every set of circuits in the library must be perfect, since an error made in one chip could be expanded in specialty circuits used in everything from cars to ovens. (Extracted from New York Times, 6 January 1988)

New series of 32-bit chips and peripherals

Hitachi, Fujitsu and Mitsubishi have unveiled the first of a series of 32-bit chips and peripherals mainly aimed at engineering workstation makers worldwide. Hitachi said the Gmicro-200 microprocessor unit (MPU) it developed under a development-sharing scheme will be offered in sample quantities in the second quarter of 1988 and output amounts in the third quarter of 1988. The three firms are an ad hoc group sharing in developing the made-in-Japan "Tron" ("Real-time operating system nucleus") microprocessor; Tron was developed by Tokyo University Professor K. Sakamura as a standard architecture for MPUs and personal computers. The Gmicro-200 can support a Tron operating system, Unix systems, and multi-tasking-and-windowing. The Gmicro-200, rated at six mips by EDN benchmark tests and four mips by Whetstone benchmark tests, uses a distributed memory cache, multi-sequence pipeline and horizontal microprogramming. Meanwhile, Fujitsu has developed a direct memory access controller, interrupt request controller and tag memory, all peripheral chips that will be offered in the third quarter of 1988. (Extracted from Metalworking News, 18 January 1988)

New technique for drawing circuit lines

Hitachi (Japan) has developed a technique for drawing circuit lines only 0.3 micron wide. This will enable it to produce a 64 M-bit DRAM. Low-temperature dry etching is used to improve processing precision, and liquid nitrogen is used to cool the silicon wafer to -100°C. This deters chemical reactions between sulfur fluoride and silicon. Hitachi wants to use its new technology to make 3-D semiconductors. (Extracted from Japan's Economic Journal, 29 November 1987)

Electron accelerator for etching chips

Sumitomo Heavy Industries (Japan) will introduce an electron accelerator for etching 16M-bit microchips. It uses a powerful magnetic field to reverse the direction that electrons travel. It accelerates those electrons almost to the speed of light. This produces extremely strong X-rays that can etch 0.5 micron wide circuits on a silicon chip. Sumitomo Heavy Industries claims its accelerator is smaller than conventional equivalents. The device will be available in spring 1988. (Extracted from Asian Wall Street Journal, 18 January 1988)

RAM works at room temperature

Fujitsu has produced a 4 Kbit high electron mobility transistor (HEMT) static RAM that works at room temperature. The device has a 0.5 ns access time, a rate that was achieved by reducing the gate length to 0.5 microns from 2 microns. The 2.7 by 3.0 mm HEMT chip incorporates 29,994 transistors. The chip features four blocks of 1 Kbit memory cells, which are configured in 32 lines times 32 columns in a 1,024 times 4-bit architecture. (Extracted from Electronic Engineering Technology, 19 October 1987)

Electronic beam machine for chip making

Perkin Elmer has developed an electronic beam machine that could revolutionize the making of custom electronic chips. The unit has been installed at the European Silicon Structures (ES2) plant in Rousset, France. The unit writes the pattern of the circuit directly onto the silicon wafer, which has been coated with a layer of resist. (The conventional technique is to expose silicon to UV light through a mask.) ES2 will use the device to make standard cells that are custom designed to carry individual features and performance according to customer specifications. ES2 will offer chips in volumes of up to 10,000 units. Such a small volume usually cannot be economically produced using UV methods. ES2 also promises much faster delivery (two to four weeks) than normal (up to 18 weeks). The Perkin Elmer unit can produce up to 30 wafers/hour, each with 400 circuits. The fastest ES2 machine previously available produced three to four wafers/hour. (Extracted from "New Scientist", London, 15 October 1987, the weekly review of science and technology)

High temperature transistor

North Carolina State University researchers made a microelectronic transistor that operates in temperatures up to 1,200°F. The new chip uses silicon carbide instead of the crystalline silicon usually used for computer chips. Commercial and military applications are being developed by Cree Research, a firm spun off from the university. Chips that are able to withstand high temperatures could be

used to improve the efficiency of engines, chemical reactors and furnaces. Most microchips currently in use stop functioning before the temperature reaches boiling point. (Extracted from Business Week, 25 January 1986)

Fastest computer chips yet reported

NEC Corp. and International Business Machines Corp. both laid claim to the world's fastest computer chips, but of two different types.

In Tokyo, NEC, one of Japan's leading electronics companies, said it had developed a one-kilobit random access memory chip with an access time of 570 trillionths or a second. It is used with superconductors, which require cooling with liquid nitrogen to several hundred degrees below zero.

The chip is five times faster than similar devices and hundreds of times faster than other types of chips with speeds measured in billionths of seconds, the company said. The chip, measuring six millimeters (0.2 inches) square, has a low power consumption.

IBM announced that it had developed an experimental dynamic memory chip, the world's fastest of its kind, with an access time of 20 billionths of a second, three times faster than the current generation of advanced dynamic random access memories, or DRAMs.

IBM said the new development shows that DRAMs can attain speeds approaching those of their high-speed cousins, static random access memory chips, or SRAMs. (Source International Herald Tribune, 18 February 1986)

Rockwell's design used for 8-bit GaAs processor

A new bit-slice architecture lets Rockwell International Corp. move gallium arsenide to LSI density levels in an 8-bit microprocessor. The chip packs in 9,600 transistors on a 4.9-by-3.9mm die - and that is a record level for GaAs density. As a result, the processor built by scientists at Rockwell's Microelectronics Research and Development Center, Anaheim, California attains peak performance of 150 million operations/s at 4.2 W.

In a conventional bit-slice layout, GaAs device densities are too low to reach performance levels needed in some applications. One accepted GaAs design rule, for example, is that no more than two gates can be connected in a series, so inputs are limited. In CMOS technology, as a comparison, multiple-input NAND gates permit much higher density.

To get the higher density that supports greater device speed, Rockwell designers realigned the processor's floor plan on the basis of a bit, rather than a word. With this floor plan, one bit from each of the registers, arithmetic logic unit, multiplexing logic, and the three major internal buses form a bit slice. This slice is repeated eight times.

The key change in the cascadable processing device is an interleaved architecture that packs the register, processing and multiplexing elements tightly together, with the buses serving as the common interface. With such a bus-oriented architecture, its shift-out-carry and shift-and-borrow paths and address/control lines are positioned orthogonally to the eight slices to help save space.

The arrangement of the circuits makes them much more compact than the usual bit-slice organization. Conventionally, functional blocks are fabricated and located at separate locations on bit-slice chips, requiring many interconnections and extensive fanout and causing high line capacitance, but in the Rockwell bit slice, the data flow is so compacted that minimum signal lengths circumvent the limitations of GaAs technology.

The processor features a 31-word-by-8-bit two-port register file and a fast eight-function ALU. Also on chip are an eight-way shifter, an 8-bit address port, and an 8-bit function data port, along with associated control, multiplexing, and interface functions. A lower-power version, which executes 100 mops at 4.2 W, is obtained by slightly varying the process. The chip is fabricated in 1.0 V depletion-mode metal semiconductor FET technology with 1-μm gates at the GaAs pilot line operated by Rockwell for the Defense Advanced Research Projects Agency, Newbury Park, California.

Rockwell designed the processor as part of a chip set to run MIL-STD-1750A instructions, for NASA's Goddard Space Flight Center. A controller chip that is yet to be developed in the GaAs technology will complete the set, which would employ two of the 8-bit slices side by side.

Although the processor is oriented to the 1750A instructions, Rockwell researchers believe the architecture, with its 10-bit microcommand structure, is flexible enough to support other computing applications. A reduced-instruction-set computer is one possibility because such functions as the multiply-and-divide microsteps are comparable to those of RISC. For a 32-bit RISC computer, a configuration of four of the 8-bit slices would be the recommended approach. Researchers also believe that the interleaved layout could serve to speed the operation of silicon devices, and a proposal is in the works to investigate this possibility. (Extracted from Electronics, 18 February 1986)

Laying out mixed chips takes IBM days, or weeks

IBM Corp. has a new way to lay out custom chips with mixed analog and digital functions that cuts the design cycle from weeks to days. The place-and-wire system works on the device level, forming functional logic blocks from smaller "bricks" - predefined rows of transistors and resistors laid out on a silicon master slice.

Engineers in the VLSI Development Group at IBM's System Products Division in Rochester, Minn., report their program can produce 77 per cent or better chip densities and can typically complete a design in less than a day. Manual checking and analysis generally extends the design cycle to about five days.

Unlike other approaches to combining digital and analog circuitry in custom and semicustom chips, the IBM approach does not rely on predefined standard cells. Although such cells can be incorporated into a design, the system's advantage is that it builds circuits from the device level, so each circuit on the chip is tailor-made for its given application.

IBM's heavy emphasis on analog circuitry, which is not easily reused in subsequent designs, makes the standard-cell approach impractical.

The bulk of the master slice is a repeated pattern called a brick. Each brick is made up of two resistor bars separated by three npn transistors and a pnp transistor. There are 1,296 devices on the chip, plus input/output pads, capacitors and some larger transistors that fill out the edges.

For designs with fixed open contacts, the system will automatically connect resistor bars in series or parallel to create different resistor values. Manual controls let designers fine-tune current handling capability and the matching of devices. When movable contacts are used, resistor values are built by placing contacts on the resistor bars spaced in such a way as to produce the required resistance. A connection is then generated between the resistor and the wiring grid.

The program automatically connects devices that require power connections according to a predefined distribution layout. Again, there is a facility to allow designers to manually override the program. The IBM wiring system also puts down electrical nets to either I/O pads or I/O drivers, an advantage over most standard-cell systems that do not give the designer a choice.

This flexibility is what makes the tool so valuable. Without it, time-consuming manual reworking would make some designs almost impossible.

Device-level wiring design does have its shortcomings, however. It cannot, for example, produce chips of the same complexity as standard-cell system because the basic building blocks are transistors, as opposed to gates - which are formed from multiple transistors. The wiring program has so far been used on four designs. The IBM engineers claim to have produced working chips on the first pass in each case. (Extracted from Electronics, 18 February 1988)

New transistor structure for 64 M-bit DRAMs

Hitachi (Japan) has come up with a new transistor structure that it regards as suitable for the production of 64 M-bit DRAMs and other next-generation semiconductors. An impurity is deliberately incorporated into the silicon crystal to prevent short circuits, which sometimes happen because 64 M-bit DRAM chip circuits are less than 0.5 micron wide. (Extracted from Japan's Economic Journal, 9 January 1988)

New application-specific ICs developed

Analog Devices has developed a pair of application-specific ICs that recover data from disc heads at 50 Mbps, double the rate of competing devices. The new chips are expected to ease the bottleneck in disc drive performance. The new ICs also recover data at error rates as low as discrete active components and small-scale ICs. The new ICs are the AD890 precision wideband channel processing element, and the AD891 rigid-disc data-channel qualifier. The chips work together to generate low-jitter, accurately positioned digital pulses corresponding to recorded flux transistions on the disc platter. The devices were fabricated with a 4GHz bipolar process, dubbed Flash, which uses thin-film resistors and complex mixed-signal capabilities. Analog Devices came up with the 890/891 as a result of several influences. These include the targeting of markets where existing technology may be inadequate; the desire to find high-volume niche markets; process technology that permits high-speed, reliable designs; and an understanding of the requirements of disc drive manufacturers. (Reprinted from Electronics, 17 December 1987, copyright 1987, McGraw-Hill Inc., all rights reserved)

New dry-etching method developed

Hitachi (Japan) had developed a dry-etching method that will facilitate the VLSI chip production process. The substrate is cooled to below -100°C so it can be etched in the vertical direction only, without a protective gas. In current etching techniques, gas is used to protect the VLSI from scratches, but this method cannot be used for line widths narrower than 0.5 micron. Hitachi's new low-temperature dry etching method can be used to etch lines 0.3 micron wide, and could lead to the development of 64 M-bit DRAMs. (Extracted from Asian Wall Street Journal, 1 February 1988)

New VLSI component

Synoptics Communications has unveiled a new VLSI component that combines many Ethernet functions on one chip. The new on-board tranceiver gets rid of the need for outbound coupling devices by integrating many functions of Synoptics' Lattis Net unshielded twisted-pair ethernet network. With the chip-level implementation, Ethernet interface card suppliers will be able to offer shielded and unshielded twisted pair functions directly on a network interface board. The shielded and unshielded twisted-pair products are currently available to suppliers wanting to integrate this technology onto IEEE 802.3 Ethernet interface cards. (Extracted from Technology Update, 29 February 1988)

X-rays in chip production

Even more powerful computer chips might be produced with X-rays. By the mid-1990s, the X-ray produced chips will dominate the high end of the $100 billion/year chip market. X-ray chip development is being funded this year with $25 million in US Government funds, but observers say the Japanese and European Governments are spending far more. Giant particle accelerators (synchrotrons) would be used to etch finer semiconductor circuits than ever before. X-ray lithography could produce chips with up to one billion circuits as against the million or so now possible. The increased circuit density would greatly increase computing power and speed.

Building a synchrotron-based chip factory would cost $500 million, according to C.H. Ferguson of MIT. No single firm has the resources to develop the technology. Photo lithography currently used to make semiconductor chips can etch circuits one micron across. The X-ray technique could make circuits 0.1 micron across. X-rays close to the ultraviolet are needed for the technique, but these wavelengths are hard to produce. Synchrotrons are generally huge, but IBM has contracted to have a 20-foot diameter prototype built for $15 million. The FRG and Japan are developing synchrotrons 6 feet in diameter. The smaller machines will use superconducting magnets. Japan's MITI is spending $700 million to build a prototype small synchrotron. Other technical developments needed for X-ray lithography are the development of masks and techniques for handling the wafers during etching. (Extracted from New York Times, 23 February 1988)

High-speed linkages being developed

High-speed linkages to allow computers to transmit huge volumes of information rapidly are being developed by researchers at Los Alamos National Laboratory. D. Tolmie says a standard link is needed to allow any two computers to be linked, allowing them to communicate up to 240 million bits/second. The new Los Alamos link is likely to be adopted by the computer industry as its standard. The channel is a package of wires and IC chips to distribute and control the flow of electrical pulses. A fiber-optic version may eventually be produced. (Extracted from Science News, 30 January 1988)

A torrent of future products at the solid state conference

The annual International Solid State Circuits Conference, convened in San Francisco looks like the best one yet. More than ever, the 31-year-old conference is turning into the leading barometer for reading the future direction of the semiconductor industry and its systems customers. Not only does the ISSCC continue to be the premier forum for reporting on

new technology, but it is now the stage on which chip makers preview major new products slated for introduction any time from the next few months to the next two years. This year's incredibly rich harvest of papers points to the following new products:

- A flood of various memories that push the frontier of density and speed. This year, papers from Hitachi, Matsushita, and Toshiba report on 16-Mbit dynamic random-access-memory designs. Equally impressive are the high-density high-speed static RAMs, including sub-35-ns 1-Mbit circuits from Fujitsu, Hitachi, IBM, Mitsubishi, and Philips, as well as sub-15-ns ECL-compatible BiCMOS SRAMs from Hitachi, Fujitsu, National Semiconductor, and Texas Instruments. These devices make it possible for system designers to rethink the hierarchy of memory storage. For example, 16-Mbit dynamic RAMs mean replacing several megabytes of disk drive with a single circuit. And sub-50-ns static RAMs in the 1-Mbit range can be substituted for dynamic RAMs in the main memory of many 32-bit microprocessor-based applications;

- A slew of specialized application- and algorithm-specific processors performing functions previously handled in software. One particular focus this year is graphics, with specialized processors from General Electric, Matsushita, Nippon Telegraph & Telephone Corp., Toshiba, and Visual Information Technologies;

- A host of analog-to-digital-converter chips that show there is more than one way to get high speed, accuracy, and resolution.

Along with the general trends are the individual achievements. These include:

- Intel Corp.'s introduction of a 4-Mbit ultraviolet-erasable programmable read-only memory. It opens numerous new application areas. A single nonvolatile memory chip will be able to store as much data as several floppy discs;

- Rockwell International's 6-bit-slice, 1-μm depletion MES FET gallium arsenide processor. As well as reaching an impressive level of complexity for GaAs, it runs at 150 million operations per second;

- Actel Corp.'s antifuse-based configurable gate arrays. They could combine the density of traditional gate arrays with the flexibility of EPROM and EEPROM-based programmable logic devices;

- The source of many future chips will be IBM's computer-aided-design system, which is capable of designing chips with a mixture of analog and digital devices and standard cells that have 75 per cent routability. It uses a maze-runner algorithm to generate wiring automatically. (Reprinted from Electronics, 18 February 1988, copyright 1988, McGraw-Hill Inc., all rights reserved)

New digital paper

ICI Electronics (UK) has developed a polyester film that it calls "digital paper". The new paper is intended for an ablative data writing process that uses lasers (originally developed for optical disk drives) to form pits on the paper. The paper can store data for five cents/Mbyte. Potential applications include satellite data acquisition, medical imaging and backup storage of large tape libraries. NASA says that satellite data will be accumulated at the rate of 2.6 terabytes/day in the 1990s. The new film is held on a reel, and the system is easily integrated with IBM mainframes. The polyester-based substrate 25-75 microns thick is coated with an IR-absorbing dye polymer. The medium is nonerasable, and has a life of 10 years. Further development will increase this to 25 years or more. The film can be formed into tape, discs, strips or tags. Optical disk drives to use optical disks of the new material cost about $2,700, against a few hundred dollars for magnetic disk drives. (Extracted from Chemical Week, 24 February 1988)

ASET's image repeater gets down to submicron resolution

In the drive to develop technology that can fabricate integrated circuits with submicron design rules, the image repeater has generally been overlooked, but now American Semiconductor Equipment Technologies Inc. has built a repeater that can handle submicron design rules, giving photolithographic fabrication techniques an important edge in their battle with newer electron-beam methods.

Repeaters, the precision tools used in making photomasks, function similarly to steppers - they project the pattern of a computer-generated design for an IC onto a section of the mask material, then move and project the pattern onto another portion. Besides reproducing the resolution of the design itself, they must be able to move and stop with a high degree of accuracy. ASET's 600 series of repeaters can handle resolution as low as 0.8μm. Its positional resolution - the precision with which the repeater can move to a given position - is 0.1μm, a 50 per cent improvement over the 0.2μm that is standard both with competing repeaters and with e-beam equipment. Along with increased precision, the new repeaters provide significantly expanded stage travel, of 13 by 13 inches, which can produce a mask pattern of this size. By contrast, present systems typically travel only 6 by 6 inches, or 6 by 9 inches at best.

ASET, a Woodland Hills, California, company that builds photolithographic fabrication equipment achieved the improvements by drawing on technology borrowed from steppers. The 600 series includes an entirely new camera and employs high-numerical-aperture Zeiss lenses. The company also totally redesigned the mechanical staging that moves repeaters and the laser interferometer system that monitors this movement. The result is a system that can handle resolution down to 0.4μm over an entire 14-mm-by-14-mm image field, and 0.8μm over 11 mm by 11 mm.

Besides its finer resolution, the 600 series maintains the key advantage of photolithography over e-beam techniques: faster throughput. For typical circuit densities on six-inch wafers, the repeater can make a mask, or reticle, in about five minutes or less. An e-beam system takes several hours. To aid throughput, a reticle changer under program control handles up to four reticles, and can exchange and align each within six seconds. Present image repeaters require 15 to 20 seconds. (Reprinted from Electronics, 17 December 1987, copyright 1987, McGraw-Hill Inc., all rights reserved)

New programmable filter

A new family of microprocessor-programmable switched-capacitor active filters boasts a combination that has eluded filter designers till now: a wide range of programmable features and superior performance. The MAX260 filter series from Maxim Integrated Products Inc. can be reconfigured by a microprocessor to serve as any of a wide variety of lowpass, bandpass, allpass, and notch filters - and there is no need for external components. Under direct microprocessor control are the centre frequency, the Q value, the order of the filter, the resolution, and the type.

The performance of the MAX260 series should open new applications for programmable filters. It features a maximum centre frequency of about 75 to 100 kHz, a four to five times improvement over competitive devices, and a Q value range of 90. Moreover, the centre frequency can be programmed to any of 64 values over its range, while the Q can be programmed to take on any of 128 values over its full range.

Systems designers are searching for satisfactory programmable filters because they find the task of analog filter design bewildering. That is not surprising, given the number of variables and choices going into the shaping of a needed circuit response. After the question of exact shape comes one of filter type, then parameters, and then the choice of implementation - passive or active. Both active and passive filters, once designed in, are pretty well fixed, and with the conventional, nonprogrammable filter, changing the filter characteristics would require a change in components, something digital designers are not prone to do.

Recent attempts to build microprocessor-programmable switched-capacitor filters have met with mixed results. On the one hand, a number of active-filter-based designs have emerged that combine reasonably high performance and microprocessor programmability but only by keeping tight constraints on applications. Such a filter, for instance may be confined to a job in data communications, telecommunications, or instrumentation. On the other hand, some general-purpose switched-capacitor filter designs can be reconfigured under microprocessor control, but only at substantial performance costs compared to traditional switched-capacitor filters. In exchange for this programmability as to type and order, such designs have kept centre frequency to no more than 20 kHz, Q values to 20 or so, and clock frequency to no more than 300 kHz.

Another advantage of the MAX260 family is that it can be programmed as a second-, fourth-, or eighth-order filter. Competitive devices cannot directly implement a second- or fourth-order filter; they require the addition of an allpass filter to bring the order from the eighth to the sixth, fourth, or second. Competitive microprocessor-controlled universal filters operate at clock frequencies that go nowhere near the MAX series rate of 2 MHz. (Extracted from Electronics, 17 December 1987, copyright 1987, McGraw-Hill Inc., all rights reserved)

A new memory technology

A new kind of memory technology, exploiting the well-known but little-used ferroelectric effect, may be the key to the ideal memory device: nonvolatile, fast, dense, and radiation-hard. The technology is about to emerge in the form of products turned out by two startups: Ramtron Corp. of Colorado Springs, Colorado, and Krysalis Corp. of Albuquerque, N.M.

Nonvolatility is inherent in ferroelectric memories, and if these new RAMs deliver the promised read/write speeds and long life, they could largely supplant erasable programmable read-only memories and electrically erasable PROMs. Furthermore, they could be a threat to dynamic RAMs. They are relatively simple - a 4-Mbit ferroelectric RAM could be built without trench capacitors, for example - and it is possible that further development could bring their cost and their read/write times down into DRAM territory.

Although the ferroelectric effect was discovered in 1921, it was poorly understood until the 1960s.

The ferroelectric effect is the tendency for certain crystalline materials to spontaneously polarize under the influence of an externally applied field and remain polarized after the field is removed. Reversal of the field causes spontaneous polarization in the opposite direction. So ferroelectric materials can be modeled as bistable capacitors with two distinct polarization voltage thresholds.

No external electric field or current is required for the ferroelectric material to remain polarized in either state, so a truly nonvolatile ferroelectric "digital memory capacitor" can be built for storing 1s and 0s. Data stored in a ferroelectric memory element can be read by sensing the interaction of an applied field with the element's polarization.

In practice, ferroelectric materials do not polarize instantaneously, and polarization thresholds are not perfectly defined. Most early ferroelectric research concentrated on finding materials with better characteristics. Those efforts were unsuccessful, but now Ramtron and Krysalis, working separately, say they have made the breakthroughs in materials, processing, and circuit design that will turn ferroelectrics into commercial reality. (Reprinted from Electronics, 18 February 1988. copyright 1988, McGraw-Hill Inc., all rights reserved)

Superfast 1 Mbit DRAM

Alliance Semiconductor has developed a superfast 1 Mbit DRAM that boasts a 60-ns access time, and a 100-ns cycle time. The DRAM's high speed eliminates the need for wait states when it is used as the main memory in high-performance 15- to 40-MHz 32-bit systems. The new AS4C1002 is made with a 1.25-micron double-polysilicon single-metal n-well CMOS process. Despite this conservative method, the AS4C1002 is twice as fast as the competing 1 Mbit DRAMs fabricated using similar geometries, and some 25 per cent faster than DRAMs fabricated with submicron geometries. The company attributes the DRAM's speed to circuit design enhancements, including reducing power-supply noise. The device measures 81,000-sq mils, and is small enough to fit in an 18-pin, 300-mil wide plastic dual-in-line package. (Extracted from Electronics, 7 January 1988, copyright 1988, McGraw-Hill Inc., all rights reserved)

The next wave: 16 Mbit DRAMs

Hitachi, Matsushita Electric and Toshiba have developed 16 Mbit DRAMs. Hitachi has unveiled a 16 Mbit design using a transposed data-line structure. Matsushita's chip features an open-line architecture. Toshiba's chip has a unique design featuring a serial 1 Mbit high-speed read/write mode. When these chips are offered on the commercial market, advanced 16- and 32-bit microprocessors will have a memory chip to complement their megabytes of address space. Despite the progress made by the Japanese, technical problems with these 16 Mbit DRAMs must be solved, and introduction of the DRAMs in sample quantities will not take place until 1990. Hitachi has developed a 5 V design with an internal 3.3 V operating voltage for the memory array. The design permits access times in the 60-ns range and cycle times of some 180-ns, with a typical power dissipation of 420 mW. Matsushita's chip has approximately the same access and cycle times as Hitachi's chip, but Matsushita's chip is squeezed into an area of 4 sq. microns. Toshiba's 70-ns DRAM uses a combination of advanced CMOS processing, a new stacked trenched-capacitor cell and a pseudo-open-bit-line layout, to achieve its 16 Mbit density. (Extracted from Electronics, 18 February 1988, copyright 1988, McGraw-Hill Inc., all rights reserved)

High-speed 64K CMOS EPROM developed for use instead of bipolar devices

A 64 K (8K by 8-bit) CMOS EPROM has been developed that has speeds comparable to bipolar devices (45 ns) but with a significant reduction in power consumption.

The process utilizes double polysilicon/double aluminium layers. The two metal layers result in decreased signal line resistances in very compact devices. They also increase the stability of the power lines that supply the bipolar-equivalent output buffers.

The device size is 0.129 in. on a side with minimum geometries of 1.5μm. Much of the speed that is realized is due to the small geometries. A single transistor cell is used as opposed to other high-speed memories that use multiple transistor cells for differential sensing. Fast bit-line recognition is achieved by comparing the memory cell to a reference cell through a differential sense amplifier.

The CMOS device has a standby current that can be reduced further by internal fuses, bringing it down to the 100μA limit on standby. Also, bipolar devices generally have fuses that must be physically blown to test the device. The complete device cannot be tested because the fuses cannot be reconfigured once they are blown. (Extracted with permission from Semiconductor International Magazine, November 1987, copyright 1987 by Canners Publishing Co., Des Plaines, IL. USA)

Intel close to production with a 4-Mbit EPROM

The one-time leader in ultraviolet-erasable programmable read-only memories is striking back. Intel Corp. is unveiling a production-ready 4-Mbit EPROM that outstrips the aggressive efforts of Japanese competitors Fujitsu Ltd., Hitachi Ltd., and Toshiba Corp.

A number of companies, including Intel and Texas Instruments Inc., have entered the EPROM market with 1-Mbit devices. But the only previously announced 4-Mbit EPROM was an experimental 0.7-μm 512-K-by-8-bit device, which was unveiled by Toshiba.

At Intel's programmable memory operations facility in Folsom, California, a 4-Mbit EPROM is being readied for production. Although a formal introduction date is still to be determined, the process and circuit design have been fully tested and devices have been fabricated. The part features an active power dissipation of only 100 mW and a standby of only 50 mW.

Rather than go to a submicron process and scale the entire chip, Intel stuck with its well-understood 1-μm n-well CMOS technology, using one polysilicon and one silicide layer to minimize the RC delay lines of the word lines and peripheral gates. Scaling occurs only in the EPROM cell itself to reduce channel length to 0.45μm. To avoid hot-electron degradation, Intel uses a lightly doped drain process in the peripheral n-channel devices. To get higher current densities without the attendant electro-migration problems that often occur at submicron geometries, it adapted a multilayer film technique used in its standard process. The result is a cell size of only 11.9μm^2, allowing the entire 4-M bit array and peripheral circuitry to squeeze into a chip measuring 84 mm^2.

One important effect of scaling the channel length in the EPROM cell was to decrease the minimum time required for programming to below 10μs per word at the same 12.5-V programming supply voltage used on less dense EPROMs. As a result the 4-Mbit array can be programmed in less than three seconds, without the use of block programming. This speed is equivalent to that of a number of EPROMs of 1-Mbit and under, and better than others.

Because many of the applications of high-density EPROMs are in high-speed 16- and 32-bit embedded-processing applications, a prime consideration was fast access time. Intel targeted 90 ns to allow processors to operate without any wait states. To achieve that, the company modified the high-voltage programming scheme, used a feedback-biasing circuit to improve sensing speed, and incorporated a feedback scheme in the output buffer circuitry to reduce noise. (Reprinted from Electronics, 18 February 1988, copyright 1988, McGraw-Hill Inc., all rights reserved)

Semiconductor lasers come to the fore

Steady increases in output power are allowing semiconductor lasers to infringe on the traditional territory of higher-powered lasers. The first example has just emerged from IBM's Thomas J. Watson Research Center in Yorktown Heights, New York. Researchers there used semiconductor diode lasers to deposit ("write") conductive metal patterns on the silicon and polyimide surfaces used in electronic devices.

Gas lasers can also be used for this but are bulky and expensive. The semiconductor laser is compact enough to be packaged with a microscope. It is also much cheaper - IBM used a commercial single-chip array consisting of many laser diode stripes in parallel. This costs about $1,000 (around £550) compared with about $10,000 (£5,500) for gas lasers used in other experiments.

The laser writes the patterns by heating the substrate to temperatures high enough to break down metal-containing compounds so that they leave metal layers behind. In one variant, the electronic device is put into a cell containing an organometallic compound, which decomposes when it contacts the laser-heated spot. An alternative is to use the laser energy to decompose a metal-containing ink deposited on the surface, then wash away the nonmetallic residue.

Although the ink forms metal films with lower conductivity, the process is simpler because it does not require a special chamber. Both processes are under development for repair of faulty microelectronic components. Laser writing is too slow, and the deposited metal too high in resistance, to make the process attractive for patterning entire circuits. Another possible application is to repair masks used in making semiconductor devices.

The researchers at IBM needed a laser with a power of only 0.2 watts to decompose compounds containing gold. The laser array normally produces a broad beam, but the IBM group focused it to write gold lines as small as 2 micrometres across. They are investigating the prospects for depositing other metals. (This first appeared in "New Scientist", London, 17 December 1987, the weekly review of science and technology)

Cubic BN diodes function as semiconductors

Diodes made of cubic boron nitride that perform the function of semiconductors at temperatures up to 650° C have been developed by the National Institute for Research in Inorganic Materials (NIRIM) Japan. Silicon semiconductors, in comparison, do not work at temperatures above 200° C. If electrode materials can be developed to withstand equally high temperatures, the cubic boron nitride diodes could be used in space, nuclear reactors and other hostile environments. The NIRIM has said it will not attempt to develop the electrode materials alone. (Extracted from Chemical Week, 4 November 1987)

High-pressure reactive evaporation

A process that produces thin films of high-temperature semiconductors at lower processing temperatures and at lower cost versus existing methods has been developed by engineers at Cornell University. The new technique, called high-pressure reactive evaporation, uses beams of high-energy electrons to evaporate yttrium and barium inside a 700° C chamber filled with oxygen at high pressure. Copper, the

superconductor's third component, is evaporated from an electrically heated wire. The vapours deposit, as a thin film of yttrium barium copper oxide, on a substrate of zirconium oxide (which costs about 10 per cent as much as strontium titanate, the substrate used by other researchers). The new technique's lower processing temperatures allow superconducting films to be produced on computer chips with less risk of heat damage to surrounding components. A drawback to the technique is that it is incompatible with silicon substrates. (Extracted from Chemical Week, 2 December 1987)

New high-speed channel developed

Los Alamos National Laboratory (Los Alamos, NM) has developed a high-speed channel (HSC) that may change the way computers are designed, manufactured, and used before the end of 1988. HSC, which is quickly becoming a computer industry standard, is a modest-looking computer communications device that dramatically speeds data between computers. It will provide a quantum leap in how data is handled by computer-intensive markets, such as auto and aerospace design, banking, insurance, medicine, and oil exploration. IBM, Digital, and Cray are among 80 manufacturers of computers and related equipment already interested in HSC. Los Alamos National Laboratory is run by the Energy Department of the University of California. (Extracted from Electronic Data Processing, 18 January 1988)

Matra's RISC design yields a faster controller

A reduced-instruction-set-based controller - the handiwork of Matra Design Semiconductor Corp. and Weitek Corp. - can be configured for 16- or 32-bit operations and run at up to 40 million instructions per second. It can operate as either a full-function 32-bit arithmetic logic unit or as two separate 16-bit ALUs, each with its own register file and execution channel.

On-chip features, such as instruction and data caches, and the 2901 bit-slice-based architecture make the chip 25 to 50 per cent faster than competitive devices aimed at computation-intensive applications in speech processing, robotics, expert systems, and graphics work stations. With two separate ALUs, integer processing power can be doubled in many dedicated applications to nearly 40 mips from 20 mips.

The 2901-based reduced instruction set plays a key role in executing a wide range of embedded control applications. In addition to being able to control its own 16- or 32-bit integer path, the processor also provides direct parallel control over a companion single- or double-precision 32- or 64-bit floating-point coprocessor from Weitek, of Sunnyvale, California. Replacing over 40 integrated circuits in a conventional design, such a two-chip combination can deliver a 50-ns two-stage pipeline or a 25-ns per fetch/execute operation.

The combination of an advanced 0.8-μm CMOS process and on-chip cache memory gives the chip its speed and high level of integration. The controller, which is called the Cxris, for controller having reduced instruction set, incorporates 256 words of 96-bit-wide cache-memory to reduce time delays associated with off-chip instruction cache and 2 Kbytes of on-chip data cache to provide scratch pad memory or extended register file space.

Also advancing performance are the proprietary Fast Bus that allows simultaneous and local access of instructions and data, a two-stage fetch/execute pipeline, and parallel data paths. Available now in sample quantities, the Cxris sells for $280 in 1,000-piece quantities in either a stand-alone 180-pin package, or packaged with a Weitek coprocessor in a single 144-lead pin-grid array.

In addition to the instruction and data caches, the Cxris also incorporates a 16-bit microsequencer, three address generators consisting of two 16-bit ALUs and a 16-bit address counter, as well as a built-in 32-bit barrel rotator which can shift its contents 1 byte in a single-clock cycle.

The Cxris's reduced instruction set consists mainly of 96-bit instruction words three times the width of competitive 32-bit designs. It allows the many parallel tasks to execute in just one instruction, and the microcode structure boosts throughput in each cycle. Also eliminated is the need for a deep pipeline, which is replaced with other performance-oriented circuitry, such as advanced caching.

Another speed enhancer is the Cxris's integration of both data and instruction caches, where most complex- or reduced-instruction-set processors incorporate only the data cache. By containing the instructions most likely to be accessed on any given fetch, the on-chip instruction cache eliminates the typical time delays of 100 ns or more associated with an off-chip cache. What makes this possible is Matra's area-conserving advanced 0.8-μm CMOS process. (Extracted from Electronics, 4 February 1988, copyright 1988, McGraw-Hill Inc., all rights reserved)

Smart power technology

The excitement surrounding the development of semiconductor "intelligence" over the last ten years has focused on microprocessors and on the other large-scale-integration (LSI) "logic" circuits. This has diverted much interest away from corresponding developments in power semiconductors - those capable of providing electrical outputs large enough to drive such real-world devices such as motors, solenoids, lamps etc. For all the rapid improvements in their technical specification over the last few years, these power semiconductors have logically remained more or less at the level of individual transistors, as opposed to the 500,000 or more transistors that go to make up the "intelligent" LSI logic devices.

All this is changing, thanks to a new development in semiconductor design that has become commonly known as "smart power". As the result of new semiconductor fabrication processes, a single integrated circuit can now combine both the minute transistor of the LSI logic devices and the more muscular power-handling transistors typical of power semiconductors, so providing both logical and power-handling functions within the same "chip". Because of this the new smart power devices can, at a minimum, greatly reduce the number of integrated circuits needed to perform typical engineering functions. Beyond this, however, the new smart devices also open up the opportunity for engineering designers to develop new forms of engineering systems based around the devices' "intelligent" power-handling capabilities.

The first of these smart power devices are now coming into practical use. Not surprisingly, these initial smart power products and the applications in which they are being exploited are relatively uncomplicated, with voltage regulation and thermal protection being typical examples. This relative simplicity should not disguise the fact, however, that even the current smart power semiconductor fabrication processes are capable of providing considerably more "intelligence" on each smart power chip than even the most advanced of today's applications can use. In other words, the real limitation on the sophistication of even current smart power products lies not so much within the devices themselves but outside - in the ability of engineering designers to make full use of smart power intelligence.

When used to implement specific forms of speed and position control, particularly with electric motors, the potential of smart power devices is even greater.

With very little practical limit to the degree of on-chip "intelligence" that can be added to current smart power devices, complex control functions can readily be supported. For example, a microprocessor controller can simply transmit to a bus-based smart power device both the required final output voltage and the required rate of change, leaving the device to control the overall change in output accordingly. Even with simple open-loop control of the load, this kind of approach is capable of considerable sophistication.

Where closed-loop load control is provided, by feeding back tachometer or other sensor outputs directly to the smart power device itself, more complex and even full PID control is also possible - with only high-level involvement being required from the system's microprocessor, which is therefore freed from all involvement with the control loop itself.

Given current developments in exploiting microelectronic "intelligence", however, full closed-loop control can increasingly be provided without the need for separate transducer inputs. By analysing the instantaneous currents flowing through the load, smart power controllers with appropriate on-chip programming can increasingly detect load responses. Taken further, this can develop into complex "signature analysis" of a load's characteristic operating conditions, which can also be used to detect and respond to incipient load failures.

One of the main limitations of smart power products is that the smart power manufacturers are subject to the problem of "application specificity". Because of their nature, most potential smart power applications require devices that are more or less specific to the particular kind of application under consideration, and the more complex the function the smart power device is required to perform the more specific to the individual application its design is likely to be. Only the simplest smart power applications, therefore, such as voltage regulation and thermal protection, are likely to be widely applicable enough to generate the volume demand that makes low-cost production of any semiconductor device commercially practical. The emergence of more complex smart power devices on the general market is therefore likely to be delayed until this problem receives some effective solution.

One solution to this problem, and the one that is being most actively pursued by the semiconductor manufacturers, is the stimulation of new mass markets for more complex smart power devices. There may be some scope for this in the consumer-electronics market, but the real key market for future smart power developments is undoubtedly that for automotive electronics. Already, practically all the major semiconductor manufacturers, often in collaboration with the major vehicle manufacturers, are developing whole ranges of "smart power" products designed for the new generation of automotive-electronic systems. These new products, nearly all of which are based on new designs of in-car bus, include controllers for vehicle lights, solenoids for engine control, motors for ancillary functions etc. If and when such products come into widespread use for new car production, they and their adaptations are likely to become widely available for more general design applications at extremely attractive prices.

Another alternative to the "application specificity" problem associated with smart power devices is to adopt semiconductor design techniques that allow what are effectively application-specific devices to be produced economically in small volumes.

Typical techniques that are already being used in the same power field include the use of standard-cell libraries to allow a designer to customize functions on the final smart power chip from a library of standard offerings.

Semiconductor industry figures estimate that smart power sales will be well into the $1 billion/year range by the early 1990s, which is good news not only for the manufacturers of the new smart power devices but also for all the engineering designers who will be able to exploit them to add a whole new flexibility to their new designs. Inside engineering systems, in the car, in the factory and even in the home, this new era of flexible, low-cost and above all "intelligent" electrical power handling will make smart power technology one of the most far-reaching engineering developments of the 1990s and beyond. (Extracted from Engineering, November 1987)

Special metals in electronics

Beyond the common conductors, a handful of expensive metals possess special properties that are indispensable to progress in electronics. These special metals find application in optical as well as electronic devices at raw-material purities as high as 99.999 per cent or higher. The demand for these elements and their compounds is linked directly to the advancement of electronics technology across a broad spectrum.

Tantalum: dominant electrode

Tantalum is used to make high-quality, compact electrolytic capacitors - an application that amounts to half the free world's annual demand for Ta_2O_5. Carbide cutting tools, chemical tank linings, and high-temperature alloys are other major tantalum markets.

Sintered electrodes

The tantalum electrode is made of sintered powder. The total surface area is anodized, and the remaining space in the highly porous sintered body is filled with MnO_2. Current technical efforts focus on producing tantalum powders with the highest surface area while optimizing physical properties that permit a low sintered density (high porosity).

There is active competition to produce powders that offer ever-higher volume efficiency (surface area) combined with physical properties that allow high-volume production at low finished density. Tantalum powders usually have surface areas on the order of 0.4-0.6 m^2/g (BET), but the industry describes the material in terms of electrical performance in units of CV/g.

Since anodized film thickness is a function of the voltage used, and capacitance varies inversely with thickness (making the product of capacitance and anodizing voltage relatively constant), CV/g provides easy comparison of tantalum powder performance. Tantalum powders worked at 1,000 CV/g in 1960, but this increased to 4,000 in 1970, and to 10,000 in 1980. Today, devices are produced in volume at 12,000 to 15,000, with reported production above 20,000 CV/g.

Efficient use of expensive tantalum is the key to effective competition with lower-cost capacitor materials. The dramatic reduction in average anode weight that has taken place reflects the use of higher CV powders and increasing production of smaller capacitor ratings.

Tantalum and niobium oxides: key additions

Tantalum and niobium oxide additions to the $BaTiO_3$ used as a ceramic capacitor insulator reduce device temperature dependence. $BaTiO_3$ materials, as used in the MLCs are expanding in importance.

Tantalum, niobium, tungsten, and lead oxides are combined to produce relaxor dielectric materials and ceramic capacitors. These tantalates, niobates, or tungstates have a perovskite crystal structure, and can

be tailored to specific needs. These materials offer high dielectric constants (15,000-20,000) compared to $BaTiO_3$, and offer better volume efficiency.

Crystals are produced by reacting Nb_2O_5 and Li_2CO_3, and pulling a single crystal (Czochralski method). Today, 75-mm (3 in.) diameter crystals are standard. Wafers are cut and polished by conventional methods. Circuits or metallic transducers are deposited on the wafer surface. In a piezo function, the electrical input is transformed into physical activity in the crystal, then transformed back into electricity at the output, providing a signal delay, a frequency change, frequency filtering, etc.

$LiTaO_3$ has better temperature stability, but $LiNbO_3$ is less expensive and generally more efficient. As such, $LiNbO_3$ faces an exciting future as design engineers develop new circuits that exploit its properties. Oxides for this use have tight specifications on purity and physical properties.

Yttrium also has gained attention of late as the most popular rare earth of several suitable for use in the new oxide ceramic superconductors. The most celebrated compound is $YBa_2Cu_3O_{7-x}$, but it is too early to tell whether this application will demand large quantities of yttrium.

Gallium and indium for the new electronics

Gallium arsenide and phosphide continue to show impressive growth. Free-world consumption of high-purity gallium is now about 50 tons per year. Use in 1995 is forecast at 500 to 1,000 tons per year, a broad range that depends largely on the speed with which computers incorporate new high-performance electronic devices that use gallium arsenide.

Computer advantages

Of the compound semiconductors, GaAs is under the most intense development as a functional material for transistors and integrated circuits (ICs). GaAs ICs operate faster than silicon components, and are "radiation hard" (resistant to damage from ionizing radiation) - an obvious advantage in military systems.

Semiconductor compounds containing gallium appear to have a firm base for future growth, with a large portion of the work in Japan. Gallium is a by-product of the aluminium industry, and arsenic usually is found in copper and zinc ores. Scrap utilization is similar to that of silicon (and earlier, germanium), so that an active GaAs scrap recycle business exists.

AT&T Bell Laboratories is now talking of computers that process information by photons rather than electrons. This will give obvious increases in operation speeds. GaAs and AlGaAs are reported to be suitable for SEEDS (self electro-optic effect devices), or "optical transistors". These devices would fit in well with signal transmission via fibre optic cables. Technical competition between photonics and electronics is accelerating.

Magnetic bubbles

Oxides of gallium and gadolinium are used to produce single crystals of gadolinium gallium garnet (GGG) for "bubble memories". These devices, which store information in tiny magnetic domains or "bubbles", are "non-volatile" in that the information they contain is not lost during a power failure.

GGG crystals, pulled vertically from an iridium crucible, are ground, cut into wafers, lapped, and polished. The small magnetic domains reside in a layer of selected rare earths formed by liquid phase epitaxy (LPE). Oddly, the high-purity gallium oxide required is produced by the hydrolysis of recrystallized gallium metal. Typically, the Ga_2O_3 used is 99.99 per cent pure.

Germanium for infrared transparency

Elemental germanium finds its major use in infrared windows. Germanium has relatively high transparency to long-wavelength infrared (8 to 14 μm), and is the preferred window for devices or systems seeking warm bodies, internal-combustion engine exhausts, etc., where the temperatures are below 500° C (900 °F). Silicon is useful for windows at red heat, such as jet-engine exhausts, etc. These windows, the major market for the germanium industry, are polycrystalline with large grain size.

Tellurium: active component in passive sensors

Military heat-seeking systems require a photovoltaic element, and tellurium plays an important role in the compound semiconductors used for this purpose. The photovoltaic element, cooled by liquid nitrogen in a vacuum envelope, receives infrared radiation through a germanium optical system. Photovoltaic materials used include PbSnTe, InSb, HgCdTe, and others. Consumption of HgCdTe (called MCT), the most popular for this use, has grown to several tons per year. (Extracted from Advanced Materials and Processes Inc. Metal Progress, November 1987)

In-process wafer test and measurement

The last few year have witnessed an explosive increase in the sophistication of process control techniques used in wafer processing.

Major investments in equipment development, traditionally directed toward improvements in wafer processing equipment, are increasingly going into development of instrumentation for better ways of monitoring and controlling wafer-processing production.

The reasons for this trend are rooted in both economics and technology: process control is cost-effective because it increases device yields and performance. It also enables semiconductor manufacturers to produce more complex integrated circuits that, in turn, require more process control.

Engineering awareness

Today, semiconductor engineers have a growing list of techniques, most available in commercial instruments, to test or measure many of the important process control characteristics in wafer production.

The choice of characteristics to monitor is based on need, correlation, timeliness and costs. Process control characteristics that fluctuate excessively must be monitored, and if the causes of these fluctuations are known, the variables causing the fluctuations should be monitored also.

As semiconductor devices become more complex, the wafer processing required for their production becomes more sensitive to variations and a wider variety of process control characteristics must be monitored. This increasing sensitivity to process variations is the primary force behind the increased use of process control evolving in semiconductor manufacturing today.

For the process engineer, it will become increasingly important to know how each of the techniques of in-process test and measurement characteristics and techniques can be used most effectively.

For example, some process characteristics are impractical to measure directly, making it necessary to monitor a secondary characteristic that has been shown to correlate with the desired one. The higher the degree of correlation, the more useful the monitored characteristic is as a means of controlling the process.

Time-consuming procedures, or tests requiring lengthy data analysis, might be useful for setting up new processes or for trouble-shooting existing ones, but they are hardly practical for controlling processes that need rapid feedback. Computerized data analysis has made techniques such as residual gas analysis (RGA) practical for real-time process control. Other techniques, such as automated measurement of critical dimensions (CDs) and film thickness, although still not fast enough for real-time control, have been made vastly more effective by shortening delay times and by making larger sample sizes practical.

Cost-to-benefit relationship is the final determinant in choosing particular in-process control techniques. When choosing between techniques with little difference in effectiveness, it generally makes sense to use the less expensive method.

Until recently, there were so many poorly controlled processes in semiconductor manufacturing that it was often fruitless to control particular process characteristics too tightly. The small added benefit would just be lost among other poorly controlled characteristics. But with widespread improvements implemented in the last few years, the elimination of small individual errors becomes more beneficial. In a poorly controlled process, a few improvements do not help much, but in a well-controlled process, a few small errors can cause much harm.

Current developments in in-process wafer test and measurement appear to be headed in the right direction. Increased automation, emphasis on operational cleanliness and the ability to monitor a growing number of characteristics all bode well for meeting future requirements.

In the future, real time direct feedback of process control data will allow the industry to make truly effective use of process monitoring. It is not necessary, and might not be desirable, to implement total interactive control of an entire manufacturing operation. Real time feedback can, and should, be implemented in small steps. Much of the hardware and software required to begin the task is already available.

More extensive use will be made of process modeling. Some of the most critical controls required today are the result of our own lack of flexibility in the way we define processes. Through more intelligent use of models, we could maintain process balance while allowing specific parameters to drift through wider ranges than can curently be tolerated.

As the needs for new process monitoring tools become recognized, equipment vendors will continue to supply them. However, better communications between vendors and users could significantly shorten the lead time for these new products. Too often there are problems looking for solutions while, simultaneously, new techniques are going in search of applications. Technical and trade organizations should devote some degree of ongoing effort towards identifying the kinds of tools that are needed and trying to match those needs with potential solutions.

Process control functions will become more closely integrated with manufacturing processes. Eventually, the distinction between the two will begin to fade and it will become difficult to separate one from the other. We are still a long way from having processes that control themselves, but future trends will almost certainly be in that direction. (Extracted with permission from Semiconductor International Magazine, January 1988, copyright 1988 by Canners Publishing Co., Des Plaines, Il. USA)

VLSI packaging and assembly

With the semiconductor market recovering, nearly all IC package types will experience growth through the balance of the 1980s (see table): Packages with >28 pins should grow at a unit rate >30 per cent compounded annually. Plastic and ceramic dual in-line packages will experience moderate growth through 1990, still accounting for nearly three-quarters of all IC packages; on the other hand, small outline integrated circuits (SOICs), plastic leaded chip carriers (PLCCs), plastic quad flat packs (PQFPs), plastic pin grid arrays (PPGAs) and ceramic chip carriers will all experience growth rates from 27-90 per cent annually.

Surface mountable IC packages should, at last, experience phenomenal growth, achieving 26 per cent of the total IC packages by 1990 (a 62 per cent CAGR). This growth will be fueled primarily by SOICs for 28 pins and below, PLCCs for pin counts from 28-64, and PQFPs for 84-164 pins, and by tape automated bonding (TAB) above 164 pins. Gullwing leads will continue to be the most popular surface mount configuration (by 1990, 82 per cent of total surface mount IC packages, compared to 10 per cent for "J" lead). Leadless packages will decline in popularity.

Table 1. Worldwide Integrated Circuit Packaging Trends 1990 vs 1985

Measurement	1985	1990	Compound annual growth rate (CAGR)
Total packaged IC (millions of units)	14,780	24,953	11%
Package trends by pin count (% of total)			
<28 leads	97.2%	93.9%	10%
28-68 leads	2.7%	5.7%	29%
>68 leads	0.1%	0.4%	47%
Package sales by pin count (% of total)			
<28 leads	75%	45%	-0.4%
28-68 leads	21%	32%	30%
>68 leads	5%	23%	50%
Package trends by package type (% of total)			
PDIP & CERDIP	95.7%	73.3%	5.3%
SOIC	2.0%	18.5%	73.3%
PLCC & PQFP	0.3%	4.2%	68.2%
Ceramic chip carrier	0.7%	2.3%	40.9%
Flatpack	0.5%	0.2%	-7.0%
PGA	0.1%	0.2%	27.5%
Others	0.7%	1.5%	29.3%

(Sources: Insight Onsite, Rose Associates and Indy Electronics)

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Light measures fast electronic circuits

Ultrafast integrated circuits can produce electrical pulses that cannot be measured in conventional ways. This poses a problem for engineers developing the circuits.

Now Janis Valdmanis of AT&T Bell Laboratories in Murray Hill, New Jersey has found a solution. He has devised an electro-optical measurement technique with a resolution of 0.3 picosecond - that is a hundred times faster than the sampling oscilloscope now widely used for fast electrical measurements.

Valdmanis takes advantage of the extremely high speeds of optical interactions. He places a tiny lithium-tantalate crystal probe, 40 micrometers across at the tip, close to the surface of the integrated circuit. Then he fires pulses of laser light, each lasting 0.1 picoseconds, through the crystal. The tip is coated to reflect the pulses of laser light back to a high-speed detector. Electric fields from two-dimensional electrode structures on the integrated circuit rise above the circuit plane, and pass through the probe. These fields change the refractive index of the lithium tantalate, and thus alter how much light is reflected back to the detector.

With the probe tip 20 micrometers above a test circuit, Valdmanis measured electrical pulses with a risetime of 0.3 picosecond. The laser light can be focused onto a 5 micrometer spot, allowing extremely precise measurements.

Similar electro-optical techniques have been used to measure electric fields before, but the application to integrated circuits is new. Most prior optical sensors of electrical fields have measured high-voltage fields that change comparatively slowly.

Because it does not depend on the integrated-circuit material, the AT&T technique can be used on circuits fabricated on different types of substrates. It also needs access to only one side of the integrated circuit, so it can probe packaged circuits as well as wafers. (This first appeared in "New Scientist", London, 4 February 1988, the weekly review of science and technology)

New polymer films over versatile switch designs

New piezo/pyroelectric polymer films are offering engineers nearly unlimited versatility in switch designs, according to J.V. Chatigny and E. Tom, both of Pennwalt's (Philadelphia, PA) Kynar Piezo Film Dept. The film, made of specially processed polyvinylidene fluoride shows the highest piezoelectric and pyroelectric activity of any known plastic so far. The film thus reacts to stress/strain or heat by producing a voltage and conversely the film responds to a voltage input with a mechanical deformation. In recent years, many ingenious piezoelectric switch designs have been unveiled. The technology can be applied with variations in dimension, substrates, metallization patterns and design concepts, thus bringing in new products. (Extracted from Design News, 23 November 1987)

Parallel lines converge

The next generation of powerful supercomputers will work by yoking many microprocessors together and getting them to co-operate. Such parallel computing is an idea whose time has come. But it has problems. Some believe they can be overcome by building up the number of processors slowly and adding more only after simpler designs have been mastered. Others want to jump straight to computers with thousands of parallel processors.

The principle behind parallelism is disarmingly simple: two processors should do a job twice as quickly as one. Although this holds true for simple tasks - such as adding up several columns of figures at once - computer programs are not so straightforward. They contain thousands of different tasks, and the result from one is often needed to finish another. This is where parallel computers run into trouble. When one processor needs to use another's results it has to talk to its colleague, in order to discover when that result will be ready and where it will be found. Such chit-chat between processors gets in the way of their sums.

With only a few processors to worry about it is easy enough to divide the work tidily among them so that such chatter is minimal. But as the number of processors increases, policing the division of labour becomes trickier. After a certain point (either 32 or 64 processors, depending on the job) the chatter grows to a din. The processors then spend more time telling each other how far they have got with their tasks than they do solving them. Most experts argue that a successful parallel machine needs a clever "compiler", which parcels out instructions to the processors. The compiler can seek out sections of a program which can be done without chit-chat between processors.

The majority of established supercomputers therefore work with a few high-powered processors. Of the 80 or so supercomputers that could work on different bits of the same sum in parallel, only one is known to do so. That is the one responsible for Britain's medium-range weather forecasts. Perhaps more do, but they are unknown.

Better and better compilers are the strength of the conservative approach to parallelism. They will let new computers run programs that have been developed for old machines, "parallelising" as they go. But some anti-evolutionary heretics predict a millenarian upheaval. They are the harbingers of the massively parallel computer.

These have more than 1,000 processors. As well as being too fond of chit-chat, massively parallel machines have problems with memory. Processing power and memory are usually kept separate and connected by a "bus". When information is required, the processor summons it along the bus. With thousands of processors clamouring for attention, the bus clogs up and the machine grinds exceedingly slow.

The problems may be solved by two massively parallel machines, the Distributed Array Processor (DAP) built by Active Memory Technology based in Reading, England, and the Connection Machine built by Thinking Machines from Massachusetts. These have 1,024 and 65,536 modest processors, respectively.

In the massively parallel machines, each area is the responsibility of one processor with its own private memory. Its neighbours will be responsible for the adjoining bits - so each processor can find out what it needs to know just by talking to its neighbours. This is quicker and quieter than shouting to processors on the other side of the computer. Many natural processes can be mapped on to a parallel computer in this way.

The other trick they use is to take a lesson from parade-ground discipline. In a DAP or a Connection Machine a master processor broadcasts the same instruction to all its troops at once. When everybody has finished their sums, the next command is bellowed. So the processors both stay in step and know where they stand.

However, not all of mathematics is as easy. Sometimes programs rely on approximations. In such problems there will be some bits that need lots of repetitions and some easy bits that require only a few. This means that the speed of a massively parallel machine will be determined by the speed of the slowest processor at each step.

Another way of building large parallel computers appeared in the early 1970s from Dr. Iann Barron, working at INMOS. He was worried by the communication problems that occur when normal processors are hitched in parallel, and set out to design a chip that would meet them - the transputer. It has two advantages: its own store of memory, and circuits that are designed to talk to other chips. By silicon legerdemain, it can receive four messages and send out four of its own at the same time, while continuing to compute.

Meiko, an English company based in Bristol, makes the Computing Surface, which can be fitted with any number of transputers. Floating Point Systems from Beaverton, Oregon, markets a machine that uses 4,096 of them. They use more silicon than the Connection Machine or the DAP - each transputer has to carry its own copy of its part of the program - but they can work much

quicker because each processor is smart enough to move on to its next task without waiting to be told. While the other machines are square-bashing recruits, the Computing Surface is a commando squad.

Programs written for these machines can get results as quickly as a Cray and at much less cost. Most scientists in industry and universities, however, are interested in solving real problems, not in abstract capabilities. They have spent 40 years perfecting programs that run on traditional machines. To switch over to massively parallel machines would require new programs, which might involve years of expert rewriting. The companies who make massively parallel machines say a switch is easier than people think. But they do not have the staff to travel with their machines and help customers manage the transition from old to new. For scientists, it is more tempting to rely on the clever compilers found in conservative parallel machines.

As compilers become cleverer, computers should become more parallel. Then the massively parallel machines will spread out from their niches in applications where conservative supercomputers are not so strong, such as image processing. For the next five to ten years, the market will probably be Cray's. Then the real competition will start. (Source: The Economist, 6 February 1988)

Dielectric failure detection

A technique for detecting dielectric film faults in packaged integrated circuits has been developed by KLA Instruments (Santa Clara, California), a manufacturer of image systems for the semiconductor industry.

The new technique combines optical microscopy, computer image processing techniques and night vision technology to inspect and locate defects associated with dielectric failures. The technique is incorporated in the EMMI (emission microscope for multilayer inspection) system, recently announced by the company.

According to KLA it has previously been difficult to pinpoint the exact location of these dielectric defects which include: process or structure induced oxide breakdown, random failures, ESD damage, latch-up conditions, saturated transistors, impact ionization and electromigration voiding areas. These defects can be located with the new technique, typically within 5 minutes or less with precision of $\pm 1\mu m$.

The technique cannot, however, detect spiked junctions, metal shorts, poly shorts, very heavily damaged oxide and any defects lying under extremely wide metal layers.

The basic function of the technique is to identify the photon emission associated with various modes of electrical test. Some of these emissions are indicative of device failure by current leakage through dielectric isolation film materials used in building layered semiconductor structures. These layers commonly include silicon oxide layers and passivation layers. The problems are typically referred to as "oxide rupture" and "junction breakdown". Another observable problem is referred to as "hot electron effect" that occurs when transistors are switched.

Since the EMMI technique is specifically tailored to detect certain types of defects, it can find them much faster than the mechanical and contactless probing techniques now used for design debug and failure analysis. The EMMI can be run by a relatively unskilled operator and can typically pinpoint defects within two to six minutes. If the operator has no prior information concerning the specific area of the defect, the DUT is positioned so that the entire die is shown within the field of view of the camera. At 1X magnification, the operator can inspect a die slightly larger than 1 cm x 1 cm.

After finding the "bright spots" in the macro view of the die, the operator can zoom in to a desired defect (at the selected magnification) by simply pointing to the bright spot in the overlay image. With this information, failure analysis engineers can locate the IC layer and determine the probable cause of failure by consulting the composite layout of the device tested. Alternately, it can be determined if the failure is process related. (Reprinted with permission from Semiconductor International Magazine, January 1988, copyright 1988 by Canners Publishing Co., Des Plaines, IL. USA)

Diamond thin films for transistor and IC manufacture

Diamond thin films were discussed in several papers presented at the recent Materials Research Society Fall Meeting. These films have received much attention recently. They are of interest to IC manufacturers because of their extreme hardness and their ability to protect ICs from moisture and corrosion. Manufacturers are interested in diamond transistors for use as high power, high frequency devices, with the ability to function at high temperatures.

The diamond films are being deposited using microwaves to excite a hydrogen-methane gas plasma at Penn State University, University Park, Pa. A frequency of 2.45 GHz and pressures of 10-90 Torr are used. Gas flow rates are 100-500 sccm and the temperature is 950-1050° C. A film 1μm thick is deposited in about one hour using this process.

The films are characterized using Raman spectroscopy to determine if they are actually diamond. Researchers at Penn State report that the Raman spectrum gives a distinct peak at 1332 which is the fingerprint of diamond. X-ray diffraction has also been used to verify the diamond film.

The diamond film deposition rate decreases as the temperature increases above 1000° C. Some graphite often forms during diamond deposition. Graphite is a conductor, thus the film would become conducting rather than insulating. Because the graphite bonds are much more reactive than the diamond bonds, graphite can be etched away selectively using a hydrogen plasma.

The diamond films are very hard, electrically insulating, thermally conducting, optically transparent and corrosion resistant. Because the films are electrically insulating, they would be useful as an IC passivation barrier layer. They are scratch resistant and do not corrode. They are resistant to all acids, alkali and organic solvents. The only thing that attacks them is heat. The diamond films burn in air above 700° C, depending on the purity of the film, but are stable to 1400° C in vacuum.

The diamond thin films have been successfully doped with sufficient amounts of boron to become an electrically active semiconductor. The boron is incorporated into the film by including diborane gas with the other growth gases during deposition.

Vertical field effect transistors (FETs) were made by depositing metal on the top and the bottom of a grating etched in the semiconducting diamond substrate to form ohmic and Schottky contacts.

The diamond film is etched by a process very similar to reactive ion etching (RIE). Nitrogen dioxide gas is used. It physically absorbs on the diamond surface. When the absorbed nitrogen dioxide is hit with an ion beam it chemically reacts with the diamond to etch it away. Nitrogen dioxide is allowed to continually absorb on the diamond surface and the ion beam causes the etching until a sufficient amount of diamond is etched to form a vertical structure.

Metal is then evaporated onto the diamond so that the bottom and the top of the grating is coated. No metal is deposited on the sidewalls due to the steep slope of the grating lines. The metal on top of the gratings forms an ohmic contact while the metal on the bottom of the gratings forms a Schottky contact. The grating in this FET has a 4-μm period.

It is not inconceivable that diodes and rectifying circuits could be made out of this material at some point in the future. The quality of the films must be improved first. As to how radiation hard these films really are, nobody knows for sure yet. The use of diamond-like films for IC manufacture is so new that the potentials for these films are still unknown. But that will come eventually, just as any new innovations do. (Reprinted with permission from. Semiconductor International Magazine, February 1988, copyright 1988 by Canners Publishing Co., Des Plaines, Il. USA)

A new algorithm delivers 50 per cent faster modem throughput

Look for a new wave of modems to hit the market in the next six months, boasting a data-compression algorithm that speeds up effective bit-rate throughput by as much as 50 per cent compared with the already enhanced speeds delivered by the industry-standard Microcom Networking Protocol Class 5 algorithm. Using Adaptive Computer Technologies Inc.'s CommPressor algorithm means that a 2,400-baud modem, for example, can run at an effective rate of 7,785 bits/s in transferring a dBase II file - compared with an effective rate of 5,104 bits/s with the Microcom Corp. modem. ACT boosted performance by a variety of techniques including variable-bit-length codes, generalized string substitution, and the ability to adapt to the type of information being transmitted - from English text to computer language. The Santa Clara, California company licenses source code for $2,000 - $20,000 after 1 April. (Reprinted from Electronics, 4 February 1988, copyright 1988, McGraw-Hill Inc., all rights reserved)

III. MARKET TRENDS

SCs set for boom

Worldwide semiconductor sales will work on the rises of this year and move into top gear in 1988 with a growth of 11.2 per cent, according to a new survey. Total market value for the combined discrete and integrated-semiconductor market will reach $30.6 billion in 1988, up from $32.9 billion this year. Growth in 1986 was just 1.2 per cent.

Leading the way in the world's growth league is the US, which will see its market grow by 14 per cent, followed closely by Europe which will grow at 11 per cent. Japan will grow at seven per cent, a turnaround from a contraction in 1986 and 1987.

Also included in the report is a technical breakdown of world markets which says CMOS will command 44 per cent of the world market in 1991 compared with its slice of 23.5 per cent in 1986.

Profile of the Worldwide Semiconductor Industry is available from Benn's Electronics Publications, P.O. Box 28, Luton, LU2 0ED. (Electronics Weekly, 11 November 1987)

Surface mounting will spark hybrid-circuit sales in Europe

By 1990 the European market for hybrid circuits will be worth around $2.5 billion, up by more than $1 billion from 1986, reports Minal Sinnadurai, chairman of the UK Chapter of the International Society for Hybrid Microelectronics. His estimates cover surface-mount technology used on printed-circuit boards up to ¼ in. on a side, in addition to the traditional hybrids based on ceramic substrates with thick- and thin-film interconnects. The greatest growth will be in surface mounting on small pc boards, he says, which in 1986 accounted for just three per cent of sales. By 1990 the devices will be 27 per cent of the overall market. The Benelux countries will show the fastest growth with a 300 per cent jump in consumption for a combined market of $252 million. The largest consumer, however, will be the FRG which will spend just over $1 billion on hybrids in 1990, over three times more than the UK and France, the next biggest consumers. (Reprinted from Electronics, 18 February 1988, (c) 1988, McGraw-Hill Inc., all rights reserved).

European chip-makers forecast

Motorola's forecasts for the semiconductor industry, which it presents annually to a meeting of journalists and analysts, predicts the European market growing 8.3 per cent in 1988 to a total value of $6.58 billion. This will come as something of a relief to chip-makers as, Motorola says, figures indicate that the European market has not grown at all in 1987.

The UK market has stood up reasonably well during these stormy times. Motorola expects it to show 8.2 per cent growth this year over 1986. In 1988 it will be worth $1.25 billion, a growth rate of 10.1 per cent. This rate of expansion is pipped only by Italy, which, although a smaller market at $700 million, is expected to grow by 10.3 per cent next year. Driving the market in the UK is the upsurge in the communications market.

The industrial market is also seen as a strong performer by Motorola, especially on the strength of its export results. Computer market growth is still sluggish, although personal computer sales are now being stimulated by sales of IBM's Personal System 2.

The use of electronics by the automotive industry sees that end-user sector accelerating. At present an average of $50-worth of electronics can be found in today's cars, but Motorola expects that to rise to between $200 and $250 by 1990.

Surprisingly the FRG market, while still the biggest in Europe for semiconductors, is looking decidedly peaky. According to Motorola it will actually have seen a downturn of 0.9 per cent this year.

Motorola forecasts the FRG market will expand next year by 7.3 per cent to a value of $2.09 billion.

The weaker dollar affected exports in all industry segments. Particularly affected was communications where a weak export performance saw sales down ten per cent, and a horrendous industrial sector downturn of 20 per cent, again caused by problems in the export market.

The FRG will continue to lose market share in the world electronics market, said Motorola.

Of the other European countries, France keeps its hold on third place in the semiconductor stakes behind the FRG and the UK.

Motorola figures suggest a 9.1 per cent growth in 1988, which would take total sales in France to $1.08 billion.

With growth forecast at 10.3 per cent for next year, the Italian semiconductor market is setting the pace. Government-backed initatives in the communications industry, a return to form by Olivetti in the personal computer market and heavy government spending on electronics should take the Italian semiconductor market to $700 million in 1988.

The Scandinavian market will be worth $935 million in 1988, said Motorola, a growth of 7.5 per cent.

The rest of Europe will grow by 6.9 per cent in 1988 to a $930 million semiconductor market. (Source: Electronics Weekly, 18 November 1987)

Co-operative spirit guides european chip-makers

Europe is turning away from the national "go-it-alone" philosophy that has divided it in the past. The argument for a homogeneous, unified market for European Economic Community (EEC) based companies becomes increasingly strong from the perspective of establishing a competitive semiconductor industry for all Western European countries. Individually, each country represents a relatively small segment of world-wide semiconductor consumption and production.

Despite the arguments for greater regional co-operation and integration, there are equally powerful pressures in the opposite direction. First, there is the traditional reluctance of Western European semiconductor firms to collaborate, making proprietary technology available to potential competitors. Second, there is the political argument for each country to have its own full range of semiconductor technology. Under these conditions, however, producers may have difficulty achieving sufficient sales of any particular device to justify large scale, cost-effective production, forcing them to be undersold in their own market or to match their competitors prices resulting in low profitability.

Europe's economic future depends on a healthy semiconductor industry, maintains the European Electronic Component Makers Association (EECA). The group calls for more concentrated, selective and effectively subsidized efforts from governments to make European chip-makers competitive by world standards.

The EECA argues that within 10 years, the European electronic sector will be larger than any other manufacturing industry, including oil and chemicals, with most of this potential coming from integrated circuits. The group's four-point programme to boost European competitiveness proposes:

- Support for co-ordinated research and development projects that promise major breakthroughs;
- State stimulation of the european market through ambitious electronification projects, pan-European product development and harmonized standards;
- Tax concessions for IC manufacturers with low cost loans for investment in semiconductor production equipment over the coming decade; and
- Strengthening of existing short-term tariff barriers against imported chips until the beneficial effects of its other three proposals eliminate the need for such measures.

Unless these four points are adopted, and Europe establishes itself as a market entity, it is likely to become a battle-ground for US and Far East attempts to dominate the future markets.

The best-known examples of European technological collaboration are ESPRIT and the EUREKA Initiative.

ESPRIT, the European Strategic Program of Research in Information Technology, is intended to promote joint research among European Community members, and in this capacity, has helped break down the "old country" barriers. This exchange of ideas has created an information network that never previously existed in Europe, and fostered interest in working on common problems.

EUREKA, which was proposed to encourage joint development of commercial products and services, groups the 12 European Community states plus Sweden, Norway, Finland, Austria, Turkey, Switzerland and Iceland. EUREKA has no central administration or funding, relying heavily on subsidies from the governments of participating companies.

Along with government-backed collaboration programmes, there has been a parallel growth of co-operative research ventures by industry. The most ambitious of these is the Megaproject, a joint effort by Philips of The Netherlands, and Siemens of Federal Republic of Germany, to develop submicron technology for VLSI chips. In addition, GEC of Britain and Thomson of France are working together on ASIC technology, and Siemens, Alcatel of France, Plessey of Britain and Italtel of Italy and co-operating on component designs for telecommunications.

Cross-border mergers and acquisitions are another recent development for Western Europe. For example, 1986 saw the merger of SGS-ATES, Italy's principal chipmaker, and the non-military semiconductor business of French-owned Thomson. The thought behind the merger; only very large companies can offer a broad enough product line to weather Japanese and US competition. The success or failure of this effort may determine future ventures of European IC firms.

Also reflecting the changing structure of the European industry, is European Silicon Structures, (ES2) a startup custom microchip manufacturer that was set up as a pan-European corporation involving several of Europe's major high-tech firms. (Reprinted with permission from Semiconductor International Magazine, February 1988. Copyright 1988 by Canners Publishing Co., Des Plaines, Il. USA)

ICL urges European trade unity

ICL has spoken out against the knock-on effect in Europe of US/Japanese trade agreements and warned that Europe should stand more united against it. Mike Watson, director of ICL marketing and technical strategy, said other nations could do as they pleased in terms of joint agreements but they should not expect Europe to accept the resulting fall-out.

In particular he mentioned the recent semiconductor agreements between the US and Japan which forced up prices for components in Europe.

ICL does 80 per cent of its business in Europe. So it has a particular interest in pushing for closer co-operation in terms of pan-European agreements and agreed standards. (Extracted from Computing, 26 November 1987)

Big systems and the European market: forecasts

On the basis of a study carried out by the market studies firm, IDC, the European big systems market, after recording a 12 per cent rise in 1986, is expected to fall off in 1987 and thereafter to pick up at about 6.5 per cent in coming years, thus representing a reversal of the falling market, though less marked than for that of medium systems.

In 1986, the big system market comprising materials for over US$1 million of 3090 or SPS8 type, saw an increase of 12 per cent in volume (from 1,349 to 1,513 units), or half of the world market, and of 13 per cent in value (from US$5.48 to US$6.18 billion).

In 1987, it slowed down with a general progression of 4 per cent in volume and 4 per cent in value, but from now until 1992 the average annual growth is expected to be 6.5 per cent, which would represent at that time 2,185 units and US$9 billion, and would be clearly less than the forecasts of 3,100 units and US$11 billion, made last year by IDC.

As far as the big systems are concerned, IBM's strategy continues to be decisive and already represents 43 per cent of the European systems market in volume and 60 per cent in value. For their part, AMDAHL, NAS and COMPAREX each hold some 4 per cent of the global big systems market amounting to 1,515 units, while in value terms they represent four, three and two per cent respectively.

Siemens continues to be second in Europe (with 19 per cent of the market) thanks to the place it occupies in the FRG (52 per cent of the market, preceding IBM, with 31 per cent), BULL's place, which is not so important in France (where it holds 15 per cent of the market, compared to IBM's 56 per cent) is practically multiplied by two at European level (7 per cent in volume and 6 per cent in value) thanks to the setting up of HONEYWELL BULL Inc. In the United Kingdom (with 6 per cent) and above all in Italy (with 17 per cent). Thus BULL takes its place at ICL level (with 8 per cent in volume and 5 per cent in value). UNISYS is the last big European firm (with 5 per cent in volume and value) which however, was overtaken in 1985 by BURROUGHS-SPERRY (holding 6 per cent of the European market).

It is the FRG big systems market which, alone, accounted for 30 per cent of total sales in Europe in 1986, although by 1992 it is not expected to represent more than 22 per cent. As far as the United Kingdom is concerned, the IDC forecast points to a modest but regular growth which will enable it to catch up with the FRG in 1992, with 430 units. France, with 209 units and US$971 million in 1986, should reach by 1992 a volume of 357 units for a market worth US$1.5 billion. (Source: bulletin IBIPRESS, No. 156/04, December 1987)

Bleak prospects for the European medium-sized system market

Last year International Data Corp. (IDC) foresaw that the European medium-sized system market will reach US$14.8 billion in 1991 and a volume of 53,680 units. Today, however, the forecasts for 1992 are 27,100 units and US$8.9 billion. This was the result of a technical readjustment, but also of a crisis in the sector of medium-sized systems with a fall in 1986 and a weak recovery in 1987.

In 1986, the European medium-sized system market decreased, with respect to 1985, nine per cent in volume (16,700 units) and five per cent in value (US$5,641 million). IDC foresees a 10 per cent growth in volume (18,400 units) and 12 per cent in value (US$8,897 million) for 1987.

Undoubtedly the market has become fairly saturated, but the reasons for the recession can also be found in the manufacturers': a decline in the 43XX series, the early announcement of the 9370 by IBM, the recent launching of the VAX 8XXX of DEC, facts which have weakened the market offer in general.

1987 will be marked by a recovery thanks to the growth of the 9370 and the VAX 8XXX. 1988 should show a larger increase and reach a volume of 24 per cent (22,380 units) and a value of 18.5 per cent (US$7.5 billion). But, according to the study, it could fall to less than 10 per cent in 1989 and 1990 and to less than 5 per cent in 1991 and 1992, which proves that the weakening of the offer is not the whole problem, and that there is also a lack of demand.

The French market has partially avoided the European crisis in 1986. It should suffer a recession in 1987 and a renewed growth of 40 per cent (4,350 units) in 1988 to be established in 1992 at 4,900 units and US$2bo million, to be placed after the FRG and the UK.

As regards the large manufacturers, in 1986 IBM was still the leader in Europe with 3,551 medium-sized systems sold, bleak prospects for the European medium-sized system of which 1,900 were 4381 and 1,350 were system 385, which represents 21 per cent of the market in volume and 33 per cent in value (37 per cent in value in 1985). At the top end of the range, 43 per cent in volume and 49 per cent in value and at the bottom end of the range, 17 per cent in volume and 22 per cent in value. DEC is second with 14 per cent in volume and 12 per cent in value and is also better placed at the top of the range - 17 per cent in volume - than at the bottom end - 13 per cent (1,500 VAX 8XXX, 800 VAX 11/7XX sold).

For HONEYWELL BULL Inc., if one adds the market share of HONEYWELL to that of BULL, it takes second place, in front of DEC. In France, on the medium-sized systems market, BULL beats IBM with 43 per cent in volume and 38 per cent in value against 19 per cent in volume and 30 per cent in value. IBM remains, however, in first place as regards the top end of the range. (Source: bulletin IBIPRESS, No. 155/04, December 1987)

European market of value added networks

According to a study carried out by Frost & Sullivan, the European market of Value Added Networks (VANS) which amounted in 1986 to 900 million dollars is estimated to increase to 5 billion dollars between now and 1991.

According to Frost & Sullivan, value added networks, which are often difficult to define, concern any telecommunications network which offers a supplementary service with respect to the simple establishment of a liaison between two interlocutors. While this definition has the advantage of being clear, its main drawback is that it is so vast that it does not indicate the specificity of different infrastructures and different services, services as different as databank consultation, video-conferencing, tele-alarm, videotex, electronic messaging and data exchange.

It is foreseen that this market will have an average annual growth of 40 per cent which will be the strongest during the next three years, from 1988 to 1990, with a rate of 57 per cent.

Companies, as opposed to individuals, will use value added services the most, the proportion being 80/20.

This study also states that database consultation is the most frequently used service and represents 65 per cent of the services of the text and data type which equal themselves to three quarters of the total market value of VANS. Another service which is undergoing a strong increase is electronic messaging, thanks especially to the emergence of the X400 standard which will enable the interconnection between different messaging services.

The UK is the largest user of value added networks with 35 per cent of the European total, or $314 million in European market of value added networks in 1986. France follows very closely with $225 million or a quarter of the European market for the same year. The share of these two markets, however, is destined to be reduced when the FRG, which in 1986 only represented 12 per cent of the market, begins to catch up. (Source: bulletin IBIPRESS, No. 157/04b5, January 1988)

The electronic document interchange market

The EDI (Electronic Document Interchange) market is considered by experts as one of the most attractive as regards future possibilities. Research carried out by the IRD (International Resource Development) has foreseen, by 1994, an EDI market equal to US$1 billion.

The major beneficiaries of this development will be the suppliers of Value-Added Network Services. Among these IBM, General Electric, etc. will play an important role, considering the growing interest of these firms in this sector.

According to IRD, the Regional Groups of BELL Co., created by the deregulation of ATT, are also ready to enter all the markets for Value-Added Services and therefore see the EDI sector as particularly attractive, even though it is very complex.

In effect, the EDI users can avail themselves of, in addition to the suppliers' services, software packages which would allow them to enter directly in contact with the large computers of the correspondent users, bypassing the suppliers.

The sellers of software packages for EDI use are already numerous, but a large increase is foreseen in the near future as the volume of the interchange of documents increases.

Those industries which deal with forms and documents and fast document delivery services are destined to suffer. For the first the fall in business could reach a rate of 10 per cent within the next few years. For the second, the traffic of collection and delivery could slow down by at least 10 per cent.

Electronic interchange of documents should use already existing transmission infrastructures, that is those of the government, even if this, in some cases, would mean a taxation by transmission unit. (Source: Bulletin InIPRESS, No.155/05, December 1987)

Year of the right moves

1987 has been a year of profitable growth for those electronic component distributors who had the foresight to assess and realign during the 1987 industrial recession. Clients have been less fortunate and have faded away or been absorbed into larger groups.

1988 will bring solid growth in the electronic sector once the effects of the Wall Street crisis has passed. Cranbrook Electronic Holdings has not experienced any negative trading effects from this financial implosion.

Distributors that have identified the right markets look set for a period of sustained and healthy growth. In particular, those that are in 'niche' markets will see the greatest improvements. Good examples of this are the growth in both the IBM bus architecture as a basis for flexible industrial control and in digital telecommunications.

The recent shake out in the distribution network will work through to the benefit of the end customer and 1988 will see a further strengthening of distribution groups through acquisitions.

Caution is needed where, to increase market share, distributors are holding conflicting lines. At first sight this may appear to benefit the customer, but in the long term will be to everyone's disadvantage.

Market demand for flexibility in component functionality is driving the semiconductor manufacturer and distributor to re-evaluate their strategy to best serve these needs. Some distributors are making major investments to provide a full custom service. Others are taking the programmable device route, while the majority are standing on the side lines.

1988 will be a year to make the right decision. (Source: Electronics Weekly, 9 December 1987)

Leaner times

The UK market for products sold by electronics distributors has experienced growth in the region of five-eight per cent during 1987 depending on the product areas involved. While this is less than seen in the 1970s it is still encouraging.

There are, however, several factors which have been present for some years that now suggest we will see substantial changes in the industry. Electronics distribution is based on offering customers a simply superb range of services and benefits - but pressure on both profitability and the ability to invest in customer services will tax the ingenuity of all distribution companies and groups.

If we consider the current environment in the electronics industry, we are experiencing; (1) Worldwide overcapacity in component manufacturing. (2) Pressure in OEMs to reduce capital investment and pre-production inventories. (3) Decreasing product life cycles and new technologies across all component areas.

All these factors combine to reduce prices at a time when investment in inventories must grow. They force the distributor to look at his own costs at a time where OEMs are expecting better and more complex services - with JIT (Just-in-Time) production being but one manifestation of this.

It will only be the most professional distributors backed by the soundest finance who can afford the investment to support these customer services.

The result of this market environment has been a number of mergers and acquisitions both in component manufacturing and distribution. This will continue. However, there is now a move by component manufacturers to require both knowledge and expertise as an integral part of the backing for their franchised distributors and not just straightforward finance. It will, therefore, become more difficult for newcomers to enter the market by acquisition.

The industry, therefore must continue to become leaner and more efficient if it is to survive in a profitable manner. (Source: Electronics Weekly, 9 December 1987)

NEDA and SIA see growth in 1988

The US National Electronic Distributors Association is forecasting healthy 10 per cent to 15 per cent growth for distribution sales this year, despite uncertainty over the effects of October's stock market crash. Expanding exports by US equipment producers and increasing computer purchases by US industry are among reasons for the optimism. Following the stock meltdown, US distributors boosted "the strongest November in anybody's memory", notes Tony Mack, executive vice president at the Chicago-based trade association, with distribution shipments and orders rising by seven per cent and nine per cent, respectively, over October. The distribution book-to-bill ratio rose to 1.10 in November, up from 1.08 in October and 1.05 in September. Shipments for the first 11 months of 1987 rose 15 per cent over 1986, says NEDA.

Meanwhile, US semiconductor billings rose five per cent to $920 million in November from $876.5 million in October, says the Semiconductor Industry Association. November 1987 billings were 37 per cent higher than those of a year ago. The Cupertino, Calif., trade organization also sets November's preliminary book-to-bill ratio at 1.07. This marks a full year in which bookings out-numbered billings, a consistency not seen since 1983-1984, the SIA says. (Reprinted from Electronics, 7 January 1988, (c) 1988, McGraw-Hill Inc., all rights reserved).

Rise in access control market expected

The US access control market is expected to triple by 1995 from the present $2 billion per year business, according to International Resource Development (Norwalk, CT). The biometric control devices market is expected to rise to about $245 million in 1995 versus $3 million in 1985, largely because biometric devices are expected to have only slight end-user resistance due to the AIDS panic and other health concerns. The card readers, electronic keypads and smart locks market is expected to rise to $1.25 billion in 1995 versus $175 million in 1985, largely because of white-collar crime. Bar codes, smart locks and biometric signature verification will likely be used in this area. The bar coding equipment and services market is expected to grow to $1.77 billion in 1995 versus $250 million in 1985. Despite personal objections, the concern about physical security will support market growth. (Extracted from Security, December 1987)

Forecast of gallium arsenide ICs

Sales of gallium arsenide integrated circuits (ICs) are expected to reach only $1 billion by 1990, instead of the projected $2 billion, according to analysts. Once characterized as the technology of the future, gallium arsenide ICs, according to the local Silicon Valley joke, will always be the technology of the future. Despite great expectations, gallium arsenide will account for only a small part of the total semiconductor market, which was worth $32 billion in 1987. The expectations were largely based on solid technology that proved more difficult to work with than silicon. While GaAs chips can carry electrical signals at higher frequencies, using a fraction of the power required by silicon chips, engineers have not yet been able to insert as many electronic components onto a single GaAs chip as they can on a silicon chip. Moreover, single volumes are so small in gallium arsenide that the cost is often 1.5-2 times more than a silicon chip. While some 70 per cent of GaAs ICs now go to the military, gallium arsenide chips are now viewed as a specialty market.

To compete with the silicon chip market, companies, such as Vitesse Semiconductor and Microwave Monolithics, are focusing. While Microwave Monolithics is concentrating on microwave circuits, Vitesse has agreed to take some microprocessor, controller and signal-processing silicon chips from Advanced Micro Devices and implement them in gallium arsenide. (Extracted from Forbes, 1 November 1987)

Forecasts for semiconductor products

In 1988 the boundaries among various semiconductor products, processes and design techniques will become fuzzy. Several companies will begin to offer standard, semicustom and custom ICs based on next-generation CMOS technology with 0.8-1-micron design rules. This development blurs the distinction between exotic high-performance technology and standard commercial offerings. Joining Performance Semiconductor and Cypress Semiconductor in the submicron ranks are Intel, LSI Logic, Motorola, and Texas Instruments, and some Japanese companies.

Products that will be offered include devices with up to 200,000 gates, compiler-based standard cell designs coming close to 450,000 gates, and full-custom and handcrafted standard designs with more than 500,000 gates, according to J. Meindl, vice president and provost, Rensselaer Polytechnic Institute.

Another key development in 1988 will be the first generation samples of 4 Mbit DRAMs from 1 Mbit DRAM stalwarts Fujitsu, Hitachi, Motorola, NEC, Siemens, SGS, and Texas Instruments. NTT and two other Japanese companies will also be sampling experimental 16 Mbit designs. In 1988, ultraviolet-erasable and electrically erasable PROMs will increase in density, with CMOS designs becoming more popular, and n-MOS designs slipping into oblivion. Also, the development of flash EEPROMs will move in on the traditional territority of conventional EPROMs and EEPROMs. The boundary between logic and memory circuitry will blur in 1988. On the memory side, special-application SRAMs and DRAMs will come on the scene featuring more intelligence. On the digital side, standard, semicustom, and custom designs will incorporate larger portions of memory on-chip. (Extracted from Electronics, 15 October 1987, (c) 1987, McGraw-Hill Inc., all rights reserved).

Market niche for minisupercomputers

Minisupercomputers offering almost the performance of multimillion-dollar supercomputers at prices just above minicomputers' high end are becoming a vital niche, according to spokesmen at the 1987 Autofact trade show in Detroit, MI. Dataquest, a market research firm, estimated the market share of leading minisuper producers. As they cut into the low end of the supercomputing market, minisuper makers must worry about competition at their own low ends from higher-performance minicomputers styled superminis. While superminis are 32-bit machines that have scalar architecture, supercomputers including minisupers are 64-bit processors with vector architecture or some other type of parallel processing; thus high-end superminis in some ways can duplicate low-end minisupers' performance. (Extracted from Metalworking News, 30 November 1987)

Rise expected in laptop computer demand

Laptop computers will gain greater acceptance among MIS managers in 1988, according to industry analysts. T. Bajarin, executive VP of Creative Strategies Research International (Santa Clara, CA), a consulting firm, observed that users want higher resolution and true portability. Laptop sales rose significantly in 1987, according to industry estimates. Venture Development expects 850,000 laptops to be shipped in 1992, versus 455,000 in 1988 and 350,000 in 1987. Major suppliers expected to announce laptops in 1988 include IBM, with an Intel 80286-based PC Convertible, and Zenith, which will offer a system that reportedly improves LCD resolution without heavily draining the battery supply. Apple Computer and Compaq Computer may debut laptops in 1988 if market opportunities are strong enough. Overseas rivals Mitsubishi and Samsung Electronics may increase their presence soon in the expanding laptop market. (Extracted from Computer World, 8 February 1988)

PC sales rise expected

Personal Computer manufacturers expect their sales to rise 20-30 per cent in 1988 versus 1987 as demand rises for the more powerful generation of equipment, according to an industry conference held recently at Silicon Valley, CA. IBM's 10-20 per cent growth estimate is more conservative, but the expected rate is still acceptable. Motorola, one of the world's largest microprocessor producers, is developing a new microprocessor chip based on reduced-instruction-set computing (RISC). The microprocessor will offer an alternative to the 6800 series that is now used in Apple's Macintosh computers and in other key personal computers and workstations. Compaq, which produces IBM-compatible personal computers, expects a 20-30 per cent sales rise in 1988 after nearly doubling its revenues to $1.1 billion in 1987 versus 1986. Apple computers expects revenues to rise as customers buy higher value systems. Growth rate optimism may result in overproduction of too many types of personal computers in 1988, because every company thinks that it will grow faster than the industry. (Extracted from New York Times, 9 December 1987)

Marketing forecasts for monitors

The market for monitors will total $9.3b billion in 1994 as against $3.9b billion in 1987, according to Stanford Resources. Some 39 million units will be sold in 1994, up 8.4 per cent per year from 1987. US and European vendors' lowering of prices in 1987 to hold on to or increase market shares has affected their profitability. As a result, some firms have divested their monitor businesses in 1987; for example, RCA sold its monitor activities to Cardinal Technologies, and Motorola sold its monitor business to DisplayTek. There is a demand for monitors with higher bandwidth specifications, more colour options, and higher resolution, due to most manufacturers' desires for better flicker-free monitors with enhanced text and graphics presentation capabilities. (Extracted from Electronic Data Processing Weekly, 15 February 1988)

Market shifts from mainframes to micros

The computer industry is undergoing a profound change as the market shifts to micro computers and away from mainframes. Once considered in perpetual infancy, the computer industry may have turned the corner following the market slump that began in late 1984.

This series of related articles discusses the market shift toward 'distributed processing' and away from monolithic back-office mainframes in terms of new technology (the advent of more powerful microprocessor chips and the economic feasibility of micros that perform like minicomputers and mainframes), the ease of programming a new function on a micro versus a larger machine, the PC user's familiarity of computing on a PC, the changed habits of computer buyers, the commodity mentality that lowers margins because of interchangeable machine parts, and the 'turnpike effect' - networking. The impact of powerful microchips on PC developments and competition is considered. Charts include a graph in the rise of US shipments of computer hardware, software and services in 1982-87; shipments of PCs, small computers, medium-sized computers, and mainframes in 1982-91; the industry's shrinking operating margin in 1982-87; the number of IBM 370 and 370-compatible systems in use; and micro's price/1 million programme instructions/second versus the mainframe's price. (Extracted from Business Week, 30 November 1987)

'Ultraparallel' future

The way forward for hardware technology lies in 'ultraparallel' database machines - a message to be heeded by market leaders IBM and Digital Equipment (DEC). This was the forecast made by James Martin at a London seminar on the 'future culture' of computing development. But Martin said he envisages resistance in the IBM camp, where the move to parallel processing - and therefore cheaper computing - could cause loss of revenue.

Martin's advice to DEC was to attack this IBM Achilles' heel by signing an agreement with Teradata, leader in the hardware database field. He said hardware databases are essential for gaining improved transaction processing (tp). Software counterparts, such as Db2 and Oracle, can at the moment reach only around 48 transactions per second (tps). The more processors you add to a database machine the more tps you can do.

DEC is working on development of its own parallel database machine which should reach the market within five years. (Extracted from Computing, 26 November 1987)

High-resolution ADCs are changing the market

The most dramatic advances in data conversion unquestionably are in high-resolution monolithic and hybrid analog-to-digital converters. For the first time, designers have ready access to monolithic and hybrid ADCs with resolutions of 14 bits and above - and many of the new converters are fast, to boot.

It is not surprising that technological advances in high-resolution ADCs are changing the shape of the marketplace. Of all ADC units consumed worldwide, parts having a resolution of 14 bits or higher now have a worldwide market share of about 23 per cent, says Selantek Inc. By 1990, their share of the total ADC market will be 27 per cent, predicts the Mountain View, Calif., market research house.

It looks like these new hybrid and monolithic parts will be dethroning the present king of high-resolution ADCs, the 12-bit converter. Of the worldwide consumption of 12-bit and above converters, the share of 14-bit or better ADCs will jump from 44 per cent to 53 per cent between 1987 and 1990. (In the total worldwide ADC market, 12-bit and above parts take a consistent 52 per cent share).

In addition, more new designs than ever before are using ADCs, especially as front ends for digital-signal-processing systems. That is good news, since the worldwide market for all stand-alone data converters is, at present, relatively stable. Interestingly enough, in spite of new ADC applications such as DSP, the world continues to consume more digital-to-analog converters. DACs account for about 52 per cent of all data converters. Of course, ADCs are usually more expensive than DACs, so 52 per cent of dollars will continue to be spent on ADCs. By 1990, ADCs will have worldwide revenues of around $898 million, compared with about $816 million for DACs.

Fast-moving technological change also is erupting in other areas of the analog and power world. Power-supply technology is harnessing resonant circuits to shrink supply size without degrading efficiency, as switching frequencies climb to the megahertz region. (Reprinted from Electronics, 7 January 1988, (c) 1988, McGraw-Hill Inc., all rights reserved).

PC still spells automation

A remarkable average annual growth rate of 17.8 per cent over the next four years has been forecast for the european programmable controllers market. According to Frost & Sullivan's recent market research report, Programmable Controller Networks in Europe, the market is expected to be worth US$1,400 million by 1991. The fastest rate of growth is expected from networked applications of medium-size controllers - those with 129 to 896 input/output channels - with average annual increases in consumption of 24.9 per cent over the same period; these are expected to reach a total market value of US$148 million by 1991. This however, is still only 10 per cent of the total market.

The largest, and currently, the second-fastest growing category is that of stand-alone medium-size controllers. These are expected to have a phenomenal growth rate of 20.4 per cent per year and to achieve total sales of US$430 million by the end of the decade. This represents 30 per cent of the total projected market. The report further states that it is the considerable cost of complete automation networks that makes potential users hesitate to commit themselves. They prefer instead, to install programmable controllers and other automation hardware capable of operating within a network system at a later date.

A further factor, besides cost, is the incompatibility of different manufacturers' networking schemes, so that users of these schemes have felt impelled to stick with a single supplier. The idea is to create a standard data communications scheme which, if designed into future products, would allow components to communicate with each other regardless of their manufacturer.

Most of Europe's programmable controller suppliers have launched, or are close to launching, MAP-based products. In France, however, an alternative common standard, JeUS, has found favour.

In the UK one of the most up-to-date automated production lines using programmable controllers is at Ferguson's factory in Gosport which produces more than 5,000 TV sets each day and is probably Britain's leading TV set producer.

Early in July GEC Industrial Controls announced that its GEM80/700 controller for industrial process automation had successfully completed MAP conformance tests. This is believed to be the first such system to achieve this outside the US.

The 700 controller, with MAP version 2.1 is an enhanced controller within the GEM80 family, and the inclusion of an integral MAP interface within the unit makes it unique. It incorporates a single-board computer fitted with a central highway, which implements MAP and enables communications between different manufacturers' equipment. Quite a few manufacturers have developed new types of motion controller.

With a great deal of development work taking place and the continued widespread and increasing adoption of programmable controllers in a host of applications, their days are by no means over in industrial automation. (Extracted from Engineering, November 1987)

COMPANY NEWS

IbM will pull together its Unix-based networking strategy by 1989

Underlining its intention to be a leader in the Unix marketplace, IbM Corp. is promising a raft of networking-software additions and improvements for work stations that run on IbM's AIX version of Unix. At the Uniform show in Dallas, IbM announced that by March 1989 it will start reselling Sun Microsystems Inc.'s Network File System, which gives users access to files on other network nodes. IbM will also have an electronic-mail package for the AIX systems - RT PCs and, by autumn 1988, the PS/2 model 80. Although an AIX system on an Ethernet or Token-Ring network will be able to act as a server to personal computers running under the DOS and OS/2 operating systems, IbM has not announced products for full, transparent communications between those PCs and nonserver AIX systems sharing a net. (Reprinted from Electronics, 18 February 1988, (c) 1988, McGraw-Hill Inc., all rights reserved).

HP and Microsoft work to plug a hole in the IbM strategy

Aiming to fill a gap still open in IbM Corp.'s latest local-area-network offerings, Microsoft Corp., Redmond, Wash., and Hewlett-Packard Co., Palo Alto, Calif., are working together on a product to be called LAN Manager/X. LAN Manager/X will bring the functionality of Microsoft's OS/2 LAN Manager to Unix systems, beginning with those based on Intel's 80386 microprocessor. Due by early 1989, LAN Manager/X will let PCs running DOS or OS/2 communicate with Unix-based systems on the same network. HP plans to bring LAN Manager/X to its HP 9000 systems running under the HP-UX Unix variant, and other vendors say they will add LAN Manager/X capability to their Unix systems. Like OS/2 LAN Manager, LAN Manager/X will use the Server Message Block protocol defined by IbM, Microsoft, and Intel Corp. (Reprinted from Electronics, 18 February 1988, (c) 1988, McGraw-Hill Inc., all rights reserved).

IbM restructures

IbM has decentralized its management structure by creating five highly independent line-of-business units (LOBs) to govern development and manufacture of its complete product line. However, according to Nikko Securities analyst D. Haback, the effect of the move is minimized since the same people are making the decisions. IbM also created IbM United States to manage the new businesses. The new organization will bring more independence for IbM product development and manufacture executives, and will boost their function in strategic planning for products. Product development executives will have more involvement in the marketing of their products, which, in the past, was primarily done by the company's marketing subsidiary, Information Systems Group. Also, to boost the LOBs concentration on strategic product planning, IbM established a new position for an assistant general manager of marketing planning at each LOB. (Source: Technology Update, 29 February 1988)

IbM launches a major supercomputing initiative in Europe

While IbM Corp. was making headlines by promising to develop a next-generation supercomputer with Steve Chen, they were busy on other fronts as well. IbM announced that it will spend $40 million over the next two years to advance supercomputing in Europe. IbM's investment will be used in part to set up supercomputing centres in Europe similar to those in the US created by the National Science Foundation in 1985. The five European centres it is planning will be based at major universities or research institutions, and will be supported by IbM, the institutions and national governments. IbM will also supply over 25 other European educational and research institutions with advanced processors or vector facilities. The first European centre will be at the Centre National Universitaire Sud de Calcul in Montpellier, France, and is expected to begin operating in January 1988. (Reprinted from Electronics, 7 January 1988, (c) 1988, McGraw-Hill Inc., all rights reserved).

The IbM-Chen deal could make supercomputers king of the mountain

There is no longer any question that the supercomputer market is shaping up as one of the most important for computer makers in the 1990s. But if any doubt remained, it was erased by IbM Corp. late last month when IbM announced plans to forge an alliance with Steve Chen - the 43-year-old former superstar designer for Cray Research Inc. - to develop a supercomputer 100 times faster than anything available today. IbM will provide funding for Chen's three-month-old company, Supercomputer Systems Inc., and will give Chen access to its high-end technology. In return, IbM gets the right to market the machine, along with Supercomputer Systems, when it is ready for commercial introduction in the early 1990s.

The IbM move is unprecedented for the world's largest computer maker. It has formed outside alliances in the past, but never before has it signed up with an outsider for the development of an entire high-end system.

But though the nature of the deal may be surprising, an IBM thrust in high-end supercomputers was not unexpected. Because the Chen machine is not expected to emerge until the next decade, it is generally not seen as a near-term threat for Cray, the Minneapolis-based leader in the supercomputer market, or for the other major vendors - ETA Systems Inc., the St. Paul, Minn., subsidiary of Control Data Corp., and Japan's Fujitsu, Hitachi, and NEC. (Extracted from Electronics, 7 January 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

IBM's strategy for technology protection

IBM's (US) strategy for protecting its PS/2 technology and market may have given its competitors what they needed to survive. Positioning itself in the market by threatening clonemakers who imitated the proprietary designs in its Personal Systems/2 computers with legal action, IBM has yet to issue a utility patent, which covers functions or processes, but not specific designs. While computer companies may well be working on their own PS/2 products, most are treading lightly. The big question is are the parts designed by component suppliers legal? For example, Chips & Technologies (San José, CA), whose chips are used in 85 per cent of the PC/AT clones, has designed a set of chips for cloning the PS/2s. While the company, like Western Digital, claims it has legally duplicated the Micro Channel technology that IBM claims will be a key element in hooking up its PCs to larger systems, no one can guarantee the clonemaker's designs are legal.

In the meanwhile, sales of IBM's PS/2 pushed the company's sales up 25 per cent to about $7 billion in 1987. However, the competition did better, largely because customers are concerned that buying the PS/2 will lock them into a proprietary IBM design, according to the competition. The personal computer market is discussed in terms of IBM's new technology and its clonemakers. (Extracted from the 21 December 1987 issue of Business Week by special permission, (c) 1987 by McGraw-Hill Inc.).

Philips in national, European parallel computer projects

As fast as the chip developed, one problem is catching up with it: the fact that it faces the job alone in every computer, which limits the processing speed of that apparatus. But the day will come when you can simply add a few chips to a computer that is too slow.

At Philips they believe that that day is only two years away.

In a number of laboratories in the world, not least in the Physics Laboratory of Philips in Eindhoven, computer scientists now think they are close to the "parallel computer". Two years from now in Eindhoven a prototype with about 100 chips is to execute its first programme in parallel.

Philips is not doing it all by itself, but is involved in a Dutch and European project. Together with the universities of Amsterdam, Twente, Leiden and Utrecht and the Center for Mathematics and Computer Science in Amsterdam they are working on a "Parallel Inference and Storage Machine" (PRISMA), with a government subsidy via the Stimulation Project Team for Computer Research in the Netherlands (SPIN). The European project, which is carried out in co-operation with AEG (German Electric Company) and Nixdorf, get a subsidy via the ESPRIT programme and carries the frightful name "DOOM": Decentralized Object-Oriented Machine. The two projects intertwine in a mutually beneficial manner in the Physics Laboratory, and "DOOM" has made the greater progress.

At a congress on parallel computers, which Philips held in Eindhoven in June in the framework of the ESPRIT programme, the most important characteristics of the new computer were outlined.

A special programming language exists for it, called "Pool": the things which the computer must do simultaneously must be written down in such a way that it knows what is expected. The programming languages used with ordinary computers are not appropriate for that.

With a parallel computer such as "DOOM", the chips are not all working at the same time. The more they do that, the more useful they are. For example, if one wanted to have such a computer do an addition in the elementary school manner, starting on the right and continuing toward the left and with or without "carrying one", it would be utilized in the worst manner. Each chip can indeed take on the addition of one figure, but except for the first chip, they will all have to wait for a report on the outcome of the colleague working one column to the right; the result will be just about as fast as when one chip does all the adding by itself.

Other problems, on the other hand, are crying out for this very same parallel processing. And a number of companies find those problems so important that they are already working on programmes for the Philips computer, even though it does not exist yet. (Extracted from Elseviers Weekblad, 8 August 1987)

Bell in Europe

Bell Canada and Bell Atlantic, this last born in 1984 from the deregulation which subdivided ATT into seven lesser groups, signed a letter of intent for the purchase of the European branches of the Canadian group.

The branches of Bell Canada covered in the agreement are situated in six European countries and some of the names have been announced - these are Eurotechnica in France, Bell technical services in the UK, Eurotech in Italy, Dataway in Switzerland and others in the German Federal Republic, Austria and Denmark.

While Bell Canada intends to concentrate its efforts on the telecommunications sector, the American Bell Atlantic aims at reinforcing the sectors of data processing and of computer maintenance. More particularly, the latter would seem to be a sector destined to expand rapidly even if many of the construction companies are rapidly gaining ground in this area too.

Bell Atlantic which, as we reported, is one of the seven American regional telephone companies, last year showed a net income of US$1.17 billion with sales equivalent to US$9.32 billion. This company comprises seven different telephone companies in as many American states. Furthermore it controls a large number of other industries operating both in the sector of cellular mobile communications and of computer maintenance, the financial sector, etc. (Source: Bulletin EUROPRESS, No. 156/04, December 1987)

Leasing house spreads its net

Swedish computer services house ICS is trying to shed its leasing company image by spreading its wings into the highly competitive network services market.

ICS has signed joint venture agreements with two US telecommunications companies, consultants Network Strategies and network management company RSI. It is marketing their products in Europe and can pull together their experts to work on business for multinational companies.

Computer leasing house Atlantic has also started selling network services, though it is developing its own range of communications products, rather than offering managed services. (Extracted from Computing, 26 November 1987)

Ferranti supplies chips to Canon

British chip maker Ferranti will supply Canon, the Japanese photocopier and camera manufacturer, with a key component for its Integrated Services Digital Network (ISDN).

Canon is working with Ferranti to produce an LSI gate array as an interface chip between Canon's L4000 laser copier and the ISDN network. A suitable component was not yet available from any Japanese manufacturer. Engineers from Ferranti are already in Japan with Canon, working on the project.

Britain could well be the next site in Europe for a Canon factory - FRG, France and Italy already have Canon installations. Although Canon is noted in Europe for its office automation products, particularly photocopiers and facsimile machines, any factory here is likely to make medical products, one of Canon's other mainstream businesses. One other possible area of investment in Britain could be in the communications area. Canon is now developing in the communications field - it recently launched a PABX in Japan, for example. (Extracted from Electronics Weekly, 4 November 1987)

New semiconductor merger

A new force on the world semiconductor market will be launched, when the merged SGS Semiconductor and Thomson Components company makes its debut as SGS/Thomson Microelectronics (STM) at the Paris Components Show.

The merger will form a company whose chip sales will top $850 million in 1987, which could just take it into the world's top dozen semiconductor companies. (Extracted from Electronics Weekly, 18 November 1987)

Sinclair cracks wafer backing

Charismatic entrepreneur Sir Clive Sinclair has stated that he had found the 'computing Holy Grail' and solved the problem of manufacturing wafer-scale integrated circuits. Anamartic, the Cambridge-based research and development company behind the development, expects to begin volume production early in 1988.

With wafer-scale integration (WSI), Sir Clive says he will be able to produce boards with 160Mb of memory, compared with just 1Mb boards with current procedures.

Anamartic has received first round financing of £2.8 million from the other co-shareholders, while industry observers estimated that up to £40 million may be eventually on tap if the product is well-received.

Tandem and Anamartic have also signed a separate joint agreement to develop secondary WSI storage for applications from fault-tolerant online processing to high performance workstations. (Extracted from Computing, 8 October 1987)

Europe favours Unix system

The Unix operating system has established a solid foothold in the European market, with most major European computer companies offering Unix-based hardware. Users favour Unix because it encourages portability in software, which means that hardware can be bought from different vendors. Software vendors favour Unix-based systems because they can write one application and offer it to any buyer with a Unix-based computer, thus relieving the vendors of the task of adapting each application to a specific operating system. Hardware vendors favour Unix because it promotes connectivity - the linking of different machines - which, in tandem with portability, makes Unix-based systems formidable competitors to IBM machines. The goal of battling IBM stimulated the formation of the X/Open Group, an organization of European and US vendors, which has promoted the Unix standard.

In Europe, the Unix operating system is receiving the strongest support in small- and medium-size multiuser systems with from 4-16 terminals, and single-user workstations for engineering applications, including CAD, according to K. Gewald, Executive Director, Data Systems Division, Siemens. The number of Unix systems delivered in Western Europe in 1986 mushroomed to 50,000, up some 120 per cent from 1985, according to Inteco (UK) and International Data (Paris). Despite this growth, the use of Unix is not widespread for mainframes or for single-user personal computers, largely because Unix is designed for multiuser environments. This multiuser focus has also prohibited the use of Unix as the operating system of choice for real-time systems. (Extracted from Electronics, 15 October 1987, (c) 1987, McGraw-Hill Inc., all rights reserved).

Banks join in testing automatic machines

Dai-ichi Kangyo Bank is jointly testing a system that links the cash dispensers and automatic teller machines of two banks with Citibank. The system uses NTT's CAFIS financial VAN to allow customers of either Dai-ichi Kangyo or Citibank to make deposits or withdrawals via the CDs and ATMs of both banks. Start-up is expected to be in October 1988, and the system is expected to be operational within one year. (Extracted from Electronic Data Processing Japan, 13 November 1987)

Motorola plans own-design DRAM process

Motorola is planning to produce its own-design 16Mbit DRAMs and 4Mbit SRAMs on a 0.5-micron process within three to five years.

According to Bob Jenkins, Motorola's director of technology management, the 0.5-micron process is now under development and will be available for commercial production in two years. The 0.5-micron process would be the baseline foundation for a 4Mbit SRAM and 16Mbit DRAM in design but the technology exchange with Toshiba would only take Motorola up to the next generation and the link would only make sense if it were a strategy towards independence.

Scotland is favourite in the race to be the first manufacturing facility to produce Motorola's 1Mbit dynamic RAM. Motorola sources say that the East Kilbride plant is the most productive of all the wafer fabrication plants it owns worldwide. (Extracted from Electronics Weekly, 18 November 1987)

Motorola confirms RISC project

Motorola is developing a 32-bit microprocessor based on a reduced-instruction-set architecture. Rumours have been circulating about the Motorola RISC project, dubbed the 78000. Motorola has refused to discuss its RISC work, but its hand was forced by the announcement by other vendors of their co-ordinated RISC projects. Sun Microsystems has signed up Fujitsu, Cypress Semiconductor, and Bipolar Integrated Technology to manufacture its Sparc chip, while MIPS Computer Systems has signed up LSI Logic, Integrated Device Technology and Performance Semiconductor to

work on its RISC chip set. Motorola says that it has been working on RISC for several years, but does not believe RISC will replace CISC. Motorola disputes claims by Sun and MIPS of RISC's higher performance and lower cost, saying that CISC can match or outperform RISC, and that it can cost less because of a greater sales volume. Motorola does concede, however, that RISC can reduce design time. Motorola is pouring $10-20 million per year on RISC development work. The RISC chip is expected to be fabricated in CMOS, run under Unix, and will probably be offered in early 1988.

While on the subject of RISC technology, Hewlett-Packard Co.'s bet-the-farm stake on RISC technology two years ago stirred mostly skeptical comments. RISC (Reduced Instruction Set Computing) technology, it was suggested, would prove a short-lived excursion for niche scientific and engineering vendors.

Such skepticism is no more. RISC is showing up in more and more systems with a commercial flavour. Vendors typically associated with office systems are planning to offer RISC-based systems this year. What is more, the idea of limiting the number of computer instructions to achieve faster processing has won a wider following among the technical computer crowd since Hewlett-Packard's plunge.

The list of CAD/CAM and workstation vendors choosing systems based on RISC technology is a long one. (Extracted from Electronics, 17 December 1987, (c) 1987, McGraw-Hill Inc., all rights reserved and DATAMATION [F] magazine [C], 15 February 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Eli Lilly joins supercomputer centre

Eli Lilly has become the third major corporation (along with Amoco Corp. and Eastman Kodak) to join the industrial supercomputing programme at the University of Illinois' National Centre for Supercomputing Applications. The four-year, $3.5 million agreement becomes effective in January 1988. Lilly will locate researchers at the centre to work on projects of interest to the company. The centre staff will assist the company in training and research and in establishing high-speed data links to off-campus Lilly facilities. Under the agreement, the university plans to add to the centre's staff a computational chemist and a computational biomolecular scientist who will be available to Lilly for consultation. Funded primarily by NSF and the State of Illinois, the centre has a Cray X-MP/48 supercomputer. (Reprinted with permission from Chemical and Engineering News, 30 November 1987. Copyright (1987) American Chemical Society)

Joint developments

Cincom Systems Inc., Cincinnati, and Nixdorf Computer AG, Paederborn, FRG, have signed an agreement to develop distributed applications that address Unix-based systems and computer integrated manufacturing markets jointly. Formal unveiling of products resulting from the agreement is expected by June. The agreement follows Nixdorf's recent release in the US of its Targon series of Unix-based computer systems and Targon Reflex relational database management system. (Reprinted with permission of DATAMATION [F] magazine [C], 1 January 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Hewlett-Packard withdraws from Spectrum development

Hewlett-Packard, after telling its largest customers over a period of months about a new, high-performance ECL-based version of its Spectrum minicomputer, has withdrawn from the development project, sources say to save on research and development expenses. Sources say the company already has poured over $20 million into the project, which was targeted to yield a uniprocessor twice as powerful as the current HP 950. The ECL project, which had been run out of HP laboratories in Palo Alto, had been under fire from rival developers at HP's growing Cupertino systems group for some time. As previously reported, that group plans to build follow-on-Spectrum systems using circuit technology that HP will get under a secret deal with IBM. (Reprinted with permission of DATAMATION [F] magazine [C], 1 December 1987, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Product manuals on CD-rom

Hewlett-Packard believes it is starting a new trend in the computing industry by offering users its product manuals on compact disc.

The company has put the 15 manuals for its 3,000 minicomputers on an indexed CD-rom (compact disc read-only memory) - and has had "an amazing number of calls" from users and systems houses about the possibility of adding the documentation for their own applications systems.

In addition Hewlett-Packard engineers have been asking about adding maintenance notes.

Users pay an annual subscription and get regular mailings of updated discs holding manuals, application notes, solutions to known problems and details of Hewlett-Packard products.

The discs run on a Philips drive, which takes one floppy disc slot on an IBM PC/AT or an HP Vectra personal computer. Each disc holds 600 Mbytes, the equivalent of a stack of manuals 25 feet high. Users can browse or access items directly. (Source: Computer Weekly, 19 November 1987)

Galileo brings IBM into its sights

IBM looks set to snatch the biggest slice of a multimillion dollar Galileo airline deal to equip one of the largest computer sites in Europe.

Galileo, the consortium set up by nine airlines including British Airways (BA) and British Caledonian (BCal), to develop a giant computer reservation system, is to spend $120 million on a new computer centre in Swindon, UK.

The computer centre will need the power of 10 IBM 3090 central processors with a mixture of mainframes from the 3090 180 to the 600.

Galileo is looking for staff with specialist IBM skills. British Airways is in the middle of a similar search for staff with specialist experience of IBM's high performance transaction processing environment. The airline chose IBM to supply hardware for the upgrade and will be provided with 20 IBM transaction processing experts to smooth the upgrade from its aging airline control system.

Galileo will be employing around 300 people at its £30 million Swindon headquarters, which opened in January. Galileo services will be sold through Travicom, the BA and BCal joint venture. Costs have been set at $120 million, significantly less than Galileo's rival, Amadeus, which is spending around $300 million, because all nine partners have pooled their software. (Source: Computing, 26 November 1987)

Siemens and Bendix form auto venture

In its latest move to become a major force in the worldwide automotive-electronics market, Siemens AG of Munich, FRG, is putting together a 50-50 joint venture

with Allied-Signal Inc., of Morristown, N.J. The two plan to develop and manufacture electronic systems for car safety, engine control, and driving comfort, which they will market internationally. The partners, Siemens's Installation and Automobile Engineering Group and Allied-Signal's Bendix Electronics division, together achieved worldwide sales in automotive electronics of more than $500 million last year. Siemens pegs the world automotive electronics market at $5 billion, with 20 per cent to 25 per cent growth annually. (Reprinted from Electronics, 7 January 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Into the breach, once again

Look for Amstrad Inc.'s renewed pursuit of the colonies' computer dollars to take a more business-related stance if its projections of penetrating the US consumer market hold up. The company is the domestic subsidiary of Amstrad Consumer Electronics plc, UK, currently number one in the European home computer market. It is planning a big push into the American market, having recently bought out its Texas-based distributor, Video, in order to handle its own marketing and distribution. An earlier attempt to enter the US market fizzled when the company cancelled its marketing agreement with Sears World Trade Inc., a unit of Sears, Roebuck & Co., Chicago, which sold the machines through its department stores. Sources at the company say it plans to expand beyond the consumer market once it has a good base built in that arena. (Reprinted with permission of DATAMATION ® magazine ©, 1 December 1987, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

IV. APPLICATIONS

Possibilities of superconductors

High-temperature superconductors could be worth $3-7 billion/year, according to P. Winson of Oxford Instruments (UK). Sales of superconductor products are currently about $750 million/year. Superconductors are suitable for any applications requiring transmission of electricity over large or small distances. Superconducting coil magnets can produce strong magnetic fields without requiring large amounts of energy, and so could be used for maglev vehicles, particle accelerators or NMR scanners. Magnetic fields can be used to switch the superconductivity on and off, so allowing superconductors to be used for transistor-like devices and Josephson junctions. High-temperature superconductors could easily displace low-temperature superconductors in their current applications, as liquid helium coolant could be replaced by the much cheaper liquid nitrogen coolant. This would reduce the cost of operating an NMR scanner UK£17,000/year. Planners also estimate that high-temperature superconductors will make it cheaper to build and operate particle accelerators.

It is not yet clear, however, what properties high-temperature superconductors will have when they become commercially available or how they can be processed into useable products. IBM says current density of 100,000 amps/square centimetre are possible, sufficient for most applications. Claims of superconductivity at temperatures of over 0°C have yet to be verified. Superconducting electric transmission lines could save enough in transmission losses to equal the power output of 50 US power plants, according to researchers at Brookhaven National Laboratory. Superconducting cable could also eliminate the need for booster stations along communications cables.

Plasma spraying has already been used by IBM to deposit thin coats of superconductors on a substrate. Such coatings might act as magnetic shields in power generators or computer chips. But the technology cannot be commercially introduced until it is thoroughly tested. Producing uniform materials with the proper characteristics may be difficult. The thin films might also be adversely affected by small magnetic fields. Etching superconducting films for computer chips is also a difficult task. The brittleness of ceramics might limit their use in cable, although a polymer binding might solve this problem. Superconductors might not be commercially profitable for at least 10 years, according to Oxford Instruments. And developing the latest generation of superconductors might be made obsolete if room-temperature superconductors can be developed. Meanwhile, Japanese firms are pushing ahead to develop a superconductor computer by 1991. (Extracted from New Scientist, 22 October 1987)

Superconductors propel an electrical motor

An electrical motor, based on a superconductor property known as the Meissner effect, will debut in February. Built by scientists at the US Dept. of Energy's Argonne National Laboratory (Argonne, Ill.), the "Meissner motor" consists of an 8.5-in. circular aluminium plate with 24 electromagnets mounted along the outer edge, explains Roger B. Poeppel, ceramics group manager of Argonne's Materials and Composites Division. The aluminium plate sits above two ceramic discs composed of yttrium, barium and copper oxide. The discs are submerged in liquid nitrogen to keep them at about the temperature at which the combination becomes superconducting, 94 K, Poeppel says. The Meissner effect is the property of superconductors that causes them to expel lines of magnetic force. As the Meissner motor's electromagnets approach the superconductors, the superconductors' own magnetic field pushes the magnet away. The motor operates at about 50 rpm, or about the speed of a phonograph. The next step for the research group is to try to make it a little more rugged. The output from the motor is negligible, "but it demonstrates that the concept is possible," says Poeppel. (Source: Chemical Week, 27 January 1988)

New chip introduced

LSI Logic has introduced a gate-array chip with a grid of one million transistors that can be hooked up to as many as 100,000 gates. Until now, most such chips contained fewer than 5,000 logic switches, or gates, for a total of about 20,000 transistors. Equipment manufacturers use them to customize their products by adding the proprietary features of their choice. LSI's new chip has more than twice the density of any previous gate array - enough to build circuits as complex as those found in the latest 32-bit microprocessors. LSI's chip will initially be more expensive than similar competitors, but should be cost-competitive by 1990, the firm believes. (Reprinted from the 9 November 1987 issue of Business Week by special permission, (c) 1988 by McGraw-Hill, Inc.)

HIGFETs that function at microwave frequencies

ITT has produced the first heterostructure-isolated-gate field effect transistors (HIGFETs) functioning at microwave frequencies. The new HIGFETs integrate aluminium gallium arsenide with gallium arsenide (AlGaAs/GaAs), and have the capability to function at significantly higher frequencies and at lower noise levels than standard GaAs FETs. The new devices feature a 2-D electron gas generated at the undoped AlGaAs/GaAs interface under the gate electrode by the accumulation of free electrons from adjacent ion-implanted n plus regions self-aligned to the gate. The new HIGFETs are fabricated with ITT's

multifunction self-aligned gate (MSAG) process. In test situations, 1-micron gate devices have shown a 2 dB noise level and 7 dB associated gain measured at 10 GHz. Applications for the HIGFETs include millimeter-wave systems and high-sensitivity radar receivers. (Extracted from Micro Waves, January 1988)

New semiconductor fabrication process

Northrop claims its new semiconductor fabrication process yields 10 times the industry average. The firm's Research & Technology Center (Rolling Hills Estates, CA) fabricates "night-vision" chips in groups of 25 on a semiconductor wafer, for an average of 5 chips/pass. The process eliminates the need for a semi-transparent film, which leads to improvements in both performance and yield. Yields are also improved by the chip material, indium antimonide. (Extracted from Industrial Week, 19 October 1987)

Half-micron stepper

The first Japanese stepper manufacturer to start marketing an excimer-laser photolithographic system for fabrication of chips with feature sizes below 0.5 μm will be Nihon Kogaku K.K. (Nikon). The Tokyo company says the NSR-1505EX stepper can be used initially for development of 16-Mbit dynamic random-access memories, and will be suitable for mass production later on. The resolution of better than 0.5 μm is made possible by a krypton fluoride excimer-laser light source operating at a 258-nm wavelength. The NSR-1505EX provides 5:1 reduction of the reticle pattern for lithography of an area measuring up to 15 by 15 mm per shot. The $2.3 million stepper will be available 10 to 12 months after receipt of order, and Nikon will start accepting orders from Japanese customers in January. Matsushita Electric Industrial Co., Osaka, and Canon Inc., Tokyo, are expected to announce competing products soon.

Stepper production is accelerating in Japan. Two leading stepper manufacturers, Nippon Kogaku K.K. (Nikon), Tokyo, and Canon Inc., Tokyo, will increase production of stepper photolithography systems to meet the rapidly increasing worldwide demand for semiconductor production capacity. Nikon, which exports around 30 per cent of its steppers, has just revised upwards its shipment estimates for steppers for fiscal 1987, which will end on 31 March 1988, by 30 per cent to 200 units, and the company expects to sell more than 300 units in fiscal 1988. Canon says that the annual shipments of its steppers will top the 100-unit mark for the first time by 31 December. Canon also says it will boost its production rate to 20 units a month from the current 15 units by next spring. (Reprinted from Electronics, 17 December 1987, (c) 1987, McGraw-Hill Inc., all rights reserved.)

Laser used to cut pc-board line widths to 2.5 mils

A direct-image-patterning system for printed-circuit board production from Nikon Precision Inc. uses a water-cooled argon laser to directly pattern lines in conventional pc-board material with widths as small as 2.5 mils - less than half the 6-mil geometries of conventional contact-printing methods using film. The LP-3000D boasts feature-location accuracy of ±15 μm and can repeat a feature's location with ±5 μm. For a direct imaging system, it is very fast - patterning a 20-by-24-in. board in a minute, which is only four times more than conventional contact-printing methods. The San Bruno, Calif., company is aiming the LP-3000D at prototyping and small- to medium-volume production, but expects technologies that increase its speed could make it viable for volume production. The LP-3000D can also be used to produce film for conventional contact-printing methods. It costs $600,000 and will be available in the third quarter of 1988. (Reprinted from Electronics, 21 January 1988, (c) 1988, McGraw-Hill Inc., all rights reserved.)

Compiler cuts design time for base-array configurations to six days

National Semiconductor Corp. will be able to have the starting base arrays of its new family of 1.5-μm CMOS chips ready for customer design in six days instead of the six weeks it took for the 2-μm generation - thanks to a master-slice silicon compiler. Small semicustom houses employ similar design-automation strategies to speed customization of the base arrays, but National appears to be one of the first major silicon merchants opting to replace hand-crafted steps with fully computer-compiled parts. The internally developed compiler is being used on the Santa Clara, Calif., company's SCX6000 series. The series boasts densities of 400 to 15,000 equivalent 2-input NAND gates and pad counts of 28 to 200. Besides laying out gates, interconnect channels and pads, the compiler creates a place-and-route data base that is later used to predict routability of customer designs. Development charges start at $12,000. (Reprinted from Electronics, 21 January 1988, (c) 1988, McGraw-Hill Inc., all rights reserved.)

Colour frame grabber will cut image-processing costs

Data Translation Inc. is getting set to introduce a frame grabber that will reduce the cost of colour image processing and graphics applications, including machine vision, animation, and electronic prepress processing. The board will contain two custom CMOS chips designed by the Marlboro, Mass., manufacturer of data-acquisition and imaging subsystems. The two chips implement colour space conversion, which until now has required off-board processing using an array processor or small computer. The chips take 8-bit RGB colour input signals from an analog-to-digital converter; convert them into adjustable values of hue, saturation, and intensity; then reconvert them to the three colours for digital-to-analog conversion and display. Firm pricing is not set, but it will be under $4,000 - much less than the cost of the array processors or small computers now used to do the same job. (Reprinted from Electronics, 12 November 1987, (c) 1987, McGraw-Hill Inc., all rights reserved.)

Speed boosts in 16-by-16-bit multipliers

High-speed applications in radar, digital filtering, and fast Fourier transforms could open up for 16-by-16-bit parallel multipliers, now that Integrated Device Technology Inc. has built a 75 per cent speed improvement into its multiplier family, already a performance leader. Its 1.2-μm logic-oriented process has spawned the IDT7216 and 7217, both boasting 20-ns multiplication times, compared with the 35-ns speed of their predecessors. The Santa Clara, Calif., company's CMOS multipliers consume 120-mA, one-tenth the power of compatible bipolar parts. The 7216 is pin-compatible with the MPY016H/K from TRW Inc., Redondo Beach, Calif., and the Am29516 from Advanced Micro Devices Inc., Sunnyvale, Calif. The 7217 requires a single clock with a register to be compatible with AMD's bipolar 29517. In 100-piece lots, the multipliers sell for $145 each in plastic 64-pin dual in-line packages. Volume shipments will begin in the first quarter of 1988. (Reprinted from Electronics, 12 November 1987, (c) 1987, McGraw-Hill Inc., all rights reserved.)

AT&T develops a better way to probe VLSI chips

Probing, characterizing, and timing VLSI circuits has always been daunting, but now a researcher at AT&T Co.'s Bell Laboratories has found a way to do the job quickly and non-destructively. Janis Valdmanis's technique can resolve timing signals down to 0.3 ps - 100 times better than conventional electronic measurement systems. The entirely external technique can be used on any kind of material including silicon, gallium arsenide, ceramics, or hybrid circuits and requires no specially designed test circuit on the

chip itself. The probe used is a pyramid-shaped crystal of lithium tantalate attached to a quartz rod. Sampling and triggering pulses from two laser beams are focused into the tip, which can be placed close to any point on the chip using an X-Y-Z table for accuracy. Local electric fields at any node affect the birefringence of the crystal, and the effect on the intensity of the pulses can be measured. (Reprinted from Electronics, 17 December 1987, (c) 1987, McGraw-Hill Inc., all rights reserved.)

Selective epitaxial growth finds new applications

Recent advances in low-temperature/low-pressure selective epitaxial growth (SEG) have made a number of new applications possible in MOS, bipolar and BiCMOS device structure technology, particularly in the areas of lateral isolation and selective doping. These new applications were reported at the International Electron Devices Meeting in Washington, D.C.

SEG involves the selective growth of single crystal silicon over silicon through windows in an oxide layer. It was originally developed as an alternative to the popular LOCOS (local oxidation of silicon) isolation technology, which cannot be scaled much below 1.5-2μm due to "bird's beak" encroachment. This encroachment is actually a lateral extension of the field oxidation into the area under the silicon nitride used to define active regions.

Although other types of isolation schemes have been proposed, including variations on the LOCOS scheme such as sidewall masked isolation (SWAMI), selective epitaxy growth appears to have some distinct advantages. For one, the field oxide is grown first in SEG, followed by the definition of active regions. This eliminates any problems with bird's beak encroachment, makes the techniques scalable to very small dimensions (0.25μm wide, 4μm deep structures have been reported), and allows the field oxide to be grown much thicker than in LOCOS. A thicker field oxide reduces the chance for latch-up in CMOS devices.

In one application SEG was used to reduce latch-up in an advanced submicron CMOS process.

In the processing sequence used to fabricate the device, a thick thermal oxide of 1.1μm is grown and active p- and n-channel transistor areas are defined. Two independent heavily-doped boron and arsenic buried layers are then defined and implanted for the n- and p-channel transistors respectively. The SEG was done at 950°C, 25 Torr, in an H_2 + SiH_2Cl_2 + HCl ambient. Subsequent processing steps followed a typical bulk silicon buried layer CMOS process.

SEG is also being used to refill deep trench isolation structures for high-speed bipolar and BiCMOS devices, since it results in planar refill, is free of void formation and can refill varying trench widths simultaneously.

The major advantage of SEG, however, is that, in addition to being a good technique for lateral isolation, it provides the potential of forming selectively doped epitaxial structures - without much increase in process complexity.

SEG has also been used to form independent bipolar npn and pnp transistors, independent bipolar and CMOS device doping levels (in BiCMOS), thin bipolar base structures and sidewall base contact bipolar transistors. Selective doping by SEG can also be used for shallow junction formation and self aligned contact refill and planarization for interconnects. The formation of three-dimensional structures using silicon on insulator (SOI) technology is another major application of SEG.

The use of low temperatures (<1000°C) and reduced pressures (<80 Torr) is a relatively new development in SEG, and results in:

- Improved epi surface morphology and planarity,
- Improved selectivity,
- Reduction in Si/SiO_2 sidewall interface defects,
- Reduction in the in-situ pre-clean temperature, thus eliminating oxide lifting and undercutting, and
- Improved epi thickness uniformity for different Si/SiO_2 ratios and window sizes.

SEG still suffers from a few problems in certain applications, including enhanced sidewall leakage and steep corner faceting. Sidewall junction leakage can cause a "kink" effect in the n-channel device subthreshold characteristics and faceting leads to non-planarity.

The faceting effect can be minimized by selecting SEG growth conditions and device layout design, although it appears that some selectivity must be traded to reduce faceting. (Reprinted with permission from Semiconductor International Magazine, January 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, IL. USA.)

New smaller, cheaper, supercomputers

The new generation of supercomputers will fit on a desktop and sell for about $100,000. The largest, fastest supercomputers used by government laboratories and others who require a great deal of computing power cost around $20 million. The slower, smaller mini-supercomputers cost $200,000-1.5 million. The new generation of machines will occupy a price and performance niche right below mini-supercomputers. They are being called superworkstations, graphics supercomputers or personal supercomputers. They can manipulate large amounts of data quickly, and have 3-D graphics capabilities. R. Shaffer, editor of the Technologic Computer Letter, says the machines will have to find new applications to become popular, but believes they are sure to appeal to "all the macho computer guys".

Ardent Computer (Sunnyvale, CA), Stellar Computer (Newton, MA), Apollo Computer and Silicon Graphics (Mountain View, CA) are all preparing to introduce personal supercomputers. The machines will initially be used for applications that are currently divided between conventional workstations and supercomputers, such as mechanical engineering, computer modeling in computational chemistry and seismic interpretation. Ardent's Titan graphics computer is only 10 per cent as fast as a conventional supercomputer, but the latter have to be shared. An engineer could actually solve a problem in less time using a relatively slow single-user model like Titan. Some industry sources doubt there is a large market for single-user mini-supercomputers with a price tag of more than $100,000. (Extracted from New York Times, 26 February 1988)

Attractive microcomputer trends

Microcomputer makers are capitalizing on several trends in computing that make microcomputers very attractive. Computer makers are producing machines that can communicate with machines by other vendors that all use the same software. Customers are taking advantage of this to network machines, and microprocessor-based microcomputers are becoming as powerful as minicomputers or even mainframes, at a

fraction of the cost. The trends have hurt mini- and mainframe makers like IbM, Data General and Wang Laboratories. Others, like AT&T and Digital Equipment, have formed alliances with microcomputer makers such as Sun Microsystems and Apple Computer. Proprietary operating systems are being replaced by a few standardized operating systems. Analysts speculate that there will soon be three groups of computer makers. IbM will be by itself; Digital and Apple; and everyone else (including Cray Research, Apollo Computer, Unisys, NCR and Hewlett-Packard), who will use the Unix operating system. The industry is also being affected by the trend toward linking desktop microcomputers to larger central computers. Standards are also developing for these linkages which are facilitated if both types of computer are using the same operating system, such as Unix. (Extracted from New York Times, 23 February 1988)

Italian tele-dialysis system

The Italian firm La Traccia has set up a tele-dialysis system which resolves the problems relating to the monitoring and management of patients in dialysis at home or in assistance centres. The doctor-patient contact is made thanks to a telematics system which guarantees the doctor who follows the dialysis, real time and automatic memorization of the data of the person under dialysis. Sophisticated software, as well as guaranteeing the transmission of data, allows the parameters and the memorization of the medical history of the patient to be confronted, supplying statistics and general data relating to each patient.

The system is composed of a hospital centre in liaison with assistance centres with several dialysis machines and with dialysis machines installed in the patients' homes.

The hospital centre supervises the system with an IbM-compatible personal computef, connected by a modem to the telephone. The doctor can monitor in real time the data of the patients in dialysis in a selected area.

The assistance centre, which collects the data from several dialysis machines, also has an IbM-compatible personal computer, a modem, a multiplexer and apparatus with RS-232 interfaces. The monitoring and preparation work of the dialysis consists of loading into the computer the place, time, weight, blood pressure, pulse rate, blood flow and pre-dialysis symptomology of the patient. The dialysis, which is the fundamental phase of the system, is then started during which each dialysis machine is read, thanks to the multiplexer which allows the visualization of the data relating to selected patients, the periodic memorization of the data received by the readers which can be transmitted at the request of the connected centre. The patient's data are available at the beginning and end of each dialysis. Home dialysis requires an IbM-compatible personal computer, a modem, a monitor with RS-232 interface. The same data as that of the assistance centres is loaded into the computer. Then the monitoring and automatic acquisition of the data of the person under dialysis, which are regularly memorized, is carried out. The hospital can at any moment put itself in contact to monitor the dialysis and intervene in the case of abnormality. The doctor can also request data to be sent in order to analyse the graphic development of the most significant parameters for use in statistics. (Source: Bulletin IbIPRESS, No. 55/06, December 1987)

Going for the gold with the help of a computer

The value of using computers in sports - the measuring, the testing, even the monitoring of athletes - may have been obscured by the fear of the unknown. Today, that fear has largely given way to a new age of enlightenment, particularly on the part of the athletes themselves.

The 60 pieces of software developed by Len Jansen, the sports science division's manager of computer services, can tell an athlete just about everything he or she wants to know but was afraid to ask.

In this Olympic year, the more answers the merrier. The Games are the apex of the life of every world-class athlete classified as "amateur". It is especially important this time around because US and Soviet athletes will - or at least were scheduled to at press time - compete in the summer Olympics for the first time since 1976.

So, if Jansen's programs provide the user with even the slightest edge over a competitor, any qualms about sharing one's personal life with a computer will be relieved.

Need help on your biomechanics? Then the sports science laboratory's high-speed film and video capability is for you. After taking pictures of a runner, the information is sent back to the laboratory where it is crunched by a Data General MV 10000. The results allow trainers to examine the stress and pressure on each of the body's joints.

Worried about your heart rate, maximum oxygen intake, percentage of body fat, and blood chemistry? The answer lies somewhere within Jansen's physiological programs.

If you are into mind games, Murphy has a few. The Competitive State Anxiety Inventory measures one's stress and anxiety in competition. The Psychological Skills Inventory for Sport tests confidence, concentration, motivation, and other factors that may mean the difference between the silver and the gold. The Profile of Mood State checks the users' depression, tension, confusion, fatigue, and vigour.

The abundance of programs may be a blessing to some, but there are critics.

The tests are good enough to satisfy the more than 200 athletes who have gone one-on-one with the sports science division's computer and lived to tell the tale since testing began last June. The sports science division hopes to develop a standard profile of all top athletes. The only trend from the preliminary data that is discernible to date indicates that top athletes suffer a greater impact from burnout than does the general population. There is also some feedback confirming what is commonly known: when these guys get beat, they take it a whole lot harder than the average weekend jock.

How reliable is this output? It is not infallible, but researchers think it is orders of magnitude ahead of the paper chase.

The acceptance rate may be higher, too. No matter how sheltered an existence athletes may have led, computers are not creatures from another galaxy to most of them. That familiarity makes it easier for Jansen and colleagues to convince coaches that the computers will not take over their jobs. The sales pitch that the machine is just another tool with which to analyse an athlete's training methods and techniques seems to be winning more and more converts. Of course, it is far more difficult to turn around a coach who has been in the business for 25 years than an athlete who has not even been on the planet that long.

Nor does it hurt an athlete's test-taking confidence to be assured that the results will remain confidential. Incidentally, players on the smaller Olympic teams are more likely to share the results with their coach than those on larger teams.

Electronic monitors for parolees

The US Justice Department has begun using electronic sensors on a small group of federal parolees to monitor their movements outside prison, on an 18-month trial basis. The monitors, used by several state governments alert law enforcement officers when a parolee travels from home without permission. The US Parole Commission said the monitors could save millions of dollars/year by allowing the early release of some prison inmates. Civil liberties groups say the sensors are an invasion of privacy and might replace valuable face-to-face contact between newly released prisoners and parole officers.

The lightweight, plastic monitors equipped with computer chips send a signal to a transmitter mounted on the parolee's home telephone. The transmitter relays the information to a computer programmed to know when the parolee should be home. The pilot programme requires that a parolee be home at all times except for work, treatment programs authorized by their supervisors, and church. If the electronic signal from the sensor is broken for over 15 minutes and the parolee cannot be reached, a probation officer is informed. The sensors would be used on parolees who do not need halfway houses - generally those who have a family, job, relatives or place to live. Agreeing to wear the monitor would allow the parolee to be released from prison directly to the community up to six months before the original parole date. (Extracted from New York Times, 10 February 1988)

A new revolutionary system in the field of microbiology

A new automated system known as Gene Amplification System, has been perfected by two companies working in the electronics and in the biotechnological fields respectively. This instrument is expected to speed up and revolutionize the sector of medical research through its potential applications of extreme importance. These include the early and effective detection of the AIDS virus.

Cetus, one of the foremost American firms in the field of biotechnology and Perkin-Euer, an important producer of laboratory material and integrated circuits equipment have together enveloped this electronic control instrument which automates the procedure followed for the reproduction of genes.

This biotechnological proceeding, known as PCR (or, polymerase chain reaction) allows microbiologists to produce millions of copies of the pre-established component of DNA. Thus this new procedure permits a very rapid selection of sequences from all of the DNAs, only reproducing those which are necessary and thus reducing the research work from a few weeks to two or three hours only.

The first commercial application of this system will be out of the test to diagnose the mortal AIDS virus. The firm of Cetus, in collaboration with Eastman Kodak, has developed this test and hopes to obtain the product's authorization from the US Federal Drug Administration as from the beginning of next year.

This automated system of gene cloning could have other important applications such as the test for diagnosing leukemia already while it is developing. In addition this system may prove extremely useful for detecting genetic alterations such as certain anaemias, muscular atrophies and haemophilia as well as genetic predispositions such as diabetes.

This method could also be used in determining tissues in the case of organ grafts or of determination of paternity. (Source: Bulletin IMPRESS, No. 150/06, December 1987)

3D computer video helps surgeons

An interactive 3D computer video can allow surgeons to assess the effects of various procedures on a patient. The system, developed by researchers at University College Hospital, London, UK, is already in use for orthodontic surgeons who perform operations to correct facial deformations. The computer uses data from computer-aided tomography or nuclear magnetic resonance imaging. Surgeons can inspect the bones and tissues and cut out and remove sections of them in different ways. Surgeons currently must use photographs or expensive plastic models when preparing for surgery, and neither option now allows for an analysis of several different ways of performing a surgery. The system requires a great deal of data, and manipulation now can take up to 20 minutes. Further improvements to the system may lead to a computer built of 64 Transputers, the parallel microprocessor offered by Inmos. (Extracted from New Scientist, 8 October 1987)

New on-line patient care conferencing

The Karenet (Kellogg Affiliated Remote Environments Network) microcomputer and data communication network in Texas will offer on-line conferencing and consulting on patient care, access to database information, automated health records, and continuing education programs; completion date is set for 1989. The purpose of the network is to provide medical professionals in rural areas with the same access usually available to urban healthcare professionals. The project has a $1.5 million grant from the Kellogg Foundation and a $210,000 gift from AT&T. Rural medical personnel will be hooked up to the Texas Technological Health Center, a regional teaching hospital. The four-stage project is now in the second stage - the implementation of AT&T's Truevision, a PC-based imaging system that will enable remote sites to send and receive colour images, including X-rays and photographs of a patient's injuries. (Extracted from MIS Weekly, 4 January 1988)

New video-conferencing system

Compression Labs (San José, CA) will offer a new video-conferencing system as an entry-level system or as an inexpensive way to extend a video-conferencing network to low-volume sites. The modular Gallery 2000 supports Compression Labs' Rembrandt or Rembrandt 56 coder/decoders for transmission of full-motion video, still-frame graphics, and voice between remote sites. The Rembrandt coder/decoder offers the higher quality video and requires network facilities that can accommodate speeds of 384 Kbps to 3 Mbps. The Rembrandt 56 coder/decoder, which can be used with AT&T's Switched 56 dial-up 56 Kbps service, uses 56 Kbps and 384 Kbps facilities. The Gallery 2000 features a 25-inch monitor that displays the conferees, a 25-inch monitor that displays documents or other still-frame graphics, a main camera for photographing the conferees, another camera for photographing still-frame graphic images, a Shure Bros. 4-port AMS4000 audio mixer console, and three microphones. It also includes a room controller unit, which is a stand-alone box wired to the cabinet that allows users to pick camera angles and run other system functions. (Extracted from Networking World, 25 January 1988)

New networking products

TRW Information Networks Division will unveil a new line of Transmission Control Protocol/Internet Protocol (TCP/IP)-based networking products at the Communication Networks Conference & Exposition (COMNET) in Washington, DC, in January 1988. The new products are part of an aggressive attack on the local- and wide-area networking environments. TRW will design and develop the new line, instead of

buying network components - such as bridges and adaptors - from other suppliers, as it does for its present line. TRW will introduce the 11-product Nb2000 line of net bridges, which includes six that operate with IEEE 802.3 local networks housed in the same building, and five with remote networks. The bridges run transparently to higher level protocols, allowing for the interconnection of networks with a combination of protocols, such as TCP/IP and Digital Equipment's DECnet. The company will also introduce three new network adapters for IBM PCs and compatibles, and a line of IBM PC-based network management products, including a packet monitor. The Advanced Connector Unit (ACU) 2000 communications server, which runs TCP/IP, was introduced in early 1987 and began being shipped in late 1987. (Extracted from Networking World, 4 January 1988)

New networking architecture

Ungermann-Bass has introduced a new networking architecture to provide "network delivery system" products. Ungermann-Bass's Access/One product line will use standard telephone wire to connect microcomputers, asynchronous terminals, and IBM 3270 terminals over Ethernet or token ring to one point in the wiring closet, where the administration of the network will take place. The wiring closet cabinet will include 11 slots for interface modules, which correspond to each type of network device, as well as a module that handles local network management jobs. The modular approach to the system enables users to update as technology advances. Users can also reduce cost and clutter through the use of the line's standardized wire - unshielded, twisted pair. Network access is easy: it is achieved from the telephone jack on the wall. The Access/One's six modules include the Access/One Network Interface module, the Access/One Supervisor module, the Access/One Asynchronous Interface module, the Access/One 3270 Interface module, the Access/One Ethernet Concentrator, and the Access/One Token Ring Concentrator. (Extracted from MIS Weekly, 25 January 1988)

Computer scents

Interest in the actions of a single neuron to the metropolis of hundreds of thousands of nerve cells interacting in myriad brain circuits and architectures? This is the question that in the last few years has spurred a remarkable meeting of minds among neurobiologists, psychologists, computer scientists, physicists and philosophers.

And it has sparked a revival of interest in computer simulations of the brain's neural networks.

At the third conference on the Neurobiology of Learning and Memory, hosted by the University of California at Irvine (UCI) last autumn, the problem of how to improve the translation between neurobiology and computer models took centre stage.

Neurobiologist Gary Lynch, computer scientist Richard Granger and their colleagues at UCI, have built a simulation of one layer of neurons called layer II, in the rat's pyriform, or olfactory, cortex - a brain area that has been linked to the sorting and storage of smells. The researchers decided to model the olfactory cortex because it is one of the anatomically simplest and best-understood regions of the brain and because it constitutes one of the shortest routes between memory and the outside world.

In contrast to most other work, Lynch's group took a "bottom up" approach. The researchers threw together what they had learned in experiments about the physiological properties of pyriform neurons and how they interconnect, gave the computer a set of stimuli representing odours and, without asking it to solve any particular problem, simply watched what the simulation did. The computer organized information in unexpected ways and predicted a number of physiological phenomena, which the researchers have since confirmed with live rats and pyriform slices in the laboratory. (Extracted from Science News, Vol. 133, 9 January 1988)

Oxford Dictionary now available on disc

Gigabyte is the latest word at the Oxford English Dictionary, a measure of the one billion bytes needed for what will be a major event in the history of both computerization and lexicography: the transference and updating of the entire 16-volume OED onto three compact disks.

The task is so mammoth that to put the same work of 22,000 pages and 500,000 definitions and usages onto conventional computer floppy disks would require more than 3,000; compact disks are far roomier.

The first two disks containing the basic 12-volume dictionary, minus its four-volume supplement, have appeared, and Oxford University Press expects wide subscription from the world's libraries. It may appeal even more to the computerized layman eager to put aside the magnifying glass that is the proud tool of the current owner of the printed OED and turn to the keyboard for a trip through the language.

The multiple search powers of software, for example, would permit someone to trace a particular German-rooted word and then tangentially inquire into how many such German words came into the language in a given century, or two or three. Or a reader checking on a gastronomical word could impulsively inquire into all the words involving cookery that have been traced to late 13th-century French. No entry is ever discarded, only listed as obsolete with change. Another is that each entry has the earliest possible printed reference from history.

The computer dictionary has main headings for 300,000 words plus an additional 200,000 subsidiary usages - an increase of 25 per cent over the original OED.

The initial computer disks will result in a new printed edition of the OED, in 1989, but the main bonus of the conversion to the computer means that the dictionary can be fluidly updated as the new century arrives. (Extracted from International Herald Tribune, 15 December 1987)

Design accuracy enhancer for boats

Elevating Boats (Braithwaite, LA) has used the analysis capabilities of a CAD/CAM system to boost design accuracy. The Applicon Bravo3 system quickly allows engineers to perform finite-element analysis and large-displacement analysis on cranes and barges commonly used by major oil firms. One of the primary reasons for purchasing the Applicon system is that the Graphic Finite-Element Modeling and Interactive Finite-Element Analysis and Design (Grafem/Ifad) software and the 2D Mechanisms package are completely integrated within the Bravo3 database, which enables analysis to be performed without re-entering geometric and mass data. The Grafem/Ifad software allows engineers to completely model booms within one day. The 2D Mechanisms package allows designers to optimize the pin position on the force triangle formed by the boom, the hydraulic cylinder, and the top of the base. Elevating Boats, a maritime boat and crane manufacturer, also uses the Applicon system to design its own vessels, called "elevating boats". (Source: Technology Update, 11 January 1988)

New system for editing broadcast tapes

The British Broadcasting Corporation has developed a system for editing broadcast tapes using 16-bit digital code on Winchester discs. Until now, different takes of a performance or interview were manually spliced. The new system will allow transfer of a tape to a disc. When a mistake is heard, the engineer presses a button to insert an inaudible code onto the disc. A similar code is put onto the tape of a performance without the mistake. The disc then automatically switches to the better performance when it reaches the signal, and the better performance is then transferred to the disc. Accuracy of one millisecond is possible, which is 10 times better than manual splicing of magnetic tape. The new system also blends the sounds over 50 milliseconds, to make the transition smoother. (Extracted from New Scientist, 31 December 1987)

V. COMPUTER EDUCATION

Future training

Education is as key an element in successfully installing and operating a CIM program as computerized machines, deficient education and training causing many CIM efforts to falter. Training in the future, to be more comprehensive, varied and ongoing versus hitherto, will be increasingly used to unveil new managerial methods, help shape attitudes and instruct technology users. Training in future plants, geared to take advantage of the shop floor worker's intelligence, will take up higher amounts of time and effort. The firms with the best trained work-force will be the leaders, as education like quality provides the largest benefits for the least cost when it is integral to an organization. (Extracted from Metalworking News, 11 January 1988)

Modems usurp the classic classroom

American colleges and high schools are adapting the traditional chalk-and-talk classroom format to the age of computers and telecommunications. Over 20 institutions in the US are working with an interactive system that lets an instructor lecture to students at a remote site through a speakerphone while controlling blackboard-like displays on personal computers at the students' locations. The programs let part-time students take courses without having to travel to the university - a serious problem in some parts of the sprawling US.

The common thread is a modem that can simultaneously transmit voice and data over a single phone line, which New York-based Optel developed with software to give the instructor control over the remote computers. Normally the instructor prepares displays, and distributes them on floppy discs before class to students at remote locations. As the lecturer talks during the class, he or she can call up particular displays on the screens of distant students. By marking on a special pen-pad, the instructor can generate modifications to the screen which will be communicated to the remote sites, and which can be saved on the students' discs.

Louisiana State University's "telelearning" program includes graduate-level classes not available from other schools in the state. The audio, video, computer, and telecommunications equipment cost about $9,000 per site, says director of distant learning Donald Partridge. The equipment includes modem, software, a personal computer, and large-screen display. Despite that expense, the university can still save money by avoiding the cost of sending a professor to a remote part of the state especially if the course is offered at multiple sites. The savings are a key issue in Louisiana, a state with economic troubles that have left its government near bankruptcy.

The program started in 1985, and Partridge said that last spring it had 104 students. The total was lower last autumn but he expects about 100 students again this semester. Some students are as far as 250 miles from the main campus in Baton Rouge.

With a grant from the Annenberg/CPB Project, the Cambridge Teleteaching Group of Cambridge, Massachusetts used the hardware and software to develop a first-semester calculus course offered by Harvard University's Extension School. Each three-hour class uses 50 to 60 screen displays, says Mindy Zatto, co-director of Cambridge Teleteaching and a teacher of calculus at the Harvard Extension School.

Meanwhile, a voice-data modem has been developed that can transmit 1,200 bits per second, instead of the 300 bits per second handled by earlier models. Like the older models the new modem cuts a "notch" of frequencies out of voice signals to reserve for data transmission. (This first appeared in New Scientist, London, 18 February 1988 the weekly review of science and technology.)

Educating computers

Illinois University is conducting research into explanation-based learning by computers. This allows a computer to learn something from one example, rather than by comparing several. A computer using an explanation-based approach would deduce the concept of a chair from one example, rather than by comparing several, the standard method for artificial intelligence learning. (Extracted from Computing, 1 October 1987)

New language training device

Toshiba has developed a portable tutor device with ROM cards to teach languages. IC-Voice looks like a Walkman cassette player, but uses language education courses produced by the British Broadcasting Corporation and reduced to ROM chips of 16 Mbit capacity. The chips produce up to 480 seconds of pre-recorded speech. The pupil repeats key phrases into a RAM memory of 256 Kbits to store and replay 32 seconds of sound. Pupils can then compare their pronunciation with that of the permanent example. R. Maxwell's International Learning Systems Japan has ordered 50,000 of the unit over the next three years valued at UK£11 million. (Extracted from New Scientist, 15 October 1987)

An expert system for training air force pilots

Beginning in 1988, an expert system will help train young US Air Force pilots in combat techniques. This system is based on the experience acquired by veteran pilots and shows officers how decision factors are linked and teaches them to conceptualize problems.

Endowed with a budget of $US 1.6 million, the research programme groups together knowledge engineers and computer specialists. It is carried out on the basis of the experience of two pilots who accomplished more than 100 missions in North Viet Nam. Both of them have drawn up, with the researchers' assistance, combat scenarios which include: weather conditions, the distance of the target, the explosive charge necessary for its destruction, the number and configuration of the planes.

The aim is to identify mental schemes which are then transformed into computer data in order to make them accessible to the students.

As recently illustrated at the IJCAI in Milan, the major lines of research in artificial intelligence are logic programming, parallel machines and computer-assisted learning. The development of expert systems has given a large boost to research on learning and has been useful in numerous domains. However, the applications are still limited given the

inability of the systems to acquire knowledge. Current research is therefore aimed at providing new solutions. (Source: Bulletin IBI/BIP, No. 154/87, December 1987)

Appeal for funds to set up a centre for computer-based job training for the disabled

Hummanitec, the computer industry charity has launched an appeal to fund a computer-based training scheme for disabled people to be based in London's Docklands. A similar scheme is already in operation, and putting its trainees in work, in Northern Ireland.

The setting is picturesque and rural - an isolated farmhouse in the rolling countryside a few miles south of Belfast. The interior, by contrast, is very much hi-tech, with a desktop publishing unit and an interactive video system, Acorn BBC Masters, BBC Compact and an Olivetti M24 thrown in for good measure. Soon, these will be augmented by an Acorn Archimedes, an IBM PS2 and an Amstrad PC.

This is the Nante Training Centre, which has the seemingly daunting task of helping young, disabled, unemployed people find work in the difficult conditions of Northern Ireland. It was founded by two computer consultants, David Brew, who is based in Ulster, and Julia Schofield of Richmond, Surrey.

The two share considerable experience of using computers to help people overcome their disabilities, and an innovative approach to computer-based training (CbT), on which the tuition at Nante relies heavily.

The idea for the centre arose from their earlier work in this area. Since 1979 Brew has been administering the National Computing Centre's Threshold scheme in Northern Ireland, which offers training in technology skills to the disabled.

Schofield, who is blind herself, came to the project through her work with spinal injury patients, using computers for both rehabilitation and training for re-employment. The scheme started at Stoke Mandeville, but has spread to hospitals throughout the UK, including Musgrove Park in Northern Ireland.

Nante opened its doors at the beginning of 1987, and aims to take on about 20 students a year, of whom the first dozen are now in training. Academic qualifications are not of prime importance.

While tuition in computing skills occupies most of the first phase of the course, this is not the main objective of the training. In phase two, an individual programme of coursework is designed for each trainee, geared to his or her particular aptitudes and employment objectives.

An additional advantage is that trainees can spend some of their time working at home if, say, they have transport difficulties. Similarly, some trainees, especially the more severely disabled, will probably end up employed in their own homes.

The hardware has all been chosen for specific reasons. For the BBC Masters a wide range of ancillary equipment is available, such as special keyboards and suck-blow tubes, which means that they can be used by people with almost any degree of disability.

The scheme has already generated interest on the UK mainland, particularly from London's Docklands, where there are plans for a similar scheme on a slightly larger scale. (Extracted from Computer Weekly, 19 November 1987)

National issues on computers in education - IC3 workshop held in Bombay

National Issues on Computers in Education was the subject of a workshop organized by the International Federation for Information Processing (IFIP) Technical Committee on Education (TC3), the Computer Society of India, and the Indian Institute of Technology, Bombay. The aim of the Workshop, held in Bombay in March 1987 was to produce a "working document" that would contain specific conclusions and recommendations on the effective exploitation of computers in education. The Workshop was not concerned with computer science education per se but with computer science and informatics in the broader context of all education, i.e., "learning with computers" rather than "learning about computers".

The Workshop followed a TC3 meeting in Bombay, the first time since the early 1970s that TC3 has met outside Europe and the USA.

The Organizing Committee was headed by Prof. B. Nag (IND), and Prof. Josef Isaac (IND) was Program Co-ordinator. Prof. Wilfried Brauer (D), TC3 chairman, and Maj. Gen. A. Balasubramanian, representative of India to the IFIP General Assembly, delivered remarks at the opening session.

Sixty participants from 23 countries convened to discuss problems related to effectively integrating computers into education. All agreed that major support for professional training should have the highest priority. While historically there has been emphasis on the acquisition of hardware and software, the major problem now facing all nations is a lack of adequately trained teachers. Unless this problem is solved, we shall never realize the tremendous potential which the computer provides for giving teachers a tool to improve the quality of education.

The major conclusions and recommendations of the Workshop are summarized here:

- "Learning-with-Computers" offers a very powerful tool for educators, and all efforts must be made to harness the potential of computers and informatics in education. Further, this technology enforces a deeper appreciation of educational pedagogy.

- Unless backed by well-planned short- and long-term projects at the national level, the full potential of this educational technology cannot be exploited. Considerations of hardware/software costs should be subservient to educational objectives.

- The all-pervasive nature of computer/informatics necessitates awareness and literacy programmes and the exploitation of computer-based technologies in both formal and non-formal educational sectors.

- Computers and informatics should play a supportive role in all educational areas, and the basic principles and methodologies of algorithmic and systems-oriented thinking should be inculcated in traditional/new teaching systems in all disciplines and areas of learning and teaching.

- The computer's versatility makes it an ideal tool for special education requirements, such as educational aids for the handicapped and for the mentally retarded. Also, computers can offer multilingual support facilities, widening the sphere of effectiveness into rural areas and breaking down cultural barriers.

- Computer-based education offers excellent scope for exploiting the "multiplier effect" of good teachers and can be an effective tool in distance educational systems. This educational technology could therefore have a more encompassing role to play in the developing world.

- The key to exploiting computer-based technologies lies in effective teacher training. Teachers have to be trained to: (a) accept and adopt computer/informatics-oriented techniques and methodologies into their own teaching and/or (b) teach relevant computer science topics and techniques to make students more competent in their own disciplines.

- Computer-based national and regional education testing and information services should be set up to support educational planning and implementation efforts.

Copies of the detailed report may be obtained from: Prof. B. Mag, Director, Indian Institute of Technology, Powai, Bombay 400 076, India. (Source: IFIP Newsletter, Vol. 4, No. 4, December 1987)

Networking research on information technology and education - A UK programme and its links overseas

Electronic networks are serving to foster collaboration and information exchange within the research community in general and the educational research community in particular. In North America, communication systems appear to be technologically advanced and co-ordinated; in Europe there is a diversity and incompatability of systems. Despite these disadvantages we do claim a richness in innovation with a broad cultural base. We are currently aiming to disabuse current "folklore" that runs:

"invented in Europe;
patented in North America;
marketed in Japan".

This article focuses on the Information Technology and Education (ITE) Programme that is sponsored by the United Kingdom's Economic and Social Research Council (ESRC) as an example of a networking initiative. The ESRC, restructured from the previous Social Science Research Council in 1982, is one of a number of UK Research Councils (e.g., the Medical Research Council, the Science and Engineering Research Council) which are charged by the UK Government to stimulate and sponsor research in their fields of expertise. The Education and Human Development Committee (EHD) is one of about six major areas that ESRC supports from its annual budget of around £25 million per annum for research training and substantive research funding in universities and similar bodies. Research grants and doctoral studentships are awarded through open competition by peer review.

Recently, ESRC has encouraged more focused initiatives in particular fields. Early in 1983 the EHD Committee identified and circulated for discussion an initial listing of important topics which warranted expanded support or accelerated development through specific programmes of work, termed "initiatives". These have included Teacher Education; Information Technology and Cognitive Science; Multicultural Education; and ITE.

With respect to ITE, the Committee emphasized its intention that research would be centered not only on the effect on education of machines to help teach the existing curriculum, but on the development and adaptation of the curriculum to equip people, including those of school age, to deal with a life changed by the arrival of intelligent machines. In particular, the Committee identified questions concerning both cognitive and organizational factors which facilitate or inhibit the adoption of Information Technology in Education, and allied to these, questions around the nature, characteristics and development of information technology literacy.

Two reports were commissioned, and detailed discussion and workshops were held in 1983. In its further considerations, the Committee was conscious of the fact that the research community in the UK is widely scattered and has relatively few large groups of researchers. Furthermore, it recognized the importance of involving practitioners and policy-makers in the development of its programme of substantive research and research-related activities and the necessity of ensuring close collaboration with commercial organizations such as publishers, software houses and hardware manufacturers.

These considerations led the Committee away from the establishment of a single new Centre, and towards the appointment of a co-ordinator as the focal point for the development of the initiative throughout the country. This approach is distinctive in its organization, moving away from more traditional forms of direct support for substantive research and research training towards a networked programme of collaborative research.

The ITE "infrastructure" programme reports directly to the EHD Committee, but also has a small Steering Group to assist it. An initial three-year programme in 1985 with a three-year budget of £250,000. Additional funds for research and training are available through normal ESRC grant competition and the attraction of funds from many other sources.

The Programme has tried to be responsive to the wishes and needs of the research, practitioner and policy-maker community in the UK. Now, after two years, the Programme's main functions, as identified above, remain central to its policy. These functions reflect the Programme's role in providing an infrastructure for co-ordinated research. The priority areas originally identified remain, viz:

- Information technology literacy;

- Implanting innovation and teacher education;

- AI tools in computer-assisted learning (CAL) development.

The foci within these areas have become more clearly defined. In particular, the programme is promoting research into:

- Classroom processes and peer interaction;

- Teachers' education through teachers, roles as researchers and developers;

- Intelligent advice and explanation as an adjunct to traditional CAL simulation and games;

- IT in the whole curriculum;

- New learning environments (e.g., microworlds).

New policy initiatives have led to:

- Involvement in AI in training;

- Evaluation of vocational training;

- A perceived need to bring about better understanding, and hence collaboration, between cognitive scientists and educationalists;

- Research training for doctoral students and teachers.

A number of European agencies that promote scientific collaboration are well established and have provided longstanding support for research in the natural sciences (e.g. the Centre Européen de Recherche Nucléaire and the Européen Space Agency). More recently, the Council of Europe has established links in the field of education and provides certain electronic services.

At the moment, in conjunction with agencies in the field (e.g., Commission of the European Communities (CEC), European Science Foundation and the Council of Europe), many nations are seeking to strengthen the links across Europe. This is not an easy task, as our strength in cultural diversity is also a weakness both in technical ways (as mentioned earlier) and in the intrinsic linguistic ones. While working in a community of academic researchers, we may assume a knowledge of at least two European languages; this is not the case for the larger practitioner community. This is no reflection on the quality of our teachers, simply a fact of life, and becomes critical because we see practitioners as an integral part of our research effort.

Our UK programme is one of a number of national initiatives seeking to add to the efforts of European agencies. We believe that effective collaboration can only come through personal contact, and this is a problem because in Europe we boast the world's highest cost per mile for air transport! European seminars are costly and relatively rare. An important one which the ITE Programme is organizing in June 1987 for the CEC brings together two representatives from the research councils (or their equivalent) from each member State. We aim to share priorities of policy and action in our research into IT and education, and see the outcome as building links between research teams in various parts of Europe. We aim to establish better electronic services to provide the long-term backup.

The on-line services through JANET (the Joint Academic Network in the UK) and EARN (the European Academic Research Network) provide fast, direct messaging and document transfer. EARN does not yet cover all major locations in the whole of Europe. Also available through the ESRC-ITE Programme are on-line databases and the bulletin boards through JANET in the UK and via DIALCOM services worldwide where packet-switch systems keep costs to a reasonable level.

Our cornerstone database is called PEOPLE as we wish to emphasize that it is individual researchers and practitioners who form collaborative teams. The database contains profiles of individual researchers and innovative practitioners. The services are integrated so that, for example, a search for people with a particular interest/expertise can be turned automatically into an e-mail address list for a document, notice, invitation, and so forth. These services are far from advanced but it is inevitable that communications systems will improve rapidly over the coming years. Bearing in mind the community we wish to serve, it is essential that the services are easy to use because not all people are habitual computer terminal users. This is particularly significant because we are adamant that technology-driven inroads into our educational systems are not acceptable and we need the participation of classical, low-technology educators. In the past, it has been said that the more innovative a project, for example one proposing curriculum change, the less likely it is to find acceptance among practitioners. In no area is this more likely to happen than in the application of the new technologies to learning.

In addition to the active participation of practitioners, the emphasis on "networking" (in its broadest sense) is significant for two reasons:

- The IT field is multidisciplinary; its community comprises researchers from various traditional disciplines, computer science, psychology, education, linguistics, and cognitive science. Communication between such workers is not as well-established as it is within the disciplines themselves.

- Those active in the field exist in very few newly formed groups but most are widely dispersed and often isolated.

These features of constituency and distribution characterize new fields of study, particularly in the area of new technologies where the rate of growth is large.

Detailed papers on the ESRC-ITE Programme are available from the author at the Department of Psychology, University of Lancaster, LA1 4YF, United Kingdom. (Extracted with permission from the author, from an article written by Prof. R. Lewis, Co-ordinator of the ESRC-ITE Programme, University of Lancaster, UK, which first appeared in Technology and Learning, Vol. 1, No. 4, August 1987)

VI. SOFTWARE

New way to visualize computations

Brand-new high-powered graphics software from Ardent Computer Corp. provides supercomputer users with an easy way to add visual presentations to the results of computations. Doré, the Dynamic Object-Rendering Environment, is a set of high-level libraries based on an object-oriented data base plus flexible rendering software, and it means that application programs and programmers no longer have to handle the graphics details of drawing objects and rendering them into complex scenes.

As supercomputer usage increases, so does the demand for interactive visualization of the simulation or design computation being performed. Doré is a graphics software tool kit for adding visualization and conceptual design to supercomputer applications. It is used to define abstract scenes using high-level subroutines for building a hierarchical, object-oriented scene data base drawing upon a library of five types of objects. An abstract scene is one that completely defines the objects in a scene, but which has not yet been rendered into a scene that can be displayed.

Abstract scenes are rendered into displayable scenes using Doré's three levels of rendering. The more realistic the scene, the slower the rendering process. Users can create dynamic displays using low-level rendering; more realistic results are achieved with intermediate rendering techniques; very realistic static scenes are produced with ray tracing.

Among Doré's unique attributes that make graphics easy is the ability to dynamically change the style of rendering on an object-by-object basis. This allows intermixing of representations so that some objects are displayed in a quick fashion with minimal detail while other objects in the same scene can be displayed with more detail.

Ardent is developing a single-user supercomputer with integrated graphics and rendering capabilities; the Doré graphics software developed for this machine will be offered as a stand-alone software package for use on other hardware platforms, such as technical workstations, minisupercomputers, and supercomputers. In addition, Ardent wants to establish Doré as a visualization standard on multiple hardware platforms. The company plans to provide source code

to universities and research laboratories for $250. The price to commercial users is $15,000 plus $5,000 per year after the first year for source code maintenance. Ardent is seeking a partner for the marketing and support of Doré and will continue the development work and maintenance itself. (Extracted from Electronics, 4 February 1988 (c) 1988, McGraw-Hill Inc., all rights reserved.)

Moving PC-based debugging to real time

For years, software developers using personal computers to write programs for microprocessor-based systems have been frustrated by slow debugging. The problem was that in-circuit emulators, coupled to the computer via a communications link, RS-232 or IEEE-488, could not interact with the computer in real time.

Now, a solution is at hand from Applied Microsystems Corp., a Redmond, Washington startup. Designers there have moved debugging into the real-time realm by moving most of the necessary intelligence to the emulator end of the loop, thereby eliminating the communications-line delay. Initially, the EL800 advanced-event system, as it is called, will work with the Zilog Z80 and Hitachi HD6-180 8-bit microprocessors. Coming later are pods for other 16-bit and 32-bit processors that will free the programmer from the need to buy dedicated development systems and emulators.

The key to the system's speed is its tight coupling, permitting the computer to interact with the process as it happens. To achieve its tight coupling, the EL800 comes with an advanced breakpoint system whose command language allows the software engineer to program logical debugging tasks for it.

The system consists of hierarchical comparators. Two are address-range comparators and two are data comparators. There are also status comparators and counters. Commands can be written that use the comparators as addresses in the command statement. The programmer can create up to four groups of programs and switch between them in one clock cycle. In that cycle, every comparator is switched from the conditions required for one program to the conditions required for the next.

The software, dubbed Easy Link, contains format converters to convert compiled programs into code that can be executed on the target system via the EL800. Each language will need a slightly different set of format converters. The company will sell the software but eventually plans also to licence the programs to software vendors. (Extracted from Electronics, 4 February 1988 (c) 1988, McGraw-Hill Inc., all rights reserved.)

Users see a CASE advance in reverse engineering tools

The construction of new relational database models in minutes by extracting physical models from existing production databases are foreseen. These plans take advantage of software development tools that extract physical or logical models from existing databases through a technique called reverse engineering. As proposed by Bachman Information Systems Inc., Cambridge, Mass., reverse engineering seeks to bring many of the heady promises of CASE technology to database maintenance and development.

Early users praise the tools' ability to hasten the development of - and erase inconsistencies in - physical and logical database designs.

The foundation of Bachman's reverse engineering process lies in its data modeling regimen, which builds on the widely used entity-relationship models and diagramming techniques advanced by James A. Martin and Chen & Associates, Baton Rouge.

The modeling technique describes many-to-many and one-to-many relationships that the others do not support. Such relationships can more closely depict real-world conditions and free data analysts from having to address environmental or database restrictions.

As important as a good design, in some early users' eyes, is the promise of a smooth introduction of new database technology, such as IBM's Db2, into existing environments.

Bachman's initial packages support IDMS' design, and with support of IBM's Db2 planned in June, the physical structure of an IDMS database can be extracted and used to build a logical model for a Db2 database automatically. Since the tools will also propose database designs using knowledge-based rules, they can be used to improve existing designs, as well as to build entirely new ones.

The company expects to extend that same reverse engineering technique to applications design and development within a year. Bachman officials say it will release integrated tools for systems analysts and programmers late this year and early next year. In essence, the database work presages the ability to take a COBOL application, extract its underlying logic, then generate a modified or new application. Just as a semiconductor can be reverse engineered to create functional equivalents, Bachman's tools promise to decompose existing software or database designs to arrive at the new designs.

Users say that one of the major advantages of Bachman's database tools is that they do not impose a strict methodology. (Extracted with permission of DATAMATION® magazine c, 1 February 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved.)

Clone makers are facing an uphill climb

Since IBM anointed PostScript as its page description language of choice early last year the race to clone the desktop publishing industry's de facto standard has moved into the final stretch.

By the end of the year, several printer manufacturers, such as Canon USA Inc. (Lake Success, N.Y.), and Nissho Electronics USA Corp. (Irvine, California), should have laser printers on the market using a PostScript-type product.

The arrival of a PostScript clone, however, may not bring about the cost-cutting, speed enhancements, and proliferation of options that many desktop publishing observers foresaw last year when companies began to talk openly of cloning Adobe Systems Inc.'s omnipresent page description language.

PostScript, which enjoyed initial success in the Apple desktop publishing environment, won the endorsement of IBM as a component of SolutionPac, a personal publishing system for the PS/2.

One reason users may not reap the anticipated benefits of PostScript is that its code has proven more difficult to crack than many thought when the race began, but developers of PostScript clones say that their products stand up well in comparison with PostScript, although they admit the development process was difficult.

Palo Alto-based Adobe had assumed that more significant clone competition would appear earlier, but potential cloners underestimated the task, says a company spokesperson. Now, with many of desktop publishing's major players already under its wing, Adobe is not as concerned about PostScript clones taking flight. Adobe currently has 19 companies signed on as oems, including Apple, IBM, Texas Instruments, and Digital Equipment Corp.

Meanwhile, PostScript's two major competing languages, InterPress from Xerox, and DDL from Imagen Corp., Santa Clara, announced PostScript compatibility programs last year, a further indication that PostScript is currently the page description language of choice. Imagen announced UltraScript, which provides support for applications software compatible with PostScript, while Xerox announced an agreement with Control-C for Interpress support of CGS-Page.

Hewlett-Packard, which has the lion's share of the laser printer market with its LaserJet line, is keeping its options open on page description languages. Currently, the company's laser printer division in Boise, Idaho, has its own PCL language for dot matrix printers and laser printers. But PCL is not as powerful as PostScript, InterPress, or DDL, say analysts, so HP has a product line that has PCL and, through third-party suppliers, DDL and PostScript compatibility offerings, as well. (Reprinted with permission of DATAMATION® magazine ©, 15 February 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved.)

IS shops push for a consistent networked software plan

By now, most users have heard all the promises being made by vendors of networked co-operative processing workstations and software: sharing data, applications, and processing power across a network will vastly improve organizational flexibility while retaining all the interactive characteristics that PC users have come to know; integration of data and communications will be easier; productivity will soar.

Big engineering and scientific users in particular have been attracted to network computing; many of them have strung together large networks of Sun, Apollo, and Digital Equipment Corp. workstations. Now, of course, many of them are discovering that some key pieces of the network computing puzzle are missing and are beginning to scream for their vendors to make good on their promises.

One of the things users are calling for with increasing urgency is a consistent, common way to licence, distribute, and administer applications software across a network. Currently, most vendors licence applications in one of two time-honoured ways: on a per-processor basis or via a by-site licence, but those licencing methods are inadequate for networked environments where applications are shared by users on heterogeneous computers and where the network itself is constantly changing size and configuration.

What is needed, users and vendors agree, is a common set of programming interfaces and a common system for distributing networked applications and for charging users according to how much or by how many workstations an application is actually used. Such a system could even electronically distribute documentation and automatically monitor software usage so that IS managers could better justify new software purchases.

The problem is that while the leading vendors of networked workstations and software can agree that such a system is needed, they cannot agree on what such a common software licencing scheme for networks should look like. While the vendors are arguing, users are losing their patience.

Although the network licencing issue has emerged in the technical workstation market first, most observers feel it will become equally important to commercial information systems users as companies such as DEC and Apple continue to push the idea of distributed, network-based computing for commercial users. When that happens, the large vendors of commercial information systems will have to solve the same network licencing problems now being faced in the technical market. (Extracted with permission of DATAMATION® magazine ©, 15 February 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved.)

QTC makes it easy to design custom processors

Designers and programmers of specialized microcoded processors will find in the Software Foundry a product they have been sorely lacking - an integrated set of tools that tightly links hardware and software design. This tool kit from Quantitative Technology Corp. lets engineers evaluate design iterations - both hardware and software - as they make them, without waiting for a final version of either, and it makes the tedious and costly process of writing microcode by hand obsolete with a compiler that produces highly optimized microcode from code written in a high-level language.

Some of the tools, which run on Digital Equipment Corp. VAX systems, are available now, and others will arrive during the spring and later in the year. The full package is priced at $50,000 for a work-station-level system.

For these six tools - C compiler, optimizer, assembler, linker, simulator, and debugger - to work with any architecture, they must all be retargetable. That is, they must readily adapt to new and highly complex architectures, including those involving high degrees of parallelism (of the single-instruction, multiple-data type) and multiple-level pipelining. The Beaverton, Ore., company provides this adaptability by means of a configuration file. Written in a configuration language reminiscent of the Prolog artificial-intelligence language, the file describes the target hardware and all its peculiarities of resources, timing, and interconnection.

Once a file is written, the full QTC tool set is in business. Now the design team can compile software and simulate it as it will run on the hardware. Indeed, simulation is the key to integrating the two development processes: changes in hardware or software can be evaluated, and their interrelations seen. Designers can examine the performance trade-offs between implementing functions in hardware or software and make informed decisions about overall system design.

QTC brings very advanced optimization techniques to bear within the family of tools. Many of the techniques work as well on hand-written assembly code, if the user prefers that to writing in C. Loop rolling and unrolling, trace scheduling, and the efficient use of parallel and pipelined hardware resources are among the forms of optimization carried out automatically.

The linchpin of the system is the configuration file with its description of the system under design, which is used by all the tools. To make such files possible, QTC developed a language to write them in. (Extracted from Electronics, 21 January 1988, (c) 1988, McGraw-Hill Inc., all rights reserved.)

Software that helps you plan for your start-up

Most venture capitalists will not even think of investing in a start-up company unless there is a solid business plan behind it. Yet developing that plan is where many entrepreneurs are tripped up. So Venture Software Inc., a Cambridge (Mass.) start-up itself, has developed VenturPlan, a series of personal computer software packages that generate financial

figures to help small businesses set goals and map strategies. The software is part spreadsheet, part data base, and part word processing package. Budding Bill Gateses or Sam Waltons answer hundreds of questions posed by the programs, ranging from anticipated sales and compensation levels to floor spacing and holiday planning.

Based on the answers, VenturPlan constructs a series of three-year financial projections. Mary H. Cahill, president of Venture Software and a long-time small-business consultant will have her first VenturPlan, a $495 program for retail business, ready to be shipped in December. Other applications, for small professional, service, and manufacturing operations, will be developed within the next 18 months. (Reprinted from the 7 December 1987 issue of Business Week by special permission, (c) 1987 by McGraw-Hill Inc.)

Measures for reinforcing Japanese software

The world software market, estimated today at $US 27 billion, is to develop more quickly over the next few years and by 1990 it will have a turnover of approximately $US 40 billion. The United States and Europe have a good share of this market. Japan does not. Therefore, to catch up with the others, in this field and in the field of hardware, Japan has embarked upon an ambitious project called SIGMA.

The American market of business software had a turnover of $US 3.19 billion in 1986, 10.8 per cent up on last year, while the turnover for 1986 in the European market amounted to $US 23.5 million, 19 per cent up on last year. This market, along with the informatics services market, will grow at an annual rate of 22 to 23 per cent over the next four years. In 1991 it is expected to top $US 50,000 million.

It is in this fully expanding market that Japan lags a long way behind, especially with respect to the West. Its objective therefore, under the SIGMA project, is to quadruple its software production figures by 1991 and to do this, it intends to use new development tools.

Launched at the initiative of MITI (the Japanese Ministry of International Trade and Industry), this project has a wider scope than the fifth generation project which it encompasses. Its budget of $US 150 million is smaller however than the budget for the fifth generation project due to the fact that SIGMA shall co-ordinate and integrate several older projects (which will keep their own budgets), supervise new projects and facilitate the implementation of standards as well as the creation of technical and financial structures.

SIGMA will benefit from the participation of the private sector, not just the main computer companies but also the small and medium firms.

Since at present Japanese software is, in the main, created by the manufacturers and the Japanese software houses are a long way from holding the same importance as their American equivalents, the objective of SIGMA is an ambitious one. (Source: Bulletin IbIPRESS, No. 153/02, November 1987)

ADAPSO accuses IbM

With the Fujitsu/IbM dispute which dates back to 1982 barely over, ADAPSO (the group of American software producers and services) has just launched another attack against the informatics giant. This association accuses IbM not only of favouring Japanese firms to the detriment of American software companies but also of practising bundling (the forced sale of software) and criticizes it for the restrictions made in the communication of its source codes.

ADAPSO, which has not yet officially published its document, is making every effort to block IbM's manoeuvres and to win the battle it is hoping to gain the support of other pressure groups, private ones in particular.

Firstly, ADAPSO criticizes IbM for once again practising bundling in three major fields: VM/ls, the VM devoted to 9370 and OS/2. Last summer complaints were made when IbM decided to create a new entity devoted to application of software called asd. IbM was accused of marketing an extended version of OS/2 containing a communications management system as well as a database management system.

The source codes are another cause of ADAPSO's discontent. In fact, in the agreement between Fujitsu and IbM, each of the companies has access over the next ten years, after the deposit of the copyright, to information on around 1,000 software programs of the firm (and even in certain cases the communication source code).

The American software suppliers, which have been complaining for several years about the source codes, feel that the terms of this agreement handicap them against their Japanese competitors.

The battle will certainly be very tricky since there is no law which gives IbM the moral right to assist its competitors, and moreover, despite all the threats of ADAPSO, it will not be easy for this association to obtain source codes and to make IbM renounce the extended version of OS/2. (Source: Bulletin IbIPRESS, No. 153/04, November 1987)

Memory expansion

The new version of the 4.0 memory expansion board of the EMS standard of the LIM (Lotus, Intel, Microsoft) group allows the reconciliation with the EEMS standard of the AQA (Ashton, Tate, Quadram, AST). In fact, the EMS 4.0 version, according to AST, could be supported by the EEMS specifications, the characteristics of which it has adopted.

At the cost of some sacrifices to performance due to the sectoring of 640 Kb (1 Kb is equal to 1,000 characters) of the central memory available on microcomputers using the MS-DOS operating system, the informatics community will be happy to know this traditional barrier of 640 Kb has been superseded. Thanks to this sectoring, the LIM 4.0 version increases the central memory from 8 Mb to 32 Mb, which allows optimal use.

The various associates of the LIM group are preparing to adapt their application to the new standard. Thus, the 3.0 version of the Lotus 1.2.3 uses a total of 32 Mb. On the other hand, some of Lotus' emulation software - such as that of the above disk - and other utilities no longer operate under the new version. For Intel, these new memory expansion boards allow the OS/2 application announced for 1988/1989 to be executed in this new environment.

More than 200 manufacturers have started to work in the sector of expansion boards which, on the basis of the figures relating to this market, is considered to be one of the most dynamic sectors of microinformatics. For example, the specialists foresee for 1990 the delivery of 4.7 million units. The market opening for memory expansion boards is one of the most promising, given the growing need for memory space for the execution of applications. (Source: Bulletin IbIPRESS, No. 153/05, December 1987)

Computer sabotage

Viruses, of a sort, can be a headache for computers as well as other creatures. This is because today's computers are sociable machines. They chat to

each other on business networks and over telephone lines, swapping data and programs. That can be dangerous if a virus comes free with the information one computer gets from another.

In the world of computers, a "virus" is usually a seemingly innocuous program of no more than a few hundred lines long - hardly noticeable when it is nestling within a "host" program that is many thousands of lines long. The first such bugs were accidents: left-over scraps of old programs reawakened by new commands. Now they are designed with specific purposes in mind.

Some bugs are relatively benign, but most are written with more malicious intent. Biological viruses take over living cells, make copies of themselves and then escape to infect other cells. A computer virus may lurk unseen in a computer's memory, calling up and infecting each of the machine's data files in turn - i.e., replicating itself onto each file. Then, perhaps at a predetermined date, the virus might erase all the files it inhabits from the system, scramble the computer's directory or memory, alter data, or simply switch the machine off. One such virus, which is currently making itself known to owners of Commodore's Amiga computer, can crash the program the computer is running. It then resets the machine. Other brands of microcomputer have suffered similar fates.

Almost every computer system, however sophisticated, is vulnerable to viruses. Air-traffic control systems, banking networks, hospital records and military computers are liable to infection each time they link up with other computers. In some cases, disasters have been avoided only by the narrowest margins.

Catching a virus is easier than apprehending its creator. Relatively simple programs can hide themselves until they are triggered, so their human parent may have fled months before. Employees may program a virus into their office computer which will be activated only if their personal password is erased from the system. If they are sacked they can take revenge at arm's length. And the virus, by destroying its host programs, can wipe out all traces of its own existence. Few viral villains have been caught. Those who have are often needed to unscramble the mess left by their offspring.

Digital delirium, like its human equivalent, is easier to prevent than to cure. Like humans, computers are safe from infection only if they are kept in isolation. The Pentagon transmits classified data between some machines along lines that are enclosed in gas-filled tubes. Any attempts to "hack" the system results in a loss of pressure which alerts the operators. Its high-security computer rooms are shielded by metal to prevent electronic signals from escaping. Passwords are changed regularly - several times a day, in some cases.

Such measures might not deter a hardened saboteur working inside an organization. A program sometimes known as a "trapdoor" can record users' passwords each time they log on, thus noting any changes. And although high-security computer networks can give different users different levels of access - depending on their security clearance - an entire system may share the same operating programs, thus leaving the door wide open for saboteurs. A virus that infected the lower levels of a system might then contaminate the upper reaches with ease. (Source: The Economist, 28 November 1987)

Test of knowledge

A knowledge-based ATE system which uses artificial intelligence was announced by DCA Technology Productronica this week.

A major feature of the Protech PRO-1990 system is the use of artificial intelligence which speeds the board fault detection process greatly enhancing the overall effectiveness of the test operation.

As it tests more boards so the system becomes more "expert" at diagnosing board problems enabling the unit to detect faults at the component level more rapidly and comprehensibly than other equipment currently available, says the company.

Programming of the system has been simplified to reduce the time normally spent on board test program development. With only simple inputs from a programmer, the system has the ability to autolearn device configuration and modify library routines and to automatically generate graphics and board interconnect listings.

The software enables the operator to isolate faults rapidly by performing seven tests for each component. In cases of difficult fault identification the systems experience takes over. (Source: Electronics Weekly, 18 November 1987)

Software development productivity

Corporate bad management is part of the reason for poor software development productivity. Today corporate computer programmers spend 80 per cent of their time repairing and updating software. While companies spend tens of billions of dollars each year developing software to offer new services, manage the company better or save money through automation, the breakdowns and complexities of developing new programs can produce delays that are costly in terms of money and market. According to E. Yourdon, software projects are typically 100 per cent over budget and a year behind schedule. When completed the programs are sometimes obsolete or unwanted. According to A. Rullyn, who is in charge of IBM's internal software development, managers outside of the computer departments would be surprised at how little correlation exists between their goals and the way the computer departments are spending money. Another source of problems are the scores of programmers who have not documented how they approached a problem. The present programmer has to navigate blindly through a program that may have been patched and repatched over 10-20 years. In the end, the programmer may be able to write 5-10 lines of new computer code/day. (Extracted from Wall Street Journal, 22 January 1988)

PC-like application software to control MIS costs

Personal computer-like applications software is being installed on minicomputers and mainframes to further control MIS costs. Firms using ported personal computer software can integrate training courses for both personal computer and mainframe users, rather than having separate training sessions. They can also more easily access large portions of corporate information housed on host mainframes. IBM will soon begin marketing Lotus 1-2-3/M, a mainframe version of the best-selling personal computer spreadsheet software, through an exclusive marketing agreement with Lotus, which is presently developing the product. Lotus 1-2-3/M is part of IBM's move to standardize Systems Application Architecture (SAA). Enhanced Connectivity Facilities (ECF), another SAA product being developed, will let personal computer users access large amounts of disk storage space on host mainframes. According to B. Harris, work systems marketing manager, Digital Equipment of Canada (Toronto, ON), there are also many examples of personal computer software that has been ported to DEC's VMS operating system, such as PC/Focus, Autocad, and a spreadsheet program called 20-20. (Extracted from Computer Data, February 1988)

Integrated Information Support System

Software that simplifies how aerospace companies access data stored in individual databases on different computers is being developed by the USAF's Data Automation Processor (DAPRO) project. The Integrated Information Support System (IISS) concept can also be applied to large manufacturing firms with dissimilar computer systems. The IISS project's primary objective is to facilitate the management of information in a complex system of mixed computers by linking them via a common enterprise database and consisting user interface. It has a layered architecture similar to the International Standards Organization (ISO) protocol used in MAP/TOP. The IISS approach is built around a so-called three-scheme architecture: individual users interact via the external schema; data are stored in the internal schema; and data are transferred between the external and internal schema via a conceptual schema. IISS is made up of four major subsystems: a Common Data Model developed by prime contractor Control Data, the User Interface developed by Structural Dynamics Research, the Network Transaction Manager and the Communications subsystem. The initial implementation of a prototype IISS is at Boeing Military Airplane's Integrated Sheet Metal Center (ISMC) (Wichita, KS). (Extracted from Technology Update, 8 February 1988)

Software cuts PLD design time from months to weeks

Those ultra-dense, 30,000-fuse programmable logic devices that used to take months to design and program can be finished off in a couple of weeks even by inexperienced designers with the PLDesigner software from Minc Inc. The Colorado Springs, Colorado, startup's tool boasts a library of more than 1,800 devices and automates the time-consuming, endlessly iterative process of deciding which fuses to blow to achieve the right logic. It accepts waveforms, boolean equations, truth tables, and state-machine language as inputs and can be programmed with weighted priorities on cost, speed, and number of PLDs, depending on the solution the designer wants to use. Once the underlying logic is derived, six proprietary algorithms reduce the solution to its most efficient form - a step rarely taken now because of its complexity - and a fuse map is generated. PLDesigner runs on an IBM Corp. Personal Computer AT or compatible. Available now, it costs $1,950. (Reprinted from Electronics, 21 January 1988, (c) 1988, McGraw-Hill Inc., all rights reserved.)

Software market trends

The US packaged software market will reach $28 billion by 1990, as against $22 billion in 1991, $18 plus billion in 1989 and $3.4 billion in 1980, according to Business Communications' report, "The Changing Software Market". In the 1990s, the highest growth segments of the market will be in microcomputer software; meanwhile, the mainframe sector will experience a steady decline. Regarding technology trends that will affect software development, there will be greater graphic capabilities and the blending of photographic, audible, and video-based information in some computer systems. The move toward microcomputer software is shifting industry power away from hardware vendors, computer service firms, and mainframe software companies to turnkey product firms, microcomputer office automation software companies, independent software houses and specialized software distributors. The industry will become more marketing- than technical-controlled, i.e., software will be ruled less by codes and language and more by information and interaction.

By sector, the microcomputer systems software market will total $1.8 billion by 1991, as against $1.7 billion currently. The minicomputer systems software market will total $4.5 billion in 1991, as against $3.4 billion currently. Mainframe systems software sales will total $2 billion, as against $3.4 billion. The market for office automation software will reach $9.4 billion in 1996, as against $6.9 billion in 1991, and $4.4 billion currently. Microcomputer office automation software sales will total $4.5 billion by 1991, as against $1.8 billion currently; minicomputer office automation software sales will be $1.9 billion in 1991, as against $1.6 billion currently; and mainframe office automation software, $500 million as against $1 billion. The market for specialized software will be $10 billion in 1996, as against $7.1 billion in 1991, and $4.5 billion currently. (Extracted from Electronic Data Processing, 21 December 1987)

Software eases text, graphics searches on STN databases

STN International is making a move to ease access to its scientific and technical databases for on-line searching. It unveiled new software at the International Online meeting in London last week that simplifies on-line searching for an inexperienced searcher or streamlines it for the experienced professional.

Called STN Express, the new "front-end" software for personal computers enables a searcher to construct chemical structure and other queries off-line for uploading to the STN International system. It also enables the searcher to capture a transcript of the on-line session, including graphics, on a disk for off-line viewing, editing, and printing.

Because chemical structures can be constructed off-line, the inexperienced searcher need not use costly on-line time to work out a structure, and searching can be done by a scientist without the necessity for, and perhaps delay involved in, having the search done by an information specialist.

The software is now in the "beta test phase" of development, with organizations in Europe and the US working with STN International to test it. Commercial shipment of STN Express is scheduled to begin during the second quarter of 1988. The price will be $595, with discounts to academic institutions and for quantity purchases.

STN International is a scientific and technical information network operated co-operatively by the American Chemical Society's Chemical Abstracts Service; Fachinformationszentrum Energie, Physik, Mathematik GmbH (FIZ Karlsruhe) in West Germany; and the Japan Information Centre of Science & Technology. The Messenger software designed for searching the STN files provides computer communications and the search language needed for access to all the databases.

STN provides more than 45 files such as BIOSIS Previews, the life sciences database produced by Bio-Sciences Information Service, and Compendex, containing citations of engineering and technology information (1969 to current listings) that correspond to Engineering Index Monthly. Also among the databases is CAS Online, which encompasses the CA (Chemical Abstracts), CAOLD, and Registry files produced by CAS.

STN Express runs on IBM PCs, the IBM PS/2 series, and 100 per cent IBM compatibles. Equipment requirements include 640K RAM; MS-DOS or PC-DOS 3.0 or higher; hard disk drive with 4 megabytes of space available and one floppy disk drive; Hercules Monochrome, Hercules Plus, EGA monochrome or colour, or VGA graphics card; Microsoft, Mouse Systems, PS/2, or compatible mouse; and Hayes compatible, internal network, or manual dial modem. (Abstracted with permission from Chemical & Engineering News, 14 December 1987. Copyright (c) 1987) American Chemical Society.)

New diagnostic databases

Logica, Computer Resources International, Judex Datasystems and the University of Aalborg have developed computer software to aid the diagnosis of muscle and nerve diseases. Diagnosis in electromyography is often done by measuring the speed at which electrical signals travel along a nerve. Interpreting the results can be difficult, however, so the new expert system was developed. A more advanced version of the software will also indicate what tests a doctor should perform to aid diagnosis. The current version also is limited to only about ten muscles, three nerves and 20 different diseases. The final version will be able to analyse data from about 300 nerves, 300 muscles and 500 diseases. The project is part of the European Economic Community's ESPRIT programme.

SoftSearch and Massachusetts General Hospital offer a computerized diagnostic data base. Any physician with a modem can call DXplain, transmit the symptoms and receive a list of possible diagnoses, ranked in order of probability. DXplain costs $40/hour to use, and now contains information on about 2,000 diseases. More will be added. Similar systems at the University of California (San Francisco) and the University of Pittsburgh are available to medical schools and teaching hospitals, but DXplain is the first to be available directly to physicians. (Extracted from New Scientist, 8 October 1987 and Medical World, 26 October 1987)

Software for smart medical equipment

Researchers at Hewlett-Packard's laboratory in Bristol are attempting to devise computer programs that will make sense of the output from medical instruments and relieve humans of the chore of watching over their equipment.

A team led by Bill Sharpe, director of Hewlett-Packard's information management laboratory, is working on computer models of clinical knowledge that can be embedded in individual pieces of equipment to interpret their output. The models would provide nurses and doctors watching over instruments with a proper description of what the equipment is monitoring in general terms, rather than just a series of numeric readings.

The system would attempt to interpret events for, say, an anaesthetist, providing information over and above raw data. The researchers will need to work out many different models and many combinations of circumstances.

Medical staff often turn off alarms on medical equipment because these easily go off when a signal in the equipment reaches a threshold value. What is required is a system that is aware of the overall situation, which is a function of many variables. Like nurses, such a system should ignore meaningless alarms, based on one variable only. Hewlett-Packard makes medical equipment and has already added programs that make use of human knowledge to a machine that measures brain activity. The expert system in medical equipment will match output readings against a computer model to describe the situation it is observing.

Application of the research is some way off. The research team is still working with tape recordings of data from sensors. (This first appeared in "New Scientist", London, 24-31 December 1987, the weekly review of science and technology.)

A hyperactive path through hypertype

Hypertext is just the thing for people who like to browse through information on a path of their own choosing. Nuggets of information linked by tangled threads: no one tells you that if you want to get to Dublin, you should not start from here. With hypertext, you can always start from exactly where you happen to be.

The online documentation that comes with a Symbolics workstation is a hypertext document, but no one made much fuss about it. You could buy NoteCards from Xerox, though it is still an unsupported product. Now hypertext has hit the mass market.

Apple is giving away a copy of Bill Atkinson's HyperCard with every Macintosh. HyperCard was reportedly a big draw at the MacWorld Expo in Boston, Massachusetts in August, and was one of the main excitements at the MacUser Show in London earlier this month.

It looks as though the S-shape learning curve will be traversed at speed - from maybe 10 per cent of personal computer users being aware of the hypertext concept, to 90 per cent or thereabouts within a few months.

Esther Dyson, New York publisher of Release 1.0 newsletter, already observes the phenomenon she calls hyper-hype: old software packages are being repositioned as hypertext products to please the gullible.

Dozens of research teams are building their dream hypertext systems, and they are all different. The Hypertext 87 conference, held at the University of North Carolina in November 1987, drew participants from many US universities, as well as companies like Apple, MCC, Tektronix and Xerox.

In the September issue of the US journal Computer, MCC's Dr. Jeff Conklin presented a 25-page survey which explains the many varieties of hypertext and traces the concept from its origins in the 1940s to the present. Three pioneers prepared the way for everything that followed.

Vannevar Bush, President Roosevelt's science adviser, wrote a visionary article in Atlantic Monthly in 1945, called 'As we may think'. It described a massive online library of text and pictures that could be explored from a multiscreen workstation.

Bush envisaged that a person using this system could record notes and create trails through the data. He attached great importance to the ability to create a labelled link between any two points in the library. This, for Conklin, is an essential feature of hypertext. It is all about links between items of information.

Two decades later, Dr. Douglas Engelbart of Stanford Research Institute (SRI) was engaged in an influential programme of research on the ways computers could augment the human intellect. This research saw some of the earliest work on interactive graphics, and the first use of Engelbart's best-known invention, the mouse.

By 1968 the SRI group had implemented a system called NLS (oN Line System) in which they hoped to store all their notes, programs, memos, bibliographies, designs and other data. It was to be a library index, mail system and electronic notebook combined. It evolved into the networking system NLS/Augment, now marketed by McDonnell Douglas.

Theodor Nelson is another hypertext visionary who is at last able to see his ideas bearing fruit. He coined the term "hypertext", and has spent years designing a kind of global electronic public library called Xanadu. Nelson sees hypertext as a public market for ideas, and in Xanadu he has included provision for copyright protection and royalty payments. The underlying database has been implemented in Unix. According to Conklin, the user interface of Xanadu is not so well developed.

Hypertext systems come in many different varieties. Some are private, others public. Many are designed to be shared by a team. Some are seen mainly as environments for research and reading, others for writing, though this distinction cannot be absolute since everything that is read must first be written. There is always a database consisting of nodes joined by links. Text or graphics are stored at a node. Links lead to other nodes, holding related information.

A human being can browse through a hypertext database. It is specifically designed for this. This distinguishes it from database management systems or artificial intelligence knowledge bases, which are generally designed so that programs can tap their information without human guidance.

It follows that the other important part of a hypertext system is the human interface. A style of interface based on multiple windows has become widespread, though not universal. Each node is represented by a window on the screen. Usually only a few windows can be open at once, so most of the database remains out of sight. Icons and a mouse are used to navigate round the database, manipulate windows, edit the text within them, and to create and destroy links.

Conklin draws attention to two other ways of browsing the database. One can search the network for some string of characters, keyword or attribute value. Or one can display the network or part of it, as the kind of bubbles-and-arrows diagram that people often use when they are sketching out ideas on the back of an envelope.

In the same article, Conklin identifies four broad application areas for hypertext systems. The "macro literary systems" are essentially electronic libraries with rich links between documents instead of a conventional index. The "problem exploration tools" are used by individuals or groups for brainstorming, problem solving, programming and design.

Next come "browsing systems". If the macro literary systems are for scholars and critics, the smaller browsing systems, with their emphasis on ease of use, are suited to teaching or public information systems. Some authoring systems for computer-aided instruction could be included here.

A fourth, catch-all category, "general hypertext technology", takes in other experiments in computer-supported reading, writing or collaboration. In this category comes NoteCards, developed at Xerox Palo Alto Research Centre (Parc).

Many different applications have been built on top of NoteCards. Originally a single-user system, it now allows a team to collaborate on a shared Notefile. There are between 50 and 100 users outside Xerox, among them the Central Intelligence Agency. This is why published examples of NoteCards screens often seem to show US and Soviet nuclear missile statistics, or maps of world trouble spots.

Many techniques which can help a team develop a large software system may prove to be equally relevant to the creation of other large information products, such as books and interactive video-disks.

But there are also important differences between a computer program and a document which is intended to communicate information to other human beings. Computers do what they are told. People, on the other hand, may be persuaded or they may hit back with counter-arguments. They may want to look at alternative opinions on a subject and make up their own minds.

Some of the most interesting hypertext systems have left the world of neutral, passive data and plunged into argumentation, persuasion and debate. At the University of Maryland, Randall Trigg wrote his PhD thesis on Textnet, a hypertext system to support literary criticism. Many types of link were provided, some of them expressing such ideas as support, refutation or irrelevancy.

Trigg went on to become one of the architects of NoteCards at Xerox Parc. Some of the NoteCards research has studied ways of building argument structures which an author can use to get a point across in a finished document.

Of course, the same processes of argument and persuasion go on within any team of people collaborating on an intellectual task. Group problem-solving involves one person putting up an idea, and others accepting it or shooting it down, many times over. Dr. Horst Rittel has built Issue-based Information Systems (Ibis) to support teams as they tackle so-called "wicked problems" - the kind you can only understand by solving them.

Ibis has nodes representing issues, positions and arguments. Browsing the database, one can see who supports which ideas and why.

Outlining tools and "ideas processors" such as Think-Tank have helped to spread many of the ideas underlying hypertext. But Conklin points out that most of them represent documents as hierarchical tree structures rather than richly connected networks. He mentions two new products that are more ambitious: Houdini, an extension of the MaxThink outliner, supporting rich non-hierarchical networks, and ForComment, a word processor allowing up to 15 people, on networked machines, to collaborate on a document.

Predictably, hypertext ideas will spread into many mainstream computer applications, just as outlining is already just another word processor feature. The link to computer-aided software engineering has already been mentioned; and hypertext systems are seen as highly relevant to the newly trendy field of computer-supported co-operative work. The ideas have been around for 40 years. Perhaps we now have the networking, the powerful workstations and the database technology to make them work. (Source: Computing, 26 November 1987)

Computer-aided systems/software engineering (CASE) technology

At a time when users are screaming out for ever faster solutions to dynamic business problems, all too many dp departments persist in laboriously fashioning hand-crafted artefacts.

That is thankfully now changing - with the help of computer-aided systems/software engineering (CASE) technology. Many CASE products are emerging to automate the whole dp software development life-cycle.

There are two major reasons dp departments ought to be looking at CASE seriously. One relates to "raw" productivity, the other revolves around improving the quality of the system produced by the average dp department.

On the productivity side, statistic after statistic reinforces the CASE. For example, US researcher L.F. Rothchild says that software productivity is only increasing by 7 per cent each year, while hardware performance is increasing at about 30 per cent a year. Fourth generation language (4GL) guru James Martin, noted that if we do not provide software developers with power tools soon, 150 million programmers will be needed by the mid-1990s.

But what sort of tool? The answer to that question provides the other major argument in favour of CASE. Many organizations already use "power tools" such as 4GLs, to boost programming productivity. Is that the answer to dp problems?

Again, statistics indicate not. Most organizations, for example, admit to horrendous application backlogs. Within many organizations, the invisible backlog is probably incalculable. Users just do not bother to ask any longer.

The reason for such backlogs is fairly clear. Most dp staff spend over 80 per cent of their time "maintaining" old computer systems. No wonder they cannot supply enough new ones.

But, most of that work is not maintenance at all. Rather, it is the "correction" of often gross errors perpetrated during the initial stages of systems analysis. The earlier a mistake is made while designing a computer system - and missed - the more expensive it is to correct following system implementation.

CASE provides a way of overcoming that problem by shifting the emphasis during dp software development away from programming towards analysis and design.

Many suppliers are developing CASE tools. Various research organizations back their judgement. IDC puts CASE market growth at 35 per cent a year. In 1990 the market could be worth $1 billion. Information gathered by Ovum from more than 30 CASE suppliers and users points to a $1.79 billion US market by 1992.

The ultimate aim of CASE is to automate the whole of the software development life-cycle. "Front end" CASE components will populate a dictionary with analysis and design information. "back end" components will generate program code from that dictionary. Programming as we understand it will disappear.

The text at the end of this article outlines the sort of "ideal" product the serious CASE suppliers are working towards. Apart from a few exceptions we have not reached that nirvana yet.

"Back end" products let software developers boost their productivity by replacing manual coding techniques with automated ones. Their overall philosophy is to eliminate as many programming tasks as possible, then provide automated support for those tasks that remain.

Most products have several components. The most common are a data and file definition tool, a screen painter, a report generator, and a dialogue specifier. Most 4GLs and application generators are marketed as straightforward "back end" tools. Only a few, notably Telon and APS, come with the CASE label.

By contrast, many products once called "analyst workbenches" are now marketed as "front end" CASE tools. Most are for the analysis stage of system development, but some also address the design stage as well.

All depend to some extent upon some sort of systems development methodology. Indeed, front end CASE tools can be best understood as the medium to automate development methodologies.

The key to the power of front end tools is their use of diagrams. Diagrams that represent a computer system are fundamental to systems design. Diagrams are invaluable aids to understanding among dp staff and end users. Front end CASE tools typically support a range of analysis and design diagrams, but three types of diagram are emerging as fundamentally important - hierarchical decomposition, entity/data model and data flow.

The benefits of front end CASE tools fall into two categories. First, the tools can obviously improve the straightforward productivity of analysts and designers.

In addition, the tools employ diagrammatic techniques that, by and large, are comprehensible by end users. For the first time, end users are thus able to comment effectively on the quality or otherwise of analysis. The tools make quality control of systems analysis a realistic possibility.

Hardly any suppliers active in, for example, the old analyst workbench are also active in the application generation/fourth generation language market - and vice versa.

So in the short term, what you might term "back and front end" suppliers are being forced to co-operate to produce presentable CASE products.

The recent link between Excelerator and Pansophic's Telon application generator was one of the first such tie-ups. Each of these links is similar. Information captured during analysis and design is "exported" from the front end tool to the back end tool, where it forms the basis of code generation.

The drawback is that the sub-components are typically difficult to mesh. The resultant CASE products are often only a subset of the combined features of the originals.

A far more radical approach is being followed by another set of CASE suppliers. Their products attempt to be a comprehensive CASE tool, supporting the whole of the software development life-cycle, all the way from systems analysis to system construction. At present only a few CASE products of this type are on the market.

All these products have one major characteristic. They support the "business modelling" approach to system development, as found within modern methodologies such as information engineering. At their heart lies a comprehensive data dictionary, called an encyclopedia. It stores all the information needed to build computer applications.

It is no coincidence that each of these products comes from an organization that also markets its own business modelling-oriented systems development methodology.

Business models are a crucial feature of this class of CASE tool. But this philosophy is radically different from that which normally permeates dp departments. Put succinctly, this philosophy says - if you can successfully build models of a business environment, those models will form a sound basis upon which to develop computer systems.

To build models that accurately, users must be fully involved. Hence the emphasis of all these products on advanced graphical displays.

CASE is a new technology. Dp staff, faced with having to sort the hype from the reality, will doubtless treat it with scepticism. But it looks certain to change their work radically, so perhaps they should embrace it wholeheartedly.

Code-generating CASE products offer a clear advantage over earlier dp technologies. While other productivity tools have provided great gains on individual phases, products like Cor-Vision tackle the life-cycle as a continuum - the true Gestalt where the whole is greater than the sum of its parts. CASE products also allow the more nimble dp departments to meet users' expectations, in turn allowing business managers to get systems to meet their strategic business objectives. CASE is about what the dp department is going to do tomorrow - not what it did yesterday.

One thing seems certain: CASE cannot be ignored. From being a buzzword it is rapidly becoming a commercial reality. The effect of CASE on the working practices of most dp departments will be profound.

Whether that happens sooner than some expect, or later, is really only a side issue.

What should the user look for in a CASE tool? An "ideal" product may have the following:

This is a "wish-list" of features a user ought to be looking for in an "ideal" CASE environment. For the foreseeable future at least, such an environment will need to be constructed around at least more, individual CASE products.

- Support for the entire development life-cycle, including the automatic generation of 100 per cent of the executable code from graphical specifications.

- "Base" components. These include diagramming tools, a centralized repository of information, a design analyser based on a formal information model, an integrated code generator, personal computer workstation orientation and the use of a knowledge base incorporating expert system rules.

- Use of a repository to store the meaning of diagrams in abstract form, not simply a representation of the form of the diagram. The repository should be a central source of specification information that can be viewed in many graphical forms.

- Support for the essential "trio" of diagramming techniques that are required to represent a software system, viz. data flow diagrams, data model diagrams and decomposition or tree structure diagrams. A tool may also support other diagram types such as decision trees, action diagrams, state transition diagrams, network management diagrams and so on.

- Good user interface, including subsecond online response, elimination of complex command mnemonics, and online diagnostic and Help facilities.

- Availability of the tool on widely used workstations, including the IBM PC and DEC MicroVAX series.

- Networking capability permitting the interconnection of multiple workstations and facilitating access to corporate mainframe databases.

- Open architecture, including PC/MS-DOS compatibility.

- Compatibility with widely used software facilities that are likely to be available at a computer site, including major databases such as IMS, Db2, RDb and application generators such as APS Application Factory, and Cobol generators such as Telon, APS and Micro Focus Cobol.

- Closely integrated family of procedural and non-procedural functions using a common command syntax, including:

  database query and update;

  report generation;

  screen painter;

  graphics generator;

  decision support and financial analysis functions;

  project management tools;

  well-structured, very high-level procedural language.

- Support for a variety of familiar, manually oriented structured specification methodologies, including LSDM, SSDAM, Yourdon and DeMarco.

- Support for more recent methodologies, that integrate many of the strategic processes of an organization into a single, coherent structure.

(Source: Computing, 26 November 1987)

VII. COUNTRY REPORTS

Latin America

Latin American computer industries: Perspectives and challenges by Ricardo J. Soifer 1/

The three major Latin American countries (Argentina, Brazil and Mexico) now have policies and/or programmes for their computer sectors. 2/ Other countries like Venezuela or Peru have achieved quite interesting results in specific areas, such as digital communications equipment or microcomputers, but they have not established comprehensive policies so far.

The policies of the larger countries differ in their degrees of reliance on the internal and external market, role allowed to foreign firms, goals in integration of local designs, parts and components and other variables.

It seems correct to say that these policies have "evolved" to their present structure rather than been established in one comprehensive move. The evolutionary trend in Brazil has been in the direction of a progressive widening of scope and consolidation of the policy, in Mexico it implied a partial shift of objectives and means (such as taking a more outward-looking character), while in Argentina, where the policy-making activity started only recently (1984 3/), actual decisions have in practice been less ambitious and comprehensive than what the first report of the National Informatics Commission indicated.

1/ The author is a consultant to the Inter-American Development Bank in the area of the advanced technologies in Latin America. He is however solely responsible for the contents of this paper. This paper was presented at the IDb/Prometheo Workshop on Latin America in the Emerging Global Information Economy, 12-13 November 1987, Sao Paulo, Brazil.

2/ In this short paper I shall mainly discuss industrial policies in the computer sector of the electronics complex. I shall not discuss other industrial segments, nor the diffusion and application of electronics-based technologies in business or other sectors.

3/ I.e., under the civilian Government in power since December 1983.

Perhaps the most important feature of the current policies of most of the countries we have mentioned (i.e., including Venezuela and Peru) is that, although the overall policy design is based on the internal market, the central concept is not "import substitution" per se, as in the older industrialization policies, but "technological learning". This in turn requires national control of firms, production under local brand names, limits on technology licensing (not in the sense of a prohibition but rather in the sense of local development of second generation products) and a good deal of learning by designing, by making, by marketing, by giving after-sales support, etc., under national control.

The Brazilian policy is based on the internal market for mini and microcomputers, industrial automation equipment, some segments of microelectronics, etc. The administrative authority has consistently promoted the use of local components and the allocation of large amounts of resources to development and engineering. The results have been criticized by some external and internal observers in terms of high prices and danger of technological isolation. On the other hand, it seems clear that the results achieved in sectoral development, range and type of products, technological learning, degree of business organization of firms, quality of staff, internal competition, are not to be dismissed lightly.

The Brazilian thrust in the computer industry is broad and comprehensive, and certainly open to problems and pitfalls but it seems successful in establishing a firm foundation for the future even if the transit to such future is not free of problems.

The Mexican computer policy was never published in an official document. Certain rules, taken from a 1981 draft policy document and followed by administrative authorities, operate as informal guidelines, although determined opponents (like IBM, which in 1985 sought a 100 per cent authorization for a microcomputer plant) have managed to break and weaken them.

In any case Mexican policy-makers have been much more cautious than the Brazilians in terms of local control and integration of production, even before the IBM case and other decisions. Furthermore, the global economic policy is now oriented towards exports and the computer sector is also required to comply with performance requirements in that aspect. Neither local design and product engineering nor integration of components are immediate priority areas. Only a handful of local firms have reasonably active engineering groups (foreign affiliates do not seem to do any local development, except the odd memory-card design). Given wide access to foreign inputs, prices are within a reasonable range of international prices. Firms are said to have learned to "break open the kit" (i.e., the CKD kit) and the emphasis is in efficiently buying the components and establishing some manufacturing (mostly assembly) and some direct or indirect export activity (indirect exports are achieved producing sub-assemblies for foreign affiliates).

Yet the case of Argentina is different. In the 1960s and 1970s the country had started production of some computer products, as a pioneering firm launched a rather ambitious effort with government support. Things changed however, both in the world at large and in the country's economic and policy environment, and this enterprise closed its computer operation. It was not until the beginning of 1985 that a new proposal for the computer industry was launched by the Industry Secretariat. The proposed strategy had many points in common with the Brazilian policy but it also had several differences: (i) as it was a "catch-up" policy both with respect to Argentina's earlier experience and with respect to the worldwide development of the sector itself, it aimed to establish "packages" of activities in different types of computing products (just failing to do the same in industrial control and communication products as well, before different opinions prevailed after a reshuffle in the relevant government departments); (ii) imports are not prohibited but subject to declining tariffs; (iii) foreign firms were given more space than in the Brazilian case, e.g., foreign partners can act as technology suppliers (the Brazilian strategy does not allow a joint venture to be based on the technology of the foreign partner on the grounds that it creates long-term dependency and thus defeats the central objective of the policy, which is local learning by local engineering effort under local control); and (iv) integration of local components is initially postponed because a main incentive for participating firms is a period of access to duty-free components. It is too early to discuss results achieved by the Argentine policy, as negotiations with firms applying to receive incentives started in 1986 and 1987 and production has hardly begun.

Opportunities and challenges

As we have tried to show, with the exception of some aspects of the Mexican strategy, the external market has received low priority in the policies just sketched. We shall not question nor defend such emphasis as it is rooted in the overall development strategy of Latin America and any attempt at a serious discussion of the subject would certainly take up more time and space than is here available.

Under such an assumption, and therefore evaluating the policies on their own terms, it is clear that Brazil's large internal market could be a strong asset for the further development of the computer industry which already has achived significant quantitative and qualitative dimensions. On the other hand, the overall electronics market is fragmented, as the telecommunications sector has its own rules (and modus vivendi with foreign firms), while the entertainment sector as well enjoys special conditions in the Amazon region. The electronics complex is not integrated in Brazil.

The "challenge for Brazil" will be defined in different ways by different people.

The harshest critics of the model will probably say that the challenge for the Brazilians is to bring themselves to give up the market reserve, and what the critics call the attempt at "technological autarky" (which is not a Brazilian objective but is said by some to be), let the multinationals in, accept the proposed treaty on intellectual property for integrated circuits, and so on. The champions of the model will in turn see the challenge in deepening and extending its reach (e.g., in micro-electronics), investing even more in technology development and human resources, and of course, trying to keep the policy alive for the time required for maturity (even if it requires a few decades). Finally an independent observer concerned about some problems arising from the policy and/or the overall economic environment of Brazil, would contribute recommendations such as to tackle the problem of fragmentation of the national electronics industry to really integrate the potentially ample Brazilian market; to identify and correct causes of excess cost such as, perhaps, the problem of price and quality of components; to intensify efforts towards exporting; to emphasize production of more competitive, probably non-commodity, products; all of that without giving up the basic goals of the policy as long as they are perceived as worth pursuing. It is of course difficult to reconcile these suggestions with the real

life conditions and constraints, but that is precisely why this programme is to be considered a challenge (there is in fact reason to believe that the government and the entrepreneurs are already looking into these issues).

Mexico's opportunity may come from the current export thrust, but some key factors seem to be missing for that. While the Asian countries or Brazil have largely established their own firms, technologies and brands (and/or a technical capacity to offer credible OEM supplies) to compete in the export market, Mexico so far relies on imposing export performance requirements to foreign firms while national firms seem to have little incentive to go beyond simple manufacturing (some would say assembly). Is it possible for a Mexican (or Argentinian, Brazilian or Korean) firm to set itself up as a solid exporter with no internal product engineering and control of its technology? The challenge for Mexico lies in achieving a fuller technical and productive status either to supply the internal market, exports, or both.

The case of Argentina is not midway but somewhere in between relative to Brazil and Mexico. An optimistic scenario would have Argentinian-owned and joint venture firms developing new versions of microcomputers, super-microcomputers, peripherals and perhaps other products (including some semicustom integrated circuit designs), by, say 1990. The actual degree of achievement will depend largely on whether the authorities uphold the policy (and now), and the attitudes of the private sector. Also, Argentina shares with Brazil the critical problem of the three-way split of the computer, telecommunications equipment and entertainment electronics industries. Furthermore, the role of the State in the economic life of the country is under very severe criticism from influential groups in the private sector and within the Government itself: it does not seem therefore likely in the short term to see government departments or enterprises assuming an efficient and enlightened role in using monopsony purchasing power to promote technological learning, e.g., in communications. The challenge for Argentina is to take advantage intelligently of the commitment already made to develop what could become the foundation of its computer industry and to find ways to enlarge the scope of its policies and optimize the overall results.

The case of Venezuela is interesting as this country has established a strong capacity in some areas of digital electronics other than computers. The foremost example is in private telephone exchanges. It will be interesting to follow the case of Venezuela (where a policy decree has been drafted) to learn more about alternative approaches to the information technology industries in Latin America. Venezuela's PABX industry benefits from protection and other advantages available on a project basis but it has become quite proficient and competitive on the basis of its own strengths, such as qualified human resources. The question is, how far can it go in that direction on its own and whether efficient government policies could be designed and implemented to promote further development of the various professional electronics sectors.

Europe

Joint European Submicron Silicon Institute

The Joint European Submicron Silicon Institute, a project that some observers had considered dead after its proposal in 1986, appears to be taking off. The Federal Republic of Germany Government has earmarked $18 million in its 1988 budget for the planning phase. JESSI's goal is to develop the process technologies necessary to make chips with feature sizes down to 0.2μm - dimensions needed, for example, in 64-Mbit memories and the high-density logic circuits of the mid-1990s. Siemens AG and Philips are the only two manufacturers participating in JESSI at this point, although other European semiconductor manufacturers - Thomson-SGS for one - are said to be interested in joining. Co-ordination of joint efforts will be done by the Federal Republic of Germany's Fraunhofer Institute for Microstructure Technologies. Construction of the JESSI microelectronics centre is expected to begin in 1989, in Schleswig-Holstein. (Electronics, 4 February 1988)

Computing the best for Europe

The pace and complexity of modern research has dramatically increased the need for fast, reliable and easy to use communication. Developments in communications and information processing have made it much easier for the many thousands of researchers in academic and government institutions to communicate with each other and with industry, and to undertake collaborative work. Researchers now depend on computing and communications tools and are handicapped without them.

In Europe, the growing emphasis on collaboration through programmes such as ESPRIT and RARE is increasing the demand for closer international co-operation and improved communications. In line with the development of such programmes, there needs to be a parallel development of the European communications infrastructure for research. To understand the issues this raises, some background information is needed.

The European Academic Research Network (EARN) is a computer network linking tens of thousands of academics in Europe to their peers and colleagues throughout the world. The network was started in 1983, and was modelled on BITNET in the United States. The model is of a store-and-forward network, where mainframe computers are linked together by leased lines and, using standard software, provide electronic mail and file transfer services to users. The BITNET model is simple but elegant: new institutions connect to the network by leasing a telephone line to an existing member and the network tables are updated.

EARN is not quite the same as BITNET, in that each country has a key or "backbone" computer site, and other institutions in each country are connected to these backbone sites. The national backbone sites are themselves connected together by international lines. The basis of EARN, then, is a European backbone network, linking to and incorporating the component national networks.

Since 1983 EARN has grown rapidly, and there are now 20 countries connected to the network, including the Côte d'Ivoire in Africa, and approximately 600 host computers. Most of these computers are either DEC VAX/VMS or IBM VM/CMS systems. The various national parts of EARN work in several ways - in some countries the network is an extension of EARN and in others a mixture of the two approaches is taken. In addition, EARN is connected to BITNET, and thus to ARPANET, NSFnet, CSNET and to most of the other academic networks in the world. Upwards of 30,000 academics now use EARN for their day-to-day research activities.

EARN provides three basic services - file transfer, electronic mail and remote job execution. On top of these, a variety of additional services are available, including electronic mailing lists, file servers and data base services accessed by electronic mail.

The EARN services are heavily used, most particularly electronic mail between individuals or groups of researchers who can discuss and plan new work, prepare a paper, submit a new proposal or complete a report. Researchers may also subscribe to

one or more of the many electronic mailing lists on topics bearing on their research, and in this way they can follow discussions between colleagues throughout Europe and the world and themselves contribute to the debate. Initially, most of these mailing lists were hosted on the US ARPANET network, but a growing number of lists on topics of particular interest to European researchers are hosted in Europe.

The other EARN services are used in a variety of ways - to exchange data; to submit work to larger computers; to transmit experimental data to collaborators at other institutions; to send files from a file server maintained at a particular site. Traffic levels are growing steadily, and many sections of the network are becoming heavily loaded at times.

The EARN organization is modelled on the network itself. EARN is an association, registered in France, and is run by a board of directors, one from each of the countries connected to the network. Each institution with computers connected to EARN is a member of EARN, and the EARN director in each country represents the members. Every two years, or as posts become vacant, the board elects an executive committee to run the association. The day-to-day affairs of the association are run by a management team, currently with offices in Dublin and Paris.

The migration of EARN to the use of ISO/OSI standards remains a key issue. A draft migration strategy is being developed, and it is hoped that it will be adopted by the board later this year. However, it is becoming clear that the implementations of the ISO/OSI protocols are immature, and do not provide the same level of service that EARN users currently enjoy. This is expected to change quite rapidly over the next two or three years. In addition, there are technical issues which affect the actual migration process. None the less the EARN board remains committed to a migration to ISO/OSI standards as soon as practicable. In this matter, EARN will be working closely with RARE.

RARE (Réseaux Associés pour la Recherche Européene; Associated Networks for European Research) is a European organization of national research networks, established in 1985, which currently has full national members in 17 countries. RARE also includes a number of countries interested in full membership, a number of associate (non-European) national network members, and several international members, including EARN.

The objective of RARE is to establish a communications infrastructure for academic research in Europe. However, unlike EARN, RARE plans to achieve this, not by building a European networking infrastructure, but by unifying, or harmonizing, the national research networks and connecting them through the use of existing public telecommunications facilities, specifically public X.25 PTT services. To achieve this, RARE supports the principles of Open Systems Interconnection (OSI) as defined by the ISO, and is working to establish functional standards which specify the particular choices of ISO/OSI standards which actually make interworking using OSI possible. Thus RARE fully supports the European standards organization CEN/CENELEC to establish these functional standards. In this, and its view of European networking, RARE is actively supported by a Directorate (DGXIII) of the Commission of the European Communities (CEC). RARE's activities are pursued through eight Technical Working Groups, and the annual Networkshop.

RARE is an association legally constituted in the Netherlands, and is run by a council of administration made up of delegates from each national member, and observers from other members. It is funded through annual subscriptions paid by the member countries.

The RARE model for services is that all services will be charged on a usage basis, and these usage charges will be billed directly to each researcher.

So RARE, supported by DGXIII of the CEC, takes the multinational approach to European networking; that is, the view that a European academic computer networking infrastructure can be created by ensuring that the various national academic networks obey the same ISO/OSI functional standards in the future, and thus, using the public data network interconnections between the national PTTs, will be able to intercommunicate.

An important activity of RARE is the work undertaken under contract for COSINE. This began in 1986 when RARE was invited to draft an outline plan for the infrastructure of the European Research Network project COSINE. This COSINE infrastructure is to provide the rapid establishment of an environment to make data communications services available to users from academic and industrial research organizations in Europe, using common carrier services and commercially available hardware and software communications products. The COSINE project is supported by the European governments, and by DGXIII of the CEC, and a total of 800,000 ECU has been provided by the national governments for the one-year specification phase. Like RARE, COSINE seeks to establish a European infrastructure based on a multinational approach, and the COSINE project specifically states that "the implementation phase will involve a shift of emphasis from international and centralized activities within the project to national and decentralized activities". The specification phase, due to end in mid-1988, covers functional standards, charging and accounting, address and route management, directories, testing and diagnostics, PTT facilities, and organization. A secretariat is provided by DGXIII of the CEC.

Although there are many similarities between the activities of EARN and RARE, there are also striking differences. The first is the overall perspective of the two organizations.

EARN is dedicated to providing services to users today; to changing those services to ISO/OSI when this is the proven path to better (or at least equivalent) services; to a market-driven approach to the supply of basic telecommunications services; and perhaps most fundamentally, to a wholly European approach to the provision of computer networking in research, and not a multinational approach.

RARE and COSINE, on the other hand, are dedicated to enabling the provision of services to users based on the emerging implementations of standard ISO/OSI services; to a standards-driven and PTT-based approach to the supply of basic telecommunications services; and, most fundamentally, to a multinational view of European networking. In this, it is strongly supported by the CEC, and by the national networking organizations.

The second key difference between the EARN and RARE approaches is in the way the costs of networking services are presented to individual researchers.

EARN is dedicated to providing a European networking infrastructure where both the capacity and the costs of the network are known in advance and fixed. Thus the costs can be borne by the EARN member institution, and are easily budgeted for in advance. As a consequence, EARN services are provided at no charge to the individual researcher, and, within the overall capacity of the network, researchers are encouraged to exploit the network to best meet their individual needs.

RARE and COSINE, by contrast, are dedicated to the use of the PTT data services, where the charges are directly related to usage. Costs are not known in advance, are not fixed and are, in principle, unlimited. Member institutions cannot budget for them, and network services are charged directly to each individual researcher.

One of the first and most important questions to be asked about the development of a networking infrastructure concerns the cost. One should be able to go to the telecommunications supply market and get competitive quotations for the services required, and, indeed, get a variety of technical responses, with perhaps widely varying costs and performance characteristics. One should then be able to choose from these offerings to build the appropriate and most cost-effective solution to the requirement. This is a perfectly normal and business-like approach. The situation at present is quite different. A telecommunications services supply monopoly is the norm in European countries.

Despite the current restrictions, however, the market for the supply of these services will rapidly become competitive. This view is encouraged by the recent publication of the CEC Green Paper on the development of a common market for telecommunications services and equipment, which clearly signals the need for such a competitive market-based approach, and by the CEPT/PTT plans for the development of what CEPT calls Managed Data Network Services (MDNS), and the proposals for "one-stop shopping" for telecommunications services in Europe. Basically, the MDNS concept is that the PTTs will combine to provide customers with a complete data networking service - that is, they will build a private network for a customer from the component PTT services available. As a by-product, they will offer one-stop shopping where the customer can deal with a single national PTT for a trans-European network, rather than have to deal with many PTTs with all the complications that involves. CEPT has indicated that these MDNS services will be introduced in 1988.

There are, at present, two basic services provided throughout Europe. These are the X.25-based public packet-switched data network services (PSDN) which provide data rates at effectively 2,400 bits per second, and the analogue leased line telephone circuits for private networks, which support data rates of 9,600 bits per second. PSDN services are based on volume and duration charges, and are tariffed for low-volume traffic between terminals and hosts. At higher volumes, such as are typical between computers in the academic world, the current X.25 services become prohibitively expensive. Leased lines typically have an associated fixed annual rental charge, and no duration or volume pricing, because the customer is renting a point-to-point capacity, and the customer provides the switching of traffic between leased lines as required. Thus, for many networks, the leased lines approach is the most cost-effective. However, in Europe, leased lines between countries are extremely expensive, many times more expensive per kilometre than within countries, and very much more expensive for comparable distances than in the United States. Thus, at present, building a European network using leased lines, while more cost effective in most cases than using X.25 services, is much more expensive in Europe than in the United States. Clearly, this situation cannot continue and the prices of leased lines will fall and be much more closely related to the costs. The CEC's Green Paper on telecommunications policy highlights these problems.

However, the situation is worse than it first appears. Some PTTs have proposed a volume- or time-related charge on leased line circuits, on top of the annual rental charges. The prospect of paying an annual rental for a fixed point-to-point capacity, and on top of that paying for the use of the circuit, does not gladden the average telecommunications manager's heart. When the volume charges are comparable to the PSDN charges, as is proposed, one might expect an unenthusiastic response from customers. Paying a volume-related price to a supplier whose costs for the service are fixed is hardly a move in the direction of competition.

The current situation with the national PTTs is a consequence of a multinational rather than a European approach to the provision of telecommunications services. With the forging of closer links between countries clearly stated as Community policy, the telecommunications authorities are presented with a unique opportunity. A vast open market for products and services could be opened up, with the twin advantages of high volumes and increasing demand for specialized services. Yet instead of grasping the opportunity to create a European Telecommunications Authority (ideally, with several competing providers of services) the PTTs persist in a multinational approach.

Although there is a lot going on in academic computer networking in Europe, most of the organizations involved take a traditional view of networking - that is, of users on large-scale computing systems connected to a wide-area network. In practice, most researchers are now using advanced work stations or personal computers for their work. In general, these work stations are connected together using some Local Area Network (LAN); in turn these LANs are connected together, and to the larger-scale computing facilities, by a Campus Network, using a variety of technologies and a variety of communications protocols. What is now required is that the researcher, through the single window of the local work station, via local, campus and national/European networks, should be able to gain access to required computing facilities and databases, and communicate with colleagues throughout the world.

Researchers should be able to access and interact with remote resources, as if they were local, and be able to take advantage of remote high-performance computing resources from the graphics display work station at their desks. The bandwidth requirements for such an advanced computing and communications environment are orders of magnitude larger than currently available on the networks described above.

Such a high-speed network of networks, or Internet, is the model for academic networking in the United States, and is currently being implemented by the National Science Foundation's NSFnet programme. Such a model should be adopted immediately by the European academic community, and a concerted effort made to put it into practice over the next two or three years. This effort will require the co-operation of the current European networking organizations; the co-operation of the PTTs, so that high-performance (64 kbit s^{-1} to 2 Mbit s^{-1}) circuits can be made available across Europe at prices comparable to those in the United States; the co-operation of the national networks; and, most importantly, the adoption of a European attitude.

To achieve such a truly European networking infrastructure requires, of course, a European source of funds. This necessity for European (as opposed to multinational) funding is common to all such activities, and is the greatest political challenge to the Community. (Extracted from an article by Dennis Jennings, Director of the Computer Centre, University College, Dublin 4, Ireland, the current President of EARN, which appeared in Nature, Vol. 329, 29 October 1987)

ASIC developments in Europe

The ASIC market is considered vital to the survival and growth of the electronics industry. The British Alvey programme has focused much of its efforts in this area. One project under its auspices involves an advanced 1μm bulk CMOS VLSI process offering state-of-the-art ASIC performance with up to four levels of metalization. It is now entering production at 1.5μm, with pilot production at 1μm scheduled for the summer of 1988. Production will then be transferred to Plessey and GEC facilities. Another collaboration involving STC, British Aerospace and Racal Microelectronics, involves an intermediate 1.25μm bulk CMOS process currently being sampled at STC.

Ferranti, also under the Alvey umbrella, is currently developing a 1μm collector diffusion isolation bipolar process providing very low-cost VLSI circuits for ASIC applications, especially where mixed analogue and digital functions are required. A progressive scaling of the process technology is being undertaken from 4.5μm and 3μm through to 1.5μm to 1μm.

The European Silicon Structures (ES2) companies in France, Britain, the Federal Republic of Germany, Sweden and Italy are collaborating in a Eureka project for the automatic design and production of custom chips using direct printing on silicon wafers. The service will enable engineers designing electronic systems to carry out operations on the basis of custom chips using silicon compilers, and aims to supply the chips in less than two weeks. Philips in The Netherlands will be involved in the development of the production technology, while British Aerospace (UK), Bull (France), and Olivetti (Italy) may participate in the development of the silicon compilation software. Silicon wafer production will take place at Aix-en-Provence, France, and software development near London.

Texas Instruments is adding a second electron beam direct write machine at its Bedford plant in England. This location was the world's first commercial direct write facility, and according to the company the new machine will permit continued process development geared to gate arrays at 1μm and below. The first machine will still be used for fast turnaround prototyping of current gate arrays.

TI's Europe ASIC manager, Clive Hogger, forecast: "The sheer number of designs required by the user industry will force a change in the conventional semiconductor approach to the manufacture of silicon. Increasingly, we will have to move to single slice processing approaches, such as those offered by the e-beam direct write facility."

Swiss company Lasarray S.A. has introduced a rapid in-house system for cost-effective design and production of silicon ASICs in batches of 5 to 2,000. An optical recognition system using a red He:Ne laser scans the surface of prestructured silicon base wafers of up to 300 chips; it recognizes structures already on the wafer without exposing the photoresist.

Based on the data gathered during scanning, a blue He:Cd direct write laser (DWL) emits 10 mW at 442 nm with about 0.5 mW delivered to the wafer surface. The DWL is switched on and off at up to 20 MHz by an acousto-optical modulator. The precision mechanical stage moves so that the beam exposes a positive photoresist on the surface of the wafer in a linear raster pattern to produce the required design. Accuracy is on the order of 0.5μm at a scanning speed of 300 mm/sec.

Photochemical processing with a low power laser followed by chemical resist processing avoids the heat problems associated with other laser systems. The Lasarray dual laser technique eliminates expensive maskmaking which is a limiting factor for prototyping and small volume production. The semicustom design can be transformed into full custom design, eliminating all unused active and inactive silicon areas.

The present Lasarray system cannot be used for analogue products, but the company is to collaborate with Delft Integrated Circuit Engineering BV of The Netherlands, in a Eureka programme. An analogue ASIC will be developed which is prototypable by DWL to ensure short prototype and production turnaround times. The layout will provide for decreased layout time, more effective use of standard analogue cell libraries, and better use of silicon area. (Reprinted with permission from Semiconductor International Magazine, February 1988. Copyright 1988 by Canners Publishing Co., Des Plaines, Il., USA)

Belgium

Artificial Intelligence R&D in Belgium

Bim, a Belgian company specializing in advanced data-processing technologies, is expanding in the fields of large data-processing systems, office automation, local area networks, as well as artificial intelligence.

Bim has acquired considerable expertise in the field of networks, which enables it to integrate heterogeneous hardware (IBM, Digital, Sun, Convex, Pc, etc.) running on fundamentally different operating systems. The group is developing original products, such as Bim-Scanfile, a document filing and retrieval system running in the image mode under UNIX, or again an advanced multi-mode laser printer server.

Bim has selected artificial intelligence as one of its main activities in the intermediate term. Two main orientations were developed, based on a systematic policy of participation in national research projects (in collaboration with Belgian universities) and international projects (in particular several European ESPRIT projects [European Strategic Programs for Research and Development in Information Technology]).

Its research on logic programming experienced a first success with the recent marketing of Bim-Prolog, an implementation of Prolog that offers a very high speed (over 215,000 logic inferences per second on a Sun 3/200) and a very rich programming environment including, among other things, an interpreter, a compiler, an interactive debugger, interfaces with other languages such as C or Pascal, with Unix and with the Unify relational database system, as well as easy access to all the graphics and windowing capabilities of the Sun workstations. New enhancements of Bim-Prolog are expected, with respect to both performance and environment. Bim is also interested in developing original Prolog applications, such as Rulecalc, an "intelligent" spreadsheet project, in which recurrent functionalities are enhanced by the possibility of specifying logic rules and constraints.

As far as natural language processing is concerned, Bim is the leading partner in an ESPRIT project involving the development of a natural language interface for relational databases. This system, called Loqui, has two original characteristics. On the one hand, an extreme modularity which enables it to offer considerable portability with respect to both the application domain selected and the natural language used for input (Loqui currently includes interfaces for English and German; French and Dutch interfaces are planned); on the other hand, the interaction flexibility of the system is considerably enhanced by a speech management module based on an explicit representation of the structure of the dialogue in progress. One of the priority short-term objectives

of Bim is the implementation of a commercial product based on these results. As far as natural language processing is concerned, Bim's long-term goal is to create a "toolbox" that could easily be used for a variety of applications. (Source: La lettre de l'intelligence artificielle, October 1987)

China

Development of electronics industry

A low-cost, export-based electronics industry is gradually taking shape. Though development is being slowed by low standards of quality, a lack of profit motivation and cost inefficiencies, some US firms are convinced that in the long-term China's export orientation and its huge domestic market will make it a major player in such fields as semiconductors and computers. Based on that belief, Xerox became the latest of a number of firms trying to build an electronics industry in China. In September 1987 the firm agreed to spend $15.3 million on Shanghai factories that will make copier machines and parts. Unisys is helping Chinese workers to assemble its computers from imported kits, while Gould has licensed its manufacturing-controls technology to a Chinese factory. Foxboro has been making process-control equipment in China since 1983, and its Spec 200 model uses 50 per cent of local parts. In 1987, the firm expects to export $400,000 worth of parts made in China.

IBM and Digital Equipment dominate the Chinese electronics market, despite their refusal to assemble or manufacture machines locally. Eventually, companies that set up operations in China hope to win some of the market from IBM and DEC. That view is supported by the Chinese Government's efforts to curb a drain on hard currency by making it difficult to import electronics equipment. The Government has made it clear that all electronics factories in China are expected to export enough to cover the cost of imports. (Extracted from the 2 November 1987 issue of Business Week by special permission, (c) 1987 by McGraw-Hill, Inc.)

EEC

EEC awards grants for neural work

EEC officials have awarded £700,000 to six European research projects into neuro-computing - understanding how the human brain works in order to build more intelligent computers.

The six projects involve UK universities and research centres at Cambridge, Harwell and Stirling. The only industry laboratories involved are those of the Dutch company Philips, which is examining neural networks for data processing.

A grant of £100,000 is going to research in computer software and algorithms for problems in artificial intelligence. This will use "connectionist" models that simulate the brain's complex calculating capacity.

Institutions involved in methods that could be applied to image and speech recognition include the UK Royal Signals and Radar Establishment and universities in Cambridge, Munich and Paris.

Stirling University in Scotland is working on two projects. The first is building a neurocomputing machine, using algorithms to run intelligent robots. Its second looks at replicating the functions of the brain's outer layer in a machine.

Other projects will study the relationship between the brain's visual and motor mechanisms. Some 28 laboratories and 100 researchers are involved and further projects are likely to be announced in the near future. (Source: Computing, 26 November 1987)

Outside auditors for ESPRIT

The European Commission has appointed outside auditors to review spending within its €1 billion ESPRIT research programme.

The Commission has appointed five international firms of accountants to check on individual projects and give them the financial clearance.

Officials have denied the move is connected to earlier criticism by the Commission's own financial watchdog of a lack of consistency in evaluation and payment methods to contractors in the joint ventures.

The first phase of ESPRIT which began in 1984 is spending over €1.5 billion from community coffers, and is likely to start a second phase - twice as large - next year. (Source: Computing, 8 October 1987)

Siemens, ICL and Thomson developing CAD system or circuit design

In the framework of the ESPRIT programme, Siemens, ICL and Thomson have started a joint research and development programme known as AIDA (Advanced Integrated Circuits Design Aids). The project, which is to be implemented under the guidance of Siemens, is expected to develop new designing methods and new CAD (Computer Aided Design) instruments to be used in the production of VLSI (Very Large Scale Integration) circuits, characterized by more than 1 million transistor functions. The project, for which some DM74 million (33 million ECU) have been allocated, is expected to take four years to implement and to require a total number of work hours amounting to 300 man-years.

With the current designing systems, manufacturers have succeeded in producing integrated circuits with semiconductors having more than 100,000 transistor functions; however, these systems are inadequate where circuitry involving 1 million functions is required. It is thought that new technologies will be developed over the next five to ten years that will offer the ability to place several million transistor functions on a single design as well as new instruments for designing complex, future-generation logic circuits.

The AIDA project is subdivided into the following sectors: logic and electrical synthesis (silicon compilation), testing, data maintenance management, layout and user interface. The operations to be performed in each of these sectors have also been subdivided in the project, so that each company may contribute according to its know-how and equipment. Siemens is responsible for the layout and test sectors; Thomson is in charge of logic and electrical synthesis and of user interface; and ICL co-ordinates work in the area of data maintenance and management and of systems specifications. Inasmuch as it is the project leader, Siemens is responsible for the co-ordination of the various operations, including those carried out by the universities of Manchester, Grenoble and the Bull Research Center in Paris.

The Siemens team which is to engage in the AIDA project will include more than 30 development specialists who are to work in the Perlach research laboratory. Siemens will introduce all new developments into its Venus design system. The project leader is Dr. Knut Merten who was previously responsible for all CAD developments achieved in the framework of the Venus system. (Source: Scienza Duemila, No. 8, August 1987)

EUREKA Software Factory Workshop

The project aims at providing an EUREKA Software Factory (ESF) which is both capable of being configured for specific industries and of evolving with the innovations which arise from worldwide

research. This will be achieved by providing a reference architecture for the dual purposes of tailoring and evolution. It is recognized that many applicable technology advances will occur over the life of the ESF. Examples of these areas of technology are: formalisms, knowledge engineering, artificial intelligence (AI), parallelism, architectures, declarative systems. The open architecture will support an evolutionary exploitation of these technologies on a broad, parallel base.

The architecture will also support the movement in software engineering from existing support environments towards industrialization and automation of the software production process. Modelling of processes and human activities will be an essential part of industrialization, leading to the use of mixed paradigms based on advanced system analysis techniques, descriptive and modelling languages, rule based techniques and AI. As in most industrial processes, the idea of the re-usable components is paramount to acceptable levels of productivity.

Fundamental to these aims is the need for comprehensive, evolving integration mechanisms. These will function at an external level to support processes, methods and roles. They must additionally function internally to support object management, interoperability between tools to increasingly fine levels of granularity.

The long-term vision might be towards a knowledge assisted, configurable system capable of directly solving the "user problem" presented to it.

The remainder of this technical report describes the architecture and the technologies which are available in the medium term. (Source: EUREKA Software Factory, 1987)

ESPRIT's fault-tolerant system

Bull has assumed the primary responsibility for the ESPRIT program's Delta project. Built around its line of mini SPSs, the project is designed to develop a fault-tolerant system that will operate in a distributed open architecture environment.

The Delta-4 architecture integrates ISO communications standards in accordance with the OSI model. Through new developments, it plans to make a significant contribution to the development of new ISO work on open distributed processing (ODP). The concerned fields of application are, more specifically, factory and office automation, with an emphasis on the real time aspects of data processing.

The Consortium believes it is important to implement the overall architecture in an industrial environment. It is anticipated that the project will be conducted under ESPRIT 2 and that a large-scale pilot site will be installed at the BASF factory in Ludwigshafen, Federal Republic of Germany. (Source: Electronique Actualités, 18 September 1987)

Federal Republic of Germany

Megabit developments

In 1987, Siemens started mass production of its 1M DRAM at the Regensburg facility. The Siemens-Philips Megaproject, which started in 1984, is proceeding as scheduled with Siemens introducing the first laboratory samples of a CMOS 4M DRAM in 1987. This device is scheduled for mass production at Regensburg in 1989. Siemens has invested approximately $935 million in the Megaproject with $130 million support from the Federal Republic of Germany Ministry for Research and Technology. $330 million has been spent on the Regensburg plant and a similar amount on a new design centre in Munich.

The 4M device, when compared to the company's 1M DRAM, has quadrupled storage capacity without even doubling the chip area. According to Siemens, the R&D work on the 4M DRAM is establishing the basic technology for highly complex CMOS logic circuitry for the telecommunications and automation systems of the 1990s.

Philips has also been successful in its part of the Megaproject which has been supported by the Dutch Government. The first functional submicron 1M SRAM was produced in June 1987 exactly on schedule at the Philips research facility in Eindhoven. This is the first device yet produced in six-transistor cell full CMOS submicron technology that is claimed to ensure product suitability for battery operated and hand-held applications with resistance against radiation and voltage spikes. The 25 ns typical access time is the shortest yet achieved in this technology. Volume production of the SRAM is foreseen in mid-1989. Philips is planning to spend $1,100 million on new facilities and equipment in Eindhoven, Nijmegen and Hamburg for the Megaproject. (Reprinted with permission from Semiconductor International Magazine, February 1988. Copyright 1988 by Canners Publishing Co., Des Plaines, Il. USA)

Munich Technical University engaged in neural computer R&D

Seals at a circus show how well they manage to balance a long stick on their noses. They have learned to co-ordinate every movement with a countermovement.

Even a robot has learned to do this at the Technical University in Garching near Munich; more accurately, it was the "spirit" of an intelligent robot simulated by a computer that managed to achieve this result.

Researchers have been able to follow on the monitor how the simulated robot gradually solved the trick to keep the stick in an upright position. Professor Klaus Schulten, from the Munich Technical University, whose team deals with advanced robot intelligence, would like to discover how the robots of the future can learn all those practical things that will one day make them useful in industry (and in the home?) according to the same principles as the human brain uses in learning.

For this he needs two things: a new type of computer, developed to be similar to the structure of natural brains - in other words, veritable electron brains; and new types of software for such artificial brains. Computer specialists, physicists, and neurologists all over the world are now working on both of these problems: among EDP insiders, the construction and programming of brain-like computers in what is called "neural architecture" is seen as the most interesting task for the future.

Early in 1987, FRG research minister Heinz Riesenhuber invited 40 experts from around the world to a confidential meeting near Saarbrucken to discuss the future of neural computers. The meeting's conclusion: five years of fundamental research will be necessary to develop basic knowledge, while the development of a practically useable prototype will require another five years.

By the year 2000, according to the Saarbrucken prognosis, artificial brains will be capable among other things of understanding language and using their memory as intelligently and as quickly as man. Robots will be able to orient themselves and find their way around their environments without collisions.

Schulten, the Munich intelligence developer, would like to have such a computer, called a connection machine, to continue his work. As he cannot obtain one in the FRG, he will continue his research during the coming winter semester in Urbana, Illinois, taking along most of his 14 assistants from Garching.

The connection machine is produced by the young Thinking Machines corporation in Cambridge, Massachusetts. The corporation's founder is 30-year-old Daniel Hillis who discovered a miracle: what technical jargon calls a "massive parallel" computer. This computer is fundamentally different from conventional hardware machines; it is about half way between [conventional computers] and the coming artificial brains with neural architecture.

Hillis' main discovery was the organization of the resulting possibilities for contact in such a way that the connection machine works well overall. He succeeded in this by using a second important organizational principle of the new computer which besides working in parallel opens up completely new performance possibilities through self-organization.

The freedom to organize itself, as it is here built into a progressive computer, will also be a fundamental characteristic of all programs for future neural computers.

Computer experts want to impart the capacity for learning to their fifth generation computers and robots: they will write no more final programs. They will give the computer general rules for self-organization and for learning, they will tell it what it must do in individual cases, and then they will set an objective. Everything else will be left to the automaton.

Schulten's balancing robot implements a general principle that will be very significant in future ADP [Advanced Data Processing]: learning computers are flexible, they can adapt to changing situations without being reprogrammed; it is easier to write self-organizing, learning programs than it is to program current computers, since at present every detail must be communicated in advance.

So Schulten's objective is not to develop a robot for a specified use. Instead, he would like "to learn how to program robots so that they can learn". [This knowledge] will then later "be used in a large family of robots". Schulten estimates that this development will take a few years yet.

The performance-oriented computers now coming onto the market are "massively parallel", but as yet come nowhere near the brain's complexity and plasticity. Physicists and neurobiologists have therefore been working in their laboratories on networks that are really similar to nerves, that are truly formed in the image of the brain.

One further advantage of neural computers is that although they sometimes give approximate answers, they give them quickly. That is often better than the perfect solution for which you have to wait much too long. (Source: Hightech, September/October 1987)

Duerr tests robot with new image processing system

The first seeing robots have been installed in the automobile industry, where they are making a very decisive contribution to humanizing workstations: The V6 grey iron cylinder blocks, weighing approximately 40 kg, are removed individually from the so-called rack (a kind of parts cage) by robots working in an 18-second cycle and set down on a roller conveyor. For these handling tasks, Duerr's P 100 gantry robot system was equipped with an image recognition and processing system, whereby the camera communicates with the end effector.

Two layers of parts with twelve cylinder blocks each are stacked in each rack without any divider between the layers. First the end effector with the camera moves to the position where the first casting is located; the camera only picks up this limited section of an image from the rack, and the image recognition system processes the picture. It resolves the picture it has taken into 256 x 256 pixels. Each pixel is assigned one of 128 grey values. The image with the six cylinder bores is preprogrammed in the recognition system, which involves one difficulty: because of the V-arrangement of the cylinder bores, the bore axes lie at an angle and appear in the image as ellipses, which change as the crooked position of the part increases. The blocks are reliably recognized and picked up in an oblique position of up to 5° or 6°.

An additional program is derived from differences in brightness, influenced on the one hand by the lighting, but also on the other by the casting surface, for instance by surface rust. In this case, the advantages of grey value processing come fully to the fore. The system can adapt to certain environmental limits.

Within about 500 ms, the image recognition system recognizes the cylinder bores and other distinct points for determining part orientation. Then the X- and Y-values, as well as the tipping angle, are passed on as information to the robot control system so that the robot end effector can move over the cylinder block.

The Z-axis (vertical stroke) is controlled tactilely by a spring-loaded system. First the end effector moves quickly to the cylinder block, slowing down as it covers the last 100 mm to the workpiece. While the end effector sets down, it first backs off, then releases a limit switch. This system has proven itself in practice. It is reliable in operation, and until now it has the advantage of greater operating reliability than non-contact systems.

If the cylinder block is lying at an angle, the flexible end effector adjusts to its position. The pick-up fingers pull the block to a defined position with respect to the pick-up plate. As the Z-axis is lifted, the pick-up plate centres itself, making it possible to place the block down on the roller conveyor, which carries it away.

In general, these handling tasks involving individual non-machined castings are not very demanding in terms of accuracy. Positioning within 2 to 3 mm is adequate.

Since the recognition system is only designed to recognize the hole pattern, additional safety measures are necessary to ensure that the end effector will not self-destruct if the recognition system has not recognized a block, for instance because it is lying at too great an angle. Therefore, after a layer of workpieces has apparently been removed, there is an additional ultrasound check to determine whether a cylinder block or other part may possibly have been left lying in that layer. Only after this check does the end effector go on to remove the bottom layer.

The recognition system described here has been operating since the end of last year in an automobile factory, providing satisfactory performance. Even though this application still represents a pilot project, it still represents an essential step in the direction of seeing robots. (Source: Maschine und Werkzeug, 3 June 1987)

Scientific computing centre in Heidelberg

The University of Heidelberg has announced the creation of an Interdisciplinary Centre for Scientific Computing. If approved, the centre will bring in

several computer scientists to join professors in the mathematics, chemistry, physics and biology departments whose research touches on computer-intensive problems.

The university is negotiating with IBM for the use of a vector-processing add-on for the existing IBM 3090 computer. Heidelberg mathematics professor Willi Jäger said that the centre will concentrate on the application of computers to problems such as gene sequencing, modelling the creation of galaxies, and the chemistry of combustion. There is already a concentration of researchers in Heidelberg working on stochastic mathematical modelling. Finding collaborators in computer science is a strongly felt need in the Heidelberg basic science departments in part because the university has no department of computer science.

The University of Heidelberg is trying to follow the examples set by the Courant Institute in New York and the University of Utah, albeit on a smaller scale. With the founding of an interdisciplinary centre in this field, Heidelberg is helping to create a trend in FRG institutions toward breaking down barriers between the traditional faculties. (Source: Nature, Vol. 329, 29 October 1987)

Computers can reduce number of animal tests in pharmacology

Three research projects sponsored by the FRG Ministry of Research and Technology have concluded that the use of computers can reduce the number of animal tests used in the pharmaceutical industry by more than one third. With the aid of computerized molecular modelling, experiments have so far synthesized three drugs. (Source: European Chemical News, 19 October 1987)

Computers in pharmaceutical design

Pharmaceutical firms can design pharmaceuticals to have particular effects on enzymes by using computer technology to identify which part of an enzyme must be blocked for a given effect without unleashing other, undesirable reactions. Computers can simulate chemical processes such as enzyme-substrate interreactions and software can allow scientists to view 3-dimensional molecules from any angle and to manipulate them. (Extracted from Chemische Rundschau, 2 October 1987)

Superconductor research funds

Superconductor R&D funding by the FRG government will rise to DM 6.5 million in 1987 versus DM 4.5 million in 1986 and DM 2 million in 1985. The sharp rise in this budget is due to the rapid progress in superconductor performance and technology in recent years. In 1976-1984 funding averaged DM 1 million/year and concentrated on basic theory, while funding is now being geared more to technology and applications. As superconductors are developed that perform at higher temperatures, the potential applications for them expand rapidly. Applications research now covers equipment for R&D, data processing, medical imaging and diagnostics, transport, energy, and space and deep sea research. (Extracted from Erdöl und Kohle, September 1987)

Car-network protocol

Robert Bosch GmbH of Stuttgart, FRG, has signed another major licence agreement for the use of its automotive networking protocol, the Controller-Area-Network Protocol. This time it is Motorola Inc.'s Geneva-based European operations; Philips of the Netherlands and Intel Corp. have already signed similar agreements. The CAN Protocol, which is a strong candidate for becoming a European standard for data transmissions in cars, is designed for moving data on a car's multiplexed wiring system, as well as for fast transfers among real-time control systems. (Electronics, 4 February 1988)

GMD R&D achievements in parallel computing, computer security

In addition to carrying out its basic scientific work, the Society for Mathematics and Data Processing (GMD) will strengthen its position as a service centre for the community in the main scientific fields. As its report on last year's scientific activity indicates, there are three primary categories involved in these additional services: research teams working on the design and development of future super-computers; universities training experts on the design of very highly integrated circuits; as well as small and medium-size companies wishing to exploit the opportunities of information technology to retain and improve their competitiveness.

The most costly of these projects is the construction, which is already under way, of an experimental laboratory for completely new computers which do not carry out one operation after another, but in which hundreds of processors work simultaneously, in parallel, on the solution of highly complex tasks. This laboratory, which until 1988 will require investments of more than DM 11 million, is part of the "High Performance Computer Center for Computer-Aided Theoretical Physics and for Supercomputer Oriented Information Technology" which is being formed by the GMD, together with the nuclear research centre in Juelich (KFA) and the German Electron Synchrotron (DESY), in Hamburg. While the physicists in Juelich will work with a high-performance computer that is commonly available on the market, the GMD will try to create the foundation for the new generation of parallel computers. This task ranges from the development of completely new computer programs (algorithms), to program languages and operation systems, and to completely new internal construction of computers which permits highly complex tasks to be "broken down" so that they can then be handled by a few hundred parallel-operating "sub-computers", whose partial solutions can be joined together for the final result.

Another GMD experimental laboratory went into operation on 1 July 1987. It deals with the control of the functional capacity of very highly integrated (VLSI) chips within the joint project "Design of Integrated Circuits (EIS)", in which 51 professors from 26 universities, and Siemens AG are co-operating, led by the GMD.

The primary goal of the EIS project is to train enough experts on the design of integrated circuits in the FRG who can follow the international trend towards the placement of more than a million circuits on a silicon surface of just 1 cm^2. Until now over 200 chips have been planned and produced within the framework of the computer project. In the VLSI experimental laboratory these chips are to be tested for universities in the future.

A complete success for both producers and clients was the GMD microcomputer centre which was opened in Sankt Augustin near Berlin on 21 April 1986, where owners and workers of small and medium-sized companies in particular receive expert and objective information without obligation on the present possibilities offered by information technology for the solution of their specific operational problems. The focus of attention at the centre, which is open to other groups as well, is a permanent information exhibition in which up to 20 FRG and foreign producers exhibit their latest microcomputers and most important computer programs.

Of all the GMD's scientific work in the past year, particular attention is paid to two projects:

In the GMD Research Center for Innovative Computer Systems and Technology (FIRST) at Berlin Technical University, a project was developed for a parallel operating computer for the PROLOG programming language to be used primarily in the field of artificial intelligence. Unlike the artificial intelligence language LISP - in which the United States has a 20-year advantage - PROLOG presents the possibility of co-operating from the start on an early project of European origin. The parallel operating PROLOG computer POPE is even more important given that in Japan PROLOG has been chosen as the basic language for "fifth generation" computer systems.

The system of electronic writing on a chip board, further developed by GMD scientists, was first of all coupled with an operational computer operational system - the BS2000 used in all Siemens commercial computers - for effective access control, which stops even the most skilled "hacker". This permits the secure identification of authorized computer users on the basis of so-called asymmetric encoding processes. Without having to register the exact identity of a user each time, it always ensures that no unauthorized person gains access to the computer, and that the computer is used by authorized people exclusively for those purposes for which they are authorized. The chip board supplants insecure access control through passwords, as well as refined but not totally secure biometrical control through handwriting, fingerprints, or voice analysis. (Source: Technologie Nachrichten - Management Informationen, No. 459-460)

The rise of "Silicon Bavaria"

A new group of entrepreneurs are making their mark in "Silicon Bavaria", the high-technology community around Munich. The capital of FRG's southernmost state has become an oasis of innovation in one of the world's most cautious societies.

Unlike France, Italy, and the UK, whose Governments have been promoting free-market policies for half a decade, the FRG is still struggling to loosen restrictions on business, deregulate industry, and promote innovation in its capital markets. With growth nationwide expected to slow to 1.5 per cent or less this year, the Munich phenomenon is one of the few bright spots in Germany's economic picture.

The benefits from Munich's boom, however, extend far beyond the city itself. They have brought above-average growth not only to nearby towns but also to much of southern FRG.

Hetron and other startups around Munich represent a major move by Germany out of dying smokestack industries into new technologies, and they could be the key to the country's future economic vitality. Munich now boasts a micro-electronics industry whose size and scope are unrivaled on the continent. The 830-year-old city and its environs are home to 3,000 electronics companies and 20,000 software engineers. More than 10,000 people work in the semiconductor industry alone, and more than half of the 655,000 people employed in greater Munich have jobs in high-tech fields ranging from aerospace and robotics to telecommunications and biotechnology.

Like its counterparts in Silicon Valley and along Boston's Route 128, Munich's high-tech network draws on a concentration of leading universities and research institutes amid major industries. Electronics giant Siemens, which employs 13,200 engineers and computer scientists in Munich, laid the foundation for Silicon Bavaria when it moved its headquarters from Berlin after the Second World War and began computer research and development in the late 1950s.

What set off Munich's high-tech explosion was the arrival in the late 1970s of a wave of US companies eager to tap the German market, which accounts for 30 per cent to 40 per cent of Europewide electronics sales. Like an increasingly powerful magnet, Munich has drawn a second wave of smaller, fast-growing US electronics companies. Among the recent arrivals are Sun Microsystems, VLSI Technology, and Daisy Systems.

The influx of Americans turned Munich's high-tech community into an incubator for entrepreneurs. In addition to their inclination to take risks, the Americans brought expertise in financial management and marketing for fast-growth companies.

German engineers have often been first in the laboratory but last to market, while the US and Japan raced to commercialize new technology. In the late 1950s, Siemens researcher Heinrich Welcker discovered and patented technology for creating semiconductor materials that, in turn, became the basis for developing light-emitting diodes. Siemens never used the technology, though, and in the 1960s Japanese and US researchers rushed to market with gallium arsenide and other products based on Welcker's discovery.

In the Munich incubator, German engineers and managers employed by US companies saw firsthand a new way of doing business. Getting good ideas from laboratory to market in FRG is still not the speediest process, but industry leaders and academic researchers say technology transfer has improved significantly in the past five years. Before that, professors could not develop industrial contracts without university permission, and even then they were chastised for taking time away from teaching. (Extracted from the 8 February 1988 issue of Business Week by special permission, (c) 1988 by McGraw-Hill, Inc.)

France

GaAs and Megabit developments

Thomson of France has developed a technology for GaAs monolithic IC fabrication, the main emphasis being on digital and linear high-speed devices for real-time signal processing. Three design approaches have been used: custom designs, standard cells and gate arrays. The basic process for digital ICs (known as LOG-1) uses ion implantation with optical contact lithography, but electron beam technology is planned for submicron dimensions. A mixture of electron beam direct writing and optical lithography is used for most microwave applications. The work has been carried out at the Laboratoire Central de Recherches de Thomson - CSF and is now being followed by development and production at the Division Composants Hybrides et Microondes de Thomson Semiconducteurs.

The development of this new family of very high frequency devices has required considerable effort in the areas of testing and packaging to avoid deterioration of the electrical performance of the chip. Exhaustive on-wafer automatic testing is very difficult because of the high frequency operation associated with increasing circuit complexity. The procedure involves static tests to extract material and device parameters, functional tests at a low frequency (10 MHz) for electrical sorting, and dynamic tests on the time propagation delay on ring oscillators and on the main dynamic specifications of the devices on critical path. For this measurement a duroid microstrip card has been developed that performs up to 4 GHz. Hermetic ceramic packages have been developed with low insertion losses and good crosstalk; they offer good frequency performance to 6 GHz (an 8 input/output package) and to 3.5 GHz (16 input/output package).

Before SGS Microelectronics Spa (Italy) joined Thomson Semiconducteurs (France), they started a five-year Eureka collaboration for the development of multimegabit nonvolatile memories. The work includes development and commercialization of a 4M EPROM and a feasibility study of the technology and architecture of a 16M EPROM. Technological developments envisaged include submicron electron beam lithography, planarization and etching techniques, new memory cells, and self-testing structures. (Reprinted with permission from Semiconductor International Magazine, February 1988. Copyright 1988 by Canners Publishing Co., Des Plaines, Il. USA)

French MAIA expert system discussed

Taking advantage of the "Avignon Days" dedicated to expert systems, the French company AMAIA (Architecture, Methods, and Applications in Advanced Data Processing) announced several products intended for artificial intelligence applications: a Lisp and Prolog machine, a symbolic workstation, and LE-Lisp language coprocessors developed by the INRIA (National Institute for Research on Data Processing and Automation).

Artificial intelligence applications which devour lines of Lisp or Prolog need specialized hardware. The Americans already have Symbolic or Explorer. Until now the French have been patiently awaiting their turn. They sometimes referred to the CNET (National Centre for Telecommunications Studies) and CGE (General Electric Company) project, under development in collaboration with a company known as AMAIA, which was to lead to a machine for artificial intelligence applications (MAIA). But tangible results were sluggish.

The French AMAIA company has announced that the first European symbolic computer, MAIA, will become available during summer 1987.

Thanks to microprogramming MAIA has specific mechanisms that optimize the application of the Lisp and Prolog symbolic languages. The machine processes data by 40-bit words including a descriptor (8 bits are used to indicate the word type). The user has a virtual memory manager which controls a 470-megabyte high-speed disk.

The machine environment was developed in Common-Lisp, mainly in the United States. Maialog, the Prolog operating on the machine, is designed to interpret Lisp and Prolog. Thus, any Lisp statement can be inserted into a Maialog program. Conversely, Maialog can be accessed from a Lisp program. Interpreters and compilers are available for both languages.

This symbolic computer is also intended to bring artificial intelligence techniques to industry. Specifically, this step will be made possible by the availability of a VME bus. There is a close link between the Lisp tasks and the core of the system which manages bus interrupts. The activation of a Lisp task which monitors a manufacturing process can occur less than 50 microseconds (millionths of a second) after the interrupt.

Moreover, MAIA has an Ethernet-type local area network interface (TCP/IP, Telnet, FTP). Although MAIA is a single-user machine, it will eventually be used to service the symbolic requirements of several workstations.

The machine uses three dedicated and independent processors. One is dedicated to virtual memory management and controls the exchange of pages between the central memory and the disk unit. Another manages the bit-map screen (1,024 x 1,024 pixels). Finally, the symbolic processing unit (UCS) runs Lisp and Prolog programs.

MAIA's central memory can hold up to 80 Mb. The virtual memory, however, is physically located on a 470-Mb disk. A memory space retriever (garbage collector) prevents memory saturation and optimizes virtual memory management, which is crucial in artificial intelligence applications in which the location rule is rarely observed.

MAIA thus seems to be well-suited for symbolic computing. There is a snag: its price, which is close to Fr 800,000. At a time when American manufacturers are lowering their prices - a Symbolics system currently costs around Fr 300,000 - the French symbolic computer seems a little expensive. But the offer of the AMAIA firm goes beyond the top range machine just studied. AMAIA has designed the Personal Symbolic Computer (PSC), a specialized workstation for artificial intelligence applications.

Supplied in the standard version with LE-Lisp and V Prolog, the PSC is listed at less than Fr 90,000. It should be noted that this machine also includes the Lispeur software development environment, which complies with the LE-Lisp 15.2 specifications defined by the INRIA.

Finally, AMAIA is planning a family of LE-Lisp coprocessors to increase the efficiency of LE-Lisp language in microcomputers. This is the CL-1000 card family, which can be installed in an IBM-PC/XT, AT, or compatible.

These cards, developed under CNET licence, will be available, during mid-1987.

A French company created in 1984, AMAIA is managed by its founder, Pierre Stephan. Located at Bayonne and Paris, this stock company with a capital of Fr 2.5 million had a 1986 turnover of Fr 10 million. Forecasts for 1987 are Fr 20 million, of which 40 per cent will come from research activities and 60 per cent from product sales. AMAIA today has 28 employees. (Source: Zero un informatique, 11 May 1987)

France researches 3D ICs within ESPRIT Program

Electronic circuit manufacturing techniques have been improved ceaselessly, thus permitting the integration of an ever larger number of designs for ever smaller dimensions. However, certain factors involving specifically the dimension of connections limit the advantges introduced by integration. Stepped-up efforts over the past several years are aimed at putting together vertically integrated structures, more commonly referred to as integrated 3D circuits. This method of integration offers the possibility of having a larger number of shorter and more reliable interconnections and creating new high-density devices, thus making it possible to integrate different technologies and functional forms on the same support, and this enables us to look forward to new uses.

"Integration in terms of three dimensions consists of stacking up layers of different functional forms, for example, a sofware layer, a high-voltage layer, and optoelectronic couplers," explained Alain Roche, of Thomson Semiconducteurs (Grenoble).

This company is involved in two ESPRIT [European Strategy Programs for Research and Development in Information Technology] contracts (numbers 14 and 245), involving integrated 3D circuits and presented at the third ESPRIT Conference held in Brussels in late 1986. Contract 14, christened "Multilayer Interconnection of VLSI", uses this third dimension to put together interconnections between different levels. Grouping the Plessey, GEC (General Electric Company), and Telefunken companies around Thomson, this project is aimed at developing a system of interconnections with four compatible levels using the MOS [metal oxide semiconductor] and bipolar micron and submicron technologies.

Contract 245 deals with the superimposition of active layers specifically, MOS devices made up of SOI [silicon on insulator] on a layer of MOS circuits integrated into the silicon substrate. Thomson's French partners for this project include the CNET [National Telecommunications Studies Center], (Grenoble), the LETI (Electronics and Data Processing Technology Laboratory), the CEA (French Atomic Energy Commission), GEC-HRC [General Electric Company - Hirst Research Center], as well as the universities of Cambridge and Cork.

These two projects are a part of the ESPRIT subprogram entitled "High-tech Microelectronics" which is aimed at increasing the complexity of circuits and reducing their dimensions.

The feasibility studies involve a DMOS (double-diffusion MOS) device on solid silicon for the lower layer and CMDOS/SOI (Complementary MOS/Silicon on insulator) for the upper layer. The prototype will bring out the problems which may be raised by SOI technology as well as the interconnections between the two levels. The purpose is to check the technological choices for a demonstration circuit in 1989.

On the silicon section, which is half a millimeter thick, the circuit itself uses only a few microns of thickness, while the "active" layer and the rest of the semiconductor serve to support the software functions under good conditions. We can thus envisage using this support to make several circuit elements separated from each other by an insulating layer. Independently of its importance to 3D integration, the SOI technology makes it possible to save on a material which is relatively expensive to get.

Starting with a conventional integrated circuit, we cover it with a sufficiently thick insulating layer, then with a new semiconducting layer having a thickness of several microns on which other circuit elements are "processed". This operation can theoretically be repeated n times for each functional type.

The interconnections are made after the component parts have been defined. Several solutions are possible: either the wells are prepared in the insulating layer and are filled with metal when the upper circuit is made; or, under certain conditions, the holes are punched at the end of the process.

Jean-Pierre Colinge, of the CNET in Grenoble, calls attention to two key points of integration in three dimensions: on the one hand, to increase the semiconductor films on an insulating support; on the other hand, to make circuits on the upper layers without interfering with the good operation of the lower structures that have already been made.

Before being able really to make integrated circuits in three dimensions, we must master the materials involved in these circuits - semiconductors, insulating, metals - and above all their interfaces: semiconductor on insulator, semiconductor on metal, and the other way around. The studies conducted in these fields, in particular by the CNET and the LETI, constitute the "bricks" for the foundation which will make it possible to build three-dimensional circuits.

The LETI acquired knowledge and technological know-how in the matter of interfacing electronic and optical circuits. The Laboratory combined components of two different technologies on one and the same silicon substrate: an optical circuit linked to detection elements and a microelectronic circuit for signal processing. The optical circuit comprises microguides consisting of silicon nitride (Si_3N_4) or doped silica (SiO_2). The electronic circuit is a series of operational amplifiers based on CMOS technology.

The question that keeps many researchers busy at this time, especially those at the CNET and the LETI, has to do with the growth of the semiconductor on insulators to make a new layer on which other circuits will be implanted. The Norbert Segard Center (CNET, Grenoble) is involved in a program having to do with the integration of silicon transistors deposited on insulating materials. This is the SOI ("Silicium on Insulator") technology which opens the way to the construction of silicium [silicon] circuits in three dimensions.

This technique consists of making a thin layer of monocrystalline silicon on an insulating substrate. Two methods are possible: annealing on the basis of amorphous or polycrystalline silicon or epitaxy. The CNET team, which picked the first method, developed an original microfusion technique. First of all, a layer of polycrystalline silicon is deposited on insulating silica (SiO_2); a laser beam then locally fuses the deposit which is recrystallized in the form of monocrystals. To process the entire plate, we must sweep the entire surface with the laser. Problems can arise at the points of overlap between successive sweeps.

Recrystallization can also be achieved on the basis of silicon which was fused by preheating the substrate to 1,100° Celsius. To do that, the CNET developed a machine which permits the recrystallization of small plates with a diameter of 10 cm. To prevent the formation of drops or defects of the grain joint type, the Norbert Segard Center developed an effective method: it consists of etching into the insulating substrate a network of bands with a width of 4 micrometers, spaced 40 micrometers apart. On the substrate thus engraved, we then deposit a layer of about half a micron of polycrystalline silicon which is then covered with 1.5 m of silicon. The defects then are gathered along the length of the network bands and it thus suffices to position the circuits in the intervals between these bands.

The LETI achieved good results for the monocrystalline layer of silicon on insulator: the density of dislocations was on the order $10^7/cm^2$. The quality of the material enables us to contemplate the manufacture of several categories of micronic or submicronic CMOS circuits, in other words, in one and the same tiny spot to combine widely different components (transistors, detectors, operational amplifiers, etc.).

Jean-Francois Rochette, product manager of the Picogiga Company, specializing in gallium arsenide technique, suggests making the microwave [ultrahigh-frequency] part of the receiving head of a satellite of gallium arsenide on silicon. This company furthermore developed an epitaxy process by means of molecular jet or MbE (Molecular Beam Epitaxy) to enable the gallium arsenide layer to grow on a substrate.

To make 3D circuits, we must enable a layer of insulator to grow on the semicondutor layer so as to separate both active layers. In silicon technology, this stage does not create any problems: it is current practice to deposit a layer of silica (SiO_2) on silicon. Researchers are trying to establish a parallel between what is done for silicon and what could be done for gallium arsenide circuits. Until recent years, we did not yet know how to do a good job in making an insulating layer grow on gallium arsenide as this is currently done in the case of silicon during the production of MOS transistors. The team of Mr. Munoz-Yage at LAAS (Automation and Systems Analysis Laboratory), Toulouse, recently managed to grow by epitaxy process calcium fluoride insulator on gallium arsenide.

Finally we must also make the conducting parts of these circuits, in other words, we must grow metal on semiconductors. Experiments are being conducted at Grenoble with cobalt silicide on silicon. At Lannion, a similar approach is being pursued with the epitaxy of rhodium arsenide conductor on gallium arsenide.

"The techniques show that it is no trivial thing to make several levels," admitted Mr. Ben Sahel, of the Grenoble CNET. "Right now, the studies are concentrated primarily on materials. But," adds Mr. Ben Sahel, "the material problem is much less important than the technological problem, pertaining to the circuit manufacturing processes, which would account for 80 per cent of the work on 3D circuits. Once the material problems have been solved, the technology increases the costs and reduces the output. Besides, it is not certain that three-dimensional integration makes it possible to gain in terms of density because it is necessary to provide the place for punching the holes that will be used for the interconnections."

The ESPRIT Project is aimed at building a 3D checkout circuit of the "SOI Mezzanine Gate Array" type. It consists of placing, in solid silicon, the output power circuits which will be made in the LDMOS technology and an upper layer of CMOS/SOI, constituting the prediffused hardware control circuit (gate array). The SOI zone is shifted in "mezzanine" fashion, with respect to the power zone. A prototype of such a circuit, scheduled for 1987, should demonstrate the feasibility of 3D integration and will make it possible to contemplate a potential follow-up between 1987 and 1988.

The mezzanine-style arrangement makes it possible rather easily to solve the problem of heat dissipation. As a matter of fact, when many circuits are squeezed into a small volume, it generates heat. It is generally agreed that heat dissipation must not exceed 1 W per box. "In a 3D circuit, we will try to put the power circuits (which generate most heat energy) in the mass of the chip, in other words, the lower layer, linked to the box; the latter can contain the radiators to evacuate surplus heat," explains A. Roche. The software and memory circuits, which dissipate less than the control portion, can without any inconvenience be placed in the intermediate layers.

These studies promote progress in the development of microelectronics. We thus expect that the SOI structures will increase not only the degree of integration of components but also the operating speed of the circuits; indeed, the surfaces of the junctions and associated capacities are minimized with respect to circuits on solid silicon. The LCR (Central Research Laboratory) of Thomson, in collaboration with LETI, is studying new SOI structures - called SOZ ("Silicon On Zirconia") - which, as insulating substrate, use a stabilized zircon crystal and a thin layer of silica.

In addition to the progress which these studies produce in the development of micro-electronics, the 3D technology should make parallel computation and its applications, especially signal processing, accessible to microprocessors. The 3D circuits could constitute real complete electronic systems. (Source: Micro-systemes, June 1987)

France's VHSIC program to achieve 1.25-micron technology

The VHSIC program (Very-High-Speed Integrated Circuits) of the Pentagon was launched in 1980; it was designed to provide a technology for missile guidance, weapon systems and electronic warfare. It is a three-phase program involving nine contractors during Phase 0, which lasted 6 months; six contractors during Phase 1 (Honeywell, Hughes, IBM, Texas Instruments, TRW and Westinghouse), from 1981 to 1984; and three (Honeywell, IBM, TRW) during Phase 2, the current phase, to be completed in 1989.

In 1983, when the French VHSIC program was launched, it was out of the question that circuits under development in the United States should be offered outside the United States. Yet, the French VHSIC program still benefited from the initial phase of the US program, as some elements of the latter seeped into the public domain.

The objective of the French program was therefore clearly defined: to make circuits similar to those made in Phase 1 of the US program, i.e. to achieve 1.25-micron technology 2-3 years after US circuits. The objective being defined, the material content of the VHSIC program as well as its length were perfectly determined: the last commitments will be made during 1988.

The orientation of the studies is clear-cut: signal processing circuits must be manufactured better today than yesterday, and better tomorrow than yesterday. "Today" means the 2-micron technology which French contractors have already achieved. This leading-edge electronics - thus called because it will be used on torpedoes, sonars and on-board radars - is characterized by a small volume, low electric power, a high input rate (a few million bits per second) and a very high computing rate (measured in gigaflops). Very-large-scale integration is a must, but it can use existing resources: CAD and commercial testing tools.

The goal of the French VHSIC program was to integrate 10,000-30,000 gates per circuit. Design times are relatively high. In addition, because they are military systems, VHSICs are produced in small quantities (all the smaller as the degree of integration is higher), something to which IC manufacturers are not used, as they favour mass production to make their investments pay.

The object of the VHSIC program is to give to the French industry the means to design and produce signal-processing machines using the most modern technologies for highly-integrated digital circuits. Because systems are the main concern, the prime contractors are equipment manufacturers. Indeed, systems must receive the benefits of technological developments as soon as possible, and the specific needs of the military (working environment, self-testing capability, etc.) must be considered.

The contractors of the VHSIC program started by trying to provide equipment designers with libraries of basic function cells together with their assembly rules; they also implemented CAD resources (analysis, design, simulation) adequate to meet the VHSIC program requirements for all levels of architecture.

The VHSIC program hinges around three groups of manufacturers: the GETS (Signal-Processing Study Group) and the CCRC (CMOS Components for Radio Communications) rely on CMOS technology; the GTTS (Signal-Processing Working Group) relies on bipolar technology.

The GETS consists of ESD (Serge-Dassault Electronics), CETIA (European Company for Aided Engineering Techniques), a subsidiary of Thomson/CSEE [Signals and Electric Projects Company], and TRT [Radio and Telephone Telecommunications] for the studies, plus Thomson Semiconductors for the silicon foundry, with MSH [Matra-Harris Semiconductors] as an alternate source. The CCRC includes TRT and Thomson-DTC. Finally, the leader of the GTTS is none other than Thomson-CSF (Detection, Control and Communication Systems branch).

The CELAR [Armament Electronics Centre] is responsible for the characterization of the products manufactured. State financing currently amounts to Fr 330 million. Manufacturers will spend at least as much for their developments. (Extracted from Electronique Industrielle, 1 September 1987)

France applies parallel processing to AI image synthesis

To increase computer performance, manufacturers have thought of assembling several processors capable of operating simultaneously, in parallel. Today, these architectures, whether of the pipelined, vector or hypercube type, are full mastered. However, their use is not always optimized. The software used must therefore express the parallelism inherent in applications and thus permit the verification of process concurrence, as well as communication and synchronization among processes.

In addition to extensions of the traditional programming languages, new languages and operating systems more suitable for parallel processing are appearing. Finally, the union of parallel processing and artificial intelligence should make it possible to approximate the performance of the human brain.

A national program called C^3 (pronounced "C cube"), "Co-operation Concurrence and Communication", launched in 1983 with the support of the Data Processing Agency and the National Center for Telecommunications Studies (CNET) and headed by Jean-Pierre Verjus (IRISA [Institute for Research in Data Processing and Random Systems], Rennes) is entirely devoted to understanding the concept of parallelism. It consists of about 60 teams in France, representing about 300 computer scientists. C^3 is organized around five poles: parallel architectures; networks and distributed systems; distributed and parallel algorithms; languages; semantics and verification.

"It was in the field of distributed algorithms that the C^3 program took its first initiative, late in 1983, when it created the Atlas project (C. Jard, CNET)," J.-P. Verjus added. "Atlas is an homogeneous catalog of validated distributed algorithms." A number of parallel programming languages are being developed in the context of Atlas. These are the so-called asynchronous languages, such as Ada, CSP, Estelle; LC3 (IRISA); Occam (LGI [Grenoble Data Processing Engineering Laboratory]).

Many of the applications considered for parallel processing are more or less related to artificial intelligence. J.-P. Figer (Cap Sogeti) mentioned in particular the comprehension of natural languages in real time.

Researchers are therefore particularly interested in adapting artificial intelligence languages, such as Lisp and Prolog, for use with parallel processing. As is known, the ESPRIT [European Strategic Programs for Research and Development in Information Technology] program No. 302 deal specifically with Lisp.

There already exist several parallel logic-programming languages more or less related to Prolog; in particular, Parlog (inspired by CCS), Concurrent Prolog, GHC, P-Prolog, Delta Prolog (inspired by CSP), etc.

At the CNET in Lannion, Serge Bourgault and his team are studying this problem as well as the development of a hypercube-type multiprocessor machine, based on the 68000 (Motorola) microprocessor, to run this parallel Prolog language. They are now making simulations on IBM 3083 and MacPlus computers.

Mouloud Kharoune (CNET Lannion) has identified several ways to adapt Prolog for parallel processing.

In addition to artificial intelligence applications, which require large processing capacities, one of the principal uses of parallel machines is image synthesis; it requires a huge number of operations, especially when it must be achieved practically in real time, e.g. for computerized animation.

Very high quality images, showing the relief, shadows, lights, reflections on various types of materials (opaque, transparent, smooth, rough, etc.) and shapes (cube, sphere, cylinder, plane, etc.) are obtained by a technique called "ray tracing".

Ray-tracing algorithms can be massively parallelized, as the computation of each pixel of the screen on which the image of the scene is projected can be considered to be an independent process. The more traditional method to parallelize ray-tracing consists in assigning a ray-tree to each processor, i.e. one pixel to each elementary processor.

An MIMD [Multiple Instruction Multiple Data Stream] hardware architecture can therefore be implemented. This is what was done with the Cristal-TPX multiprocessor machine (TPX stands for "Parallel Pixel Processing"), which was developed by the Joint Center for the Study of Broadcasting and Telecommunications (CCETT) in Rennes.

Various mechanisms are used to implement this parallelism: data duplication, task distribution, bus sharing. To permit easy implementation of the ray-tracing application, Cristal-TPX is equipped with multitask monitors. The functions provided make it possible for the application software to carry out data transfers among tasks, to protect resources, count time, etc., and to carry out data transfers among processors.

New image synthesis algorithms allow data distribution. For this, the three-dimensional space containing the scene is partitioned into parallelepipedic "boxes". Each box is described, thus providing a database that is distributed among the various processors. Each processor contains only the data concerning one zone in the space, and it is possible to detect very fast what object is located on the path of a ray and in what zone computations will have to be performed. The computing time is then no longer a function of the complexity of the scene. Another machine is currently being developed at CCETT to implement this type of algorithm: the Cristal-UTZ (UTZ: Zone Processing Unit).

Other laboratories are studying how to parallelize ray-tracing. At present, in particular the PSTI-INRIA [National Institute for Research on Data Processing and Automation] in Sophia Antipolis, as well as the Signals and Systems Laboratory (LASSY) in Nice. The latter has designed the Opsila multiprocessor machine, which can operate in two different modes, both suitable for ray-tracing: SIMD (Single Instruction Multiple Data) and SPMD (Single Program Multiple Data). (Extracted from Micro-Systemes, 1 September 1987)

German Democratic Republic

256 kilobit DRAM

Do not fall behind! is the slogan of the GDR semiconductor industry. It is true that at present they follow the Western countries using developed technology at a distance of a few years, but the goal is a gradual increase in element density. Their 256 kilobit DRAM store has been made in this spirit; they would like to begin mass production of it in 1988

in Erfurt. At present there is series manufacture of 64 kilobit stores at VEB Kombinat Mikroelektronik. According to information obtained at the Leipzig fair it is not impossible that a megabit dynamic RAM store will be made in the GDR before the end of the decade. (Source: Computerworld/Szamitastechnika, No. 16, 12 August 1987)

Hong Kong

Hong Kong electronics market

As elsewhere in Asia, the electronics industry in Hong Kong has grown rapidly in recent years, becoming an essential ingredient in the territory's overall mix of exports. Last year, electronics manufacturers accounted for almost 22 per cent of Hong Kong's overseas sales, which totalled $20 billion.

But the future for Hong Kong's second-largest industry is now uncertain, forcing some entrepreneurs to adopt new strategies to be competitive.

Electronics manufacturers now appear trapped between the giants of Asia - South Korea and Taiwan - and the would-be giants - Malaysia, Thailand and others.

Tight-fisted business traditions and official laissez-faire are expected to limit participation in semiconductors, the cutting edge of worldwide electronics, because production is expensive and depends on tax breaks and incentives the Government will not grant, industry officials say.

Even if Hong Kong were to begin exporting semiconductors tomorrow, it would probably be locked out of markets that could use them. The markets are in key electronics centres like Japan and South Korea, which make the same items and are protective of their home industries, businessmen said.

Also unsettling is the prediction that a continuous flow of the old Hong Kong standby, cheap items such as "junk" radios that can be sold in large volumes, will be killed by high labour costs, with the business going to lower-cost producers in China, Indonesia and Thailand.

Electronics entrepreneurs in Hong Kong, known for their flexibility, have set to carving out a new role for themselves to remain in business.

In the high tech arena, international semiconductor companies such as Motorola and Sprague of the United States plan major Hong Kong investments, picking up the local slack.

Motorola Semiconductors Hong Kong Ltd., an arm of the US giant, will soon begin designing and assembling integrated circuits from silicon wafers. (Extracted from International Herald Tribune, 15 December 1987)

Hungary

Hungarian-FRG CAD/CAM sales firm

Beginning in September, a new FRG-Hungarian mixed enterprise will begin operation in Budapest - the MTT Kft [MTT Limited Liability Company]. The first two of the three letters stand for the Muszertechnika Kisszovetkezet [Instrument Technology Small Co-operative], the third letter refers to the Tebimpex GmbH; they are providing 48 per cent each of the base capital and Technova and Artex will be their partners to a minor extent.

The MTT came into being as a result of various aspirations. One was that the Instrument Technology Small Co-operative had already gained some experience in the area of vending CAD/CAM systems, but the constantly increasing domestic needs gradually exceeded the acquisition possibilities. Another was that of the chief authority. For a long time the Ministry of Industry has been seeking possibilities for technology flow and domestic co-ordination of computerized design and manufacture, and finally the foreign aspiration - Tebimpex, a significant Western European vendor of CAD systems, indicated to the Ministry of Industry its inclination to found a mixed enterprise for this purpose in Hungary.

Earlier Tebimpex represented CADdy, but in accordance with an agreement made with Instrument Technology they obtained the right to represent PC-Draft this year and so the MTT Kft can begin its operation with the best CAD system. The MTT Kft sales receipts plan for the first 12 months is for 100 million forints and during this time they would like to double the base capital of half a million Deutsch marks. (Source: Computerworld/Szamitastechnika, No. 16, 12 August 1987)

Factory automation R&D association established

From the viewpoint of the development of domestic industry - especially the machine industry - extraordinary significance can be attributed to the federation which has been put together by eight institutions belonging to various ministries and chief authorities after months of preparatory and harmonizing discussions organized and led by the Minister of Industry. The name of the new association is the Manufacturing Automation Research and Development Society and its members are the Ministry of Industry, the Budapest Technical University (BME), the MTA [Hungarian Academy of Sciences] Computer Technology and Automation Research Institute (SZTAKI), the Central Physics Research Institute, the Technova Industrial Development Bank, Videoton, the Computer Technology Applications Enterprise and the Csepel Works Industrial Center (the G/6 program office).

The association will aid industrial applications of CAD/CAM with the concentrated and co-ordinated use of domestic resources. It will create developmental and integrated designing-manufacturing model systems for developmental and production purposes, including those bringing direct industrial profit, which are compatible with international standards. It will see to it that the research and development results achieved in the course of operating the model systems are known and used in practice, primarily in industry. In the model systems to be created they will try out and test the domestic developmental results achieved and the hardware and software tools acquired from abroad. The association will make recommendations for industrial applications connected with CAD/CAM systems offering various solutions and will take care of "technical management" tasks when such industrial systems are set up. It will organize the teaching of CAD/CAM methods and create conditions for this.

The members of the association will study available program packages in the CAD/CAM area and if they recommend their use they will create conditions for putting them to work. They will also judge systems developed domestically. On the basis of contracts signed with the customer they will design CAD/CAM systems satisfying the needs of other areas and help put them to use.

Within the framework of the G/6 manufacturing automation OKKFT [National Medium-Range Research and Development Plan] program the Ministry of Industry will use centralized technical development funds to finance hardware and basic software tools for two model systems. According to the preliminary contracts the Budapest Technical University will get 60.5 million forints support to purchase equipment and 15 million forints for operating expenses for the CAD/CAM system to be created. The MTA SZTAKI will get

60.5 million forints for the model system to be set up at the Kende Street headquarters. After completion of the investments, which have no return payment obligation, the research and development tools will become the property of the beneficiaries (BME and MTA SZTAKI).

According to the agreement the members of the association are obliged to give priority to the orders of industrial enterprises; in this regard the Ministry of Industry maintains the right to dispose of the assets. A definite percentage of the income coming from sale of software development results must be paid to the central technical development fund of the Ministry of Industry and the account of the G/6 program. The members of the society will inform one another about software development experiences and results and transfer these results to one another within the framework of special contracts. The operators are responsible for the security of programs installed in the model systems. Ownership rights connected with software products - possession, use and disposition - are regulated as part of the membership contract.

Otherwise the society only co-ordinates marketing - the receipts therefrom and the profit or loss generated - is the risk of the vending members. (Source: Computerworld/Szamitastechnika, No. 9, 6 May 1987)

Italy

OSIRIDE: An informatics network for research centres

The project OSIRIDE (open systems interconnection on an Italian heterogenous data network) which is aimed at developing a variegated informatics network of computers of different makes located in universities and Italian research centres, has recently concluded its first phase, known as Intertest.

The OSIRIDE programme has been promoted over the last few years by CNR (the National Research Council) and entrusted for execution to the CNUCE Institute of Pisa which essentially carries out research in the sector of computer networks. Major international computer firms, such as Digital Equipment, Honeywell Bull, IBM, Olivetti and Italian groups SIP and Tecsiel of IRI, are also actively collaborating in the project.

The CNR, through this project, has wished to contribute concretely towards a wider distribution, over the nation, of the computation capacity to various sectors, by using computers of different manufactures and interconnecting various computation centres in a single network.

The reference model selected by CNR is the OSI (Open System Interconnection) established by the ISO (International Organization for Standardization). The above-mentioned manufacturers have made available, on their own system, software products for OSI communications, meeting the needs of OSIRIDE. SIP (the Italian Telecommunications Company) has, on its part, provided the necessary advice so that the best use is made of the public packet-switching network ITAPAC.

The first phase of OSIRIDE or Intertest, begun in June 1986, was concluded a few days ago with very successful results. Software for the first five OSI levels was installed on four computers - connections between pairs of computers were begun and their possible communication functions switched on.

Through carrying out tests on the special programmes designed to simulate application situations and through analysing the results obtained, it was possible to identify the problems which have prevented a correct dialogue between the systems as well as to apply the appropriate solutions.

Now that the first phase of the OSIRIDE project has been concluded, the automatisms indispensable for communication have been put into operation in some research centres, where computers are capable of exchanging information according to common protocols.

The second phase of the project foresees the extension of the Intertest procedure to the higher communication levels of the OSI in order to arrive at the use of an MHS (message handling system). (Source: Bulletin IbIPRESS, No. 153/07, November 1987)

Italian support to IbI

During the recent 57th session of the Executive Council of the Intergovernmental Bureau for Informatics (IbI), the Italian delegation stated that considering the first results of the recent months of interim management and the authorities of other member countries, Italy has considered the idea of helping to rescue the organization, above all by ensuring it the means to face a transition period, during which it has to be ascertained whether it is actually possible to put it into a condition for carrying out its institutional functions. Hence, it announced the presentation of a bill to the Italian Parliament for granting IbI, besides its ordinary contribution, an extraordinary annual contribution equivalent to some $US 6 million for 1988, 1989 and 1990. The payments will be made on the condition that the financial management is improved and the organizational chart restructured.

This contribution will be used to cover the deficit which still exists in the IbI's budget and to finance specific operational projects which will be periodically defined. Italy hopes that other member countries, who wish the survival of the organization, to join it in this initiative. It also considers that the following conditions have to be met.

An administrative reorganization, carrying through all the necessary accounting and administrative controls so that the member countries of the organization can assess the extent of such reorganization. Such conditions do not infer a lack of confidence in the current management, which the Italian delegation feels is carrying out excellent work, but merely show awareness of the fact that it is much more difficult to correct an administration that has had problems in the past than it is to start off a correct administration from scratch.

Besides an improvement in the administration, Italy wishes a restructuration of the organization which guarantees that the organization chart and the staff correspond to the nature and volume of the work to be done. It also feels that the organization must testify its serious intent by reducing costs to the maximum and adapting them exactly to the work carried out. To this effect it wishes to see the elimination of contracts with external consultants which do not directly concern specific contracts - that the staff costs remain below a certain quota of the administrative budget, for example 40 per cent - and also that a study be made on the most economical solutions for premises and property.

Apart from the administrative and structural problems, Italy assigns considerable importance to the organization's programme of activities, a programme which must correspond to the statutory competence of the organization and be attractive to its member countries - it should give precise estimates of costs and earmark resources which do not exceed those

actually foreseen. In particular, the projects to be carried out should be drawn up in yearly instalments, especially in financial terms, so that the state of progress can be verified.

Lastly, it considers that concrete support from all the member countries, through the payment of their current or outstanding contributions, is one of the conditions for the definitive relaunching of the organization. (Source: bulletin EUPRESS, No. 154/02, December 1987)

Italy achieves first domestic manufacture of supercomputers

Italy has its first domestically produced supercomputer. It is an extremely powerful computation instrument capable of performing billions of operations per second; a machine indispensable for carrying out the riskiest simulations in theoretical physics but which is also extremely useful in order to save time and money when designing bridges, automobiles, and aircraft. Everything began three years ago when, during a break in a scientific seminar, Nicola Cabibbo, chairman of the National Institute of Nuclear Physics (INFN), and Giorgio Parisi, a theoretical physicist from Rome's La Sapienza University, discussed, almost for fun, the idea of developing a supercomputer. Recalls one of the members of the project, theoretical physicist Enzo Marinari: "As soon as we obtained the necessary financial support - 1.5 billion lire - from INFN, we began to carry out research and found out that it was a much simpler undertaking than it had appeared at first. Our efforts resulted in the development of two twin prototypes, given the name of Ape, which are among the most powerful and, more important, the least expensive, in the world."

Although they have a computing capacity of 1 billion operations per second, the total cost for each unit was a mere 150 million lire. A third model, four times as powerful, which is scheduled for 1988, will cost some 400 million lire. On the other hand, the price of any one of the currently marketed supercomputers is about 15 billion lire. The only exception is represented by the Eta 10-P range, manufactured by Control Data. The cheapest model, which is capable of performing 370 million operations per second, costs less than $1 million.

During the six months that have passed since they became operational, the two machines have been used to study the behaviour of the smallest particles constituting matter.

However, physics is not the only discipline to benefit from megacalculators: in the scientific area there are new prospects for an understanding of the mechanisms governing brain functions, while several other fields, including oil research, fine chemicals, seismic prevention and meteorology, are taking an active interest in the supercomputer.

At present, no companies in Italy are operating with machines of this kind. The only two supercomputers in existence (two Cray units) belong to an interuniversity association, CINECA of Bologna. Fiat is, of course, the leader among prospective purchasers, but ENI [National Hydrocarbons Organization], Montedison, and several government research centres and institutes are also interested in these supercomputers. (Extracted from Italia Oggi, 23 October 1987)

Two projects for EUREKA

Two projects which include the participation of Ansaldo have been approved within EUREKA, the plan for European technology for the year 2000 in which 19 countries participate (the 12 EEC countries, 6 from EFTA, and Turkey). The first project is the development of new powerful semiconductors (Gate Turn-off Tyristor) which presently are of great interest to applications in railway traction. These new semiconductors will be able to carry currents of the order of 2000 amperes; this means, for example, that it will be possible to drive very powerful asyncronous electric motors at variable speeds.

The second project concerns the Eurobot AMR (Advanced Mobile Robot) program, aimed at developing a European robot for civil protection. This is a very sophisticated remote controlled mobile robot which will allow intervention in all emergency situations where direct involvement of man would be very risky - for example, handling of toxic materials, defusing bombs, fires, etc. (Source: Tecnologie Meccaniche, August 1987)

Trieste University high tech agreement outlined

An agreement establishing a programme of co-operation in sectors with a high technological content was signed by the rector of the University of Trieste, Paolo Fusaroli, and the head of the Ansaldo Transformers and Rotary Machines Division, Renato Pagano. The agreement involves the Engineering Faculty of the university with the electrical engineering, electronics, and computer science departments and is important in two respects: first, the recognition of the strategic role played in the modern world by co-operation between university and industry; and second, reconfirmation of the local spin-off created, in particular, by the synchroton light machine project. A team of young researchers will be formed within the framework of the agreement. This team will be relocated from Ansaldo to the Trieste scientific research area in order to co-operate in the design and production of the light machine. Training periods will be organized for the scientific training of these researchers in the most advanced laboratories in the sector, starting with the Daresbury laboratory in the UK, which is also involved in the agreement. Moreover, Ansaldo boasts many years of experience in the construction of components for particle accelerators, having become a world leader in the field of magnetic superconductors. On a more general level, the co-operative programmes between the University of Trieste and Ansaldo will have the following objectives: development of joint study programmes and training courses; exchanges of students and personnel among firms, universities, and Italian and other EC government and private scientific organizations; the creation of scholarships; the testing and development of joint projects for the training of university and industrial personnel. (Source: ASeT, No. 14, 10 September 1987)

Japan

Japan's race towards the supercomputer

A supercomputer race has begun between the Japanese computer manufacturers, Fujitsu, Hitachi and NEC. The only obstacle in the way of Japan's computer industry is its poor software. The MITI (Ministry of International Trade and Industry) is attempting to overcome this obstacle through its so-called SIGMA project.

The supercomputers, mainly used in scientific and technological research, are becoming the battlefield for the Japanese manufacturers. One announcement follows quickly after another. A few months ago, the NEC announced its own supercomputer called SX-2 designed and built in Japan with a computing capacity of 1.3 gigaflops, that is billions of floating point operations per second.

Fujitsu immediately replied with the announcement that it had designed a new VP-400e model which was capable of processing information at a speed of 1.7 gigaflops per second.

Hitachi recently followed suit, stating that it had produced, in the laboratory, one single processor of the S-820/80 model which was capable of functioning at a speed of 2-3 gigaflops.

Japan's general dearth of software products, and in particular those fit for this type of supercomputer risks however depriving such successes of their corresponding success on the market. At present there are 20 to 60 software programmes on the Japanese market which are adapted to these high-speed supercomputers. In the US there are about 450.

MITI has therefore stepped in with its SIGMA project which is 50 per cent financed by the Government and 50 per cent by the private sector, entailing 100 firms. Many foreign groups, for example IBM, AT&T, Olivetti, Hewlett-Packard etc. are participating through their local subsidiaries. SIGMA intends to use the Unix system V and over the next few days the SIGMA OS (operating system) will be put to the test and then extended to other manufacturers in order to increase its use.

Furthermore, at the University of Tokyo about fifty manufacturing firms are taking part in a project entitled TRON, which aims at constructing a computer which can operate with any type of software whatsoever.

If the expected shortage of 0.5 million programs is to be avoided by the end of the century, it is more important than ever before that the same effort that Japan has made in supercomputers is repeated in the field of software. (Bulletin InPRESS, No. 134/05, December 1987)

Supercomputing in Japan

Recruit Co. Ltd., a publisher of information on topics such as jobs, real estate and foreign travel, is planning to become a major influence in supercomputer development. It already has purchased two Crays, one Fujitsu and one NEC machine for timesharing use by customers of its Remote Computing Service (RCS) and expects to buy one new machine per year in the foreseeable future. It has set up an Institute for Supercomputing Research which will do advanced research on topics such as computer architectures and neural networks and will work on architectural standardization. Its Technical Development Group is trying to migrate Cray software to run on the Japanese machines and to write an interface that will allow the user to run applications on the Recruit system without worrying about which machine is being used. (Reprinted with permission of DATAMATION® magazine© 1 January 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved.)

Efforts to buy foreign chips are flagging

The percentage of the Japanese semiconductor market held by non-Japanese chip makers is now showing slippage after modestly rising through June last year in response to the US-Japan semiconductor accord. Japan's Ministry of International Trade and Industry put the figure at 12.6 per cent in June 1987 (up from 10.3 per cent a year earlier), but it edged back to 12.3 per cent in November. Japanese manufacturers say they are still trying to buy foreign, but the informal goal of 20 per cent by 1990 looks a long way off. They point out that foreign companies supply very few of the kinds of chips they need for consumer products, which represent about a third of the output of the Japanese electronics industry. Another large segment of the chip market is commodity memories, a segment most US makers abandoned in the face of the Japanese onslaught. Further, the present strong demand in the US has resulted in delayed shipments from US chip houses, which Japanese equipment makers find very hard to tolerate. (Reprinted from Electronics, 4 February 1988, (c) 1988, McGraw-Hill Inc., all rights reserved.)

New venture to develop electronic devices

Fourteen electronics firms will jointly form a venture to develop amorphous electronics devices. The firms include Hitachi, Toshiba and Mitsubishi, and they will be joined by the Federation of Economic Organizations in the Tohoku District, Tohoku University and Sendai Municipal government. The project will spend Y6 billion over six years. The project will focus on new magnetic materials and advanced devices using micromagnetic material. About 70 per cent of the funding will come from the Japan Key Technology Center. (Extracted from Japanese Chemistry, 6 October 1987)

Promoting software

Computer software may be the next high-tech product to be given a helpful shove into the Japanese market by the US Government. The US embassy in Tokyo has put software on the list of products it thinks the Commerce Department should be promoting in 1988 through trade missions, exhibitions or similar activities. The possibility of good results should be high, given the virtual non-existence of a domestic third-party software industry in Japan. Supercomputers, which were the subject of a high-profile mission in late October, are also on the 1988 list. (Reprinted with permission of DATAMATION® magazine© 1 January 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved.)

Brain simulator

Fujitsu (Japan) has simulated the operations of a computer based on the design of a human brain. The simulator is equivalent to 100,000 brain cells. Parallel processing machines are equivalent to six cells at the most and an actual brain contains 10 billion cells. Fujitsu will try to find practical uses for its simulator and as a first step will develop an AI system by the second half 1988 for use in robots on an experimental basis. A computer based on the design of a human brain would include computer chips that function like cells and signal transmitters that function like cranial nerves. (Extracted from Japan's Economic Journal, 16 January 1988)

Increase of 1-Mbit DRAM production

Japan's Ministry of International Trade and Industry says Japanese production of 1-Mbit dynamic random-access memories will jump 40 per cent in the first quarter of 1988, to 30.8 million units, and then another 41 per cent to 43.5 million in the second quarter. And when MITI forecasts, Japanese chip makers listen: although by law the Ministry is not permitted to control production, the manufacturers fall in line with the "forecasts", which are calculated to satisfy the requirements of the US-Japanese antidumping agreement. The proportion of Japanese 1-Mbit DRAM production that will be exported will not change from the fourth quarter of 1987 to 1988's first quarter, holding steady at about 63.5 per cent, but it will rise slightly in the second quarter to 65.1 per cent. MITI predicts that demand will rise in concert with production, keeping prices steady at about $16 each. Production of 256-Kbit DRAMs, meanwhile, will peak in 1988's first quarter, says MITI, falling off about 1.6 per cent to 159.9 million units in the second quarter. (Reprinted from Electronics, 7 January 1988, (c) 1988, McGraw-Hill Inc., all rights reserved.)

Popularity growth of AI

Artificial intelligence has become increasingly popular among electronics firms as a theme for new products. A number of new products are being introduced that will enable the user to develop expert systems and other AI-based systems. Expert systems give a novice the ability to do complex jobs, like

writing special software programs. Both NEC's conceptual network-based language (CL) software tool and Fujitsu's Expert Shell can be used to construct expert systems. NEC vice-president and director Y. Kato points out that governments, companies and other users will need AI programs to develop user-friendly computers, help solve problems and make up for the expected shortage of software writers during the 1990s. AI systems are helping to bring software development costs down. Kato believes the worldwide market for AI systems may reach $10 billion/year in 1995-2000. Trading companies are becoming active in the field in recognition of its considerable growth prospects. For example, Marubeni has ties with Carnegie-Mellon University.

NEC's Kato believes financial planning, manufacturing planning and computer system maintenance and diagnosis will be the three biggest AI applications in 1995-1999. Nippon Telegraph & Telephone and a Tokyo medical college have developed an AI-based "rheumatology information counselling system" (RINCS) to help patients diagnose their problems over the phone. NTT has also developed an AI microcomputer, called Elis, which can run Lisp or Prolog. It has the machine manufactured by Oki Electric Industry. Mitsubishi Electric's PSI-II sequential-inference computer is an offshoot of its involvement in the Institute for New Generation Computer Technology (ICOT) project. So is NEC's C4I (Co-operative High-performance sequential Inference machine) workstation. The Japanese market for AI language-processing machines may reach ¥600-700 billion/year in three to four years. (Extracted from Japan's Economic Journal, 21 November 1987)

Japan spreads its words

Japan is making its scientific and technological developments available to the English-speaking world over a computer network.

The Japan Information Centre of Science and Technology (JICST) has produced a database in English which is held on a computer in Tokyo. The computer is linked to computers at Columbus in Ohio and Karlsruhe in the FRG. European and American scientists can dial up the computers in the west, and be connected to the JICST by a link called the International Online Scientific and Technical Information Network (STN).

The JICST has compiled summaries and information on more than 400,000 scientific and technical articles and reports. It will be updated with about 18,000 new entries each month. The point of the STN network, which was set up in 1984, is to allow scientists to access databases wherever they are located. So far more than 45 databases are available on the network. Japan hopes that joining the scheme will increase the flow of information between its scientists and their counterparts in the West. (This first appeared in "New Scientist", London, 17 December 1987, the weekly review of science and technology.)

Semiconductors for hostile environs

One of the drawbacks of silicon semiconductors is that they do not work at temperatures above about 200°C. Now, Japan's Tsukuba-based National Institute for Research in Inorganic Materials (NIRIM) has developed four sample diodes made of cubic boron nitride that, it says, perform the function of semiconductors at temperatures up to 650°C. The next step, say researchers, would be to develop electrode materials that can withstand equally high temperatures, a task NIRIM says it will not tackle alone. If that is successful, the cubic boron nitride diodes can be used in space, in nuclear reactors and in other hostile environments. Another project that NIRIM has yet to investigate is the development of cubic boron nitride for use as light-emitting (bluish-purple) diodes. (Source: Chemical Week, 4 November 1987)

New joint venture

Denki Kagaku Kogyo of Japan and Air Liquide are to form a joint venture to produce monsilane, a key material for making silicones for semiconductors. The new venture, with a capitalization of Yen 1.5 billion ($10.5 million), will build a plant capable of producing several hundred tons of monsilane by 1989 in Niigata. Denki will hold a 51 per cent stake. (Source: European Chemical News, 12 October 1987)

Japan's new international superconductivity centre opens

Japan's International Superconductivity Technology Center, set up with massive funds from the private sector at the urging of the Ministry of International Trade and Industry (MITI) opened on 16 January. Foreign (that is, non-Japanese) companies are welcome to join - but at a price.

A committee of academics and industrialists formed by MITI in response to the explosion of interest in the new high-temperature superconductors recommended the establishment of the centre in a report released last September. The centre will both gather and disseminate information and establish a laboratory for research.

More than fifty companies, including electric utility, electronic and cable manufacturing companies, mining concerns, a gas corporation, steel and glass producers, shipbuilders, car manufacturers, even spark-plug producers and banks have signed up to join the information centre, membership of which requires a down-payment of ¥2 million (about $10,000) plus an annual subscription of the same amount.

The centre will hold international symposia, seminars and workshops, gather and disseminate information in a newsletter, invite foreign researchers to give lectures in Japan and also carry out public education campaigns.

The budget for the information centre is nothing compared with the funds going to the research laboratory. About 40 companies will donate ¥100 million each to set up the laboratory and ¥12 million a year for running costs, over and above the donations for information. This brings the total budget for the centre to about ¥4,700 million (nearly $40 million) in its first year of operation.

The laboratory will open in October this year on a site in Tokyo rented from the Tokyo Gas Corporation, one of the founding members. There will be five research laboratories covering oxide and non-oxide research, processing technology, physical property evaluation and research into the theory. A research laboratory in Nagoya will also carry out research on ceramics.

The companies that join the laboratory can send one or two researchers. And they can also have members on the board, the decision-making body of the centre. Rights to patents resulting from research will be shared by the centre and the company of the researcher that makes the discovery. According to MITI officials, foreign companies are welcome to join, provided they pay the fee. The centre may also employ its own researchers, including foreigners, in addition to those from the companies.

MITI is also studying the possibility of inviting researchers to the laboratory from foreign public research institutions, but, realizing that the membership fee may be beyond the reach of such organizations, MITI will adopt a "flexible" approach when determining the participation fees when the need arises.

MITI has already contacted several US and European companies, and brochures in English have been sent to the US Chamber of Commerce. MITI is now hunting for a suitable European organization to which to send pamphlets. (Source: Nature, Vol. 331, 14 January 1988)

New superconductor development programme

The National Research Institute for Metals may begin a $140 million, five-year programme targeted at developing single-crystal and thin-film superconductors in the fiscal year 1988. The thin films would be used in more powerful magnets and the single crystals in high-speed instruments. The Research Institute will produce crystals by lowering the solution temperature to induce crystal formation, using zone melting and Czochralski techniques. The research will probably focus on sputtering for substrate production, controlling the amounts of barium, copper and yttrium; and lowering the sintering temperature versus the current 700°C. Budget approval from the Ministry of Finance is expected by January 1988. (Extracted from Chemical Engineering, 26 October 1987)

Malaysia

Motorola announces new wafer facility in Malaysia

Motorola has announced a new wafer fabrication facility dedicated to discrete components in Kuala Lumpur, Malaysia. The project includes the acquisition of a 43,000 square foot factory in Seremban and the purchase of high-tech wafer fabrication equipment.

According to Motorola's Malaysian Managing Director, Roger Bertelson, the new plant will be an Integrated Semiconductor Manufacturing Facility (ISMF).

The benefits to this type of manufacturing concept are lower inventories, shorter cycle times and an efficient use of manufacturing equipment and factory space. Motorola's customers can expect shorter cycle time from the moment an order is placed to the time it is shipped. Cycle time from the start of silicon to shipped unit will be one week.

A core group of 16 Malaysian engineers, manufacturing supervisors and technicians are currently undergoing training in Phoenix (Ar.).

The new facility will be known as the Motorola Commodity Factory and it will be part of the Final Manufacturing and Equipment Engineering Group. (Source: Motorola Employee Weekly Publ., 18 February 1988)

The Netherlands

Siemens, Philips join forces in integrated semiconductor field

After about three years the joint Siemens-Philips Megachip project has this year achieved two considerable successes. After Siemens presented the first 4-Mbit memory to the public in March, the Netherlands partner, Philips, introduced the world's first 1-Mbit SRAM (Static Random Access Memory) in July 1987.

The joint project absorbs 40 per cent of the two companies' annual research budget. The SRAM project is subsidized by approximately DM-50 million from the FRG and Dutch Governments.

The 90 mm 1-Mbit SRAM chip will go into mass production in mid-1989. For this purpose, Philips will open one of the largest European production centres for semiconductors with extremely small micrometer structure, at the end of 1987 in Nijmegen, the Netherlands.

The first coaster-sized silicon chip with static memory was presented to Netherlands Economics Minister de Korte in June.

George van Houten, a member of the Philips board of directors in Eindhoven, presented the latest component under the motto "the state of the art in submicrometer structure within integrated circuit technology". The newly unveiled 1-Mbit SRAM is based completely on CMOS technology. As van Houten reported, it is characterized by low energy consumption and has an access time of only 25 nanoseconds, thus acquiring a leading role internationally.

According to the Philips managers, the 1-Mbit SRAM was presented at exactly the right time. Although at present there is no concrete need for it, a large number of semiconductors with extremely fine micrometer structure will be required in the 1990s.

The Dutch expect a growing demand - especially in the consumer goods industry - for digital switching circuits, an area in which Philips is involved worldwide. The company predicts future applications, for example, in digital television sets.

However, the static memory could also be used in automobile electronics, data processing, and in communications systems. According to the producers, the component is destined for portable battery-operated appliances due to its low energy consumption.

Besides acquiring actual know-how on a difficult production technique, Philips mostly hopes to have an advantage in producing consumer goods. (Source: VDI Nachrichten, 10 July 1987)

United Kingdom

UK computer research to switch to Europe

The gloomy predictions of Britain's information technology community were confirmed when the Government finally rejected proposals for a £1,000 million, five-year research programme to succeed the Alvey project, which is nearing completion. The bulk of research in information technology will instead be done through the second phase of the European Community's £1,100 million ESPRIT programme, to which Britain has contributed £200 million. A modest national initiative is proposed to complement ESPRIT, for which the Department of Trade and Industry (DTI) will provide £29 million over the next three years, with the Science and Engineering Research Council (SERC) devoting £5 million over five years.

The Alvey programme was funded by £200 million of public money (through the Ministry of Defence, DTI and SERC), with industry providing £150 million. More than 200 industrial projects received support. In November 1986, a committee recommended a continuation of the programme focusing largely on application of new technologies, with the government contribution increasing to £425 million.

The Government's response to these proposals is contained in a white paper published in January, marking the completion of an extensive internal review of the DTI, instigated by the new secretary of state, Lord Young.

Also announced is the DTI's contribution to a national programme of research into high-temperature superconductivity: a total of £8 million to be made available over three years, but there is no news yet about how or to whom.

To strengthen links between business and education, the Government proposes that 10 per cent of teachers should each year "have the opportunity to

gain some personal experience of the world of business". An extra £5 million will support advanced technology in schools and further education colleges, and The Teaching Company Scheme, which enables graduates to undertake projects in companies, will be expanded. (Source: Nature, Vol. 331, 21 January 1988)

IBM to build universities' computer centre

IBM announced plans to set up a supercomputer centre for academic research, to serve some 1,300 scientists. The location of the centre, which will be jointly funded by IBM and universities, will not be announced for two months, though Glasgow and Cambridge are both favoured. The centre will be one of five that IBM plans to build across western Europe at a cost of £40 million.

The announcement followed a meeting of representatives from academia and industry in October 1987 at the Royal Society. The meeting examined ways of injecting additional, privately-funded computer power into higher education and university research.

It marks a change in approach by the Government, which in the past has insisted that contracts for university computer facilities be put out to tender.

The meeting accepted a scheme in which industrialists would sponsor computer systems by matching university funds pound-for-pound.

The Computer Board, the part of the Department of Education and Science that oversees university computing, insists, however, that the new scheme will not alter the principle of open tendering, which will remain for 90 per cent of computer requirements. Industry would provide top-up money for novel applications.

The IBM scheme, which is worth at least £2.5 million over the next two years to British research, will increase the computer power available to researchers with problems to solve that require "number crunchers". The company wants to set up a centre based on an IBM 3090 600E computer.

This is a data-processing mainframe equipped with hardware and software to enable it to carry out vectorised calculations. There are four 3090 computers in use at British universities and research centres at the moment.

The five European computer centres will be linked to their counterparts in the US via the European Academic Research Network.

Cornell University in New York already has an IBM 3090 600; and developed a version of Fortran, a computer language for scientists, for parallel processing in collaboration with IBM. The company says British researchers will be free to do what they want with their computer.

Programs written for supercomputers made by firms such as Cray can be written almost entirely in vectorised code, while programs for the IBM machine have considerably less vectorised code.

The machine could none the less make a valuable contribution outside the three main supercomputing centres at the Rutherford Appleton Laboratory, Manchester University and London University.

In addition to the 3090, IBM proposes to give away an additional five so-called vector facilities which can be added to 3090 computers to turn them into number crunchers. IBM will supply the vector add-ons, worth £1.5 million, as part of an existing programme of support for six centres at Cambridge, Oxford, Manchester, London, Cranfield and Glasgow. It will give a further 20 vector facilities to other European IBM users. (This first appeared in New Scientist, London, 3 December 1987, the weekly review of science and technology.)

Britain names its centre for superconductivity research

The site for Britain's university research centre for high-temperature superconductivity has been chosen. Cambridge University was expected to be recommended as the site, but the final decision rested with the Science and Engineering Research Council. This is the first of the controversial centres, multidisciplinary research units that focus on areas of science that the research councils and the Government judge to be important strategically. They are expected to absorb a growing portion of the science budget.

Cambridge was competing with a joint bid from Birmingham and Warwick Universities, and with one consortium led by Liverpool University. Decisions are expected early in the new year on several more centres under the aegis of the Science and Engineering Research Council. These include centres for surface science, molecular science, and semiconductors and novel materials.

The other research councils have said little about their plans for research centres. The Medical Research Council is preparing plans for one centre, which would be run directly by the MRC in the same way as its existing research centres. The new centres planned by the SERC will be funded under the existing dual support scheme.

The SERC may announce the name for the semiconductor centre in mid-January. It is believed that the council's review panel wants to shift research away from silicon to newer research materials, such as gallium arsenide.

For the main batch of centres, the council wants the assessment team of the review panel to visit all short-listed sites by 31 December. Applicants will make detailed submissions to the review panels which will select two proposals for each centre. The council hopes to decide on the sites in February.

Other areas on the SERC's list include applications of lasers in manufacturing, engineering design, process technology and large-scale applications of high-temperature superconductivity.

The council expects the host university or colleges to share the costs of running the centres. They will have a full-time director, a management committee and a mixture of core staff, secondees from the host institutes, visiting academics and scientists from industry. Although most of the work will be strategic research, the centres will be able to devote up to about one fifth of their activity to contract research. (This first appeared in New Scientist, London, 17 December 1987, the weekly review of science and technology.)

UK firms fund technology centre

In a move to forge closer links between scientists and industrialists a £6 million industry-funded Centre for the Exploitation of Science and Technology (CEST) based in Manchester was launched last November.

The centre will monitor scientific advances both in the UK and worldwide and set up a database which can be accessed by the companies supporting CEST to help them in planned research programmes for future products.

The companies will contribute market information to highlight areas of commercial interest.

Sir Robin Nicholson, a director of Pilkington, is chairman of the group of 18 companies which have each contributed £250,000, which, with £1 million of government money, will be used to fund the Manchester-based centre.

CEST will identify specific areas of interest and cover these in detail. Although these fields of interest have not yet been fully defined, Sir Robin said that the centre will be looking at technologies which will result in products in five to ten years and suggested that likely candidates are warm-superconductors and flat-screen displays. (Source: Electronics Weekly, 18 November 1987)

Electronic engineers call for research-linked tax scheme

Britain's electronics industry is appealing to the Government to reduce corporation tax and introduce a tax-incentive scheme to allow greater investment in research by private industry. Electronics manufacturers are claiming that because of an increasingly competitive world market and the need to show high levels of profit to meet City expectations, funds are being channelled into marketing existing products abroad, resulting in a rationing of research and development expenditure not before seen in this decade.

A government white paper (policy document) on civil research and development, published last summer, concluded that additional research and development stimulated by tax incentives in the ten countries studied in the survey was roughly one half of the revenue foregone by the Treasury, "so that the average cost-effectiveness is low".

The Electronic Engineering Association, however, believes that the earlier study neglected to examine in sufficient detail the long-term advantages of the resulting increased investment in research. The association is reiterating the argument for tax incentives in a document submitted to the Government advising on ways to promote industrial growth.

The Association proposes a concomitant tax allowance of 150 per cent on research and development revenue and capital expenditure, instead of the present 100 per cent. Such a move, it claims, would enable research and development investment to increase by 13 per cent each year and, on the basis of increased sales and the reduction of the imbalance in trade (currently running at a £12,000 million deficit), it would take only three or four years to compensate the Government for the lost tax revenue. The Association believes that it would be relatively simple for the government to ensure that tax savings were being invested in research.

The Government has persistently implored industry to invest more of its own money in research and not depend on State funds. It cites figures from the Organisation for Economic Co-operation and Development showing that less than 50 per cent of total research and development carried out by British industry in 1985 was funded from industry's own pocket, compared with 67 per cent in the United States, 72 per cent in France (in 1984), 76 per cent in Italy, 82 per cent in Federal Republic of Germany and 98 per cent in Japan. (Source: Nature, Vol. 331, 21 January 1988)

Plessey readies a high-power process for building microwave GaAs ICs

Plessey plc has developed a practical, high-yield gallium arsenide process that it claims will soon be turning out high-performance microwave integrated circuits capable of dissipating up to 5 W. Developed at the company's J-D Group Ltd. in Towcester, UK, the process boasts 0.5-μm gate lengths, two-layer metalization using polyimide insulation, and a technique for etching wells in the back of the wafer. This means gold can be filled in beneath high-power transistors - leaving a layer of GaAs only 50μm thick between the transistor and the gold heat sink. Etching wells in the back of the wafer lets Plessey use wafers twice as thick as the 100μm norm, which improves yield: the 200-μm-thick wafers do not break as often. The first products made with the process - probably wideband amplifiers and switching circuits for phased-array antennas - will be available in June, the company says. (Reprinted from Electronics, 4 February 1988, (c) 1988, McGraw-Hill Inc., all rights reserved.)

A whole run of new contracts for Plessey

After three years of negotiations with various American, Japanese and European competitors, China has just selected the UK electronics group Plessey to supply it with the British digital telephone exchange, the System X. The British group has also just signed an agreement with Nokia, the Finnish telecommunications and electronics group, for the distribution of its ISDX private telephone exchange.

For Plessey, the Chinese contract which is part of a wider project for railway electrification and financed by the Overseas Economic Fund of Japan follows an identical order placed six months ago by Colombia. Plessey has announced that the exchanges would have a capacity of 24,000 lines.

Plessey is also endeavouring to introduce into the Soviet Union and Bulgaria its ISDX system, which is a very powerful exchange capable of managing very large private company networks for voice and data transmission - in this respect an agreement is about to be concluded, depending however on the rules for the exportation of high-technology products to the East. (Source: Bulletin IBIPRESS, No. 154/06, November 1987)

Megabit development in Scotland

The Motorola facility at East Kilbride, Scotland, is being equipped for a 1.4μm HCMOS process. It is expected that 1M devices will be available for qualification by the third quarter of 1988 with initial production quantities by the fourth quarter. General program manager at Kilbride, Barry Waite, said that the company's primary objective is to support the European market from within Europe, but in addition, production will be for the worldwide market.

Motorola is the second company to announce that it will manufacture megabit chips in Britain, following the Japanese NEC. (Reprinted with permission from Semiconductor International Magazine, February 1988. Copyright 1988 by Canners Publishing Co., Des Plaines, IL. USA)

USA

Development support for parallel processing

The US Government should provide more support for development of parallel processing computers. The Office of Science & Technology Policy and the Federal Co-ordinating Council for Science, Engineering & Technology recommend spending $1.7 billion over the next five years, in addition to the $500 million/year already being spent on high performance computing. The Government should especially support the development of software for parallel processing machines, including algorithms, languages and development of machine vision and speech recognition. The Department of Defense for several years has been supporting artificial intelligence development for military uses.

Meanwhile, IBM has announced that it will support parallel processing computer design research being performed by S. Chen, the designer of the Cray X/MP, who recently set up his own company. (Extracted from New Scientist, 7 January 1988)

MCC superconductor study has 13 backers

Thirteen companies have joined the Microelectronics and Computer Technology Corp.'s research study into electronic applications of high-temperature superconductivity. MCC began studying the materials last summer, concentrating on using high-temperature supercomputers as interconnects in super-cooled computers. Future work will include thin-film deposition and superconducting micro-chips. (Reprinted from Electronics, 18 February 1988, (c) 1988, McGraw-Hill Inc., all rights reserved.)

Additional support for supercomputer development

Supercomputing development should get an additional $1.5 billion of government support over the next five years, according to the Society for Industrial & Applied Mathematics. The funds are needed to accelerate creation of innovative hardware and software, develop new mathematical techniques and develop new university curricula to attract students to computer science and engineering. Software development is lagging behind other developments, and demand for supercomputing is already beyond the capabilities of existing machines. (Extracted from Science News, 21 November 1987)

MIMIC program

The goal of Phase I of the US Department of Defense's Microwave/Millimeter-Wave Monolithic IC program is to produce these GaAs ICs at a reasonable cost. The Department of Defense expects to let Phase I contracts in April 1988. The MIMIC market is expected to be worth $1.78 million by 1997, versus $64.4 million in 1991, and $4.5 million in 1986, according to Electronicast. The MIMIC program is designed to provide the military with microwave and millimeter ICs that are required for the new generation of radar systems, smart munitions, and radio-frequency communications. The key is to figure out how to build these chips at a practical cost, according to E. D. Maynard, director of computer and electronic technology at the Department of Defense. Currently, manufacturing remains difficult and costly, prohibiting the use of MIMIC devices in most military programs. The Department of Defense intends to invest some $41 million in the fiscal year 1988 and $500 million over seven years in the MIMIC program. (Extracted from Electronics, 26 November 1987, (c) 1988, McGraw-Hill Inc., all rights reserved.)

Texas wins R&D centre

Sematech (Santa Clara, CA), formed as an experimental electronics industry research consortium, will build an R&D centre in Houston, Texas. Participants include International Business Machines, Digital Equipment, American Telephone & Telegraph. Although there are no chemical company participants, Sematech will concentrate on areas of interest to electro-chemical suppliers, such as silicone and gallium arsenide integrated circuit materials, photolithography, packaging, etchants and dopants. Sematech will focus on developing ways to improve manufacturing techniques, especially increasing yields. (Extracted from Chemical Week, 20 January 1988)

University opens Center for Dependable Computing

Pittsburgh's Carnegie Mellon University has established a Center for Dependable Computing to meet a growing need for reliable computing to protect vital information stored in automated systems. The centre will concentrate on research, evaluation and development of fault-tolerant computers and reliable software to apply to life-critical systems, process control in manufacturing, transaction processing and other large automated commercial and military systems.

The CDC's first fault-tolerant computer is a Stratus XA 2000 model 100 continuous processing system. It will be used to predict hardware failures, integrate parallel processing, and design hardware architectures. The unit will also be tested as an ultra-reliable file server for a distributed computing environment such as the Andrew system, CMU's personal computing network.

The centre was funded by the National Science Foundation, the Office of Naval Research, NASA, the US Army and IBM Corp. Equipment was donated by Digital Equipment Corp. and Stratus Computer, Inc. (Extracted from Computer, October 1987)

Airco unveils a semiconductor industry project

Airco, a unit of Britain's BOC Group, proclaimed its "commitment to the semiconductor industry" by announcing plans to construct a new research and development facility in Research Triangle Park, N.C. The $6 million building will be located near the Microelectronics Center of North Carolina, which has been working on ways to reduce contaminant levels to boost yields of semiconductors. Airco says its facility will concentrate on methods to limit contamination from gases in computer chip manufacture and distribution. Airco plans to produce research and development quantities of specialty gases for microelectronics, including silane, in "clean room conditions". (Source: Chemical Week, 11 November 1987)

DNA fingerprinting database to finger criminals

The world's first computerized data bank of "DNA fingerprint" information on convicted criminals is now being planned. The California attorney general's office has begun studies to determine the best methods for collecting and storing data, and expects the database - which will be used to identify and prosecute repeat offenders - to be on line in 3-5 years. Questions over how the data will stand up in court may delay the database's applicability.

State forensic scientists are investigating several methods for analysing samples to be entered into the database, and they are unlikely to select the method developed by Alec Jeffreys of the University of Leicester, which has been used successfully in immigration and forensic cases in the United Kingdom. The Jeffreys method uses probes for hypervariable minisatellite DNA, and produces a complex pattern of bands that may be difficult to store in a database and compare reliably to newly run samples. Data storage and comparison will be simpler with the single-locus or dot-blot approaches, according to Steve Helsley, chief of forensic services in the California attorney general's office.

The dot-blot technique is considered less labour-intensive, works on the degraded DNA of forensic samples and requires only 10 nanograms of DNA, an amount obtainable from a single hair root. The 0.1-1 micrograms of intact DNA necessary for single-locus analysis is obtainable only in 60 per cent of the cases, according to John Winkler, president of Lifecodes, a New York company that specializes in DNA analysis.

Ideally, the DNA samples for the database would be analysed in several different ways, says Helsley, because the technique used in a particular case may be dictated by the amount and condition of the DNA available for analysis.

Whatever method is chosen by California, defendants should have a source for an independent alternate test. (Source: Nature, Vol. 331, 21 January 1988)

USSR

Nyet to Microsoft

Microsoft Inc. is eager to press ahead with a major software licensing deal in the Soviet Union covering MS/DOS, but it is being stymied by the Soviets' lack of software copyright protection. The Soviets already have an operating system derived from MS/DOS and Microsoft is eager to protect itself from further copying before it enters the market officially. One possibility is compensation for past copies, but the Soviets are reluctant to agree. The USSR has copyright protection legislation under proposal, but its bureaucracy is taking a long time to settle the issue. (Reprinted with permission of DATAMATION® magazine©, 1 February 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company - all rights reserved.)

Perestroika and the personal computer

The greatest challenge facing Eastern Europe is the widespread introduction of computers in industry, schools and at home. For a long time East European governments considered personal computers a dispensable luxury, whose most disturbing side-effect was the independent intellectual activity it might stimulate. Governments now appreciate that the successful introduction of computers into industry requires the development of a popular computer consciousness. As a consequence, it is in the production of personal computers, for use both at home and in offices, that there has been the most dramatic growth in the past three years.

There are internal arguments, however, about whether to concentrate on building up indigenous industries and risk being 10 to 20 years behind the West, or to import computer technology.

By Western standards the home computer in the East is as rare as a swallow in winter. In the Soviet Union the number of owners is negligible. Poles can buy anything on the black market, but Western home computers start at around the equivalent of $10,000 in zlotys and $3,000 in treasured hard currency.

It is only in East Germany, Czechoslovakia and Hungary that an average household has a real possibility of obtaining one. The Czechoslovak Government is importing Sharp personal computers for home use which cost just under $600. The average monthly salary is $184.

In June 1985, prime ministers from the countries belonging to the Council for Mutual Economic Assistance (CMEA) gathered in Moscow to sign the so-called Complex Plan for the Development of Science and Technology to the Year 2000. The main aim was to avoid the duplication of R&D in the East European countries, and exploit the scientific resources of the socialist community in its attempt to keep up with technological developments in the West.

In certain areas, noticeably biotechnology and robotics, this has happened to an extent, not so much thanks to the massive research centres founded in Moscow, but through a string of bilateral ventures. The Soviet Union has set up robotics projects with Bulgaria, Czechoslovakia and East Germany, thereby maintaining close control over the industry.

The philosophy of co-operation does not seem to work so well with computers. With the exception of Romania, whose R&D programme has been going into reverse through lack of funds and other problems, the Eastern bloc countries are developing computer systems in competition with each other. It is a strange rivalry, however, since it does not result in improved products. Hungary is the leading software producer in Eastern Europe; indeed, it now produces a range of games and even spreadsheets for the Western market. Bulgaria has had a problem with software as Ljubin Kozlev, the vice-chairman of the Association of the Electronics Industry in Sofia, admits. But it is also because once an R&D project has started in Bulgaria, it merely has to fulfil a set of predetermined targets while technological developments are overtaking those targets. This has led to frequent difficulties - in particular when one East European country imports computers from another.

Both the Bulgarian Pravets and Czechoslovak Tesla Orava 8-bit computers are notoriously unreliable. There have been numerous breakdowns and users cannot get machines repaired because service facilities have not been set up in the importing country.

CMEA has now decided to do something about this. At the end of last year, member governments were due to set up an organization called International Computer Equipment (IEIM), in Moscow, and an official announcement is expected very soon. IEIM will aim to co-ordinate the R&D being carried out in the individual countries with computer systems applications, and also to end the wasteful rivalry.

One key question which will undoubtedly be discussed within the IEIM forum is the willingness of East Germany to co-operate. Not surprisingly, the East Germans are leaders in domestically produced computers. The largest producer of personal computers in Eastern Europe is the Robotron electronics firm, based in Dresden. The bulk of this output is for industrial use, but the Government has encouraged the creation of training centres throughout the country where people can learn computer skills in addition to the schemes organized by industry.

According to Western reports, in East Berlin alone there are an estimated 5,500 industrial computers, 31,000 CAD/CAM installations and 73,000 industrial robots. The spread of CAD/CAM systems in the capital alone far outstrips the number in use throughout the entire Soviet Union. But because of its special economic relationship with the FRG, East Germany has always existed in a class of its own in the sphere of computer production. Robotron is already producing a 32-bit computer while the Czechs, Poles and Bulgarians are still struggling to overcome the intricacies of their 16-bit personal computers which are, however, compatible with IBM AT and XT machines.

This is not to suggest that without co-operation from East Germany the others are lost. Despite the shortcomings, Bulgaria has made remarkable progress in the past three years. The country has proved particularly adept at circumventing COCOM regulations which prevent Western countries exporting certain technology to Eastern Europe.

Despite the efforts of its allies, however, it is the Soviet Union which must make the leap into the computer age if the CMEA countries are to stand a chance of competing with Western production processes. At present, despite Gorbachov's exhortations, the implementation of computer technology, with the single exception of the military establishment, has been very poorly managed.

Since the congress, there has been an important shift towards the production of office computers - to the benefit of managers and planners - which should facilitate the decentralization of economic decision-making envisaged by the Soviet leadership. Together with East Germany, the Soviet Union is investing heavily in the development of a digital telecommunications system.

The aim of the congress is "to get a computer with spreadsheet, word processing and database facilities in every factory". In terms of software, therefore, the Soviet planners are looking both to the West and their own East European allies. Managers are now showing interest in Lotus 1-2-3 for the spreadsheet.

The Soviet industry has now caught up with the other Eastern bloc countries in the production of 16-bit minicomputers, manufacturing about 300 units a month. Perhaps more significantly, it has up to 10,000 mainframes already installed in factories. It produces its own computer equivalent to the IBM 370, but there is a serious shortage of peripherals.

The statistics suggest that Eastern Europe is at last stumbling into the computer age. But they are not sufficient to give a true picture of computers in socialist society. Schoolchildren learn programming with the help of old televisions which flicker constantly, on keyboards designed in the early 1970s and with keys which stick. To the Westerner, the gap in computer technology between East and West appears enormous and unbridgeable.

The West has, of course, contributed to this backwardness, thanks to the often vindictive COCOM regulations, but this is not the primary cause. (This first appeared in New Scientist, London, 11 February 1988, the weekly review of science and technology.)

Yugoslavia

Yugoslavian 32-bit computers

Beginning in the autumn the Klagenfurt (Austria) office of the Yugoslav firm Iskra will begin selling 32-bit computers, according to the Reuters news agency. At present the machines, answering to the name Trident, are assembled with Intel 80286 and Motorola 68010 microprocessors but the new design will be based on 80386 and 68020 types. The more powerful machines will be supplied with the Xenix operating system and IRMX basic software. Later they will also sell Micro VAX type machines, Iskra Delta Computers announced. (Source: Computerworld/Szamitastechnika, No. 16, 12 August 1987)

VIII. FACTORY AUTOMATION

Comau advanced flexible workshop exhibited in Milan

At Milan's 7th EMO, the world machine tool fair, where the world's leading manufacturers of flexible systems were exhibiting their products, the engineers of the Fiat Group's automation company erected a 2,000 square metre stage as a display for two flexible mechanical processing systems, a flexible assembly line, and a robotized laser welding cell. Overall, a high tech display worth several billion lire, managed entirely by a distributed information system capable of performing production planning, control and monitoring functions. In short, the unit operates as a fully operational "automatic factory" comprising four workshops interconnected through a digital data processing architecture capable of integrating applications involving different functional levels and of linking the computers to the workshop equipment. "This means that CIM [Computer Integrated Manufacturing] has now become a standard product for us", comment the Comau engineers.

The four integrated "shops" on display at the Milan fair represent an equal number of applications, which have already been sold to four different factories of the Fiat Group. The largest of these is the FMS [Flexible Manufacturing System], a unit used for machining steel and light-alloy prismatic components. The system is to be installed in one of Comau's five Turin plants, where the mechanical parts of Smart robots - a family of newly developed, six-axis robots - are manufactured.

The operations performed by the system include milling, boring, threading and spot-facing of robot forks and arms. The system architecture comprises a Mar-15 machining centre, an Mar-Standard machining centre, an automated gauge station where the finished units are checked, a presetting station, four shuttles for inserting the pallets into the machining centres, an automated central storage unit capable of accommodating 800 tools, and a robot-controlled trolley for the movement of tools and products. The entire unit is controlled by a data processing system based on a computer linked up to the numerical controls of the machines, which is capable of controlling up to 16 different processing functions. This FMS is supported by a smaller system designed to process circular units and featuring an Mar-15 machining centre, a Gemini turning centre, and a quality control gauge station. The products and tools are conveyed and handled within the system by a 7-axis Smart robot equipped with a gripper changing device, required for handling of all the different parts. The total number of units to be manufactured can be varied during operation by adjusting the data processing network as necessary.

The robotized assembly line for homokinetic joints, exhibited at the fair, forms part of a larger assembly system, which is to be installed in Fiat's Cassino plant, and which is based on the use of the new Cartesian robot known as Mast. The operations consist of the assembly of 10 different components, with productivity of 215 units per hour. The line, loaded and unloaded by the robots, is fed by a guided trolley. In the assembly cell proper, three robot arms perform all the operations, fitting the core, ball cage and an elastic ring into the body of the joint.

However, the most striking new system is the robotized cell used for laser welding of automobile bodywork that Comau is delivering to Ferrari at Maranello. Welding head movement is controlled by a customized 5.50 Smart robot designed with an integrated laser beam propagation system, a set of copper mirrors allowing the passage of 5-KW laser beams. The robot is programmed to perform the welding on one body at a time and is governed by an "open" control unit that can easily integrate sensors and other intelligent subsystems.

The Ethernet communications network is the data processing system which transforms these individual lines into one of the very few CIM systems existing today. The area control systems, two CAD-CAM stations, and the production management systems are all linked to the Ethernet network. In this network, normal telephone cables, coaxial cables and broadband cables can be used simultaneously, which means that different communication protocols (Decnet, MAP and TCP-IP) can coexist. Therefore, the user may operate with this system for any application whatsoever, regardless of the communication mode employed. "By exhibiting this system at the fair, we are trying to show people that the introduction of an integrated system, based on networks and machines capable of growing with the demands of the company, is a process that can be implemented gradually, over time," Comau's top executives observe. "This is an approach which offers medium-size companies also an opportunity to take advantage of CIM technology while safeguarding and ensuring the compatibility of the investments already made." (Source: Il Sole 24 Ore, 27 October 1987)

More manoeuverability and lifting capacity with Sweden's ASEA IRb3000 robot

The IRb-3000 is the second member of the new generation of ASEA robots. In a way, it is the big brother of the IRb-2000, although younger. Viewed from the standpoint of aspect alone, the two robots appear identical, except for size. In reality, the essential difference lies specifically in their respective lifting capacities, which in the case of the IRb-3000 has been increased to 30 kg; but the technologies used in both are identical.

The machine is a 6-axis robot, featuring an extended working span, hence well-suited to applications such as water-jet cutting, laser cutting, and spot welding. But primarily, this robot is designed for materials-handling and machine-tool-serving applications. Its speed and accuracy characteristics also permit its use in assembly operations.

To begin with, its axis-1 angle of rotation is more or less 180° at a maximum speed of 100° per second. Its other characteristics of freedom and speed are: for axis 2 (arm): +90° to -110°, at 100° per second; for axis 3 (upper arm): from +60° to -60°, at 87° per second; for axis 4 (wrist rotation): 200° in each direction, at 223° per second; for axis 5 (bending): 120° in each direction, at 224° per second; and for axis 6 (twisting): more or less 250°, at 213° per second. Its repeatability throughout is accurate to within ±0.15 mm.

From a rigorous "mathematical" viewpoint, these characteristics are perhaps not very meaningful, except to particularly knowledgeable specialists. Furthermore - and this should awaken the interest of those responsible for materials handling - this robot is capable of simultaneously serving two Euro-pallets (800 x 1200 mm) placed side by side either along their respective lengths or respective widths.

Its most extended zone of manoeuverability is situated at a height of 1 meter from the floor; that is, at the normal height of loading/unloading stations and conveyors.

Different assembly configurations are offered as options, and in particular that of the inverted position. In this configuration, the upper arm can be lifted very high, thus allowing greater freedom for the lower arm, and enabling the completing of full revolutions without difficulty.

Its 30-kg lifting capacity was not arrived at by chance. The fact is that the average weight of machine-tooled pieces is kept, to the extent possible, at a maximum of 10 to 15 kg, so that they can be relatively easily handled by a human operator. Thus, if the arm is equipped with a dual gripper, it can handle two pieces at a time, resulting in an appreciable time gain.

On the other hand, if its installation is to be made simple, its control system must be capable of communicating with all the equipment the robot is intended to serve.

The control system of the IRb-3000 is equipped with the most widely-used series and parallel communications interfaces, enabling it to dialogue with the vast majority of numerical controls on the market, using a very simple protocol. In addition to these communications ports, the control bay has 64 numerical input and output terminals, as well as four analog inputs and four outputs. The robot can thus be put to work in a very complete environment of sensors and actuators. At any given instant, the bay can contain a principal program and 9999 subprograms. Its memory capacity is 64 K-octets [K eight-bit bytes]. A total of 2,500 positions or numbers can be recorded. A battery power pack provides backup for a minimum period of 1,000 hours.

Certain software functions are integrated, such as tool co-ordinates, palletization functions, overload tests, alignment functions for the multiple grippers, provision for programming eight grippers, and management of the compressed air and electric power supplies.

Numerous peripherals have been developed for materials-handling and machine-service applications. These include tool changers, tool holders, and grippers ... It should be noted also that the air and electric power supplies are available all the way up to the pincers.

Thus, what the Swedes are offering is not only a new robot, but actually a coherent line of robotization equipment. (Source: Electronique Industrielle, 1 September 1987)

ESPRIT manufacturing communications network

After a two-year research effort, the first real-scale application of the ESPRIT-CNMA (Communication Network for Manufacturing Applications) research project was presented at Hannover, FRG. The acronym stands for the European version of the MAP "Automated Factory" protocol, an industrial communication standard which has been under development since the early 1980s by a pool of major manufacturers led by General Motors. The application on display in Hannover integrates a computer, a continuous path numerical control machining centre, a pair of tool loading and unloading robots, and a pallet transport system, all of which "speak" to one another through a local communication network. Thirteen European companies, selected among the leading manufacturers and users of automation systems, contributed to the implementation of the first stage of the project. These companies include the UK's British Aerospace, which leads the consortium; Italy's Aeritalia and Olivetti; the French companies Bull, Elf and PSA; and the FRG's Nixdorf, Siemens and BMW. The first machining cells are to be installed in British Aerospace's Wolverhampton plants for the production of aircraft components, and in Aeritalia's Pomigliano d'Arco factories, where they are to be used for marking the cables installed on the Airbus 320. The subsequent phases of the project have been scheduled in such a way as to enable the partners to gain the technological know-how required to tie in with the implementation of the MAP 3.0, that is, when the US protocol is completely defined by General Motors. (Source: Scienza Duemila, No. 8, August 1987)

European policies on automation R&D reviewed

Factory automation is a reality which has now taken hold in all industrialized countries, but what is its history and how do governments view it? Not very long ago, governments had an ambivalent attitude towards automation. The possibility of significant increases in productivity and therefore, wealth was recognized, but the effects on employment caused concern.

In the UK, special ministerial departments act more or less directly as far as both supply and demand are concerned. Also, there are regional structures which provide assistance and advisory services to small companies involved in robotics, [illegible] business organization. Supply is [illegible] contributions to research and innova[illegible] support measures, which in some case[illegible] to aid mergers between ailing compani[illegible]

stimulation of demand is completely separate from that of supply. It comprises programmes aimed at specific technology sectors, such as the Small Engineering First Investment Scheme or the FMS (Flexible Manufacturing Systems) Scheme.

In the FRG, industrial policy is oriented towards "indirect" methods of support. That is to say, those methods which direct companies towards specific activities without involving them in government-defined programmes. These instruments take the form of tax reductions and tax credits relating to research costs, as well as the subsidizing of up to 40 per cent of the costs of research personnel in small companies. The government has its own R&D programmes, and companies participating in them obtain financing of up to 50 per cent. Of these financial support measures, which consist of soft loans or grants, about 80 per cent goes to a limited number of large companies. The largest programme carried out at present concerns factory automation and has funding of DM 530 million for the period 1984-1988.

The situation is different in France, where a number of measures exist to support and orient demand, at both the local and national levels. ANVAR (National Agency for the Implementation of Research) is the principal organ for the promotion of research, and also for the general support of supply innovation. On the supply side, a specific programme has been established in the machine tool sector, with the allocation of Fr 2.3 billion for the three-year period 1982-1985, and two leading companies were identified in this field, MATRA and CGE. On the demand side, the MECA (Advanced-Design Machines and Equipment) procedure of the Agency for the Development of Research and Manufacturing Automation has proved to be one of the most effective measures. The agency provides credit facilities to small industries for the purchase of automated machines.

The Swedish system is particularly interesting. The Swedes have recognized that the major obstacles to automation are not technological or financial, but "knowledge based". In this case the experience gained by "leading edge users" is of critical importance, because they are able to promote the spread of automation by providing a model to be imitated by other companies.

Therefore, six "leading edge companies" which have received financing for their high risk pilot programmes were identified: ASEA, Ericsson, Volvo, Sandvik, Saab-Scania and Electrolux.

The Japanese example is certainly one of the best known, thanks to the commercial success of the manufacturers in this country. The typical characteristic of Japan's supply stimulation policy is not to finance one single company but rather to finance initiatives combining the activities of more than one company. These initiatives, co-ordinated by the Ministry for International Trade and Industry, are numerous in the automation sector. The initiatives include: Numerically Controlled Machine Tools (1971-1984, $70 million), Basic Research in Automation (1976-1983, $190 million), Flexible Manufacturing Systems (1977-1983, $60 million), and Robots for Critical Tasks (1983-1991), a "lateral" programme intended to combine other programmes such as the "Space Factory", aircraft engines, and other activities. Japan makes use of both fiscal measures (depreciation), and financial measures to stimulate supply.

Of special interest are the easy credit terms provided by the Japan Development Bank; also, the Japanese have special fiscal measures, in that depreciation rates may be applied to machinery "made in Japan".

Turning finally to Italy we see that, so far, industrial policy in the automation sector has concentrated almost exclusively on the stimulation of demand. This strategy has utilized extremely simple support measures such as the 1965 "Sabatini" law which provides easy credit terms for the purchase of manufacturing machinery.

From 1983-1986, Law 696/1983 provided smaller companies with a contribution of 25 per cent towards the purchase of high technology machines. In 1986, the same rate was adopted for the purchase of computerized systems. Demand can also be stimulated to some extent by Law 46 of 1982 which provides subsidies for research or innovative production programmes. This law has also provided a sporadic supply incentive, in that it has been taken advantage of by certain machine tool manufacturers. The National Research Council has set up various programmes within its institutes, two of which are particularly significant. These are the Mechanical Technology programme launched in 1984, with the participation of companies and universities, and the Robotics programme currently being launched.

In spite of these sporadic interventions, it would be true to say that there has never been a real supply policy for the automation supply side in Italy.

An important European experimental centre is currently being established at the Elsag plant in Genoa. The development of the centre is supported by the European Community within the framework of the technology innovation ESPRIT programme.

The centre's objective is to provide a laboratory for the development and testing of flexible "multivendor" hardware and software.

Together with Elsag, the companies and universities also participating in the programme are: Philips (Belgium and The Netherlands), SESA (France), the University of Aachen (FRG), Aeritalia of Turin, the Milan Polytechnic and the CNR [National Research Council] Machine Tool Institute of Milan.

The plant will reproduce the conditions of a flexible manufacturing workshop for mechanical parts and will be composed of a cell for the processing of prismatic parts, a turning cell, a flexible assembly cell, a warehouse, a tool preparation area, an area for the visual identification of parts, guided trolleys, and robots for the transportation and handling of parts and tools.

The data processing architecture will make it possible for the main tactical/operational functions of a manufacturing company - such as product design and processing, data control, production planning, and real time processing control - to be integrated.

Communications within the architecture, which will utilize the ELSA 5000 control system at cell level, will use the MAP (Manufacturing Automation Protocol) or TOP (Technical Office Protocol) standards in a multisupplier environment capable of incorporating subsequent developments. (Source: Italia Oggi, 15 October 1987)

New intelligent robot

Toshiba (Japan) has developed a multijointed, AI-equipped robot that can study a structure made of blocks and figure out a way to duplicate it. It is called the Assembly Robot with Intelligence. It has two cameras that function as visual sensors, pincer-like hands and an independent database that it uses to draw inferences. Its Tospix-II image processor processes data collected by its visual sensors. The robot also relies on an engineering

workstation to help co-ordinate its movements with its ideas. Its mechanical movements are co-ordinated by microcomputers. (Source: Asian Wall Street Journal, 12 October 1987)

New Soviet robot

The USSR announces that a new robot has been developed which is capable of carrying twice its own weight up walls and along ceilings, according to the TASS News Agency. The 34 lb (14 kg) robot has five legs equipped with suction pads and moves like a spider. The robot can carry loads up to 72 lb (30 kg). (Source: Wall Street Journal, Europe, 16 December 1987)

Robot hospital help

Transitions Research's new three-feet-tall prototype robot named Roscoe will take over some drudge work from nurses at Danbury Hospital in Danbury, CN, hauling meal trays and handling similar chores. The robot will be tested to see whether robotics can help ease the nursing shortage affecting the hospital and other hospitals around the country. Roscoe's first test will be to carry two to four meal trays at a time from the hospital kitchen to nursing stations on the 10 floors. If Roscoe passes the test, it will be given other jobs such as getting bandages and prescriptions and taking specimens to the laboratory. Battery-powered Roscoe is guided by small computers, sensors and a video eye. It stops automatically if it bumps into something and uses an infrared signal to call elevators. Roscoe is now being guided with a small control panel and a tether. Roscoe will eventually be given its assignments by an on-board keyboard and video terminal, which has not been installed. Roscoe's internal computers are also now being programmed to help it find its way around the 450-bed community hospital. Transition Research, which has 23 workers, is developing robots for the service industry. (Source: New York Times, 7 January 1988)

Robots in security applications

Robotics manufacturers are researching and developing mobile robotics for security applications. Mobile robotic technology, which is relatively new to the 1980s, has been largely associated with military and government applications. Sandia National Laboratories (Albuquerque, NM), a US Department of Energy contractor, has developed the Sandia Interior Robot system, a mobile robot with a variety of security applications. Odetics (Anaheim, CA), a manufacturer of robotics and artificial intelligence systems, has developed a six-legged walking robot in conjunction with the Savannah River Laboratory. The robot can be fitted with robotic arms. Denning Mobile Robotic's (Woburn, MA) 'Sentry' mobile robot was designed to work with an integrated security system that includes electronics, video and human guards. These four-feet-tall 500 lb robots are now used in Boston's World Trade Center and Bayside Exposition Center and will soon be leased to other facilities. (Extracted from Security, December 1987)

"Factory of the future"

Wescom Telephone Products, a Rockwell International telecommunications producing unit, has formed a 'factory of the future' via computer integrated manufacturing at its plant in Downer's Grove, IL. Material handling methods involved are a conveyor system to route work within the Test Process Center (TPC) area, and an automated guided vehicle system to deliver products to the finished goods stockroom. Work stations in the TPC are laid out in three parallel legs and linked via a Rapistan (Grand Rapids, MI) Production Management Systems (PMS) modular conveyor. The TPC area includes in-circuit test or part verification, final assembly area where stations mount final hardware items, a functional test area where printed circuit boards are exercised and the final visual inspection area where overall workmanship and board aesthetics are sampled.

Savings from the conveyorized system include 10 per cent overall productivity of the TPC, a 15 per cent cut in material handling costs, activity discontinuance and inventory cuts. WTPD's intangible benefits found from automated material handling based on the PMS installation alone were a 10-20 per cent improvement in supervisory effectiveness because problems are more easily recognized and remedied and a 10-20 per cent estimated improvement for the quality control function due to better housekeeping, PMS computer compatibility with the full shop-floor control scheme and more capable workload balancing. (Extracted from Material Handling, January 1988)

New welding robot for space shuttle

Rocketdyne (Canoga Park, CA) has robotized the welding of a small manifold on the space shuttle main engine, under a NASA-sponsored advanced robotic welding program. The four inch diameter, 20 inch long manifold that requires 56 inches of welding carries liquid oxygen into the shuttle engine's main injector. Rocketdyne, a Rockwell International unit, has cut the welding time to 11 days versus 90 days when the manifold had to be welded manually. A $400,000 Cybotech H8 robot was installed at Rocketdyne to do the manifold welding. An eight-position universal fixture, a drop centre tool, was designed and built by NASA and Rocketdyne at NASA's Marshall Space Flight Center (Huntsville, AL). The fixture made of ordinary tool steel allows the manifold to be positioned on two axes without changing tools. (Extracted from Metalworking News, 30 November 1987)

Tactile sensor for robots

A tactile sensor to endow robots with human senses has been developed at the University of Newcastle. The sensor that unites visual and tactile inputs to mimic human capacities gets its sight from an internal miniature rotating camera. Using input from the camera, the sensor monitor shapes and orients itself. Over 1,000 tiny transducers allow the sensor to "feel" things and convert pressure applied to the held object into a visual image. A robot with this sensor type learns to distinguish between many objects, then makes correct picks. (Extracted from Designing News, 23 November 1987)

ICs revolutionize motion control

Tiny power switching integrated circuits and microprocessors are bringing a revolution in motion control. Digital motor-control methods have become economical alternatives to methods based on discrete parts and analog circuitry. The emergence of more powerful microcontroller chips and smart power ICs have led to this development. Digital control is exhibiting itself in more precise positioning, more intelligent manipulation of motor motion, smaller and lighter drive and control circuitry and faster machine response times. Its main benefit is simplifying the design process for motion-control systems; thus more design engineers can profit from the advantages of electronic motion control. Digital control is being applied to all types of AC and DC motors in closed-loop servo and open-loop stepper circuits, the motors ranging from low fractional hp to the high-hp integral type. (Extracted from Mechanical Engineering, November 1987)

Kitchen robot tested

Translab is testing robots for handling food in fast-food restaurants. Food handling is generally too difficult for robots because food is not firm and is irregular. The new robot, which puts the hamburger on

a bun and then puts the top of the bun on, is being tested at the University of Wisconsin School of Restaurant and Hotel Management. The robot is 40 inches x 18 inches by 20 inches. All parts that touch the food are made of stainless steel and can be run through a dishwasher. The robot would work better if it did not have to be between two humans. Ideally, the entire procedure of making hamburgers would be automated, and operated remotely by the person at the cash register as orders are taken. The robot in use at Wisconsin was funded by Burger King. (Extracted from New Scientist, 8 October 1987)

New factory systems products

G.E. Fanuc Automation, North America, has unveiled a new generation of factory systems products that cuts the cost of computer-integrated manufacturing programs and thus offers the technology to an expanded users range. The new Simplicity Systems products link factory-floor controllers to Digital Equipment and IBM-compatible industrial computers, using use-specific software modules that G.E. Fanuc said provides the benefits of customized systems at lower cost. G.E. Fanuc (Charlottesville, VA) is a joint venture of General Electric and Fanuc (Japan). (Source: Technology Update, 25 January 1986)

Better cars for less

For automobile manufacturers around the world, the goal is to produce high-quality cars more economically. Regardless of what cars a company builds, improved design and assembly are crucial to low-cost production. Efficiency and quality - making cars faster and cheaper and free from defects - are key. Step by step, the way cars are built is being reinvented.

The degree of automation that is appropriate colours debates about how to improve productivity and quality. Companies like General Motors are installing factory communications networks, so-called flexible automation, and even robots with vision. But the productivity of highly automated assembly lines is sometimes surpassed by that of plants with less automation but apparently better-organized work flows.

For example, the New United Motor Manufacturing Inc. (Nummi) plant in Fremont, Calif., a joint venture of GM and Toyota, has only about 160 robots (170 of them in welding) as against the 250 or more found in a fully automated plant. Yet Nummi produces cars with fewer customer complaints than any other plant in the GM system, although its Chevrolet Novas and Toyota Corollas are simple automobiles by industry standards.

Labour relations are inseparably entwined with automation and work flow. Robots cost jobs and new manufacturing approaches threaten byzantine work-rule arrangements negotiated through the years by unions and management. Conventional plants may have 100 different job classifications where some newer ones have only two to five.

Although automation is at the centre of changes in the industry, by itself it may not improve efficiency. Companies that install robots and other machinery without changing production practices are just "automating past problems", said Keith McKee, director of the Illinois Institute of Technology's Manufacturing Productivity Center in Chicago. "You're doing very efficiently something that may not be clever."

Furthermore, even the most thoroughly automated line only reduces the cost of an automobile by $500 or so, because labour on a typical line contributes only between 5 and 10 per cent of the total cost, according to one GM engineer. Thus the search for efficiency must go beyond the assembly line.

Materials account for 50 to 60 per cent of a car's total cost, largely because most of what goes into a car is a finished product in its own right - seat assemblies, engines, instrument panels, and so forth. Some assembly plants, such as Nummi, and Honda's in Marysville, have their own stamping plants; for others, stampings are shipped to the assembly plant just like other parts.

Component assembly usually takes place in many different factories, hundreds or even thousands of miles apart. Because so much of a car's cost lies in work done before assembly, many pay-offs come from automating upstream operations in other plants or even at other companies.

How efficiently can a car be built? Most of that question is answered long before parts reach the assembly line. Design of the whole car and quality of the components form a foundation for efficient assembly. However, bad assembly can ruin a good design, and even the best assembly line will produce one lemon after another if supplied with bad parts. Furthermore, some designs are easier to manufacture than others.

Redesigning cars for more efficient assembly is just one way to change the assembly line itself. More obvious are changes in the way individual components are put together, along with changes in plant organization, that reduce work-in-process inventories and keep tighter rein on defects. But engineers sometimes think a particular task is ripe for automation, only to find on a closer look that people do it more effectively.

Key criteria for jobs to be automated are whether the work takes a long time, and whether it is dangerous, physically demanding, or mind-numbingly repetitive. Robots are not fearful; they can be made very strong; and they never become bored. They can, therefore, improve speed as well as quality. The two processes now most commonly done by robots are welding and painting, tasks that combine boredom with unpleasant and unhealthy environments. At some plants, robots deal with such heavy components as wheel-brake packages. Automated guided vehicles can move parts to the assembly line - itself, of course, a perfect example of automation.

Rethinking the production process may be more complex than simply automating it, but some changes require no automation at all, just a fresh approach. For example, manufacturers once assembled car bodies, doors and all, before they went into their initial paint bath, but for workers to install the cars' interiors, the doors had to be left open.

So to accommodate the car body and its open doors, lines were eight feet wider than for doorless bodies. Mechanical equipment had to be positioned at least four feet away from the cars, and workers dodged the doors as each car rode down the line. Cars whose doors were dented on the way had to be sent to the repair bays at the end of the line. By removing the doors after the paint job, labelling them and simply keeping track of them, many carmakers have traded record-keeping for space, safety and mechanical simplicity.

Some fundamental rethinks end up doing away with the production line altogether. At Volvo's 13-year-old plant in Kalmar, Sweden, teams of workers assemble significant parts of each car - complete interiors or suspensions or engine compartments - instead of each worker performing whatever simple task fits into the 50 to 90 seconds a car spends at each station on a conventional line. (Cars spend the same amount of time at every station, but lines may run at anything from 40 to 72 cars an hour.)

Assembly plants like Volvo's have much lower production rates than typical plants - 100,000 or fewer cars per year with 800 assembly workers, against the 200,000 to 300,000 cars per year that a large US or Japanese factory achieves with up to 3,000 workers. On the other hand, many industry analysts are calling for economical assembly lines operating at a much lower production rate. Even the most efficient conventional plant makes no profit unless it runs close to capacity.

Honda and Toyota are also trying the team approach, although in not nearly so radical a way as is Volvo. Each worker on one of their teams alternates doing one of the several tasks performed during the minute or so each car spends at a station - only a slight modification of typical assembly-line practice, where each worker does a single task.

Another level of rethinking production is to look at the way production lines and their chains of supply interact, in what is called just-in-time manufacturing. Manufacturing lines typically operate in push mode: arrival of partly completed products or components at a new station triggers an assembly operation. But just-in-time systems operate in pull mode, where components are requested only as needed. Not only are inventory space and cost reduced, but with earlier identification and tracking of defective parts, the quality of finished cars improves.

GM's highly automated Detroit-Hamtramck plant is linked by a communications network to GM component plants in Livonia, Mich., Windsor, Ont., Canada and elsewhere. As each car body comes out of the paint shop in Hamtramck, an electronic message goes to the seat plant in Windsor, where workers assemble the appropriate seats and place them on a numbered rack. Racks of completed seats are trucked across the Detroit River and delivered in proper sequence to the Hamtramck line. The seats are installed in the car body about four hours after it leaves the paint shop.

A by-product of just-in-time techniques is that manufacturers, like Toyota, can build up to seven different models concurrently on the same assembly line. Instead of producing a run of one model followed by a run of another, a just-in-time line produces individual cars of different types, apparently at random. The motivation, according to the company, is a principle the Japanese call heijunka, or levelling, which requires demand for components, equipment and labour to remain as constant as possible, rather than to fluctuate.

Each car model, even each variation within a single model, has slightly different parts and labour requirements. A luxury model, with added interior options, would require more time than the average for installing seats and trim; a simpler model would require less. A long run of one would require extra hands; a run of the other would leave workers idle. With levelling, assembly-line work balances out, as does depletion of different parts.

Just-in-time parts supply, and heijunka on the assembly line, demand corresponding efficiency from suppliers, whether captive or independent. Regardless of who runs upstream manufacturing, improvements in production efficiency happen much the same way as on the assembly line itself.

Many component plants are organized so that transportation between work areas and storage takes up the bulk of manufacturing time, according to the Illinois Institute of Technology's McKee.

In newer factories, however, machines are clustered by the type of part they produce instead of by function. An operator (or a simple pick-and-place robot) unloads the shaft from the lathe and places it directly on the bed of the milling machine; it then goes directly from milling to grinder, and so on through the entire set of manufacturing operations. The time can be cut to as little as one-tenth.

Shortening the manufacturing process cuts the lead time for building components to order, reducing in turn the inventory a supplier must carry and making possible just-in-time delivery to the assembly plant. Rather than reducing overall manufacturing costs, however, just-in-time delivery often reduces assembly plants' inventory costs by requiring suppliers to warehouse the parts and make more frequent deliveries.

Adding automation and reorganizing the work flow are attractive, but how can manufacturers accomplish it all? At new plants, like Honda's in Marysville, the job is straightforward, because no assembly plant was there to be disrupted. Most manufacturers add automation with each new line of cars; because a new line means tearing up most of a plant anyway, a change in manufacturing technique adds little to the disruption.

In existing plants, new techniques come in one job at a time, as engineers develop ways to improve one operation without interfering with others. At Nummi, robots now place batteries into cars and wrestle hoods into position; at Hamtramck, on the other hand, engineers provided for robots to attach the wheels, but later found workers could do the job just as well.

One key to adding new equipment is a communications network within the plant, through which a central computer downloads new programs to robots, programmable controllers, or machine tools. The network also lets equipment and computers exchange information about the status of work in progress. Without the network, each new machine would be a disconnected "island of automation".

But the most important ingredient for improving production efficiency is people. GM invested 2.3 million hours of training in the 2,700-member Detroit-Hamtramck workforce, and other newly automated plants have done likewise. The knowledge workers gain from years at conventional plants is still valuable in an automated setting. Positioning work lights, deciding whether machinery should have central or distributed lubrication systems, and where lubrication points should be, were all questions the workers helped answer. (Extracted from IEEE Spectrum, October 1987)

IX. STANDARDIZATION AND LEGISLATION

Europeans organize to push working standards

Eight European standards organizations have formed the European Workshop on Open Systems, whose aim is to develop open-systems-interconnection norms and the appropriate conformity test conditions. The goal is to strengthen the competitive position of Europe's information-technology industry on world markets by guaranteeing that equipment from different manufacturers can operate together in a networked environment. EWOS will seek co-operation with similar organizations in the US and Japan. The chairman of EWOS, Herbert Donner of FRG's Siemens AG, will officiate at its first meeting, to be held in Brussels in March 1988. (Reprinted from Electronics, 4 February 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Lobby gives warning of SAD disarray

European industrial data users have lobbied officials over the agreement on formats for trade data interchange networks and conflicts with United Nations standards.

Compros, the European lobby for the simplification of trade procedures, warned that computer systems would not be ready for a January deadline.

So far, 18 European countries have agreed to adopt the Single Administrative Document (SAD) from January 1988, in paper or electronic form, to standardize customs and transport formalities.

The SAD formats were only released in September 1987 and the European Commission has still to negotiate 36 changes to the United Nations data interchange standard to make it consistent with the SAD data elements. Also, some customs authorities were not going to meet the January date for accepting computerised trade data and were also not accepting parts of the SAD itself.

The Commission said it was aware that some countries would not use all eight parts of the SAD but were bound by community regulations to follow its format. The eight parts include import, export and transport.

UK Customs have indicated that 30 per cent of UK exports will use the SAD for export and transit, leaving it up to customers whether they use the import part of it. (Source: Computing, 15 October 1987)

Distributed life after OSI

Those international standards makers must be gluttons for punishment. After a decade slogging away on Open Systems Interconnection standards - and still a long way from completing the task - they are looking beyond OSI to Open Distributed Processing (ODP).

OSI facilitates information transfer between different vendors' computers. It does not resolve the substantial incompatibilities between different vendors' hardware and systems software and the applications written for those entities.

The aim of ODP is to get around these incompatibilities so that applications can be spread across multiple communicating machines and programme modules can communicate with each other regardless of the underlying hardware architectures and operating systems.

A number of research projects around the world are looking at ODP for specific application domains like computer-integrated manufacturing and office systems.

The Advanced Networked Systems Architecture (ANSA) project supported by the UK Government's Alvey research and development programme is claimed to be further ahead in its investigation of generic ODP solutions than any other research initiative in the world. It is therefore regarded as the most appropriate to influence the ODP standard work now under way within the International Standards Organization.

ANSA's international influence has been strengthened over the last 12 months by three major international computer industry players - Olivetti, Hewlett-Packard and DEC - joining the team of UK-based companies that have been working on ANSA for about three years. Specialists seconded from the participant companies work together at the ANSA research centre in Cambridge.

The ANSA participants are now well placed to respond when the European Commission puts out its call for proposals on an Esprit II project called Distributed Systems Architecture which will cover similar ground to ANSA.

According to the Esprit II work programme published in July by the Commission's Information Technology Task Force, the Distributed Systems Architecture project will concern itself with "the elaboration and standardization of an architectural framework for fully distributed systems that comprise loosely coupled processing and storage components interconnected by communication links".

The proposed architecture will allow interworking of devices and software from different manufacturers and the allocation of computing resources to the application as seems best. The Commission's specification also stresses that the architecture will support "all known major IT application areas, including office, business, manufacturing, transport and research".

Another rather important ECMA member, IBM, also contributes to its ODP standardization work through its European Networking Centre at Heidelberg. The centre is working with the European academic community on software that can be networked across IBM and DEC Vax machines at universities dotted around Europe, but IBM's main interest is in developing and promoting its own Systems Application Architecture (SAA).

SAA and ODP are both aimed at interworking between different pieces of software on different incompatible machines. In IBM's case they are its own incompatible systems.

ANSA's efforts to generate interest in its activities include the publication of a substantial reference manual aimed primarily at a technical audience, containing detailed definitions of DP components. (Extracted from Computer Weekly, 19 November 1987)

Standards briefs

Accredited Standards Committee X3, Information Processing Systems, has announced a four-month public review and comment period on the proposed adoption of the following standards. The public review and comment period ended on 14 December 1987.

A standard for fibre-distributed data interface (FDDI). This standard, American National Standard X3.166-198X, addresses the physical-layer, medium-dependent aspects of FDDI. It is intended for use in a high-performance multistation network that operates at 100 megabits per second and uses a token-ring architecture and fibre optics as the transmission medium over distances of several kilometers.

By the expected implementation date of this standard, it is likely that there will be many installations of the IEEE 802.5 token ring and of lower speed LAN products. Users of these installations should benefit from the higher data rates, expanded configurations, reduced costs, and other advantages offered by the proposed standard.

Copies of the draft standard are available from Global Engineering Documents, Inc. by calling (800) 854-7179. Single copy price: $30.00; international orders: $39.00.

A standard for interfaces between flexible-disk cartridges and their host controllers. This standard is the revised American National Standard X3.80-198x. It defines the functional and electrical requirements (including logical signals) and the mechanical requirements of the interface for connecting flexible-disk drives to a host system. The standard specifically includes drives using media specified in American National Standards, but it does not exclude drives using other media. This standard is distinct

from the specification is that it delineates a minimum set of requirements consistent with compatibility and interchangeability at the interface level. As orginally developed, it was written specifically for 8-inch and 5.25-inch flexible-disk drives. However, the standard may be applied to other disk sizes.

Copies of the draft standard may be obtained from Global Engineering Documents, Inc. by calling (800) 854-7179. Single copy price: $20.00; international orders: $26.00. (Source: Computer, October 1987)

The winds of change are blowing for MRP II users

While users of computer-aided design and engineering (CAD/CAE) software have experienced success in their push for standards, users of Materials Resource Planning (MRP II) have not been quite as successful - yet, but the seeds of standardization in this area, which carry the promise of longer-term change, are slowly being sown.

As it stands now, MRP II users are happy if they stumble upon a package that, at least to some degree, meets their business needs and is not entirely incompatible with their other manufacturing packages. These packages include both CAD/CAE and computer-aided manufacturing (CAM), which, along with MRP II comprise the heart of computer integrated manufacturing (CIM).

Users increasingly are making it known that they need and expect more help from vendors in integrating their various manufacturing software products. Current and future standards, including Unix, the Manufacturing Automation Protocol (MAP), and the International Graphics Exchange Standard (IGES), are steadily emerging as absolute requirements.

As a first step towards satisfying these demands, some users have begun teaming with vendors - for example, pharmaceuticals giant Ciba-Geigy with Management Science America Inc. (MSA) - to develop and market the custom interface and module products they have created while cutting their CIM teeth.

Part of the reason for MRP II's limited appeal is that vendors have attempted to make their packages be all things to all people, rather than introducing customized versions for particular vertical markets.

This is not likely to change soon. Almost all micro, mini, and mainframe MRP II packages include production planning, master production scheduling, MRP I, and capacity requirements planning modules. Yet, "most industries have very specific kinds of needs," says Julie Pingry, editor of the CIM Strategies newsletter published by Cutter Information Corp., Arlington, Mass. For example, among automotive manufacturers, electronic data interchange capabilities are a top priority, but among pharmaceutical vendors, extremely tight lot tracking is the prime concern.

As a result, those users that have taken the MRP II plunge traditionally have been left with no choice other than to spend up to $1 million for mini and mainframe packages (micro packages can run up to $100,000). These packages must then be stripped of unnecessary features and built up in areas where they are lacking. Further expenses include training, education, and consultants' fees. (Extracted with permission of DATAMATION[r] magazine[c], 1 February 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company - all rights reserved)

DEC beats out IBM in LAN bridge standards debate

"The perfect standard is that which is equally disliked by all people," says John Hart the hardened standards committee veteran who also serves as vice-president of network products for Vitalink Communications Corp., Fremont, California.

It appears that Digital Equipment Corp. has beaten IBM in the standards fight over competing techniques for designing bridges - devices that are used to connect LANs. Yet, in a perfect example of spirited compromise, IBM has been given (some say taken) leeway to continue with an alternative scheme now in use in its Token Ring networks. Hart says it could be another 18 months before the final IEEE stamp of approval is given to the transparent spanning-tree internetworking technique co-sponsored by DEC and Vitalink. Spanning-tree was presented to the IEEE around October 1984 and was given the go-ahead in 1986. IBM had as an alternate proposal its own source-routing internetworking technique. Undaunted, IBM refused to go along with the consensus, yet a compromise is being reached. The 802.5 committee, which oversees the Token Ring, will be allowed to develop a media access control (MAC)-specific bridging scheme (in this case source routing), which must then interoperate with the spanning-tree approach approved by 802.1.

To determine how - and if - that is possible, a flurry of interim gatherings has taken place this year, including some last month in Raleigh, N.C., the IBM communications products division's home. The next official IEEE meeting on the subject is scheduled for mid-March in San Diego.

Beyond the technical reasons for each side's partiality - and, despite its assured status as a standard, spanning-tree has its critics - the affair points up the all-too-familiar political nature of standards making.

In the case of this interoperability committee, for which the original goal was to develop one answer and one standard, that mission is no longer the reality. As a result, users of networking gear will find themselves in need of translation devices if they attempt to bridge a Token Ring to an Ethernet. "The bottom line is that there will be two bridging standards," concedes Hart.

As an alternative, most users in this scenario will probably choose to use the more complex routers, an Open Systems Interconnection (OSI) layer-three technology that requires identical protocols among LANs. The bridging controversy is taking place in layer two or the data link layer of the seven-level OSI model of networks.

The spanning-tree algorithm has been around for years and is used in the current DEC LAN bridge 100 and Vitalink TransLAN bridge products. Its name is a rarity in the communications world; it actually is quite self-descriptive if one can imagine network paths in the form of a root leading to different branches. As described in more detailed fashion by Hart, however, "It is a distributed algorithm which allows a group of systems participating in that algorithm to jointly determine if they have an arbitrary topology or links to come up with a spanning-tree".

The key is that this occurs in a deterministic fashion and without loops. Source routing, on the other hand, is similar to routers in that end stations and more complex labelling are required. Spanning-tree is on its way to standards status and some companies have already begun to use the algorithm. (Extracted with permission of DATAMATION[r] magazine[c], 15 February 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company - all rights reserved)

Standard comparison of key factors

Robot Industries Association has unveiled a draft of standard comparison of key robot performance factors. The R15.05 methodology is proposed as a national standard under ANSI supervision. The test procedure permits quantitative comparison of individual machines by testing robots from diverse

manufacturers under the same conditions using the same measures. This makes customer comparison shopping easier, and removes the burden of customized testing from robot producers. Basis of the test is movement in a standard test path and in a standard test plane using a payload selected from 1 of 12 test-weight categories. (Extracted from Metalworking News, 23 November 1987)

X. GOVERNMENT POLICIES

Sanctions dropped

The Government of Brazil has deleted sanctions imposing up to 200 per cent tariffs on imported software and criminal penalties for using illegal software. The move could lead the US Administration to delay retaliation against Brazil for curbs on US computer and software products. The tariffs covered $105 million in imports. The principal factor in the US retaliation was the Brazilian Government's denial of a license sought by six Brazilian computer hardware firms to use Microsoft's MS-DOS software. (Extracted from New York Times, 23 December 1987)

XI. RECENT PUBLICATIONS

Electronic mail and the communicators

This publication is the result of a telephone survey covering the use of electronic mail, telex and fax, carried out among a random sample drawn equally from media owners, advertising agencies and public relations consultancies. Each was asked about their usage of telex, fax and electronic mail, and their attitudes towards the latter. The 40-page survey, which reports in detail on findings, background to the study and definitions of terms used in connection with electronic mail, is priced at £195.50. The publishers are: James R. Adams and Associates, Ltd., 5 Langley Street, London WC2H 9JA. UK.

Handbook of State Trading Organizations of developing countries

Produced by the United Nations Conference on Trade and Development (UNCTAD), this Handbook provides essential information on hundreds of State Trading Organizations (STOs) in 70 developing countries. It provides addresses of offices entitled to negotiate with foreign partners; gives values, sources and destinations of the organizations' main import/export items, and shares in the turnover, as well as information on trading techniques and methods employed. Over 1,000 items, cross-referenced to the organization concerned, are covered. The Handbook contains multilingual (English, French, Spanish and Arabic) glossaries of technical terms, and is designed to accommodate regular updates. The hardback, spiral-bound publication has 720 pages, and costs $US 60.00. UN Sales No. A/E/F/S.85.II.D.7; ISBN 92-1-012014-0.

ACCIS Guide to United Nations Information Sources on Food and Agriculture

This publication is the first in a series of subject-oriented guides to United Nations information sources. It is divided into 10 chapters, dealing with: food and agriculture in general; plant production and protection; animal nutrition and health; food and nutrition; land and water development and natural resources; economic and social development; trade and commodities; agro-industries and industrial development; fisheries and agriculture, and statistics. Each chapter consists of a series of brief descriptions of information sources within its subject area. Some types of sources included are: libraries and other units maintaining document collections; computerized databases, including those currently not publicly available, and publications, particularly regular serial publications such as journals, newsletters and yearbooks, and some directories. Annexes contain: national contact addresses; addresses of organizations included in the guide, and addresses of commercial online hosts offering access to United Nations system databases. Indexes to subjects, names of organizations and departments, publication titles and databases and systems are also included.

ACCIS Guide to United Nations Information Sources on Food and Agriculture (ACCIS Guides to United Nations Information Sources, No. 1). Rome: FAO, 1987, 124 p. ISBN: 92-5-102604-1; ISSN: 1011-3756. Available from FAO Distribution and Sales Section, Rome, or local FAO Sales Agents.

In preparation: ACCIS Guide to United Nations Information Sources on the Environment

Compiled by the Advisory Committee for the Co-ordination of Information Systems (ACCIS) in collaboration with the United Nations Environment Programme (UNEP). Publication date: Spring 1988. Available from: United Nations Sales Offices, New York and Geneva.

Report of the meeting of the Consultative Group on Informatics Technology for Development (CGGIT)

As was mentioned in Issue No. 24 of the Monitor, CGGIT met at UNIDO's headquarters in Vienna from 14-16 December 1987 in order to review practical experience in the application of informatics technology for development and to identify concrete measures of co-operation at the international level, including co-operation among developing countries, so as to promote such application in a manner consistent with the requirements of developing countries. A review was also to be made of UNIDO's past and planned activities in this field and suggestions to be made for a programme of action.

Those of our readers who would like to obtain a copy of the report should kindly write to UNIDO, Department for Industrial Promotion, Consultations and Technology, Vienna International Centre, P.O. Box 300, Vienna 1400, Austria. The symbol of the report is IPCT.55, and it is only available in English.

UK to lead Europe's growth

The UK's electronics market will grow faster than nearly all the rest of Europe in 1988, according to a new report.

According to Benn Electronics Publications' latest yearbook, Britain's market for electronic equipment and components will grow 7.7 per cent in 1988 compared to an average European growth of 7.0 per cent. Only the FRG will expand faster, at a rate of 8 per cent.

The report predicts that the value of the market in constant 1986 values will be $144 billion, but that in actual value it may be some 35 per cent higher than that due to inflation and the weaker dollar.

Electronic data processing will be the most buoyant market, with an expected growth rate of 11 per cent. This, says the report, is in part due to the industry trend of buying complete systems.

Telecommunications is expected to produce a growth rate averaging 7 per cent over the period 1986-1991. This, says the report, follows on from the widespread modernization of national systems and the installation of digital switching equipment. But it warns that deregulation has opened up the door to imports and the indigenous market share will fall.

Static defence budgets mean that the communications sector will grow more slowly, achieving an average over the same period of only 3 per cent. Control and instrumentation will average 3.6 per cent over the five years.

The picture is slightly rosier for semiconductors which is forecast to grow 4.7 per cent this year, backed up by an 8.3 per cent growth in integrated circuits. Component growth in Europe will accelerate next year to 6.4 per cent and integrated circuits will rise 14 per cent.

However, growth will slow down after 1988, averaging only 4 per cent between 1989 and 1991.

The Yearbook of West European Electronics Data 1988, Benn Electronics Publications, P.O. Box 20, Luton LU2 0ED. $625.

Impacts of Artificial Intelligence

The determination and assessment of impacts of Artificial Intelligence is important in order to avoid potential damage and to encourage socially helpful and economically useful AI research and applications. Contributions from leading AI researchers, working in different areas of AI and living in countries with different social systems, present in this book a detailed description of AI impacts on science, technology, the military, economics, society, culture and politics. The book is addressed to the AI researcher, concerned about the potential impacts of his/her work, to the decision-maker in government, in a funding institution, or a private company, who spends or invests money in AI research, and to all those interested in the changes which AI will bring into their lives in the future. A main feature of this work is a bibliography on the future, and impacts, of AI listing more than 600 books, articles, and research memos which contain material related to this topic. A KWIC-index helps with the retrieval of a source. A short introduction into AI ("A One-Hour Course") makes the content of the book easily comprehensible for the novice.

Impacts of Artificial Intelligence, edited by R. Trappl, Austria Research Institute for Artificial Intelligence, Vienna, Austria. Price: $US 30.00/ Dfl. 100.00. ISBN 0-444-87587-5. Published by Elsevier Science Publishers, P.O. Box 211, 1000 AE Amsterdam, The Netherlands.

Report on microwave MESFET distributed amplifiers

The successful development of the Gallium Arsenide microwave MESFET (Metal Semi-conductor Field Effect Transistor) has stimulated interest in the use of microwave techniques for communication and electronic warfare (EW) purposes. Because of this interest ERA Technology Ltd. has carried out a six-month project under its Membership Research Programme to investigate the feasibility of producing very broadband microwave amplifiers using the hybrid distributed amplifier approach.

The aim of this project was to demonstrate the feasibility of designing and building a distributed amplifier covering the band 2 GHz to 14 GHz, as well as the advantages of a hybrid approach, in terms of cost and lead times, on monolithic techniques. Computer simulation techniques were used to predict performance using both SPICE and TOUCHSTONE.

The report provides a comprehensive introduction to the principles of distributed amplification and detailed mathematical analysis of the characteristics of distributed amplifiers. It also provides details of the design and construction techniques used to successfully produce a single stage, three transistor hybrid distributed amplifier with measured bandwidths of more than 15 GHz and input and output VSWRs better than 2:1.

Further work is now being carried out by ERA's RF Technology Centre for individual clients to develop the technology further.

ERA Report 85-0167R Microwave MESFET Distributed Amplifiers at £155 Class B members/£175 non-member per copy. (Postage free within UK, £1.50 for Europe, £4.50 outside Europe.) The report is published by ERA Technology Ltd., Publication Sales, Cleeve Road, Leatherhead, Surrey KT22 7SA, England, Telephone: Leatherhead (0372) 374151, Telex: 266045, Fax: 0372 374496.

Three essential reference documents: Qualified Products Lists for the electronics industry

PD 9002

Contains a complete list of the approvals granted to firms and their products under the BS 9000 quality assessment system for electronic components. It also includes all CECC and IECQ approvals granted to UK companies. PD 9002 is the only document which lists this information and is widely used by purchasers, designers and equipment manufacturers seeking British quality assessed electronic components.

CECC 00200

Provides information on electronic components qualified under the European CECC system. The object of the CECC system is to facilitate international trade by the harmonization of specifications and quality assessment procedures for electronic components. Components produced under the system are accepted by all member countries without further testing.

IECQ QC001005

Gives details of electronic components made under the Worldwide IECQ system and is prepared from information supplied by IECQ member countries. The specifications against which components are approved are part of an overall structure based on IEC standards. Electronic components of assessed quality are made and sold by approved manufacturers and distributors and are accepted without re-testing in member countries.

Copies of these documents are available from the Sales Department of the British Standards Institution. These publications are available on prepayment only, and inquiries should be made to the Sales Department for information on the current price and amendment status of the publications. Membership discounts or quantity reductions are not available. Sales Department, British Standards Institution, Linford Wood, Milton Keynes. Telephone (0908) 221166.

Computer humanities

Promotion Technologies surveyed academics to produce the report The US Computer Humanities Market: Current Status and Future Growth. Joseph Raben supervised and Lauren Seiler performed the data design and analysis. The report includes computer humanities use, a list of vendors and products in the market, and addresses for organizations, journals, and conference organizers. $495. Published by Promotion Technologies, P.O. Box 45069, Sarasota, FL 34277-40 9; (813) 922-7666.

Frost & Sullivan reports

Current figures show an increase of 10 to 15 per cent a year in the number of data-crime incidents, according to Frost & Sullivan, and Europeans are tripling their spending on countermeasures. Data Security in Europe (#E894, 286 pp., $2,400) details of the market and products available.

US Market for Local Area Networks in Offices (#A1660, 592 pp., $1,950) forecasts a near-doubling of yearly shipments of general-purpose LANs through 1991. The report predicts a decline in PC-cluster LANs, and a rise in high-end CPU LANs. Topics covered include technical fundamentals and design elements, user applications, and competitive analysis.

The Military GaAs Semiconductor Market in the US (#A1768, 297 pp., $1,950) predicts rising use of GaAs ICs and devices, with the GaAs semiconductor becoming a mainline product. (Available from Customer Service, Frost & Sullivan, 10 Fulton St., NY 10038; (212) 233-1080 or Sullivan House, 4 Grosvenor Gardens, London SW1W 0DH; (01) 730-3438.

Speech Communication: Human and Machine

(ISBN 0-201-16520-1, 568 pp., hardcover, $44.95) by Douglas O'Shaughnessy introduces speech communication, from a discussion of how we produce and perceive speech to computer-based speech processing. The book is part of Addison-Wesley's Series in Electrical Engineering: Digital Signal Processing. Published by Addison-Wesley Publishing Co., Jacob Way, Reading MA 01867; (617) 944-3700.

International Journal of Computer Applications in Technology, the official journal for the International Network of Centres for Computer Applications, will begin publication in Spring 1988. The journal still seeks qualified referees and papers. Contact the editor, M.A. Dorgham, The Open University, Walton Hall, Milton Keynes, MK7 6AA, UK; Milton Keynes 653945. Members of INCCA will pay $70 per year; non-members, $120. Orders Dept., Inderscience Enterprises Ltd., World Trade Centre Building, 100 Ave. Louis Casai, Case Postale 306, CH-1215 Geneva-Aeroport 15, Switzerland.

The Serlin Report on Parallel Processing is edited and published by Omri Serlin, president of ITOM International. It offers technical reporting with analyses of business and market trends. The report costs $495 per year. Published by ITOM International, POB 1450, Los Altos, CA 94023; (415) 948-4510.

Optical disks

The International Information Management Congress is distributing the book Optical Disks for Data and Document Storage (94 pp., paperback, $40 surface mail, $45 airmail) by William Saffady. The book concentrates on read-only, read/write, and CD-ROM technology. It includes a detailed analysis of turnkey document-storage systems. Published by IMC, P.O. Box 34404, Bethesda, MD 20817; (301) 983-0604.

The Supercomputer Era

(336 pp., $19.95 casebound) by Sidney Karin and Norris Parker Smith explores the technology and personalities involved in supercomputers, as well as their applications. The authors stress the importance of supercomputer centres. Order code 311b02-3. Published by Academic Press, Harcourt Brace Jovanovich, Publishers, Attn: Marketing Dept., Orlando, FL 32887-0510; credit card orders 1 (800) 321-5068.

Catalogue of reports

Electronic Trend Publications offers a free 20-page catalogue of its reports. Contact Electronic Trend Publications, 12930 Saratoga Ave., Suite D1, Saratoga, CA 95070; (408) 996-7416.

Japanese high-tech

The National Technical Information Service offers a study called Japanese High-Tech Information: A Beckoning Market (Pb87-184040/KFP, $20.50 plus $3 handling). The study proposes ways to enhance American access to Japanese technology information. Published by NTIS, 5285 Port Royal Rd., Springfield, VA 22161; (703) 487-4600.

Exporting

The Small Business Foundation of America has published the second edition of Exportise (250 pp., $29.50), written and edited by Jack Rennie. The book provides a guide to the export process, plus information on over 40 common trading partners. The 1987 edition adds sections on importing and dealing with foreign competition in domestic markets. Published by Small Business Foundation of America, 20 Park Plaza, Boston, MA 02116; (617) 350-5096 or 1 (800) 225-1482.

OSI

Volume I of the Handbook of Computer-Communications Standards by William Stalling is called The Open Systems Interconnection (OSI) Model and OSI-related Standards (ISBN: 0-02-948071-X, 322 pp., hardcover, $34.95). It discusses the seven layers of the OSI hierarchy. Volumes II and III to be published. Published by Macmillan Publishing Co., 866 Third Ave., New York, NY 10022.

Unix

A collection of tutorials, issue papers and case histories called the Unix Papers (No. 22578, 480 pp., $26.95) and edited by the Waite Group covers topics ranging from security and communications to standards. Published by Howard W. Sams & Co., 4300 W. 62nd St., Indianapolis, IN 46268; (317) 298-5400.

Proceedings of the Conference on Computer Communication for Developing Countries CCDC '87 (Editors: S. Ramani and Anil Garg)

Newton's laws of motion seem to be true to the same degree in every country in the world. They have not found a developing country version different from the original ones, at least as yet. The same is true for a number of other scientific and technical truths. We all share a common humanity, and a common science and technology. CRC-16 has worked as well for us, in the developing world, as it has done for the Swiss.

There is, however, another side to the coin. No one's future can be a Xerox copy of someone else's past. Principles, concepts, design techniques, etc., can be in common. Priorities, chosen alternatives, designs, production volumes, etc. cannot be the same. Nations which live on $300 per capita per year cannot use the same communication systems that others use to the same extent, not when it costs one's entire life savings to have one phone installed.

True, we have the same science and technology. But, we will use them in different ways, each appropriate to his own needs and resources. True, we will learn a lot from the developed world. We will buy a lot. It does not make sense to build everything, regardless of cost. But we will build a few systems of our own, and we will sell a bit once in a while.

Development is not along any straight line. The same sequence of development will not suit everyone. Some later developments will mean more to us than earlier ones, for instance, computer message systems, text broadcast, educational applications, management of critical resources such as the railway network or the electrical power grid. Some new developments will be needed exclusively by us, for instance, communication systems using our scripts. Some services will mean a lot to us after they are dead elsewhere, such as telegraphy. There are many things we will not see in our lifetime, such as a phone in

every office, let alone one in every home. But we will have modern office communication systems. We will build public data networks, we will use the technology in ways that suit us best.

These are the thoughts that motivated ICCC-87. They motivated India, on behalf of the developing world, to host the conference. They motivated a generous International Council for Computer Communication to sponsor it as one of the first of its special conferences. They motivated a record number of Governors of ICCC, starting with the president, Prof. Philip Enslow Jr., to offer papers, tutorials, and otherwise to help. These thoughts have found a great deal of sympathy from the Conference Governor, Dr. Ronald Uhlig, a champion of the cause and a promoter of effective thinking in this area for a number of years.

1986 was a bad year for many developing economies. There was a drought. 1987 is a drought year in this part of the world. As we prepare for the conference, we are all acutely aware of the suffering around us. Technology alone does not wipe out such problems, though it will and it does make it easier to cope with them. Computer communication may not get us more rain, but it can help us manage our water resources better. The Proceedings will be available shortly from Elsevier Science Publishers B.V., Information & Business Division, Sara Burgerhartstraat 25, 1055 KV Amsterdam, The Netherlands.

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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Microelectronics Monitor (502)

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