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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

Matching skills to tasks

A new referral service has been created by the United Nations Development Programme (UNDP) to benefit developing countries by improving the flow of information and thus increasing technical co-operation among them.

Known as INRES (Information Referral Service), it stores data, in English, French and Spanish, on over 2,600 institutions providing educational and training programmes, research and technological development services, consultancy and expert services, and information services. It also contains information on the previous experience of these institutions in technical co-operation with other developing countries.

Registered institutions include universities, government ministries, research centres, as well as consulting firms and information services.

Users of the service may request a civil engineer to design a hydro-electric power plant, an expert in the manufacture of pharmaceuticals, on-site training in the use of new agricultural machinery or seek to network with other similar institutions in developing countries.

INRES then sends the inquirer, free of charge, computer printouts of the relevant information. Although the INRES database does not contain the names of individual experts, it contains information on institutions where the experts are available and the specific fields in which they work. Interested parties are expected to obtain more detailed information by approaching the organization directly.

Since January 1985, INRES has responded to over 1,000 inquiries and is both willing and able to handle a far greater volume of queries. It encourages requests to be made in all fields and sectors of endeavour.

For more information, write to: INRES Computerized Inquiry Service, Special Unit for TCDC, UN Development Programme, 304 E. 45 St., Rm. 1206, New York, N.Y. 10017. (Source: Agricultural Information Development Bulletin, March 1988, Vol. 10, No. 1)

Experiments in communication

Indian and United States communication scientists are co-operating in a five-year research project to experiment with participatory approaches to developing educational and informational media material. The project involves a series of communication experiments in selected villages in the Pune and Amdednagar districts, State of Maharashtra, India.

The idea behind the research is that development work is most effective when the people who might be affected by development are highly involved in deciding what is needed, what to try, and so forth. This kind of improvement over what happens in their lives should lead to greater self-reliance.

After an extensive baseline survey of 22 villages, matched pairs of experimental and control villages will be established. The researchers say this is the first extensive field experiment to try validating communication models involving the concepts of teamwork, integrated media development and empowerment of local villages.

At the same time, the project will be building linkages between villagers and the affiliated Indian college staffs who are operating a series of community communication centres.

The project is collaborative between the University of Poona, India, and Cornell University, USA. Dr. K.S. Nair is the research director of the project. Dr. Shirley A. White, Cornell, is the chief co-operating scientist on the US side.

For information write to: University of Poona, Development Communication Research Project, School of Communication Studies, Pune 411 007, India. (Source: Agricultural Information Development Bulletin, March 1988, Vol. 10, No. 1)

Thesaurus group meets

ACCIS has been made the co-ordinating focal point for preliminary investigations into the feasibility of developing a United Nations Common Indexing Vocabulary. The decision was taken at a meeting held at the headquarters of the International Development Research Centre (IDRC) in Ottawa, Canada, from 3-5 May 1988. The meeting, attended by representatives of the Dag Hammarskjöld Library, the Information Systems Unit of the Department of International Economic and Social Affairs (ISU/DIESA), United Nations Regional Commissions, the World Bank, the Arab League Documentation and Information Centre (ALDOC), the United States Agency for International Development (USAID) (observers), the Development Centre of the Organization for Economic Co-operation and Development (OECD), in addition to ACCIS and IDRC, decided that the first phase of the project should be a series of studies and surveys, to be carried out by ACCIS and IDRC. These will look at the following issues: the needs of United Nations system organizations for indexing inter-agency data, who and where are the users of the Macrothesaurus; currently-available computer software for thesaurus management, and a comparison of the terms in the UNBIS thesaurus with those in the third edition of the Macrothesaurus and the World Bank thesaurus.

ACCIS will incorporate the results of these studies into a report for discussion at the next meeting of the group, which is tentatively planned for late Spring, 1989. (Source: ACCIS Newsletter, Vol. 6, No. 1, May 1988)

Market news service

The commodity markets of the 1980s are intensely competitive and extremely changeable. In the case of certain commodities, with prices shifting constantly, exporters tend to ship at their own risk. If exporters are unaware of the current situation, they may ship their products to markets where prices are low, rather than high. Moreover, a lack of up-to-date knowledge of the prevailing conditions may lead exporters to accept prices below even market levels.

Established by the International Trade Centre UNCTAD/GATT (ITC) in 1978, the Market News Service (MNS) aims to help developing countries maximize their earnings from commodity exports. It does this in three ways:

- By transmitting to countries participating in the scheme up-to-the-minute market information on commodities from the key importing markets;

- By providing technical assistance to developing countries, enabling them to upgrade their products to internationally-accepted standards, and to ensure that these are transported properly;

- By helping to put exporters in touch with importers and distributors.

The MMS concentrates on commodities for which current market information is not readily available, but which are nevertheless of substantial importance to significant numbers of developing countries, and for which there is promising market potential. The MMS currently assists some 92 developing countries, and covers some 120 products within its four product groups (horticultural products, common spices, cut flowers, and raw and semi-tanned hides and skins) in Europe, North America and Japan.

The MMS has received financial support from the United Nations Development Programme (UNDP), as well as the Governments of Sweden and Switzerland. As of 1 October 1987, a subscription system has been introduced through which individual exporters can participate directly in the Service by contributing towards the communication costs.

The MMS operates through a network of correspondents in the major importing markets and in the participating developing countries. At ITC headquarters in Geneva, and at its Boston branch office, the Service collects weekly reports on average wholesale prices and other market information by telephone or telex from more than 150 commercial correspondents in the importing markets. Price information is then analysed, tabulated, condensed and immediately transmitted by telex, fax, electronic mail and airmail to the developing country receivers/ subscribers. Although the regular service is provided on a weekly basis, any sudden market change, such as the over-supply of a particular product and a resulting fall in prices, is promptly relayed to the participating developing countries.

In each of the participating developing countries, there is normally an official MMS receiver for each product group, which is frequently the official government agency in the best position to ensure that the information reaches the end-users. Once received, the MMS information is disseminated by a variety of means, including postings on bulletin boards at shipping centres such as airports, by telex, by telephone by mail and through the local press.

For more information on the MMS, please contact: Market News Service, International Trade Centre UNCTAD/GATT, Palais des Nations, 1211 Geneva 10, Switzerland (TP+41 22 34 60 21; TX 289466 MMS CH; FAX 41 22 33 71 76). (Source: ACCIS Newsletter, Vol. 6, No. 1, May 1988)

Universal standard for trade data exchange

The ACCIS Newsletter for November 1986 reported on the development of a common language for trade data processing and exchange by the Working Party on Facilitation of International Trade Procedures (WP.4) of the United Nations Economic Commission for Europe (UN/ECE). Since then, a concerted international effort has led to the development of EDIFACT, a set of standards for data interchange.

EDIFACT (Electronic Data Interchange for Administration, Commerce and Transport) defines the rules for Electronic Data Interchange (EDI) and offers a standardized solution for the construction of international messages related to business transactions.

The establishment of international standards for EDI is vital if international trade is to reap the maximum benefit from new computer and telecommunications technologies. The urgent need for it to do so becomes obvious if the massive, costly and time-consuming transfer of information involved in trade transactions between countries is taken into account. To move one consignment, it is estimated that up to 50 parties in different countries may have to create, transmit, receive, process, check, correct and file hundreds of copies of more than 50 separate documents.

Agreed upon by experts from Europe and North America (which had hitherto been pursuing different routes towards EDI standardization), in a group commissioned by the ECE Working Party (WP.4) and known as UN-JEDI (United Nations, Joint Electronic Data Interchange), EDIFACT has been accepted by both the International Organization for Standardization (ISO) and the European Standardization Committee (CEN). Countries represented on WP.4 include 20 from Eastern and Western Europe, the USA and Canada; a number of major trading countries in other regions, such as Japan, and developing countries. Some 20 international organizations participate in WP.4 activities.

Strong support for EDIFACT has come from such organizations as the European Community, which provides technical support to the development work carried out by WP.4 rapporteurs, and the Customs Co-operation Council. The US Customs Service last month announced its adoption of the standards. To facilitate the transition to use of EDIFACT, the US Customs Service is to begin work on a pilot project with major importers in the USA, the European Community and ECE EDIFACT rapporteurs.

EDIFACT is structured to meet the requirements of both small and large companies. It is entirely machine- and systems-independent. EDIFACT is suitable not only for international trade transactions but also for interchange at the national level between suppliers, sub-contractors, etc.

For more information, please contact: Mr. A. Bellego, Chief, Trade Facilitation and Standardization Section, Trade Division, ECE, Palais des Nations, 1211 Geneva 10, Switzerland. (Source: ACCIS Newsletter, Vol. 5, No. 6, March 1988)

Towards a common indexing vocabulary

A proposal for a United Nations Common Indexing Vocabulary (UNCIV) will be discussed at a meeting to be held in Ottawa, Canada, from 3-5 May 1988, with joint sponsorship by ACCIS and the International Development Research Centre (IDRC). The main thrust of the UNCIV project is to work towards a merger of the Macrothesaurus, the UNBIS Thesaurus, and the World Bank Thesaurus. The resulting UN system-wide

indexing vocabulary is intended to meet an increasing need within Member States and many organizations of the United Nations system. It will be of great benefit to ACCIS, for the indexing of its inter-agency databases.

Invitees to the meeting include representatives of: the Dag Hammarskjöld Library; the Information Systems Unit of the Department of International Economic and Social Affairs (ISU/DIESA); United Nations Regional Commissions; the World Bank; the Arab League Documentation and Information Centre (ALDOC); the Development Centre of the Organization for Economic Co-operation and Development (OECD), ACCIS and IDRC. (Source: ACCIS Newsletter, Vol. 5, No. 6, March 1988)

Wanted - information on NGOs

The Secretariat is collecting information from organizations on data collections held within the United Nations system on non-governmental organizations (NGOs). This is to be entered into a referral database from which a printed directory will be produced. Questionnaires have been sent to ACCIS Focal Points, and anyone who can provide or identify NGO-related data is requested to contact the ACCIS Secretariat or the Focal Point for their organization. Address: ACCIS Secretariat, Palais des Nations, 1211 Geneva 10, Switzerland. (Source: ACCIS Newsletter, Vol. 5, No. 6, March 1988)

EC chip manufacturers welcome GATT ruling

The semiconductor industry in Europe, a longtime also-ran to the technology and market power of rival companies from Japan and the United States, presents a classic chicken-or-egg argument: Would a bigger and better semiconductor industry in Europe mean more sales for European electronics companies that need microchips for their products? Or is Europe's semiconductor industry still in a relatively embryonic stage simply because the European electronics industry is relatively small and inconsequential?

This question has long lain at the heart of heated debates over how - or whether - to spur the growth of the semiconductor industry in Europe. The issue has become less pressing, however, as a result of a GATT (General Agreement on Tariffs and Trade) ruling in late March against the 1986 US-Japan bilateral pact regarding semiconductor sales around the world.

The exact wording of the ruling has not been made public, but it reportedly strikes down the portion of the agreement aimed at limiting Japanese selling microchips at relatively low cost outside Japan or the United States.

The ruling, expected to be ratified by GATT's member council when it meets, is good news for Europe. For one thing, companies that need microchips to build computers, stereo equipment, telephone exchanges and missile guidance systems will no longer be faced with prices that have been inflated by the US-Japan pact.

The GATT ruling is also being welcomed by European chipmakers who had feared that the US-Japan agreement would keep them out of Japan's semiconductor market. "The association also believes that Japan remains obliged to ensure access to its market for foreign-based semiconductor suppliers", Andrew Procassini, GATT's president, said when the ruling was announced.

Some European companies are merging with rivals in order to ease what analysts call "fragmentation" of the semiconductor industry. Last year, for example, Plessey bought the chipmaking operations of Ferranti, another British electronics company, and France's Thomson S.A. merged its chip operations with those of Italy's SGS to create SGS-Thomson.

Plessey is also an example of a European company that has specialized, not in the all-purpose "commodity" chips mass-produced in Japan and the United States, but in application-specific semiconductors. This market for customized chips is expected to form one of the fastest growing sectors in coming years, especially in Europe.

European companies that need chips for their products have become more interested in buying from European manufacturers, because of the current world-wide shortage of memory chips.

The shortage is the result of the 1985-1986 recession in the industry; because of the downturn in demand and uncertainty over how the agreement with the US would affect future sales. Japanese chipmakers were cautious about making investments to increase capacity.

As a result, now that demand has risen for higher-density chips, Japanese manufacturers lack the capacity to keep up with it. Furthermore, the chips they do have are often sold on a priority basis to big Japanese and American companies.

As a result of the European companies' desire to be able to buy chips that are produced closer to home, a number of Japanese and American manufacturers are planning to set up plants in Europe.

Meanwhile, industry leaders in Europe believe they must compete with American and Japanese advances in semiconductor technology.

One prominent joint research venture is Megaproject, a five-year programme launched by Philips and Siemens in 1985. With financial support from the Governments of both the Netherlands and the FRG, it is aimed at developing a silicon chip with 125,000 characters of memory.

A number of manufacturers are also involved in more ambitious plans for JESSI - the Joint European Semiconductor Silicon. JESSI is being touted as Europe's answer to the much-heralded Japanese industry-government research programme, and Sematech, the six-year, $15 billion research project recently launched by leading American chip marufacturers with US Government assistance.

Earlier in April, it emerged that the main partners in the European project are disagreeing over their roles. According to reports, FRG's Siemens and SGS-Thomson are disputing the French-Italian firm's desire to participate as a full partner in the project.

Siemens executives, however, have said that Philips and Siemens, who are already partners in Megaproject, will control the actual technology development, while SGS-Thomson will be confined to work on "design and equipment".

The dispute could jeopardize the time-table for JESSI, but the potential participants - about four dozen European companies in addition to various scientific institutes - are still hopeful that the

details can be worked out before June, when a series of meetings will aim at getting the programme in operation by the end of the year. (Source: International Herald Tribune, 26 April 1988)

Modern practice in stress and vibration analysis

The objective of this conference, organized by the Stress Analysis Group of The Institute of Physics, is to bring together the active practitioners of stress and vibration analysis worldwide into a single forum. In recent years computers have become an established tool of the engineering designer and have played an increasingly prominent role in the acquisition and processing of experimental data. The current penetration of advanced numerical methods in modern industrial design and the application of signal processing for the modelling of stress and vibration problems in components and structures will form the twin themes of the meeting. Leading practitioners and researchers in stress and vibration analysis have been invited to participate in the conference which it is hoped will be co-sponsored by engineering institutions from North America, Europe and the Far East.

The focus of the conference, which will be held at the University of Liverpool from 3 to 5 April 1989, will not be on the theoretical developments but rather on the synthesis of these developments into operating computer programmes of direct interest and application to the design and modelling of engineering systems.

The meeting is designed to provide an outstanding opportunity for interaction amongst the participants. Thus, applications experts, theoretical experts and students will be given an opportunity for direct participation. The interaction will be further enhanced by the social programme which will be an integral part of the conference.

Attendance is therefore recommended for everyone who has an active interest in determining the application of modern techniques to their professional environment as well as those who are initiating research projects in stress and vibration analysis. The technical sessions will each be headed by a keynote speaker of international repute and the presented papers will be collected in a conference proceedings.

Subject areas of probable discussion within the conference include:

Numerical Methods

- Finite Element and boundary Domain Techniques. Linear stress and vibration analysis. Steady state and transient response. Geometric and material non-linearity. Plasticity and creep.

- Analytical Modal Methods. Component mode synthesis. Applications of modal analysis in design.

Experimental methods

- System identification. Estimation of parameters from experimental data. Structural modification.

- Modal Analysis. Signal processing. Industrial applications.

- Strain Gauge and Photoelastic Techniques. Advances in strain gauge technology. Applications including fracture mechanics.

- Vibration Control. Active and semi-active devices. Application of modern adaptive techniques.

For further information when available contact The Meetings Officers, The Institute of Physics, 47 Belgrave Square, London SW1X 8QX.

Low energy ion beams - 5 conferences

The Atomic Collisions in Solids Group of The Institute of Physics will be holding the fifth in the series of Low Energy Ion Beams conferences at the University of Surrey, Guildford, UK, from 3-6 April 1989.

The aim of the conference will be to bring together specialists in the fields of ion source development, beam transport, ion beam machines and the application of ion beams for the modification and analysis of solid surfaces. In this rapidly developing field ion beams and plasma deposition and etching are being deployed for damage studies, fusion research, semiconductor processing and machining, materials modification in metals and insulators and surface scattering analysis. The common thread to these important technological areas is the production and manipulation of beams and plasmas of varying properties and quality depending on their end use.

The conference programme will include coverage of the following areas:

- Ion and atom beam source technology

- Excitation, ionisation, charge transfer

- Ion optics and beam transport

- High current and large area ion beams

- Accelerators

- Ion implantation

- Ion assisted deposition and annealing

- Sputter profiling

- Microbeams

- Low energy ion beams for surface studies

- Ion and plasma etching

- Effects on ion bombarded surfaces and interfaces.

There will be an exhibition of manufacturers' equipment. (Source: News Release, November 1987)

ISDN in Europe
The Hague, The Netherlands, 25-27 April 1989

This international conference will be oriented towards an examination of the impact of Integrated Services Digital Networks (ISDNs) on all aspects of computer communications in Europe. The three-day conference is sponsored jointly by the International Council of Computer Communication (ICCC) and the International Federation for Information Processing (IFIP), and will be hosted by the Netherlands PTT.

ISDN in Europe will be held at a time when both national transitional plans and European policies for the introduction of ISDN will have matured further. Thus, the Conference provides a strategic venue for users of international data communications and providers of value-added services and computer network facilities, whether public or private.

ISDN in Europe is planned to include coverage of the following subjects:

- Business needs for ISDN
- Computer applications appropriate to ISDN
- Access to ISDN (including broadband and mobile access)
- ISDN charging structures
- Telematic and value-added services based on ISDN
- International type approval and portability of customer equipment
- Managed data networks using ISDN
- Future roles of specialized networks in the light of ISDN
- ISDN regulations - European and national policies
- ISDN evolution, including broadband plants (B-ISDN)
- Traffic patterns in ISDNs
- Security and trans-border data flow aspects
- Integration of voice and data (local- and wide-area)
- Social and economic implications of ISDNs.

The conference focus will be on developments which appear to be of special interest to professional users of the future integrated networks in Europe. The conference language is English.

ISDN in Europe is being planned by an Organizing Committee, advised by an International Advisory Committee mainly composed of European members of IFIP Technical Committee on Data Communications (TC6) and European ICCC governors, and assisted by a Programme Committee. More information about the conference can be obtained from the Secretariat, ISDN in Europe, Ms. Marijke Newman-van Aalderen, IBM Nederland N.V., Johan Huizingalaan 265, 1066 AP Amsterdam, The Netherlands, Telephone: +31 20 513 35 61.

Fourth conference on sensors and their applications

Following the successful previous conferences in this series - Manchester 1983, Southampton 1985 and Cambridge 1987 ("Eurosensors"), the fourth conference on sensors and their applications, organized by The Instrument Science and Technology Group of The Institute of Physics, will be held on 25-27 September 1989 at the University of Kent at Canterbury. As usual the event will be co-sponsored by a number of other organizations such as The Institution of Electrical Engineers, The Institution of Mechanical Engineers and The Institute of Measurement and Control.

The scope of the conference will be broadly that of the previous conferences covering all aspects of sensor research, development and applications. The programme will include plenary and parallel technical sessions together with post sessions. Workshops dealing with important topics will be a feature of the conference. A small commercial exhibition for sensor users and manufacturers is planned.

A second announcement and call for papers, to be received before 1 April 1989, will follow giving format details. Contributions on all aspects of sensors, their uses and development are welcomed.

It is expected that invited papers will be published in the Journal of Physics E: Scientific Instruments, in a special edition. Bound copies of extended abstracts of all papers will be available to attendees.

To receive further information when available write to: The Meetings Office, The Institute of Physics, 47 Belgrave Square, London SW1X 8QX. (Source: News Release, March 1988)

II. IBM DEVELOPMENTS

SiGe heterojunction bipolar transistor reported at IBM

Now some of the advantages typically associated with III-V heterojunction bipolar transistors may be possible with silicon-germanium (SiGe) transistors that work at liquid-nitrogen temperatures. Drs. Subramanian Iyer, Gary Patton, Sylvain Delage, Sandip Tiwari and Johannes Stork, from their work at IBM's Thomas J. Watson Research Center in Yorktown Heights, N.Y., reported on such SiGe transistors in a paper presented at the recent International Electron Devices Meeting.

Patton explained that pseudomorphic SiGe layers show bandgap reductions proportional to the Ge content and dependent on the strain in the layer. "This change in bandgap occurs principally in the valence band. The use of SiGe in the base of the transistor results in increased electron injection for a given doping profile, making it possible to significantly extend the performance limits of silicon bipolar technology", he said.

The collector, base and emitter layers of these transistors are fabricated using molecular beam epitaxy (MBE); all layers are deposited sequentially without breaking vacuum in the MBE system. Then, a mesa structure is fabricated using dry etching. Further processing includes low energy gallium implantation to improve the base contact resistance, low temperature oxide deposition to passivate junction sidewalls and aluminium-titanium metalization.

The doping profiles and Ge concentration of the base region are measured using secondary ion mass spectrometry (SIMS) and Rutherford backscattering spectrometry (RBS). In the experimental devices, only base width and Ge content are varied.

The effect of reducing the bandgap in the base is to increase the collector current at any given base-emitter voltage.

The significance of this experimental 77°K SiGe transistor is its advancement toward developing bipolar transistors, based on silicon technology,

that operate at more than twice the speed of today's room temperature silicon bipolar transistors.

Although encouraged by this work, the IBM researchers admit that additional advances are still necessary before such speeds can be realized in useful applications. But if this new bipolar technology proves practical, additional increases in speed may also be possible because wire interconnections between individual transistors and chips can also work faster at liquid nitrogen temperature. (Reprinted with permission from Semiconductor International Magazine, March 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, Il. USA)

New record breaking transistor created

A transistor capable of a record 113 billion switching cycles/second (113 GHz) has been created by a team of eight engineers from Cornell University and Siemens Research and Technology Laboratories (Princeton, NJ). The previous record was 80 GHz. The new device is an improvement on the modulation-doped field-effect transistor (MODEFET), which consists of a multiple-layer sandwich of silicon-doped gallium arsenide and aluminium gallium arsenide. The team precisely controlled the silicon doping in the layers to achieve optimum electronic properties. Critical regions of the transistor can be made with very few defects (scattering centres), which reduce the speed of electron flow in the structure. The device's record speed is also due to its extremely small gate (i.e. the structure that controls the flow of electrons). The technology used in the device will be used in high-speed satellite communications, spacecraft communications and radar systems.

Meanwhile, AT&T Bell Laboratories have developed a transistor that can switch current in less than one picosecond. The device is made of three strips of aluminium separated by layers of aluminium oxide a few atoms thick. The state of the transistor can change when a single electron tunnels from one aluminium strip to another. Normal transistors take much longer to operate because thousands of electrons must cross a junction to create a change in state. The new device operates only at 4K. If the temperature is higher, there is enough thermal energy to cause the electrons to cross the insulator. (Extracted from Chemical and Engineering News, 21 March 1988 and New Scientist, 24 March 1988)

High-electron mobility transistor

Fujitsu has developed a high-electron mobility transistor and a Josephson-junction processor. The devices are part of Japan's $200 million supercomputer program, and will be integrated in a 10 Gflops supercomputer. The HEMT is a multibit data register that latches four separate 9-bit input data signals and synchronizes the latched data with a clock signal. The high mobility of the HEMT architecture in tandem with a 0.5-micron gate length puts the delay between arrival of the clock signal and data output at 490 ps. The chip measures 6.1 x 6.2 mm, but some 3,335 transistors that comprise 1,137 gates are squeezed in a 2.4 x 2.4 mm area in the centre. The company's Josephson four bit-slice features niobium-aluminium oxide-niobium junctions that are temporarily stable, and are resistant to thermal fatigue. The Josephson device features 5,011 junctions making up 1,841 gates on a 5 x 5 mm chip. (Extracted from Electronics, 3 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Superconductive transistor produced

A transistor using ceramic superconductive materials that contain yttrium has been produced by T. Kobayashi, a professor at Osaka University. Although the transistor exhibited a miniscule "gain" (amplifying rate), a measure that determines transistor efficiency, Kobayashi said improving the transistor itself would elevate the amplifying rate. Computer industry sources say the transistor paves the way for development of a compact supercomputer. (Extracted from Japan Economic Journal, 9 April 1988)

IBM gets closer to making ballistic transistors practical

IBM Corporation has taken a big step towards making ballistic transistors a practical technology, but researchers at its Thomas J. Watson Research Centre say there is still a long way to go. By demonstrating ballistic-hole transistors for the first time, IBM scientists recently did what many in the physics community thought impossible. The holes are the spaces left after electrons have jumped to a new location. The problem had been that 95 per cent of them are considered too heavy and slow to charge from one gallium arsenide layer to another through a thin layer of insulation - in this case aluminium gallium arsenide - says IBM physicist Mordehai Heiblum. But by getting the right level of doping in the base material and a thin-enough layer, Heiblum was able to filter out heavier holes and still get a significant number of lighter holes to cross the insulating barrier at ballistic speed. The ballistic-hole transistor is a p-type positive transistor, and is a complement to the ballistic-electron transistor, which is n-type or negative. "Potentially this is the fastest semiconductor device type there is", he says, adding that 1-ps switching speeds are already within reach. But useful circuits are still at least five years away. (Reprinted from Electronics, 17 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Coming soon - an ECL array that's the biggest yet

Joining forces to take on the leaders in the high-speed bipolar emitter-coupled-logic marketplace, Applied Micro Circuits Corp. of San Diego, California, and Plessey Semiconductors Ltd., Swindon, UK, have come up with the first-ever 16,000-gate bipolar ECL array and the first bipolar array to use a channelless architecture. The array also sports a spectacular 100-ps-per-gate delay with a worst-case power consumption per chip of no more than 16 W. In addition to the use of the channelless architecture, key elements in achieving this amazing combination of speed, power and density are the use of an advanced 0.6-μm trenched-emitter-bipolar process from Plessey and the use of a three-level sea-of-cells methodology incorporating proprietary circuit techniques developed by AMCC to minimize delay as well as increase gate utilization to 95 per cent.

To date, the highest-density bipolar ECL arrays available reach 12,000 to 13,000 gates and then only with the use of four levels of metal interconnect. Moreover, gate delays on present high-density ECL arrays range from about 300 to 400 ps, but at the cost of higher power. To achieve comparable power dissipations, present arrays run slower - in the range of 400 to 600 ps.

The 16,000-gate Q20160 is the flagship of a new Q20000 family. Initial devices in the family will

also include the 8,000-gate Q20080 and the 1,500-gate Q20015. Test devices ranging in density from 200 to 500 gates have already been fabricated with first silicon on first members of the 1,500- to 16,000-gate family expected in June. Sampling is expected to begin in December and volume production will start in the first quarter of 1989. (Reprinted from Electronics, 12 May 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

VLSI Technology's arrays cut gate delay

VLSI Technology Inc.'s VGT200 family of 1.5-μm CMOS gate arrays is using a shopping basket full of architectural changes to cut gate delays to 560 ps - 36 per cent faster than its present VTG100 series. The new architecture also boosts the maximum number of usable gates from 30,000 to 65,000, compared with the San Jose, California, company's VTG100 series, and boosts the upper limit on input/output gates from 272 to 353. The architectural enhancements include elimination of source and drain resistance, reduced polysilicon resistance and gate capacitance, and a fivefold reduction in the source/drain diffusion capacitance. The VTG200 family will be available in April. Prices have not been announced. The next step for the company will be to move the architecture to its 1-μm three-level-metal CMOS process. (Reprinted from Electronics, 17 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Highest gate density array produced

LSI Logic has introduced a new series of biCMOS gate arrays that feature the highest gate density of any on the market, and also feature a drive current of 24 mA for each output. Up to three outputs can be paralleled to provide a drive current of 24 mA. LSI is using its 50,000-gate Compacted Array CMOS technology for the new family, merging this technology with a new I/O structure. The new I/O architecture, which exploits the drive provided by the bipolar transistors, allows ASIC designers to achieve a true system bus-interface feature for their devices. The LDD10000 Direct Drive Array family, with 50,000 usable gates - a 10-fold increase vs. other biCMOS ASICS - is well suited to the design of system-level VLSI ASIC applications. The new family comprises six master slices, with which designs of 8,000-45,000 gates can be implemented. The largest members of the family support 256 signals. (Extracted from Electronics, 2 April 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Fujitsu introduces new gate arrays

The limits are being stretched again in the drive to combine high density and high gate utilization in CMOS gate arrays. Jumping ahead of its competitors, Fujitsu Microelectronics Inc. of Santa Clara, California, has developed a new family of 1.25-μm CMOS gate arrays that combines three levels of metal interconnection with what it calls a sea of basic cells to achieve densities as high as 100,000 gates and gate utilization rates as high as 80 to 90 per cent.

Designated the AU series, the new family ranges from the 30,000-gate C-30KAU to the 100,000-gate 100KAU, and depending on application and the mix of memory and logic, Fujitsu specifies a basic cell-utilization rate of up to 75 per cent. However, when calculated the industry way, gate-utilization rates translate into about 80 per cent for a pure logic implementation and to about 90 per cent for a mixed memory and logic design. By comparison most present three level implementations using standard sea-of-gates implementations are capable of gate-utilization rates of no more than 80 per cent for designs that mix memory and logic. The Fujitsu arrays are capable of implementing embedded static random-access memory blocks of up to 16 Kbits, with access times of 20 ns. On embedded read-only memory with densities up to 64 Kbits, access time is only 25 ns.

Key to achieving such high densities without sacrificing either speed or high gate utilization is the use of a proprietary basic gate cell consisting of four normal-size transistors, two n-channel and two p-channel, similar to a standard gate, to which four more smaller n-channel transistors, optimized for memory, have been added. The exact size of both sets of transistors is proprietary, but the smaller transistors are no more than a tenth the size of normal-size n-channel transistors and a twentieth the size of the p-channel devices. This arrangement results in a basic cell about 5 to 10 per cent larger than typical two-input NAND or NOR gates used in most arrays, but the larger size is more than offset by the increased gate utilization in a typical design.

Each device in the family consists of an array of anywhere from 30,000 to 100,000 gates. Unlike present arrays, they have no dedicated wiring channel regions in between the columns or rows - dedicated channels restrict the way arrays can be connected and sometimes result in a long interconnecting line, which cuts down speed. Basic cells are spread throughout the chip, except in the input/output region, with wiring channels that can be allocated freely in discrete units wherever necessary. In addition, logic and memory blocks can be placed in arbitrary positions anywhere in the array.

Fujitsu's design contrasts with other approaches to uncommitted-gate-array design, which are generally based on basic gate structures optimized for logic rather than memory design - even though many applications require a mix of the two, especially at higher densities. A typical uncommitted gate array consists of four transistor gates suitable for implementing such basic logic functions as two-input NAND or NOR gates. It is usually implemented with basic cell columns separated by dedicated wiring channels between them. The disadvantage of this approach is that to implement a memory cell requires the use of anywhere from two to eight gates. While this is acceptable for small density memories below 4 Kbits, at higher densities - anywhere from 16 to 64 Kbits - the arrangement results in considerable wasted space being consumed by the unused channel regions between gates.

In the Fujitsu arrays, designers can take advantage of higher-density layout alternatives not available in other arrays. Indicative of the higher efficiency of the new approach is the complexity and gate density of some typical test designs using a two-level-metal, 1.8-μm CMOS 30,000-gate implementation of the same basic architecture. For example, a 16-by-16 multiplier with a 32-bit block-carry lookahead added, a 16-by-16 array, and 32-bit input and output registers can be achieved with as few as 10 basic gate cells with a gate density of about 320 gates per mm^2, equivalent to that of many standard cell layouts. The multiplier array alone, the company says, contains about 3,000

gates, has a gate density of about 230 gates/per mm^2, about 1.5 times that of a conventional uncommitted gate array. A 16-bit-by-64-word eight-transistor SRAM has a density of 230 bits/mm^2, two to three times that of conventional arrays. A 16-bit-by-256-word ROM, on the other hand, has a bit density of 1,900 bits/mm^2, about five times higher than conventional gate arrays. In the triple-metal CMOS implementation of the same architecture, gate densities and complexities should be at least doubled. (Reprinted from Electronics, 31 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Feature-based CAD/CAM

Feature-based CAD/CAM is an emerging automation technology that may allow engineering and production groups to speak the same computer language. Firms issuing CAD/CAM products that are partly feature-based include Parametric Technology (Waltham, MA), ICAD (Cambridge, MA), McDermott's Wisdom Unit (Chagrin Falls, OH), and Automation Technology Products (Campbell, CA). Feature-based CAD/CAM brings design, now confined to lines and arcs, into drilled holes, grooves, flanges and slots. Covering all produced parts, there are likely to be thousands of features by which parts can ultimately be told apart. Features and expert systems in the future could work together to produce process plans from designs automatically. A feature-based system will allow producers and designers to talk the same language, for a feature can be drawn and produced. A chief goal of feature-based CAD/CAM is to bring about cost savings by lowering the design-output team needed to move a product from concept to finished item. (Extracted from Metalworking News, 4 April 1988)

Super high-purity tantalum oxide material for producing 16 Mbit DRAMS

Vacuum Metallurgical Co. Ltd., has developed a super high-purity tantalum oxide target material for use as a new capacitance insulation film material for 16 Mbit DRAMs. The company has begun distributing samples of the material to leading domestic semiconductor manufacturers.

The tantalum oxide (tantalum pentoxide) target material features a purity level of 99.9999 per cent (6N) and impurities, such as sodium and potassium, have been suppressed to 0.03 ppm. Its uranium content, which generates alpha rays, has been lowered to as little as 0.5 ppb, thereby improving the material's reliability significantly. The insulation film is formed on the element by the sputtering method.

Capacitance insulation film material requires excellent insulation properties and must also lend itself readily to electric charging. Thus, quartz which features these characteristics has been used primarily as the material up till now. However, quartz is difficult to machine into extra thin sheets and therefore is unsuitable for producing 16 Mbit DRAMs which are fabricated in minute dimensions.

The dielectric constant of the tantalum oxide material developed this time, which represents the material's charge storage capacity, is as high as about six times that of quartz. It can be produced into an extra-thin insulation film of less than 0.1 micron. This enables the engraving of printed circuit line widths for 16 Mbit DRAMs, but still provides a charge storage capacity exceeding the necessary charge of over 200 femt coulomb. Thus signals can be transmitted back and forth without any mis-operation to substantially improve the 16 Mbit DRAM's reliability. Further information available from: Vacuum Metallurgical Co., Ltd., 11-2 Kyobashi 1-chome, Chuo-ku, Tokyo, Tel.: 03-562-3831, Telex: 252-2675 VMC J. (Source: JETRO, April 1988)

Super high-speed TTL I/O SRAM

Hitachi Ltd. has commercialized and started distributing samples of three series of transistor-transistor logic (TTL) I/O static random access memories (SRAMs) (x1 and x4) featuring the super high-speed maximum address access time of 15 ns/20 ns for 64 Kbit devices.

As a recent trend, high-speed SRAMs have become very popular in the minicomputer field, work stations and other high-speed systems as cash memory and data buffer elements. At the present stage, the 64-Kbit high-speed SRAMs with an access time of 25 ns feature the highest standards in the trade. Meanwhile, the performance of central processing units (CPUs) is being improved steadily and high-speed memories have become necessary for use in linkage with CPUs in order to design these CPUs with ample performance.

To meet these needs, the company applied its 1.3-micron Hi-Bi CMOS technology to come out with miniature elements and, at the same time, applied its circuitry technology in order to secure an ample working margin to cope with high-speed elements as well as the noises generated by high-speed operations. They then succeeded in commercializing SRAMs by featuring a remarkable address access time of 15 ns/20 ns. This now enables a substantial acceleration of the cash systems of minicomputers and work stations as well as conspicuous performance improvement in various kinds of equipment.

The newly commercialized series of TTL I/O SRAMs are the 64 Kbit x 1, 15 n2/20 ns, 300 mil Dip "HM6787HP"; the 16 Kbit x 4, 15 ns/20 ns, 300 mil Dip "HM6788HP"; and the 16 Kbit x 4,300 mil SOJ "HM6789HJP" with OE. Further details available from: Hitachi Ltd., Public Relations Secretary's Office, 6, Kanda-Surugadai 4-chome, Tokyo, Tel.: 03-258-1111, Telex: J22395. (Source: JETRO, April 1988)

The role of magnetics as the way to make ultra-large-scale ICs

The 64-Mbit dynamic random-access memory and other ultra-large-scale integrated circuits are still a decade and two generations of products away, but process engineers now have to start making the hard decisions on how to build them. A debate is starting to heat up on the role of magnetics and dry etch in the submicron process. Proponents say it is the best method to shape and smooth the deep trenches and holes needed for such chips; opponents say magnets are overrated. What will do it, they say, are dramatic breakthroughs in chemical etching.

Applied Materials Inc. of Santa Clara, California, has introduced a multiple-chamber electromagnetically enhanced plasma system. Called the Precision 5000 Etch, the equipment marries low-pressure reactive-ion technology to a unique electromagnetic system; this system, say company officials, enhances plasma properties at wafer surfaces for smooth sides in deep holes and

fine-line trenches. Such profiles are necessary for advanced three-dimensional circuits.

Using single-crystal wafers, the system has etched trenches with rounded bottoms and 21:1 aspect ratios: 0.2-μm wide by 4.2-μm deep. That feat should allow the industry to make 64-Mbit dynamic RAMs and dense logic chips well into the next century. The system is initially aimed at filling two key applications: excavating small, deep holes for posthole storage capacitors in DRAMs, and grooving fine-line trenches to isolate adjacent devices on dense bipolar or biCMOS chips.

Analysts believe Applied Material's market prowess in dry etch can swing confidence behind the technique as a way to control plasma ionization and dissociation efficiencies. Backers of magnetically enhanced plasma systems say wafer-etch rates jump dramatically and dc bias voltages can be reduced to lower the risk of damage to silicon crystals from ion bombardment. Higher grade material can result in faster circuits.

Managers at Applied Materials report the benefits of magnetics in plasma discharges have been demonstrated simply by switching the feature off. In addition, Applied Materials has seen etch rates increase by a half to one order of magnitude with the electromagnets switched on.

Applied Materials has gone the electromagnetics route in the 5000 Etch to create a volumetric field at the wafer surface. This magnetic field is rotated slowly by the system's controllers to produce uniform vectors. While the vectors change direction in the process, the scalar value of the field remains constant over the whole plasma discharge. The system has also been designed for multiple wafer-processing chambers that can run up to four wafers in parallel for high throughputs, and uses low-pressure reactive-ion etch, known as RIE (under 100 milliTorr) for anisotropic etching to achieve tight control of uniformity and critical dimensions. (Reprinted from Electronics, 28 April 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Hydrogen plasma etching of Si:H films

The etching rate of amorphous silicon films in a hydrogen plasma is reported to be about an order of magnitude greater than for microcrystalline silicon films. The work, by members of the faculty of electrical engineering, Technical University of Delft, the Netherlands, is believed to be the first reported work on the etching processes of amorphous and microcrystalline silicon using hydrogen as the etching gas over a range of conditions.

The amorphous films, 1.5 μm thick, were grown by rf glow discharge at 36 mW/cm^2 rf power level, 100 sccm flow rate 0.3 Torr pressure and 250°C substrate temperature. For etching, hydrogen flow rate was 100 sccm, pressure was 0.3 Torr, substrate temperatures ranged from 40-250°C, and rf power levels were 194-824 mW/cm^2.

Temperature dependence of the etch rate was weak in these films, indicating that surface reactions play a minor role. Etch rate was determined by pre- and post-weighing and optical measurements as 2-4 Å/sec. Refractive index decreased after etching, indicating that the film surface was saturated with hydrogen and the network of the films became less dense. Thus, the first step in the etching process is the formation of a hydrogen rich top surface.

The microcrystalline films, 1 μm thick, were grown using 2 per cent silane in hydrogen at 100 sccm flow rate, 0.3 Torr pressure, 523 K substrate temperature and 310 mW/cm^2 rf power level. Microcrystalline structure was determined by X-ray diffraction. Etching at 482 mW/cm^2 produced 0.3 Å/sec etch rate.

Typically, the etch rate for microcrystalline films was an order of magnitude lower than the amorphous films. About 90 per cent of microcrystalline material consisted of microcrystals (100 Å diameter), embedded in an amorphous network. This network is preferentially etched at a higher rate, so the total etch rate is much lower than that of the amorphous material. The microcrystalline material etching rate is very low and is comparable to that of monocrystalline silicon in a hydrogen plasma (about 0.2 Å/sec).

During growth of the films, both amorphous and microcrystalline silicon are formed. Etching of the amorphous phase is essential for the formation of microcrystalline Si:H films. Since the microcrystalline phase is also etched, a high etching rate of the crystalline phase would result in a film formed of crystals smaller than the detection limit of X-ray diffraction or TEM. The etching rate of both phases can be increased by raising the rf power level. (Reprinted with permission from Semiconductor International Magazine, March 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, Il. USA)

New etching process

A new gaseous anhydrous HF/water vapour process etches native oxide films at ambient temperatures and pressure without plasmas and without the need for a subsequent rinse/dry. It is an isotropic etch with properties similar to a wet HF process. Particles can be controlled to levels that are known to obtain hydrophobic surfaces using high purity gases and components. Metallic impurities are not added nor significantly reduced by this process because volatile species are not formed at this temperature. Applications are where there is a need to remove the native oxide of silicon and where it is presently done with diluted HF dip and a rinse/dry. (Extracted from Solid State, March 1988)

High-temperature superconductors

General Electric has made an important breakthrough to apply high-temperature superconductors to the field of microelectronics. A superconducting film was put on a silicon chip, which worked at a temperature higher than liquid nitrogen. Superconducting films composed of yttrium-barium-copper oxides on both silicon and silicon oxide were produced. This breakthrough was important because of silicon's dominance in the microelectronics field. The problem of combining superconductors with silicon was solved by using zirconia as a buffer layer between the superconducting film and the silicon. The buffer serves as an effective diffusion barrier, preventing the elements from intermingling during the annealing process. (Extracted from American Metal Market, 23 March 1988)

Bismuth group of superconductors

Bismuth-based high-temperature superconductors differ from rare-earth superconductors in physical properties. The new materials, which are made of sheets of copper and oxygen alternating with sheets of bismuth and oxygen, break off in sheets rather

like mica. The new materials also include strontium and calcium. DuPont has made about 300 materials of bismuth, strontium, calcium, copper and oxygen. The new superconductors start to lose resistance at 116K, and resistance reaches zero at 91K. Minor variations in crystal structure may determine which of the many compounds are superconductors and which are not. The newer supercoductors are much easier to produce than the first generation of copper oxide/rare earth superconductors, but there is still a long way to go before the superconductors are commercialized.

Researchers at Fujitsu Laboratories say they have discovered a way of making the superconductor into a film one-third of a micrometre thick - the thickness of a single crystal. The superconductor is a compound of bismuth, strontium, calcium, copper and oxygen.

The fact that it has been spun into a single-crystal film raises hopes that the new ceramic materials can be used in microelectronic components for a new generation of very large-scale integrated circuits.

It is important for the material to be single-crystal because in a single crystal, the material can carry a higher current before it loses its superconductivity.

The bismuth group of superconductors are a Japanese discovery. They were announced earlier this year by Hiroshi Maeda and his team at the Institute of Metallic Material Research at Tsukuba. Bismuth compounds are potentially easier to turn into practical devices than the first high-temperature superconductors which caused a scientific sensation when they were discovered at IBM's Zurich research laboratories.

The Fujitsu researchers said that they used newly developed equipment to grow the crystal. The company plans to use bismuth superconductors in the race to build a superconducting quantum interference device (SQUID) capable of measuring tiny changes in magnetic fields. This SQUID could well be important as a very sensitive switch in some integrated circuit device of the future. It could also be used in magnetic resonance imaging. (This first appeared in "New Scientist", London, 4 and 28 April 1988, the weekly review of science and technology)

US effort to commercialize high-temperature superconductor technology

The Defense Advanced Research Projects Agency (DARPA) and the Office of Naval Research have established a joint programme to commercialize high-temperature superconductor technology. The two organizations will spend $20 million in 1988 on development of large- and small-scale electronic devices based on the new superconductors. US government spending on high-temperature superconductor research will total $78 million in FY ending 30 September 1988. Under contract to DARPA, Allied Signal will develop a superconducting wire for the winding of a 3-hp, 2,000 HZ ac motor. Completion is expected to be in March 1990. General Atomics has produced a ceramic wire made of 1-2-3 (yttrium, barium and copper) material in which nearly 100 per cent of the grains are aligned. The University of California (Los Angeles) is developing a wire coating process in which an aqueous solution of yttrium, barium nitrate and copper acetate is mixed with methacrylic acid and polymerized at 100-150°C and platinum wire is drawn through the polymer, enabling a coating to form. The wire is then pulled through a heater at 900°C. (Extracted from Chemical Engineering, 14 March 1988)

High-temperature superconductor developed in joint effort

A new high-temperature superconductor has been jointly developed by US and Japanese scientists. The superconductor is made of bismuth, aluminium, strontium, calcium and copper oxide. The bismuth superconductor is stable, easily reproducible and achieves superconductivity at 254 degrees below zero Fahrenheit. Until this discovery, researchers have concentrated on a family of ceramics, which included expensive rare earth elements. A key breakthrough happened when these ceramics were found to achieve superconductivity at temperatures high enough to allow them to be cooled with nitrogen instead of much more expensive liquid helium. (Extracted from Metalworking News, 1 February 1988)

Fibres fashioned from hot superconductors

Scientists at Stanford University in California are the first to make fibres out of the recently discovered high-temperature superconductors.

The team grew the fibres, which are between a quarter and one millimetre in diameter, to study the properties of materials. Their first fibres are only four centimetres long, but they hint that they may be able to produce long superconducting "wires".

The superconducting fibres, made from bismuth-strontium-calcium-copper oxide, reached zero resistance at 85 K. Robert S. Feigelson and his colleagues at Stanford say the fibre can carry at least 30,000 amperes per square centimetre at 4 K.

The Stanford group grew its bismuth fibres with a laser heating technique developed for optical materials. A beam from an infrared carbon-dioxide laser melts the top of a rod of the superconducting ceramic. The molten superconductor is crystallized on a "seed" crystal, which is then pulled to form the fibre. (This first appeared in "New Scientist", London, 9 June 1988, the weekly review of science and technology)

A cooler thin-film process

Researchers have developed a thin-film deposition process to make superconductors in a single step, at the relatively low temperature of 400°C (rather than 800°C). The investigators, at the State University of New York (SUNY), Buffalo, believe that the work means superconductors can be incorporated into semiconductor devices without damaging the semiconductors, which cannot survive temperatures above about 500°C. That inability to withstand high temperatures, has been "a major bottleneck" in developing semiconductor devices that utilize superconductors.

In the SUNY process, an ultraviolet (UV) laser irradiates an yttrium-barium-copper oxide target in a vacuum chamber, driving off a stream of atoms and ions. Those particles pass through an ionized oxygen atmosphere, or plasma, and move toward a silicon or strontium titanate substrate, where they form a micron-thick film. The substrate is heated to about 400°C. An yttrium-barium-copper oxide thin film deposited on strontium titanate becomes superconducting when cooled to about 85 K (-188°C), and shows a critical current at 80 K (-193°C) of 100,000 amperes/sq. cm.

One application of hybrid semiconductor-superconductor devices is in computers which could be used as interconnections between transistors or other devices on a chip. Computers would be faster and smaller, because superconductors carry electricity rapidly without generating the heat conventional conductors do.

Meanwhile researchers at Sandia National Laboratories in New Mexico have produced thin films of a thallium-based material that they say becomes superconducting at 97 K - the highest transition temperature yet recorded for thin-film superconductors. The films can carry high current densities of 110 A/cm^2 when cooled to 77 K in liquid nitrogen, a key factor if they are ever to be used in electronic applications. (Extracted from Chemical Week, 27 April 1988 and Electronics, 12 May 1988)

Zero resistance in Japanese research

Japanese researchers have developed a technique for making the highest-temperature phase of the new bismuth superconductors which yields stable samples of quite high purity. The bismuth-strontium-calcium-copper oxide superconductors discovered by Hiroshi Maeda of Japan's National Research Institute of Metals a few months ago are now believed to have three phases with zero-resistance temperatures (T_c) of about 80 K, 90 K and 105 K. But it has been impossible to prepare pure samples of the highest- temperature phase, and the T_c of mixed-phase samples containing the high-T_c phase tends to decrease when an electric current is passed through the samples.

Now a joint group of researchers at Kyoto and Okayama universities claim to have prepared 85-90 per cent pure samples of the 105-K phase by incorporating small amounts of lead in the samples and by using metal oxalates rather than oxides in the preparation process. The samples show zero resistance at 107 K and maintain this transition temperature even when currents of 2-200 mA per cm^2 are repeatedly applied. (Extracted from Nature, Vol. 333, 19 May 1988)

High-critical-temperature superconductor made from glass

Japanese researchers at the Technological University of Nagaoka have succeeded in making glass from the ingredients of various bismuth-based high-temperature superconductors. Subsequent annealing at high temperature (820°C) converts the glass into a superconductor. The development could be used in the manufacture of very fine superconducting wires.

The glasses are prepared by melting various combinations of bismuth, calcium, strontium, aluminium, lead and copper oxides at 1,150°C. The melts are then quenched by pouring onto an iron plate and quickly pressing them into a slab.

Samples of $Bi_{1.5}CaSrCu_{2x}$ and $Bi_{1.5}Ca_{1.5}SrCu_2O_x$ prepared by the technique exhibit perfect glass behaviour - they are completely amorphous and when slowly heated between 400 and 500°C show an endothermic glass transition followed by exothermic crystallization. Melt-quenched samples containing lead or aluminium are also glass-like, but X-ray diffraction reveals small crystalline peaks.

Similar melt-quenching methods have already been applied to the preparation of high-T_c yttrium-based copper oxides but the melt-quenched yttrium ceramics are microcrystalline. This is the first report of glass, and the Nagaoka researchers call their new materials "high-T_c superconducting glass-ceramics".

The Nagaoka team has found that rapid cooling in liquid nitrogen after annealing produces superconductors with the highest transition temperatures. The highest T_c obtained so far is 78 K for $BiAl_{0.3}CaSrCu_2O_x$.

The great advantage of the glass ceramics is that they can easily be formed into various shapes. Professor Kazumasu Matusita, who heads the research, says that it should be possible to draw the glass out into very fine wires using the same technology that has been developed to make optical fibres. (Source: Nature, Vol. 332, 14 April 1988)

MBE grows semiconductor films

Molecular beam epitaxy can be used to grow single crystal semiconductor films, according to W.T. Moore of the National Research Council of Canada. MBE is a vacuum evaporation technique in which beams of atoms or molecules evaporating from high-purity sources are shot at a substrate. MBE can provide excellent control of individual layer thickness, and can be used with III-V, group IV or group II-VI semiconductors. The purity of the films created with MBE is limited by the purity of the source materials, not by the vacuum conditions. This makes MBE an expensive system. The substrates must be perfectly free of contamination. The vacuum system creates pressures of less than 0.00000000005 torr. MBE may use solid, liquid or gas source materials. MBE can produce GaAs films with unintentional dopant concentrations of 10 ppb. (Extracted from Canadian Chemical News, March 1988)

Superconducting film applied on silicon

Scientists at the General Electric's Research and Development Centre have achieved an important milestone in the effort to apply high-temperature superconductors to the field of microelectronics.

GE's advance is the first reported successful operation at liquid nitrogen temperatures of a superconducting film applied on silicon - the basic building block of nearly all microchips.

Samples produced by the GE researchers went superconducting (i.e., lost all resistance to the flow of electric current) at temperatures as high as -310°F - ten degrees above that of liquid nitrogen.

The attractiveness of liquid nitrogen as a coolant for superconductors is that it is relatively inexpensive, expanding potential applications. By contrast, superconductors that operate below liquid nitrogen temperature must be cooled by liquid helium (-459°F), which costs a hundred times more to produce and maintain.

The GE team succeeded in producing superconducting films, of yttrium-barium-copper oxide materials, on both silicon and silicon dioxide (an insulating layer on the silicon). In so doing, they had to solve problems with "interdiffusion" that had plagued previous efforts involving these substrates.

According to the researchers, Dr. Antonio Mogro-Campero and Larry G. Turner, the troublesome interdiffusion occurs during the high-temperature annealing process - which is when the crystal structure required for superconductivity evolves.

The key to the GE success is the use of a zirconia buffer layer between the silicon or silicon dioxide substrate and the superconducting film on top of it. This buffer serves as an effective diffusion barrier, preventing the elements from intermingling during the annealing process.

While practical applications for high-temperature superconductors in electronics have yet to be demonstrated, there are many possibilities. For example, chips might employ superconducting lines to interconnect their different functions, dramatically speeding up the rate at which they could process data. This could result in impressive improvements in the performance of high-frequency and high-speed circuits.

The GE researchers employed electron beam evaporation to deposit both the zirconia buffer and the superconducting film onto the silicon and silicon dioxide. This process, performed in a special controlled-atmosphere chamber, employs the intense heat of an electron beam to vaporize the materials to be deposited. The vapours then condense in ultra-thin layers on the substrate, which is affixed to the ceiling of the chamber.

In their experiments, the GE researchers first evaporation-deposited a 0.4-micron-thick layer of zirconia onto their test specimens - 1/4 x 3/4-inch rectangles of silicon or silicon dioxide cut from standard single-crystal silicon wafers. Then, the metallic constituents of the superconducting film were deposited.

The deposition was performed employing a low-pressure oxygen-free atmosphere for one set of experiments. Copper was deposited first, then barium, and then yttrium, and the sequence was repeated six times to create an 18-layer "stack" of the three basic ingredients having a total thickness of 0.6 to 0.7 microns. To complete the process, the specimens were annealed in oxygen at 1,470-1,650°F (800-900°C) for five minutes and then cooled at a rate of 250°F (120°C)/hour.

In a second set of experiments barium fluoride was substituted for barium, and an oxygen pressure of 0.00001 torr was maintained during the sequential evaporation process. After the multi-layer superconducting film was deposited, the samples were annealed at 1,560°F (850°C) in oxygen and water vapour and then cooled, in oxygen only, in a cycle that included a half-hour interval at 1,020°F (550°C).

The best results - the samples that went superconducting at -310°F - were obtained in the second set of experiments, the ones where barium fluoride was substituted for barium as an evaporation source. These specimens had a superconducting thin film with atomic ratios of 1.8:1 for barium to yttrium and 3.0:1 for copper to yttrium. They were annealed for 3 1/2 hours at 1,560°F (850°C). (Source: Company News Release, 17 March 1988)

Low temperature superconductor

NEC (Japan) has come up with a 1K-bit RAM using Josephson junction devices. It is made of a niobium-based superconductor that operates at a temperature of -269°C(4K). Liquid helium is used as a coolant. The device has an access time of 570 ps, much less than lead-based superconducting memories. NEC says it is the first case where access time has been below 1 ns. According to a company spokesman, the new device will facilitate the development of basic technology for a high-speed Josephson computer. NEC will spend the next two to three years working on a special processor for just such a machine. (Extracted from Japan Economic Journal, 27 February 1988)

Potential reality of superconductivity devices

High-temperature superconducting devices may be a reality by the 21st century. The high-temperature superconductors could potentially allow zero-loss power generation, transmission, levitated trains and new medical instruments. Strategic analysis says that the market for all superconductors will be $1.8 billion by the year 2005, up six times from 1986 levels. This includes current technology for niobium-titanium wires. Still, the superconductors must overcome inadequate current density, brittleness and contamination. Room-temperature superconductors might also be developed someday. Connect technology must also be developed if the superconductors are to be connected to other equipment. US industry may be hampered in the development of superconducting devices by its emphasis on product research, rather than process research. Although there are at least 42 US companies involved in superconductor research, the lead in this area is probably held by Japan, where the Government is spearheading the effort. (Extracted from Chemical Business, February 1988)

BiCMOS choice for mainstream semiconductor devices

BiCMOS is becoming the technology of choice for mainstream semiconductor devices, including interface logic, SRAMs, mixed analog/digital circuits, gate arrays, and even high-performance microprocessors and DRAMs. Proponents of biCMOS feel it will eventually drive all functions in the next decade, with critics saying it will be used only for niche applications. BiCMOS is a process that integrates bipolar and CMOS transistors on the same die. The number of firms offering biCMOS VLSI digital and analog devices has doubled in less than one year.

Players on the digital side include: Fujitsu, Hitachi, Motorola, Saratoga, Applied Micro Circuits, Barvon Technology, Cypress Semiconductor, Integrated Device Technology, LSI Logic, National Semiconductor, NEC, Signetics, Texas Instruments, and Toshiba. Players on the analog side include: Analog Devices, GE/RCA, SGS-Thomson Microelectronics Semiconductor, and Sprague Semiconductor. The market for biCMOS is currently worth $50 million, according to Integrated Circuit Engineering, and the total potential market will hit $2.7 billion by 1991, but biCMOS is expected to penetrate only 10-20 per cent of this total available market, or $270 million-$540 million. BiCMOS is expected to dominate in high-speed applications where power dissipation is very important. (Extracted from Electronics, 2 April 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Intel's plan in embedded chips

After months of industry speculation and rumour, Intel Corp. is revealing its strategic response to the burgeoning market for embedded controllers, the rapidly increasing popularity of reduced-instruction- set computer processors, and the growth of flash non-volatile reprogrammable memory technology. Intel plans to expand its role

in the embedded-control marketplace by introducing three product families that offer designers processors geared to application niches.

Intel is introducing the 80376 family to expand its position in a still-growing market for embedded controllers based upon general-purpose processors such as its 16-bit 80186 and 80286, as well as the 32-bit 80386. A scaled-down version of the 80386 central processing unit, the 80376 is paired with a new multifunction peripheral circuit, the 82370, which itself is a derivative of a similar device, the 82380, used with the 80386.

The two devices in the 80376/82370 family are designed to serve an existing market that accounts for practically all of Intel's more than 2,000 design wins with the 80186. About 20 to 30 per cent of the general-purpose 80286 and 80386 have reached the same users. In the 80376, the user gets the same instruction set and internal architecture as he does with the 32-bit 80386. In addition, the user obtains the same 2.5- to 3-million-instruction/s performance. What has been eliminated internally are the programming modes not needed in embedded applications.

The second product offering, the 80960 family of RISC-like 32-bit embedded processors, includes three devices that perform up to 7.5 Mips and feature a burst rate of 20 Mips at a 20-MHz clock rate. The 80960 family is designed to be the high-end follow-up to the company's 8- and 16-bit embedded microcontrollers.

In the 80960 series, Intel is attempting to meld elements of RISC architecture, application-specific designs, and its know-how as a major supplier of single-chip microcontrollers. The family's first devices include the 20-MHz 80960KA and 80960KB and the 80960MC. In addition to RISC design features, 80960KA and 80960KB use an instruction mix that also reflects the requirements of embedded-processing applications.

Unusual for a RISC chip, the 80960KB incorporates an on-chip 32-bit floating-point unit. Also on-board the 80960KB is a 512-byte instruction cache, a register cache consisting of four sets of 16 local registers, a 32-bit internal data bus, a proprietary 32-bit external local burst bus, and a 32-bit address bus that allows up to 4 gigabytes of linear address space. The 80960MC also has an on-chip 32-bit floating-point unit. In addition, the 8096MC incorporates features such as virtual-memory management and support for multi-processor systems that Intel says will be useful in many military embedded-control applications.

Devices to follow the 80960KB will extend both upward to higher speeds and possibly wide word sizes as well as downward into applications areas now served by Intel's existing microcontroller families. In addition, the follow-ups will diversify with a proliferation of application- and user-specific processors.

The third part of the plan is Intel's new flash EEPROM family, which includes a 28-pin 8-K-by-8-bit device, the 57F64, as well as two 32-K-by-8-bit devices: the 32-pin 27F256 and the 28-pin 28F256. They are the glue to Intel's embedded strategy. The new family of flash EEPROMs was designed to offer low-cost, in-system, alterable-code capability for storing the large programs required by many advanced embedded applications. In embedded applications such as graphics, robotics, and real-time processing, the devices will aid rapid prototyping and updates in the field. Like the other two product groups, the flash ESPROMs are fabricated using the company's 1.5 μm CHMOS IIe process.

Computer discs spin off into history

Within the next ten years the mechanical disc-drives found on nearly all computers could be replaced by data-storing microchips. Until recently, solid-state memories had just a few specialized uses. They are now finding their way into a broader variety of machines, including some consumer products such as hand-held computers. Several big computer companies are designing new products around the capabilities of memory chips. IBM, for one, thinks that much of the future belongs to solid-state memory. But how will the revolution start?

The most popular memory chips today are "dynamic random access memories" (DRAMs). The best of them can hold one megabit; last year Toshiba, IBM, and some other companies unveiled prototype 4-megabit DRAMs that could be in production later this year; 16-megabit chips should be around in 1991. Today's DRAMs are used mostly as temporary memories to hold programs and data that have been fed in from a disc. Such memory vanishes when a computer is switched off. It has to be loaded back into the computer from its permanent home on a disc each time the computer is used.

Forgetful DRAMs cannot replace discs. Picture a DRAM as an array of tiny storage batteries or "capacitors". Data are stored by charging some of these capacitors; the charged and uncharged states correspond to the 1s and 0s of binary code. This way of keeping information is unstable because the charges leak away spontaneously. DRAMs are therefore "volatile" and must be fitted with external power sources that refresh the charges thousands of times each second.

Also, when smaller DRAMs are made (as they will have to be), the problem of leakage will become worse. At the smallest scales, the location of an electrical charge can be fixed only within a margin of probability. Electrons can hop between neighbouring capacitors, or smear their charges between several at once. So stored data become hopelessly blurred.

A new sort of chip may help solve some of these problems. Two small companies, Ramtron in Colorado Springs, Colorado, and Krysalis in Albuquerque, New Mexico, have come up with "ferro-electric random access memories" which are naturally non-volatile and lend themselves to compact designs. They take advantage of the curious properties of a ceramic material, lead zirconate titanate (PZT).

To understand how ferro-electric RAMS work, imagine that the capacitors on a DRAM have been replaced or supplemented by tiny bar magnets. Binary data can be written on this magnet array by swivelling the magnets so that either their "north" or "south" poles are upright; the orientations correspond to the charged and uncharged states of capacitors on a DRAM.

Ferro-electric RAMs get close to this sort of arrangement by laying a thin film of PZT over a silicon chip. Crystalline elements in the PZT have

opposite charges at each end that can be reversed by an electric field. Because the orientations - north or south - of these tiny "bar magnets" are fixed and intrinsic, they do not weaken or vary over time. Binary data encoded in the electrical orientations of a PZT layer will last.

These ferro-electric RAMs work in various ways: Ramtron's use ferro-electric storage as a back-up for information stored on standard DRAM chips; Krysalis's chips use ferro-electric storage exclusively. Permanent memory is not their only advantage over DRAMs. Ferro-electric components produce signals that are ten times as strong as those of DRAM capacitors, so it is easier to make them smaller without garbling stored data. And because the PZT layer is resistant to heat and radiation damage, ferro-electric RAMs should be specially useful for satellites and military hardware. They can be made by conventional methods of semiconductor manufacturing. (Source: The Economist, 14 May 1988)

New switching and memory cells

Canon has developed experimental switching and memory cells using Langmuir-Blodgett polyimide thin film, held between gold and aluminium electrodes. According to Canon, the film can control a flow of electric current, responding to specific electric signals. Langmuir-Blodgett film is expected to be used in future, high-speed microchip elements. (Extracted from Japan Economic Journal, 9 April 1988)

New DSP engine with floating point

Motorola has introduced floating-point versions of its fixed-point DSP56000 series. The new DSP96001 and DSP96002 implement the IEEE 754-1985 standard for single- and double-precision floating-point operations. The new chips integrate floating point and integer operations on a single chip. The 13.33 Mips 96001 performs a 1,024-point complex FFT in less than two ms; the 96002 chip requires less than 1.5 ms. The 96001 and 96002 differ in their bus structures: The 96001 has one each of address, control and data buses, while the 96002 has two address, control and data buses. Also, the on-chip peripherals are removed from the 96002, with a bus controller and a second external address switch taking their place. The 96001 features three on-chip peripherals, namely serial communication interface, synchronous serial interface, and 32-bit host interface. And unlike the original 56000 series, the new chips' architecture features eight 32-bit-wide buses (three address and five data), expanded data ALU, dual-channel DMA controller, and higher-density RAMs and ROMs. The new chips were fabricated in Motorola's 1.2-micron double-metal HCMOS process. (Extracted from Electronics, 17 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Largest GaAs device

Texas Instruments has demonstrated a 12,895-gate, 32-b RISC GaAs microprocessor, which may be the largest GaAs device ever made. The company hopes to have the chip running at 100 MHz by the end of 1988, and is working on a 200 MHz, 200 Mips model, which it hopes to develop by the end of 1989. The chip's design is based on DARPA's MIPS (Microprocessor without Interlocked Pipe Stages) core instruction set model. (Extracted from Micro-Waves, March 1988)

Automatic test generation saves hundreds of hours

Chip designers using Silicon Compiler Systems Inc.'s Genesil tool kit can save hundreds of hours per design with a new option that creates test-vector programs automatically. To manage the automation process, the company's software engineers had to overcome a big hurdle - testing sequential circuits without manually adding special scan paths. The San Jose, California, company's Automatic Test Generation option does it by modelling sequential circuits as a series of combinatorial circuits. In addition, optimizing algorithms automatically compress test vectors so they can be used to test many faults. In practice, the designer specifies a desired level of fault coverage and runs the ATG option periodically to see if all functional elements of the design can be tested within the fault-coverage target. If adequate fault coverage is not achieved by the automated process, the designer can still manually add seed vectors or scan paths to improve coverage. (Reprinted from Electronics, 17 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Cache memory on one programmable chip

Cache-controller logic has usually been implemented with discrete circuits and cache-memory array in high-speed static random-access memory. The move to higher levels of cache integration with cache controllers was started by chip makers such as Intel Corp. and NEC Corp. Now Advanced Micro Devices Inc. is going to the next logical step: integrating an entire 8-Kbyte cache memory - controller logic and SRAM array - onto a single chip.

Scheduled for sampling in the fourth quarter of 1988, the Am29062 Integrated Cache Unit is a cache-memory component for the Austin, Texas, company's Am29000 reduced-instruction-set microprocessor. Like the other members of the Am29000 RISC family, it is implemented in high-density CMOS technology. The Am29062 employs sophisticated mainframe-style caching mechanisms; several features match it to high-performance applications. The ICU includes user-programmable caching parameters, extensive multiprocessor support, compatibility with very high clock speeds, and complete support for the Am29000's pipelined, burst-mode bus.

The Am29062 can be designed into systems as an instruction cache, a data cache, or a combined instruction and data cache. Many RISC systems based on the 29000 main processor will employ two of the chips - one for data and one for instructions. The Am29000 central processing unit has separate instruction and data buses, so a two-cache system can be built with no multiplexing or demultiplexing logic. In addition, if cache arrays larger than 8 Kbytes are required, multiple ICUs can be cascaded together.

The new ICU's 8-Kbyte cache is organized in a two-way, set-associative fashion, instead of the simpler direct-mapped organization used in other controllers. The AMD device has a 16-byte block (also called line) size, instead of the conventional 4-byte block. This reduces transfers back and forth between the processor and the 29062, and increases the number of hits, or correct matches of data.

The Am29062 was designed for maximum flexibility by implementing cache mechanisms, but

the system programmer can specify the policies. One example is the cache-write strategy. For write accesses to a cache, a strategy must be chosen for updating main memory even when a cache hit occurs. (On reads, of course, main memory is unaffected when a hit occurs). There are two main cache-hit write strategies: write-through or copy-back. The Am29062 permits either protocol to be used on cache writes. The Am29062 is compatible with the Am29000 CPU chip's bus interface and can be connected directly to it. Also, the Am29062 is designed to work with future CPU versions, up to a clock rate of 40-to-50 MHz. The CPU has three 32-bit buses - address, data, and instructions. The Am29062 connects to all three buses, and supports all of the Am29000 bus access protocols (single access, pipelined access, and burst-mode access). (Reprinted from Electronics, 28 April 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

New technology developed to produce DRAMs

Fujitsu has developed technology that can be used to make 0.3-micron-diameter electrodes for future 64-Mbit dynamic random access memories. The new chemical vapour deposition process uses disilane, a spontaneously flammable compound of silicon and hydrogen, to help form metal into submicron electrodes. Production of memory chips with capacity of over 16 Mbits requires technology capable of completely filling 0.5-micron-dia holes with aluminium. The new process allows aluminium to form at 80°C against over 300°C for conventional hydrogen vapour processes. (Extracted from Japan Economic Journal, 9 April 1988)

A megabit of memory swims in a 72K sea-of-gates

Toshiba Corp. is coming to the aid of designers who want a lot of semicustom logic and a big block of memory on a single chip for applications in graphics and speech processing. The Tokyo firm has developed an experimental chip that combines a 72-K sea-of-gates array with 1 Mbit of memory that can be configured as either pseudo-static random-access memory or virtually static RAM. The gate array has a remarkably low propagation delay of only 400 ns for a 2-input NAND gate with a fanout of two, and 2-mm of output metal interconnections. Configured as 128-K-by-8 bits, the memory has an access time of 60 ns in the pseudo-static mode and 120 ns in the virtually-static mode. The large chip - it measures 14.95 by 14.95 mm - has 1-μm features. Toshiba described the chip at the mid-May Custom Integrated Circuits Conference in New York, and says it could reach the market in 1989. (Reprinted from Electronics, 26 May 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Chip set cuts power supply design time

A set of power-system chips that will simplify the design of advanced off-line switched-mode power supplies and motor controls is on the horizon. The packaged components of the new chip set from International Rectifier Corp. will reduce both system design time and board space. The El Segundo, California, company's new devices transform design of switching power supplies and motor controls into a system design consisting mainly of interfacing circuit blocks rather than the rigorous circuit design required with discrete components. This will let engineers concentrate more on overall system issues instead of the problems of discrete power designs, thereby cutting design time by 50 to 60 per cent.

The chip set comprises two power integrated circuits - the brand-new IR2110 half-bridge driver and the IR2100 buck converter bias supply, plus power and current-sensing MOS FETs, diodes, and rectifiers. The IR2110 is a dual-channel, monolithic, high-speed driver with floating high-side outputs up to 500 V and ground-referenced 10- to 20-V low-side outputs. Designed to interface with low-level logic control signals, it can drive a pair of n-channel, high-voltage power MOS FETs or isolated-gate bipolar transistors in half-bridge or dual-forward converter topologies.

Compatible with CMOS logic levels, the high- and low-side inputs use Schmitt triggers to provide high noise immunity and accept inputs with slow rise times. The two output drivers are independent and use identical low cross-conduction totem-pole output stages, each capable of sinking 2-A and 1-A sourcing. Interface to the floating high-side output stage is accomplished by a high-voltage level-shifting circuit operated in the latching, pulsed-current mode for low quiescent power dissipation and high dV/dt immunity.

The special level shifter is needed since the upper power device of a half wave bridge has a gate potential that can vary from ground to the value of the input dc voltage supply. The level shifter provides a floating voltage referenced to the source terminal of the upper power switch for driving its gate.

The other power IC in the combination is the IR2100 buck converter bias supply designed to be operated off-line. The chip accepts dc inputs between 100 and 500 V, operates at 150 kHz, and provides a fixed 15-V regulated output with a load current up to 500 mA. The IR2100 will be available in either TO-220 or TO-3 packages and the IR2110 will be available in a 14-pin Plastic dual in-line package, small outline packages, or a sidebrazed ceramic DIP. The IR2100 will cost $9.10 each and the IR2110 $7.00 each in 1,000-piece quantities. Both parts will become available in the last quarter of this year. The remaining chips in the set are the IR current-sensing HEXSense power MOS FETs, and HEX FET power MOS FETs. (Reprinted from Electronics, 28 April 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

AT&T builds brain chips

Researchers at AT&T Bell Laboratories have taken another step towards building computer systems that can mimic the human brain. They have developed chips that copy the way the brain's neurons process a massive amount of data.

The new microchips are the latest in a series of experimental "associative memory" chips designed and tested at AT&T.

At a very simple level, chips of this type function as electronic neurons, copying the way the brain's 100 billion neurons simultaneously process massive amounts of data.

One chip described by Hans Peter Graf, a research physicist with the company, measuring 6.7 millimetres square, consists of roughly 75,000 transistors and an array of 54 simple processors. The processors are connected through a network of resistive coupling elements, and the connections are, in turn, programmable. Graf says that the researchers expect a 10 to 100-fold increase in performance with the chips.

The neural network chips are destined for research within AT&T. (This first appeared in New Scientist, London, 12 May 1988, the weekly review of science and technology)

New GaAs chip

A new gallium arsenide chip that is almost 10,000 times faster than a standard 16 MHz microprocessor has been developed by researchers at Stanford University. The researchers estimated that the new chip is running no less than 100 billion cycles per second. Its performance could not be accurately measured with the researchers' measuring equipment. The chip is a non-linear transmission line that can be used in place of step recovery diodes in electronic measuring instruments. (Extracted from Computing, 3 March 1988)

IBM builds fastest silicon chip ever

IBM Corp. scientists claim they have built the world's fastest silicon circuits using n-MOS transistors designed with 0.1-μm geometries. The chips, which are still in the experimental stage, operate only when cooled in a bath of liquid nitrogen. They can switch on or off in 13 ps - 75 billion times per second. IBM says its next challenge will be to build more complex CMOS chips using the same electron-beam lithography developed for these first chips. (Reprinted from Electronics, 14 April 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Stepper can automatically keep itself in line

One problem chip makers have always had when expanding a product from a single pilot line to full-fledged production is precisely calibrating stepper systems. Typically, external metrology tools are used to determine the precision of each machine, which are then adjusted manually to accommodate differences in magnification or alignment. If improperly calibrated, large discrepancies may arise between parts produced on different machines. ASM Lithography Inc. claims to have solved the problem by integrating a metrology subsystem into its PAS 2500 line of wafer steppers. Thanks to the high-precision optics used in the new steppers to produce submicron line widths, the company was able to make the stepper its own metrology tool, using two-point through-the- lens alignment directly referenced to the reticle. A set of 23 parameters determines misalignment, and servo controls automatically move the stepper into line. (Reprinted from Electronics, 26 May 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Siemens gate arrays let designers mix CML and ECL on same chip

Designers of high-speed semicustom logic can now mix current-mode and emitter-coupled logic on the same chip, thanks to a new family of gate arrays from Siemens Semicustom Products of Santa Clara, California. The 1,500-, 2,500-, 7,000-, and 10,000-gate SH100E arrays team the high-density, low-power advantages of CML in circuit paths where speed is not crucial with ECL's raw speed in the circuit's critical paths. The arrays also offer a range of power-programming options for each gate, allowing further tailoring of the power/speed trade-offs appropriate for each area of a design. The input/output circuits can be customized individually to TTL or ECL levels, as well. At full clip, gate delays are 120 ps, or 90 ps when differential drive is used. The arrays will be available in the third quarter, but the Oxis IIIH process used for the arrays is in production. Design manuals are available now. (Reprinted from Electronics, 12 May 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

New low-power, high-speed chips

Hitachi (Japan) has developed a new series of low-power, high-speed 1M-bit SRAMs, called HM628128. The chips have a 131,072-word by 8-bit internal organization. Four types will be available, with access times of 120 ns, 100 ns, 85 ns and 70 ns. They use up to 70 milli-amp of power for the minimum cycle time, and 2 milli-amp (or 100 micro-amp at the most) during standby. To produce the HM628128, Hitachi used the same 0.8 micron CMOS technology it used for its high-speed HM62256 series 256K-bit SRAMs. It will begin offering samples of the new chips in spring 1988. (Extracted from Asian Wall Street Journal, 22 February 1988)

National tests the waters with a complex RISC design

Responding to the slew of reduced-instruction-set-computer chips springing from Silicon Valley, National Semiconductor Corp. is circulating preliminary specifications on its own RISC chip. The NS32764, however, is not a pure RISC design. Instead, it is a complex-reduced-instruction-set processor - or Crisp. While retaining compatibility with other members of National's 32000 family, it will also incorporate most, if not all, of the features used in more traditional RISC architectures to reduce the number of cycles per instruction from the current 2.5 to between 1.5 and 2. Current RISC processors, which are theoretically able to achieve one cycle per instruction, are in the 1.25- to 2-cycles-per- instruction range. Depending on the response to the current specifications and the number of redesigns required, the Crisp chip will debut some time in late 1989. (Reprinted from Electronics, 26 May 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

RISC gains, but its role in mainstream IS is still small

All of the hoopla around the latest RISC (reduced instruction set computing) microprocessor announcements suggests that the debate over computer design techniques is splitting the computer community into rival camps. One side is pushing for the adoption of RISC, while the other is urging the community to stay with CISC (complex instruction set computing).

The recent disclosure of support for RISC by industry veterans such as AT&T, Data General Corp., Stratus Computer Inc., Tandem Computers Inc., and Unisys has placed it on centre stage among future systems.

Despite the recent commotion, the impact of RISC designs on commercial systems has yet to be seen. After all, microprocessors today are the stuff of pcs and workstations, not large-scale systems.

Successors - RISC or otherwise - logically would show up first in desktop and a limited number of larger systems. Does RISC have implications beyond the desktop and the engineering and scientific world of Unix computers?

Because of the heavy merchandising of RISC, many take an affirmative answer for granted. RISC advocates claim the technology will apply equally to developing desktop and mainframe systems.

In March, rival MIPS Computer Systems Inc., Sunnyvale, California, formed a subsidiary to recruit applications software that will be portable across any computer built using its R3000 RISC chip.

The existence of the software subsidiary as well as 88Open points out a major lack in the RISC world: software.

By and large, systems designed using the emerging chips are entering the market with Unix operating systems. And Unix is still a fractious world, as the breakaway efforts of Apollo Computer Inc., DEC, HP, and IBM to resist an AT&T Unix standard show.

Fighting against more established rivals, the major RISC chip vendors targeting systems builders - Sun, MIPS, and Motorola Corp. - are all pledging allegiance to Unix System V release 4, but it does not mean that applications developed for a Sun system will run on a MIPS- or Motorola-based system. Each version of Unix System V will be binary-compatible within that chip family only.

None the less, because of the new Motorola chip, users will be able to mix and match computers from a wider variety of vendors than is possible these days.

One area in which RISC-based systems are being used for commercial data processing is in small businesses. It is IBM's 32-bit RT PC that has become the machine of choice for organizations with fewer than 50 employees. (Reprinted with permission of DATAMATION[r] (c), 1 June 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

New VLSI memory chip with an instantaneous erasing function

Toshiba Corporation has recently begun marketing a new type of VLSI memory chip known as the 256-Kbit "flash" EEPROM, so named because it can electrically erase all stored data instantaneously.

There are two types of erasable PROMs (programmable read-only memory): A UV-E (ultraviolet- erasable) PROM, and an EE (electronically-erasable) PROM. UV-EPROMs are simpler in memory cell structure and are less expensive than EEPROMs. However, UV-EPROMs require special erasure equipment and erasure time can take as long as 20 minutes. On the other hand, EEPROMs can instantly erase and rewrite information and will retain memory even after power is cut off.

Faced with these two choices, customers have expressed a strong demand for a new type of erasable PROM which is not only as easy to use as a conventional EEPROM, but less expensive. Toshiba engineers have responded to these needs by developing a new type of electronically erasable PROM based on a conventional UV-EPROM cell structure. They did this by adding a third layer, called an "erase gate", to the double-layer transistor found in the UV-EPROM cell. By applying a high voltage across this gate, all stored information can instantly be erased. This new EEPROM is designed to be fully compatible with 256-Kbit UV-EPROMs, and since it can be packaged in plastics, as opposed to the conventional UV-EPROMs which must be packaged in ceramics, there is an additional reduction in costs.

Erasable PROMs are mainly used to store system programs for personal computers, office automation equipment, robots, and numerical control (NC) machines. In addition to these applications, Toshiba's innovative EEPROMs will be used for a variety of new applications as well, such as memory cards and floppy disc systems.

This new product, the TMM 2825p, has a memory organization of 32K words by 8 bits and is packed in a 28 pin plastic DIP (dual inline package). It is based on the JEDEC pin placement standard, common in the US and other countries, and is pin-compatible with JEDEC-based 256-Kbit EPROMs. Access time is 200 nanoseconds (ns), with 250 ns and 300 ns versions also available. Further details available from: Toshiba Corporation, Public Communications Office, 1-1, Shibaura 1-chome, Minato-ku, Tokyo, Tel.: 03-457-2100, Telex: J22587. (Source: JETRO, February 1988)

High-density flash EEPROMs

The market is about to be hit with a wave of new electrically erasable non-volatile memory chips that may soon match the bit density of dynamic random-access memories. This emerging breed of programmable read-only memories - built with single-transistor cells and called flash EEPROMs - could pack 64 Mbits on a chip by the turn of the century.

At least a half dozen silicon merchants are working on flash EEPROMs, using a variety of cell layouts. First out of the gate will be a CMOS 512-Kbit flash EEPROM, from Seeq Technology Inc. in San Jose, California. Right on Seeq's heels is Intel Corp., which has developed what executives say is a significant "process trick" for its flash parts that allows it to use the same design as in its ultraviolet erasable PROMs.

Intel believes that by the year 2000, flash memories will emerge as the low-cost, high-density champion memory. If they are right, flash EEPROMs could radically change system architectures, making it possible to build computers with all-solid-state memory systems. The flash EEPROMs would be the only direct-access mass storage in the system, replacing disk drives feeding DRAM-based main memory.

Flash memories are a marriage of conventional EEPROM and EPROM technologies, offering the high densities of EPROM thanks to one-transistor cells. The write operation is like that of EPROMs, using hot-electron injection. The erase operation borrows the mechanism of floating-gate EEPROMs - electrical erasure by cold-electron tunneling.

Most full-featured EEPROMs have two-transistor cells and can reprogram individual bytes one at a time. In contrast, the entire contents of flash-EEPROM arrays are erased quickly and simultaneously. The flash memory trades selective-erase capabilities for space-saving single-transistor cells.

"Flash" also describes the way the new memory's market segment is expected to grow, surging from near nothing today to over $1 billion in the early 1990s. The flash movement has become so explosive that market researcher Dataquest Inc., San Jose,

California, is waiting for key product unveilings before it will venture any formal forecasts of the business's growth.

The potential density of EEPROMs is what has got everyone excited. DRAMs are hitting a density barrier. It is getting harder and harder to reduce the space needed for the capacitors that store charge in each cell to retain data. Many flash-memory proponents agree. They see nothing but problems for DRAM makers trying to push the density of their parts in coming years.

Most observers also agree, though, that flash parts will not threaten DRAMs right away. Nor will they cut quickly into EEPROM sales. Right now they pose a real threat to EPROMs. Because of their high cost, conventional EEPROMs did not, as some thought they would, push EPROMs out of the market. Flash EEPROMs, however, could succeed where full featured EEPROMs failed.

Two styles of flash memories are being developed by most suppliers. One is aimed at EPROM sockets, the other at price-sensitive EEPROM jobs that do not require byte erasure. Seeq is working on products in both styles. (Reprinted from Electronics, 3 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Expert sees GaAs-on-Si problems being solved

Although several problems remain with depositing gallium arsenide (GaAs) on silicon (Si), this technology is evolving rapidly, according to Dr. Sakai, of the Nagoya Institute of Technology in Japan.

When GaAs is deposited on Si wafers it combines the mechanical and thermal advantages of Si with the solid state advantages of GaAs, such as high mobility and electron saturation velocity. Another major consideration is that GaAs-Si wafers are completely compatible with standard wafer processing equipment.

"Although 4-in. diameter bulk gallium arsenide is now under development, the crystal perfection and uniformity of these wafers is still questionable", said Sakai. On the other hand, he noted one specific example where researchers in Japan have had reasonable success growing GaAs on 8-in. diameter Si wafers using an MOCVD reactor capable of a 39 wafer load.

In his report to the Semicon/Korea conference, Sakai reviewed the progress that has been made in addressing the three difficulties of growing GaAs on Si, namely the 4 per cent lattice mismatch, the formation of antiphase disorders (caused by growth between monoatomic and biatomic crystals) and the thermal stress from the difference in thermal expansion coefficients of GaAs and Si.

"The so-called strained layer superlattice (SLS) has proved to be effective in reducing dislocations caused by lattice mismatch", said Sakai. In this method a close (0.4 per cent) lattice matched layer of gallium phosphide (GaP) is grown on the Si followed by two stages of SLS consisting of GaP/GaAsP and GaAsP/GaAs layers.

"Thermal annealing during or after GaAs growth on Si has also been demonstrated as effective in reducing defects", noted Sakai.

"However, the widely accepted method is now periodic thermal cycling during GaAs growth. By optimizing the number of the thermal cycles, the distance between the layer grown during heat cycle and the GaAs-Si interface and the layer thickness grown in the heat cycle, about one order of magnitude reduction in defect density has been demonstrated", said Sakai.

Research has also shown that antiphase disorder can be avoided by using (100)-Si substrates with a small off-angle to the crystal orientation. "If the direction of the off-angle is not equal to or equivalent directions, antiphase free GaAs can be grown on Si", he says.

Thermal stress in GaAs on Si has been a major problem "About two and one-half times difference in thermal expansion coefficients of gallium arsenide and silicon, and about a 600°C temperature drop after the growth produces about 2×10^9 dyne/cm^2 tensile stress in gallium arsenide", said Sakai.

"This stress problem has not drawn much attention until recently. As an example of one solution, we have demonstrated that the thermal stress can be reduced by depositing GaAs on prestressed (by bending) silicon wafers. The thermal stress is simply cancelled by the mechanical stress in the wafers", said Sakai.

The potential applications for GaAs on Si include solar cells, laser diodes and FETs - all great commercial markets. In one example, engineers at Texas Instruments have demonstrated a 1K SRAM using GaAs grown on Si by MBE.

"The results at Texas Instruments show that this device is a promising application for GaAs on Si. Clearly this field is moving foward rapidly", concluded Sakai. (Reprinted with permission from Semiconductor International Magazine, March 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, Il. USA)

The eight-inch wafer

The problems of working with very large, 8-in. wafers and the accelerating move from in-line semiconductor production to islands of automation will be major topics for discussion at Semicon West starting 24 May in San Mateo, California.

At a session called "Beyond six-inch wafer technology", one of the six papers to be presented will predict that the early movement to large wafers will be for production of dynamic random-access memories, where large wafer sizes will reduce costs and increase productivity. That is the conclusion of a study by Robert E. McGeary, director of semiconductor equipment at Dataquest Inc., the San Jose, California, market research firm. He also says suppliers of application-specific integrated circuits may have to participate in the movement to large wafers, depending on how quickly their foundries utilize them. However, the Dataquest study shows that 8-in. (200-mm) wafers will achieve only minor market penetration even by 1991. Their adoption will be inhibited by the large capital investment required, coupled with the reluctance to abandon current capacity.

Nevertheless, the technology has its believers. Prasad Nevrekar and Alan Levine of

Ultratech Stepper Inc., Santa Clara, California, in their analysis of step-and-repeat lithography requirements for 200-mm wafer processing, say that the advent of large chip sizes will hasten the movement to 200-mm wafers. For example, at the projected chip sizes of the 16- and 64-Mbit DRAMs, the usable area of a 125-mm wafer will only be around 60 per cent; while 80 per cent of the area of a 200-mm wafer should be usable.

For successful production of 150-mm and larger wafers, Nevrekar and Levine recommend the use of a photolithography tool with site-by-site alignment, site-by-site focusing, and site-by-site leveling to yield tighter registration tolerances, better critical-dimension control, and improved productivity. They add that a 1:1 lens with broadband spectral correction nearly eliminates the effect of standing waves and provides extremely uniform imaging over large chips and wafer sizes.

Perhaps no one can testify with more authority on the problems of starting up in 8-in. wafer production than IBM Corp. Its experience with the introduction of 200-mm wafer production to the IBM General Technology Division, Essex Junction, Vt., began in 1984.

At that time, no vendor was capable of supplying 200-mm wafers, so IBM's silicon manufacturing products group in East Fishkill, N.Y., was asked to develop and supply them. Initial processing was begun on the first delivered wafers in May 1984 while an on-site feasibility line was being constructed.

By 1985, the feasibility line was producing 64-Kbit RAMs to demonstrate parametric control and some defect learning on the 200-mm format. By 1986, the feasibility line was converted to the 1-Mbit process and the initial production tool set was defined for the manufacturing line. Manufacturing tool installation and debugging began in January 1987, followed by engineering wafer starts in June. Normal production commenced in January 1988.

The actual facility was built into an existing structure adjacent to a 125-mm line. The new line is a modified vertical laminar-flow facility capable of manufacturing two generations of product and piloting a third with some required upgrade. There was considerable focus on cutting contamination for the site, tools, and facility. For example, gases of the highest purity available were used along with low- particulate chemicals. Where it was consistent with tool architecture, through-the-wall installations were built. To hold down the introduction of tool-based particulates, certain equipments were required to be single-wafer units with manual cassette-to-cassette- transfer while others used robotics for wafer handling.

A major effort by both IBM and its vendors was required for debugging this added automation. In many cases, the level of software complexity had been underestimated. Fixing these problems delayed the learning process needed to mature the 1-Mbit memory line. To circumvent this problem, machines were run in a semiautomatic mode and the feasibility line was left in place longer than planned to gain experience on the new process. (Reprinted from Electronics, 26 May 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Graphics machine stresses interactivity

The GS1000 graphics supercomputer from Stellar Computer, Inc. has made its official debut. The system combines on a desktop the power of a minisupercomputer with high-performance real-time 3-d graphics - for a price of about $100,000.

The system executes more than 20 million instructions per second and can perform as many as 40 million double-precision floating-point operations per second. In the graphics realm, the important numbers are its ability to draw 500,000 3-d vectors per second and display 150,000 Gouraud-shaded triangles per second. That parlay gives the GS1000 computational performance equal to or better than that of early minisupercomputers combined with graphics performance that tops today's best work stations.

The GS1000's multiple-processor architecture hinges on a superwide 512-bit data path. More than half of 61 high-density CMOS application-specific integrated circuits implemented in the system are found in the extra wide data paths. Another key feature is the multistream processor, which has four full internal streams or instruction paths and consists of a three-chip set. On top of its graphics performance, the system executes more than 20 million instructions per second and performs up to 40 million double-precision floating-point operations per second - computational performance that is equal to or better than that of early minisupercomputers. The GS1000 is targeted at applications in mechanical design and engineering, molecular modeling, computational fluid dynamics, and computer animation.

The ASICs, architecture, and vectorizing compiler combine to give the GS1000 its heady performance numbers. The GS1000's high-density ASIC devices, which add up to 2 million gates, were developed and fabricated for Stellar by LSI Logic Corp., Milpitas, California. The ASIC density ranges from about 15,000 to 55,000 gates. Each chip is housed in a 300-pin ceramic package. The system delivers 18 to 20 megaflops in a 300-by-300 double-precision floating-point Linpack array benchmark, which compares favourably with two first-generation midrange supercomputers from Alliant Computer Systems Corp. and Convex Computer Corp. Alliant's FX/8, with four processors, performs 12 megaflops and the single-processor Convex C-120 does 15 megaflops. The Stellar system's 100-by-100 all-Fortran Linpack benchmark is 8.6 megaflops, compared with 6 megaflops for both the just-introduced Apollo Computer Co. series 10000 and the Ardent Computer Corp.'s Titan.

Stellar's innovative design approach is embodied in the GS1000 hardware; especially in the 512-bit-wide data path, the overall architecture, and the multistream multiprocessor. Most high-performance computers have data-path widths no greater than 64 bits. The 512-bit width is like a superhighway between the elements in the GS1000. The data path functions as an interconnect to perform switching, multiplexing, and demultiplexing. They also manage the transfer of data between system segments with disparate-width data paths. The pathways to main and cache memories are 512 bits, while the link between the data path and instruction processor in the multistream processor, for example, is 96 bits. In all, 32 of

the CMOS ASICs - all of the same design - are devoted to the data path. (Reprinted from Electronics, 17 March 1988. (c) 1988, McGraw-Hill Inc., all rights reserved)

New supercomputer on the way

Evans & Sutherland expects to launch a new supercomputer later this year. The graphics, modeling, and simulation systems manufacturer formally announced the creation of a computer division to develop and market the supercomputer. Employing a moderately parallel architecture that links together computational units that themselves have the power of minisupercomputers, the company is aiming for a supercomputer with the highest performance available for simulation and modeling. Molecular modeling, the company says, would be a major application area. The supercomputer will be for general purpose, interactive use, with graphics tightly integrated. A fully configured supercomputer, the company claims, will provide the equivalent power of more than 60 IBM 3090 computers, the high end of the IBM line, and the company expects that the price, which will likely range from $3 million to $8 million, will make complex modeling and simulation affordable for a whole new class of users and applications. (Source: Chemical and Engineering News, 18 April 1988, p. 16)

Card multiplexes five high-speed work stations on 64-Kbit/s phone line

Up to five high-speed printers, graphics work stations, and other bandwidth-hungry computer equipment can now run simultaneously at full speed over a single 64-Kbit/s phone line thanks to Symplex Communications Corp.'s NE-64 interface card. More than a simple multiplexer, the card lets users leverage the Ann Arbor, Mich., company's 4:1 data-compression technology introduced last year in its Datamizer II SDC-5664A. Each NE-64 supports an input channel running at 56 Kbits/s or 64 Kbits/s, and the NE-64 can be mixed with other Symplex cards for lower-speed devices. A maximum of four devices can be supported on a 56-Kbit/s line and five devices on a 64-Kbit/s line. The NE-64 costs $7,950 in single-unit quantities and is available 90 days after receipt of order. The SDC-5664A sells for $3,500. (Reprinted from Electronics, 17 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

X-ray resist material allows rapid exposure of fine structures

An important milestone in the FRG's national X-ray lithography project has been reached: Frankfurt-based chemicals-producer Hoechst AG has developed an X-ray resist material that allows chips to be made with structures down to 0.3 μm. The new resist - Hoechst declines to reveal its composition - boasts a sensitivity so high that it cuts X-ray exposure times down to about one minute, from the one hour or so common for conventional resists. The fine structures should enable chip makers to produce 64-Mbit memories and other high-density devices, the goal of Europe's Jessi venture. (Reprinted from Electronics, 17 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

New approach to parallel processing

A new approach to parallel processing has been developed by researchers at Sandia National Laboratories. An array of 1,024 processors can thus be used to compete with much more expensive supercomputers. The conventional wisdom, embodied in Amdahl's Law, has been that using multiple processors could increase computing speed no more than 50-100 times, no matter how many processors were linked, but the new computer developed at Sandia has increased speed 1,000 times by using the 1,024 processors. The technique has been used on just a few problems which were well suited to being broken up into discrete segments. It remains to be seen if the technique can be applied to more complex problems, such as are found in aerodynamics or weapons design.

E.H. Barsis of Sandia, however, points out that the problems that have been parallelized were not thought to be parallelizable. A great deal of work is required to reorganize each class of problems into the proper format, but once that has been done, the technique can easily be applied to other problems in the same category. The Sandia researchers used an Ncube/ten computer made by Ncube. Each of the 1,024 processors is as powerful as a minicomputer. The presumed limit on the speed of parallel processing was based on the theory that some computations in any problem must be done serially, and each operation in the series must wait until the preceding computation is completed. The Sandia researchers say that restructuring the problems can often allow greater and greater proportions to be computed simultaneously. The use of parallel processors increases the need for communication between processors. (Extracted from New York Times News, 15 March 1988)

Ultra high-speed divider

Oki Electric Industry (Japan) has used gallium arsenide to make an ultra high-speed, 1/8th frequency divider that functions at 14.4 GHz. The device could lead to more highly advanced communications equipment and more sensitive instruments for measuring frequency. It has gates only 0.5 micron in size. It derives its speed from the use of flip-flop logic circuits that were themselves developed from direct- coupled FETs. (Extracted from Asian Wall Street Journal, 22 February 1988)

New aluminium alloys for computer discs

Kobe Steel (Japan) has unveiled two new aluminium alloys for hard memory computer discs. The new AD series alloys were made in a new plant designed to produce 100,000 blanks and substrates per month for use in magnetic discs. Kobe said the AD-3 and AD-5 alloys are designed to meet the need for hard memory discs with higher memory capacities to parallel the trend towards smaller, more powerful computers. The AD-5 alloy can be used for computer discs that can store four times as much data than discs made from customary high-purity aluminium alloys. They also have smaller intermetallic compounds than customary disc materials with the intermetallic compounds dispersed all over the alloys. (Extracted from American Metals Market, 16 March 1988)

Grooved boards challenge conventional PC boards

Since the rigid printed-circuit board first appeared, the standard board interconnection geometry has been based on a planar trace with a rectangular cross section, but as geometry gets finer, planar traces often cannot handle the growing use of surface- mounted components and the higher

power densities of today's board assemblies - the fine lines do not have the current-carrying capacity.

Now engineers at Dimensional Circuits Corp. in San Diego have come up with a moulded circuit board using a new, three-dimensional trace geometry that overcomes the disadvantages of conventional geometry. It does so by combining rectangular grooves that are moulded into the board or substrate surface with a U-shaped cross section. The technology is implemented in the latest platable high-temperature thermoplastics. The combination means circuitry can be manufactured with high interconnect density and good current-carrying capacity in a form that allows self-location of component leads.

Dimensional Circuits' new plastic boards, by contrast, can be designed as replacement parts, which do not require significant changes in a customer's manufacturing equipment or technique, and because they are flat, the tooling cost is considerably lower as only the grooves have to be tooled and simpler moulding techniques can be used.

This new type of circuit trace has been developed and tested as a design option for special applications, particularly in surface-mount technology and power electronics. It uses the third dimension - depth, in the form of subsurface, vertical sidewalls into the substrate - to provide unique properties with notable implications for circuit designers and manufacturing personnel in tackling prevailing electrical and mechanical challenges.

The technology offers two major features. First, the deep, plated, U-shaped grooves - typically 5 mils wide and 15 mils deep - that are used as traces can contain significantly more conductive material, by an order of magnitude or more, with no increase in the area of the board surface. Second, the technology provides a fixturing/self-locating effect when fine- pitch component leads are inserted into the grooves for assembly and soldering. In addition, the same technique that allows Dimensional Circuits to mould the narrow grooves can also be used to mould recessed cavities that can house entire devices, such as passive components.

Other merits of the new moulded dimensional circuits are their precise tolerancing of package/ circuit features such as pads, holes, and especially the metal lines in grooves - ±0.001 in. is possible. Also, traces cannot short by "whisker" growth, since all metal is below the surface. (Reprinted from Electronics, 26 May 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Client/server computing

Client/server computing has laid the foundation for several new software programs and has become a favoured phrase in the industry. Late last year, Forrester Research predicted that "the industry is about to shift to a new processing model which we call 'client/server computing'". At International Data Corp.'s industry briefing this spring, 1988 was declared the "Year of the Server".

Client/server computing calls for one machine to run the processing-intensive part of an application. This server is connected through a local area network to workstations that handle desktop tasks, such as the user interface. Requiring a multitasking operating system such as OS/2, the client/server model allows the server's processing power and data stored on it to be shared among users.

Database management is one application area in which client/server software products - such as SQL Server, which was developed by Sybase - have been introduced. In addition to DBMSs, there are several application areas in which client/server programs will proliferate. Document handling, group scheduling, group project management, and electronic mail are all good candidates for client/server computing. (Reprinted with permission of DATAMATION[r] magazine (c), 15 April 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Study investigates wafer processing without a clean room

If the OASIS objectives are realized, the next generation of ICs could be processed by personnel working in an environment similar to today's office building. The goal of the experiment, being carried out at the National Semiconductor Research Centre, Palo Alto, California, is to determine whether clean room conditions are really necessary for wafer fabrication, or if the wafers can be sufficiently isolated from contaminants, thus eliminating the need for clean rooms.

Standard mechanical interface (SMIF) and isolation technology have been implemented with commercially available photolithography equipment for the study. Hewlett-Packard originally documented SMIF technology in 1984, and since then, several studies have been done by other companies. All of these efforts, however, were based on use of a conventional clean room environment. The aim of the OASIS (Open Area SMIF Isolation Site) project is to implement the technology in an open area while maintaining a defect density equivalent to that obtained in a clean room.

OASIS requires that the equipment be cleaned and then isolated via a canopy or enclosure, providing a Class 10 or better environment for the wafer. This involves some redesign work that includes the use of proper airflow and HEPA filtration on the equipment itself. Each piece of process equipment is continuously monitored for particles.

Presently, the OASIS project encompasses only the photolithography area. Wafers are transported, via SMIF pods, to and from a clean room where the other process steps are performed. Plans are to eventually incorporate this open area concept into all phases of semiconductor manufacturing.

Pilot wafers are currently being run and preliminary data looks positive, according to project manager Randall Hughes. (Reprinted with permission from Semiconductor International Magazine, March 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, Il. USA)

Controlling stress in PECVD silicon nitride

A technique that is said to offer independent control over stress in silicon nitride layers deposited by PECVD, without degrading other film characteristics, has been developed by researchers at Electrotech's Special Research Systems, Bristol, UK.

Stresses typically encountered in PECVD deposited films include internal stresses, due to thermal mismatch between the film and the substrate, increased internal stress due to added hydrogen, and interfacial stress which may be caused by poor adhesion. To get good film quality, it is necessary to deposit at about 300°C and the wafer is cooled to room temperature. The difference in contraction coefficients causes a stress, which can be either tensile or compressive, in the film. This is enhanced by the inclusion of hydrogen in the film. There is also a problem with interfacial stress as well, caused by cleaning and general adhesion problems. Obvious solutions to the problem, such as depositing at room temperature or controlling the amount of hydrogen in the reaction, do not work since the properties of the film are degraded.

The researchers discovered, however, that at high frequencies (up to 13.56 MHz) silicon nitride films are of a tensile stress, while at low frequencies (up to 450 kHz), they are of a compressive stress. Unfortunately, the frequency range over which stress can be controlled lies between 500 kHz and 4 MHz, which coincides with the International Communications window, and cannot be used.

The technique developed at SRS is that of frequency mixing. Preliminary results indicate that independent control over stress can be achieved without seemingly degrading other film characteristics. The technique offers the capability to choose either compressive or tensile stresses and their relative magnitudes.

A standard Electrotech SRS Model PF310-3 has been adapted to incorporate this frequency multiplexing. Dilute (2 per cent) silane in nitrogen was used to enhance the operational safety of the equipment. For all frequency mixing a standard process was used at a deposition temperature of 300°C, achieving film uniformities of about ±3 per cent.

Depositions were carried out onto both 4 inch silicon wafer and Corning glass slides type 02110-LASS. Stress calculations were performed by measuring the bow of the slides before and after a 1 μm deposition. (Reprinted with permission from Semiconductor International Magazine, March 1988. Copyright 1985 by Cahners Publishing Co., Des Plaines, Il. USA)

New inks will cut electronics costs

A recent development in polymer-based electronic printing inks could reduce the cost of electrical components in telecommunications equipment and automobiles, as well as in aerospace and weapons systems The key rests with a family of polymer thick-film (PTF) inks - developed at W.R. Grace's Washington Research Centre (Columbia, Md.) - that can act as conductors, resistors or insulators, depending on their exact composition.

The new inks will benefit printed circuit board manufacturers and those that incorporate the boards in their products by increasing production rates about 20 per cent while cutting costs at least 30 per cent. Moreover, boards made with PTF inks will be more compact and lightweight.

Although PTF inks have been available for less than a year, Grace has had more than 100 inquiries from interested circuit board manufacturers. In fact, Grace engineers are working with several companies, including AT&T, to develop test circuit boards for specific applications.

In addition, PTF inks should be useful in making multilayer circuit boards, boards with many conducting paths layered one on top of the other. Such boards, which are just now appearing on the market, provide increased circuit density, an important consideration for aerospace and automotive applications.

PTF inks can replace all electronic components on a circuit board except integrated circuits and capacitors. The inks are made up of two components: a thermosetting polymer binder and a filler. The polymer binders - including phenolics, acrylates and epoxy resins - act predominantly as insulators. Indeed, the binders can resist damage from high-voltage surges, such as lightning strikes.

The filler is what, for the most part, gives the ink its particular electronic property. Copper or silver filler, for example, makes the ink conductive. A semiconductor material, such as carbon or one of several proprietary substances, yields a resistive ink. Grace researchers also are experimenting with filler-and-polymer combinations that have sufficient capacitance to replace capacitors on the circuit boards.

PTF inks also have production advantages. Currently, most circuit boards are made by sequentially depositing a material - whether conductive, insulating or resistive - over a board's entire surface, then removing the material from areas where it is not needed. The process is both costly and time-consuming. For instance, laying down copper conducting paths can take up to eight hours. In contrast, PTF inks are applied through patterned printing screens only to the area of a circuit board where they are needed. Inks that are conductive, resistive or insulating are applied sequentially, with the board heat-cured at 200°C after each layer is applied. The process is extremely fast, with only seconds required to lay down a copper conducting path, for instance. Also, because PTF inks are added to the circuit boards - not added and then subtracted - fewer steps are needed in order to make a finished board.

In simulated production runs, PTF inks routinely meet the industry standard of 10-mL line widths and 10-mL separations between lines. Under laboratory conditions, moreover, resolution is as good as 3 mL for the line width and 2 mL for the line separation. (Extracted from Chemical Week, 27 April 1988)

Molecular wires for tomorrow's computers

American chemists have taken their first steps in the unfamiliar terrain of nanoelectronics - a new area of study that promises the next step in computer miniaturization.

Larry Miller and colleagues from the University of Minnesota, have synthesised linear molecules of precisely defined lengths of up to 7.5 nanometres (nm - or thousand-millionths of a metre). The linear molecules could act as tiny wires, connecting molecular electronic components in the futuristic minicomputer.

Molecular electronics is about persuading organic molecules that are usually good insulators to behave as electrical conductors and

semiconductors. Conducting polymers are cheaper and lighter than metals; they can behave like plastics and are, therefore, easier to process.

Their most exciting feature is the versatility of their electrical properties. Chemists can already fabricate sheets of plastic that can conduct electricity almost as efficiently as copper.

Organic molecules might also perform the electronic switching functions of the microscopic electrical circuit elements found on silicon chips. At the moment these elements (with dimensions in the range of 100,000 nm) could be fast approaching the natural limits of miniaturisation. The limits are imposed by the electronic properties of the chip's semiconducting material and the way in which it is fabricated into a device. The current methods of etching and lithography are accurate on the scale of the micrometre (one-millionth of a metre).

If molecules are to function as circuit elements it follows that the connections between them must be just as small. The only way to achieve such accuracy on the nanometre scale would be to synthesise "molecular wires" that have accurately defined lengths. Miller and colleagues have taken the first steps towards this.

Starting with chemical building blocks called polyacenequinones, the American chemists linked them in sequence via other compounds called imides. The imide molecules preserved the linear structure of the growing "wire".

The researchers managed to make molecular wires in lengths of 3.06, 5.28 and 7.50 nm which are conducting when chemically reduced. They were surprised that the compounds proved to be fairly soluble in organic solvents such as chloroform. The solubility enables chemists to purify them to the high standards required by the electronics industry.

The team from Minnesota is also developing a method of verifying the lengths of their molecular wires, using a scanning transmission electron microscope. They also hope to generate 3-D networks with dimensions ranging from 5 to 10 nm, using a similar synthetic approach. If successful, the first computer using molecules rather than chips may not be so far in the future. (This first appeared in "New Scientist", London, 21 May 1988, the weekly review of science and technology)

A look at the Motorola 88000

Motorola Inc. is finally giving the world the first detailed look at its 88000, the latest entry in the RISC race. What the company is showing off is an impressive three-chip set that offers a full systems solution for a reduced-instruction-set architecture - what Motorola is calling the third generation of RISC technology.

The basic MC88000 architecture consists of a processor chip and two identical cache chips, one for data and one for instructions. The processor is the 88100, which has a small, efficient, scoreboarded register file at its heart and both integer and floating-point computational units. Running at 20 MHz, it is rated by Motorola at 17 VAX mips - that is, 17 times the performance of a Digital Equipment Corp. VAX-11/780, as measured in millions of instructions per second - and 34,000 Dhrystones performance, making it one of the fastest RISC processors around. The cache chip is the 88200, which comes with a built-in memory-management unit.

What makes this a third-generation RISC architecture, Motorola claims, is the combination of onboard integer and floating-point units for the 88100 processor and the use of the 88200 cache sub-system with a memory-management unit. The first generation of RISC, according to Motorola, were crude research machines. The second generation consists of the RISC products now on the market - which lack the on-chip features and cache memory of the MC8800. The great advantage of the 88000 architecture is its capability for many concurrent operations. The data unit on the processing chip can transfer data between the data cache and the register file while the instruction unit transfers instructions between the instruction cache and the register file. At the same time, the integer and bit-field unit will execute instructions in parallel with an operation underway in the two-part floating-point unit. The emphasis on concurrency helps the chip set deliver twin capabilities that Motorola claims are unavailable with any other RISC processor: multiprocessing and fault tolerance.

The 88000 architecture is unusually extensible. For example, Motorola has reserved 256 operation codes for each special function unit and has set aside enough silicon-bus addresses for six future special function units - numbers two through seven. Because the 88000 chips were designed using silicon- compilation tools, it is easy for Motorola to add special-function units as the need arises, by recompiling the chip. New operation codes are implemented in the reserved spaces; the old op codes remain unchanged, so the new version remains binary-code compatible with earlier versions.

Customers can add special-function units themselves, by defining a unit with their own instructions and having Motorola implement it. Motorola reports that it is already working with one customer, which it declines to name, as a test case to produce the first such add-in unit.

Users can also design a special-function unit and implement it in software to try it out, because if the program uses one of the reserved op codes not yet implemented in hardware, it traps to software control. In other words, they can include the new unit's instructions in their programs. Until the new hardware has been compiled onto the chip the programs will run using software-implemented versions of those instructions. (Reprinted from Electronics, 28 April 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

New computer developed

A non-Von Neumann computer that processes data 70 per cent faster than a supercomputer has been developed by the Japanese Agency of Industrial Science and Technology's Electrotechnical Laboratory. It makes a large number of calculations simultaneously. With faster semiconductor elements and more processors, a non-Von Neumann computer could operate 100-1,000 times faster than the fastest computers now available. (Extracted from Japan Economic Journal, 26 March 1988)

Experimental optical neurocomputer

Japan is developing an experimental optical neurocomputer that uses learning to enhance capability to recognize images. The "optical associatron" is in its early development stages at MITI's Industrial Products Research Institute. The new system features optical analog calculation to implement an associate image memory. Integral to the system is a microchannel spatial light modulator

developed by Hamamatsu Photonics. The modulator transforms an incoherent-light input image that hits a photo cathode into a charge image on a lithium-niobate plate. This charge image can be interpreted by a helium-neon laser as a coherent image using the Pockels effect - changes in a crystal's refractive properties that are proportional to the strength of an applied electric field.

Meanwhile, high-performance character-recognition systems may start turning up in a year or so on personal computers and work stations from NEC Corp. The Tokyo firm reports its new recognition equipment - based on neural-network technology that apes the organization of neurons in the human brain - can identify 62 alphanumeric characters printed by dot-matrix printers, with an accuracy of more than 99.8 per cent. Conventional character-recognition systems are accurate only 98.5 per cent of the time. The improvement in NEC's new system stems from a repeated-character-learning method, called a back- propagation learning algorithm. The neural network checks characters and corrects them, if necessary, before the character is output by the system. (Reprinted from Electronics, 31 March and 26 April 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

The fastest DSP add-on board around hits 8 mips

The fastest digital signal processing add-on board now available for IBM Corp., PC AT and compatible personal computers runs at 8 million instructions per second. It turns a PC into a high-speed signal processor and a number cruncher for real-time applications. The board comes from a company in Ettlingen, FRG called CMS GmbH.

When four of CMS's DSPB 2100 boards are plugged into a PC, it becomes a powerful 32-Mips number cruncher selling for less than $25,000. But for most real-time applications just one board will do, says Jürgen Walter, co-owner of CMS - the name stands for Computergestützte Mess-systeme, German for computer- aided measuring systems - and head of development at the four-year-old, 18-person firm. Plugged into a PC, a single board will handle frequency analysis jobs "about 50 times faster than an IBM PC AT fitted with Intel's 80386 microprocessor and 80387 arithmetic processor", Walter says.

A version for the Apple Macintosh II will be available by mid-year, and a faster version of the board - 12.5 mips - is planned for later this year. The price of the current 8-Mips board, including software and documentation, is about $4,450.

The board owes its speed to three factors. One is the use of a fast DSP chip made by Analog Devices Inc. of Norwood, Mass. The second is a large amount of fast memory that keeps data ready for the processor. The third is the DSP architecture, which CMS has designed to avoid timing and communication delays, incorporating input/output sections that offer a fast link between the PC and the board.

Another design element that further enhances the board's speed is the way the board is coupled to the host PC. To prevent overloading of the PC's data bus, the incoming signals are fed via an on-board parallel bus and the FIFO buffer memories into the board's processing section. With this concept, the data throughput is boosted even when the PC uses several DSP boards. The signals coming in at up to 70 Mbytes per second are distributed over the input FIFOs of up to four boards. Data reduction takes place on board. The compressed data is fed to the PC's data base for storage or to its monitor for display.

A follow-up product to the DSPB 2100, a 12.5-Mips board, is now in development at CMS. It will use a faster version of the ADSP-2100 DSP chip and will reach the market four to six weeks after Analog Devices starts delivering that chip in volume - Walter figures the 12.5-mips boards will be available during the fourth quarter of this year. (Reprinted from Electronics, 31 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

At last: ROM BIOS for PS/2 clones

The first read-only memory, basic input/output system products for manufacturing hardware equivalent to IBM Corp.'s Personal System/2 models 50 and 60 are appearing. They were jointly developed by Faraday Electronics Inc. of Sunnyvale, California and Phoenix Technologies Ltd. of Norwood, Mass. The ROM BIOS serves as the interface between operating systems, applications software programs, and hardware components for PS/2 machines. The BIOS will be marketed by both Western Digital Corp., Faraday's parent, and Phoenix Technologies. An evaluation kit will be available this spring for $2,500. (Reprinted from Electronics, 14 April 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

III. MARKET TRENDS AND COMPANY NEWS

Artificial intelligence, the next generation

For all their phenomenal number-crunching power, the first computers were not good decision makers. Too precise, too logical, too linear.

Not so today. Researchers in the field of artificial intelligence (AI) are programming computers to "think" more and more in complex ways and to make ever more "intelligent" decisions.

Europe lags well behind the cutting edge of "fifth generation" AI research in the United States and Japan, but European companies and countries are none the less intent on creating practical programs. For example, the race for AI has led to an unusual alliance between Bull, the French computer group, and two of its main European competitors, UK's ICL and FRG's Siemens.

The three computer companies have collaborated to form an AI research centre in Munich. Staffed by 50 employees, 15-20 from each company, the two-year-old centre does basic research that is shared equally. Eventually, the companies hope to use the results to develop AI programs for customers.

There are a number of other notable AI efforts under way in Europe. Olivetti has developed several "intelligent" systems, a number of them intended to help diagnose electronics problems in its own systems and thereby save a significant portion of its internal operating costs.

In addition, the European Community last year asked six prominent scientists to produce a program for teaching a computer to "see" and "learn" by recognizing objects and making judgements that can be retained for future reference.

In the UK, a new company called Advanced Training Technology Associates is using a combination of government grants and private investments for a £5 million program aimed at creating AI teaching programs.

The goal is to gather the accumulated knowledge of a field and then let computers teach students or train workers at their own learning pace.

One of the first large-scale commercial uses for AI in Europe has been in reviewing leasing applications for financial institutions. Artificial Intelligence Software, a Milan company, used "rules" provided by an association of Italian banks to develop a computer program that makes quick - 10 to 15 minutes on average - risk assessments on whether certain customers should be granted certain leases.

The Italian banks have been so satisfied that the software company recently created a similar program for Banco Hispano Americano, the Spanish bank with the country's largest leasing services operation. (Extracted from International Herald Tribune, 26 April 1988)

SMD components

Surface-mountable components are becoming increasingly popular, with the selection of SMD parts proliferating. A large selection of packaged SMD capacitors and resistors are available, making it easy for designers to be choosy in finding the right component. SMD technology provides such benefits as higher board densities, smaller size, less inductance, elimination of through-board holes, and potentially higher reliability. And previous problems, such as the lack of standards, are no longer relevant, with standards aplenty set by the Electronic Industry Association.

The US passive surface-mount devices (SMD) market will grow 14.5 per cent per year through 1991, according to Frost & Sullivan. Also, by 1991, some 25 per cent of all capacitors and nearly 40 per cent of all resistors will be SMDs. Two key forces are driving the SMD market - the space savings resulting from the smaller SMD parts, and enhanced reliability of SMDs resulting from the elimination of through-holes in pc-boards. Japan is currently the leader in the SMD field, with a market some six times that in Europe, and four times that in the US. (Extracted from Electronics, 2 April 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Semiconductors keep outdoing predictions

The US semiconductor business is continuing to show stronger growth than many industry experts had predicted. Order bookings in Febru ry reached the highest level in three years, the Semiconductor Industry Association says, and the book-to-bill ratio reached 1.18 ($118 in orders booked for every $100 shipped), the highest level since last May. The good news should continue through at least the rest of 1988. (Reprinted from Electronics, 17 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

The SIA foresees an early end to the 1-Mbit shortage

As the task force of chip makers and users started grappling with system makers' complaints and considering proposed changes in the US-Japan trade agreement, the Semiconductor Industry Association was predicting that the dynamic-random-access-memory shortage that helped create the problems will soon end. The association thinks the 1-Mbit DRAM woes will ease soon, and one of its officials says a glut could come as early as this summer - as 256-Kbit demand falls off.

The semiconductor trade group says that any one of three scenarios is possible for the months ahead: continued steady growth in the electronics industry; a general slow-down in chip demand in 1988; or recession in 1989. SIA officials maintain that existing fabrication lines, planned additions, and conversions of 256-Kbit lines to 1-Mbit production will cool the shortage.

But that could leave many 256-Kbit users still resorting to any method short of larceny to get parts, even more desperate in what some call the worst memory shortage ever. (Reprinted from Electronics, 17 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Worldwide sales of smart-power chips still do not amount to much

Sales of smart-power chips still have not taken off. The parts, which combine logic, conversion, and switching functions on a single chip, were supposed to revolutionize the market for power semiconductors, but in the first detailed report on the smart-power market, Electronic Trend Publications, a Saratoga, California, market researcher, says 1987 sales of monolithic smart-power chips were just $51 million. Publisher Gene Selven told a group at the Power Electronics Conference/88 West in Anaheim, California, that hybrid circuits still account for 80 per cent, or $204 million, of the total $255 million market. Monolithic chips still are not available in large-volume quantities and remain more expensive than hybrids. By 1992, however, single-chip parts will account for nearly two-thirds of the smart-power market, which will then be worth more than $1 billion. (Reprinted from Electronics, 3 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Prices and lead times soar as shortages grow in dynamic RAMs

The shortage of dynamic random-access memories may get worse before it gets better. Even as the scarcity of 256-Kbit and 1-Mbit chips pushes DRAM prices into a giddy climb, panicky system houses are scrambling for what were once parts galore.

In 256-Kbit parts, for users that buy from distributors - including the spot market - prices and delivery lead times are going out of sight, climbing from $1.80 and immediate delivery a year ago to $4.50 and up to 20 weeks' wait today. For the big equipment houses buying large quantities direct from manufacturers, prices have risen in recent months to above $3 from just under that mark, say US-based suppliers. And for 1-Mbit parts - just reaching the market and difficult to get - some users report January's $24.50 has become February's $28.50.

Executives at chip makers agree that the shortage is worsening, blaming much of the gap on the industry's slow moves to add wafer-fabrication capacity as markets recovered in 1987 from history's worst chip recession. Also contributing is the timing of the shift from 256-Kbit to 1-Mbit chips.

Production of 1-Mbit chips has not gone smoothly: only one maker, Toshiba Corp., is currently turning out more than one million units a month.

Suppliers are proceeding carefully. Motorola Inc. has restarted DRAM production after quitting in the mid-1980s. National Semiconductor Corp. in Santa Clara, California, is studying its options. Texas Instruments Inc. is working under a self-imposed ceiling designed to prevent over-involvement in commodity markets in favour of more profitable segments. The chip maker is currently declining new orders for 256-Kbit chips in 1988. (Reprinted from Electronics, 3 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Economic modelling gains despite accuracy concerns

Economists are finding that as they are increasingly mistrusted and criticized, greater demands are being made for their prognostications, and when their pronouncements take centre stage, they turn to detailed simulations of economic behaviour for verification.

Errors are smaller than in the recent past

Just how accurate a verification these models provide is subject to debate. By and large, the forecasts most often cited remain little more than elaborate extrapolations of present trends. Such econometric forecasts are provided by such firms as Data Resources Inc., Lexington, Massachusetts, and the WEFA Group (formerly Wharton Econometric Forecasting Associates), Bala-Cynwyd, Pa.

What improvements there have been in the accuracy of economic forecasts are measurable only when viewed over the course of many years.

Sam Cole, a professor at the State University of New York at Buffalo and an econometric model builder, researcher, and critic, says the largest and newest models - the so-called global models - for the most part follow a "classical" structure based on well- established theories of capital accumulation and capital input/output ratios.

"The difference among these models is whether or not they deal with environmental or ecological limits and the linkages they show between countries", he says.

While most global models are classically econometric in structure, they are a relatively recent phenomena. According to Cole, about two dozen have been developed worldwide, and their spread most often is tied to the widely publicized 1971 study, World Dynamics (Wright Alenn, Cambridge, Mass., 1971), which painted a pessimistic long-term economic outlook.

Due in large part to the growth of global models, economists have begun to explore technologies such as graphics, distributed processing, and networking to improve the underlying structure of econometric models and their analyses. Faye Duchin, director of the New York-based Institute for Economic Analysis and a New York University professor, says that the larger models, such as the institute's World Input/Output model, are too complex for the simple analyses that earlier models permitted.

While such graphics presently are not part of these large modeling programs, Duchin sees movement towards developing models that address the need for more accessible simulations of economic forces.

The need to improve and update the World I/O model has prevented it from being used for five years. Now negotiating with backers to resume work on the economic model, Duchin says that the model's data requirements and structure need refinement. So far, that work has prevented the institute from accepting even limited studies.

Lawrence Klein, a University of Pennsylvania economics professor and the originator of Project Link, says that a global model threading together econometric models from 80 countries to forecast short-range economic conditions, faster computers, and increased use of networking has benefited global forecasting. Such multicountry models lead to faster and more accurate portrayals of economic conditions, Klein says. With funding from sources as diverse as the United Nations, the Bank of Norway, and the World Bank, Project Link strings together models of countries with centrally planned, developing, and industrial economies to produce a world economic model. The present version incorporates up to 20,000 equations that work best when processed simultaneously.

Faster processing speeds enable Project Link to run "What if?" scenarios more quickly to pinpoint previously unknown interactions in world economies. Researchers then can test conditions suggested by the model simulations against existing data. Higher processing speeds also enable University of Pennsylvania researchers to study what impact random deviations - so-called stochastic shocks - in the economy of one country will have on conditions in other countries.

Klein and his Project Link associates are using networking to analyze policy decisions almost simultaneously with world economic summits. In June, the group expects to convene an electronic assembly in conjunction with the annual summit of the seven major industrial countries.

The group's goal is to involve economists the world over in monetary or trade policy discussions as the economic summit progresses.

In other applications, Project Link has been used to study the impact of fluctuating world oil prices on Norway's economy, to evaluate the inflationary pressures associated with US-USSR arms spending, and to consult with the Government of the Philippines on its foreign debt, he says. Project Link presently runs on an IBM 3090 Model 600E with vector facility at the Cornell University Supercomputer Centre, Ithaca, N.Y. Klein's research associates also have tested new models at IBM's supercomputer centre in Rome. Each of Project Link's country models are run individually on an assortment of computers that feed the version on Cornell's IBM 3090.

The size of the Institute for Economic Analysis's World I/O model illustrates why researchers desire larger computing facilities. World I/O divides the globe into 16 regions, and compiles and analyses data going back 50 years for 55 production sectors within each region. The production sectors cover such things as automobile manufacturing, and leather and wheat production and consumption. The last time World I/O was run, the institute used a Control Data Corp. Cyber 205 at Colorado State University in Fort Collins.

Yet, for all the many equations large econometric models process, there is still no certain answer whether such models accurately simulate economic conditions to gauge the impact of

government economic or trade policies. MIT's Forrester says that most econometric models attempt to simulate the recurring conditions found in short-range periods, or under 10-year periods that economists call the business cycle. Forrester believes that "prediction of the business cycle is, on the whole, a wasted effort. They are trying to do things that cannot be done".

Project Link's Klein cites the long list of government sponsors and requests for congressional testimony as measures of Project Link's esteem and influence. But Kenneth G. Ruffing, assistant director at the UN's office of development research and policy analysis, says that simulations are but one of many factors that feed policy debate at the UN.

SUNY Buffalo's Cole, who has researched the World Bank and the UN's use of global economic models, says the logical basis to using larger models is their greater detail.

While too many issues remain to say simply that bigger models produce better forecasts, there have been definite impacts from the larger models. Forrester's World Dynamics system and a subsequent work, Limits to Growth by D. Meadows, et al (Universe, New York, 1973), for instance, "sent out a powerful message... It certainly did affect the way people thought [and] stimulated debate", declares Cole.

He sees direct influences as well. The World Bank uses a global model in its lending, says Cole, sometimes to the detriment of its debtors. "When the World Bank lends [a country] money, it expects that country to have a [repayment] plan, and usually persuades that country to accept World Bank forecasts. Since its forecasts are usually wrong, these countries end up with debts and no way to repay them", says Cole.

It may be that larger technology bases will serve only to raise expectations that the models today cannot satisfy. The use of supercomputers may be moving economic forecasting in the same direction as weather forecasting; thus far, however, there has not been comparable improvement in the models' predictions.

According to the UN's Ruffing, "Larger models are better because they provide more detail. They probably are more accurate, but not so much more you would bet money on the outcome". Echoing these reservations, Cole believes that although the application of increased technology, such as supercomputers, to forecasting has produced larger models, those models are not necessarily more accurate.

The reason may lie in the nature of economic analysis. MIT's Forrester says econometric models such as Project Link are inaccurate because of their reliance on statistical extrapolations. Such extrapolations have built-in limits, unlike the Systems Dynamics approach, he says. "Econometric models are based on trends. System Dynamics is representative of the structure of the system. There is nothing in the model that says what it will do", says Forrester.

System Dynamics endorses a long-wave theory of economic behaviour that asserts over production leads to upheavals every 45 to 60 years.

Others say that today, economic conditions are too complex and too dependent on human behaviour to simulate accurately on a computer. "Social systems cannot be modeled with the same accuracy as physical systems", argues Ruffing. As such, those who attempt to improve accuracy solely by applying more sophisticated technology may be barking up the wrong tree. Supercomputers lend themselves to modeling conditions such as wind and ocean currents that are better understood than behaviours such as savings, productivity and industry.

As a result, the choices that economists make in categorizing such data can influence the way a model acts and skew its results. Moreover, the larger models' increased data requirements and coupling of economic relationships may not be sufficiently understood.

While calling present global economic models "marginally useful", Cole also says the work being done has advanced the theory and accuracy of forecasting economic behaviours. Whether computer simulations will significantly improve economic predictions - as they have weather forecasting - is something Cole believes has yet to be demonstrated. "We have improved short-term weather forecasting using bigger computers. I just do not think we are at the same point yet with economic models."

What is clear, even taking into consideration economists' biggest gaffes - the failure to forecast the 1974-75 and 1981-82 recessions - the model's smaller errors suggest that it has made more gradual improvement in the last decade.

Even as debate rages over whether ever larger econometric models lead to greater accuracy, or that such models are inherently flawed, there is a changed climate among those who employ the forecasts.

A look at three of the largest models

Project Link:

One of the largest of the global models, Project Link threads together 8? econometric models supplied by participating Governments, researchers, and the United Nations. The model research focuses on international trade issues and relations and provides forecasts for three-year periods. Developed and maintained by researchers including Prof. Lawrence Klein at the University of Pennsylvania, the FORTRAN language program runs on an IBM 3090 Model 600E with vector facility at the Cornell University Supercomputer Centre, Ithaca, N.Y. It is the only model to include econometric models of centrally controlled, free-market, developing, and industrialized nations. The model has more than 20,000 equations. Link econometric basis is similar to the Japanese FUGI (Future of Global Interdependence) and the UN's GEM (Global Econometric Model).

World Input/Output:

Derived from work begun originally by the UN, World I/O is a model written in FORTRAN that analyzes 55 different production measures for each of 16 regions. A long-range model, World I/O was last run five years ago on a Control Data Corp. Cyber 205 supercomputer to provide projections through to the year 2030. Data compiled from national input/output tables examine the connection

between technological change and accumulation of capital. Other examples of input/output models - which focus on underlying economic structures - include the United Nations International Training and Research (UNITAR) model, developed by Prof. Sam Cole of the State University of New York at Buffalo.

System Dynamics:

The essence of System Dynamics is the study of interactions between parts of a system to yield an understanding of the whole. Its National Model focuses on the interactions between economic demographic, and ecological parts of the world to address growth, inflation, unemployment, etc. Written in a continuous dynamic simulation language developed by MIT's Systems Dynamics Group, the National Model depicts the so-called long wave theory of economy originally put forward by the Russian economist Nikolai D. Kondratieff. In the theory, over expansion leads to collapse approximately every 45 to 60 years. Other models that employ systems approaches include the Systems Analysis Research Unit Model (SARUM), begun by the British Government in response to World Dynamics' (Wright Alenn, Cambridge, Mass., 1971) pessimistic forecast, and Global 2000, a modeling program begun under President Jimmy Carter and discontinued in 1980. (Reprinted with permission of DATAMATION® magazine (c), 1 April 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Increased use of supercomputers in commercial applications

Supercomputers will be used in an increasing number of commercial applications in the next 10 years, according to P. Patton. chairman and chief scientists, Consortium for Supercomputer Research. Applications of supercomputers are being found in discrete manufacturing, especially in the automobile industry; database management systems, due to the computational demands of business, finance, commerce and manufacturing; financial markets, such as currency arbitrage, economic trend analysis and commodity trading; and in academic areas of research. The supercomputer market is limited by a lack of personnel to write application code, an applications shortage, and a lack of people trained to use the technology. The use of supercomputers in universities is important, because the above limitations are addressed there. Regarding technology developments, future supercomputers will be able to perform 64 1-ns processing; workstations will have the power of one Cray X/MP operating at about 20 Mflops.

Advances in technology are leading to a proliferation of supercomputers and companies offering them. Modern single-user supercomputers offer the performance of the original Cray-1 machine, and modern high-end supercomputers offer nearly 25 times the performance of the Cray-1. The number of supercomputer suppliers is increasing as evidenced by the flurry of production offerings in the first quarter of 1988 alone. And new applications for supercomputers are continuing to grow, fueled by the availability of software - much of it based on parallel-processing architectures. Despite the good news, analysts feel that with so many companies fighting for a share of the minisupercomputer and midrange market, a shakeout is possible. Japanese companies, sticking to single-processor technology in the face of the movement toward parallel-processing, are competing with US companies for world market share.

Cray Research is still the leader in the field, but upstarts in the supercomputer field will have to contend with supercomputer offerings from giants Digital Equipment and IBM. The supercomputer market is segmenting into three markets, based on price and performance. One segment, single-user supercomputers, is expected to match or surpass the growth of the other supercomputer classifications. The other two segments - high-end supercomputers and mid-range supercomputers - are expected to grow at 40 per cent per year against 10 per cent per year for computers on the whole. (Extracted from Electronics, 3 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

AI industry

The artificial intelligence industry is in the midst of a major retrenchment. It has failed to live up to its promise of developing computers that can reason like a human expert, understand English or recognize objects, but AI technology is being subtly incorporated into conventional computer programs.

Many of the AI industry's problems stem from poor business decisions by the companies involved. They tried to introduce expensive computers specifically tailored for AI, but the machines were not very compatible with those already in use. Symbolics (Cambridge, MA) leads the market for special AI computers and has suffered heavy losses for several quarters. Lisp Machines, its rival, went bankrupt in 1987. AI computers from Xerox and Texas Instruments are selling poorly. Companies offering software tools that enable the user to develop expert systems are also hurting. In January 1988, Teknowledge (Palo Alto, CA) stopped selling its computer and dismissed over 33 per cent of its workers. Inference (Los Angeles, CA) and Carnegie Group (Pittsburgh, PA) are having problems, and Intellicorp (Mountain View, CA) has suffered losses for the last few quarters.

Despite this, however, AI as a technology is continuing to spread. P. Harmon, editor of Expert Systems Strategies, says that over 1,000 expert systems are now in use at companies. Applications include scheduling of plant operations and failure diagnosis in equipment. DuPont alone is using over 100 expert systems. (Extracted from New York Times, 4 March 1988)

Potential of ceramic superconductors

The discovery of the potential of ceramic superconductors is the focus of most examinations with some product development at the same time, and the development work on ceramic technologies for heat engines is not falling off, according to G. Fisher, the American Ceramic Society technical services director. In electronic device uses, the materials are expected to be accepted commercially in five years, especially in military and medical uses. The demonstration of a small size electron motor using the materials by Argonne National Laboratory researchers shows that small electromagnets will be possible in the same timeframe as electronic products. Research on the system La-Sr-Nb-O may offer the prospect of higher Tc superconductors. Improvements in the Bi-Ca-Sr-Cu-O and La-Sr-Nb-O systems are seen in the future. Research teams saturating the exploration of the Y-Ba-Cu-O system and are not involved in developing marketable product lines may be diverted to research the two systems for feasible breakthroughs. (Extracted from Ceramic SB, April 1988)

PCs as choice for expert systems development

Personal computers, specifically those based on the 386 chip, have emerged as the vehicle of choice for expert systems development, said W.P. Martorelli, director of the Advanced Software Development service for New Science Association. Expenditures for personal computers related mainly to the development and delivery of expert systems will increase 10 times in 1989 from about $70 million in 1987, according to New Science Association. The trend towards personal computer-based expert systems is the result of many factors, including low cost, user autonomy, and limited IS budgets and lengthy applications backlogs. Also, often personal computers were already installed within the functional groups, while 3270-type terminals continued to dominate the IS arena. Article further discusses the AI pioneers, the emergence of expert systems for data centres, the limitations of personal computer-based expert systems, and OS/2. About 3 per cent of Compaq Computer's (Houston, TX) Deskpro 386 sales are directed toward expert systems activity. The company, which probably sold more than 3,000 units for AI alone in 1987, expects that percentage to increase in 1988. (Extracted with permission of DATAMATION® magazine (c), 1 April 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Silicon chips in computer memories

The replacement of magnetic disks with silicon chips in computer memories would vastly change the way computers are designed; information would be stored and software would be sold on wallet-size cards containing chips. Computers would be faster, quieter and more portable without disk drives. Such forecasts are fueled by the fact that silicon memory chips continue to gain in storage capacity while costs decline. Progress is being made in overcoming memory chips' loss of memory once the electric power is turned off - magnetic disks do not have this problem.

Flash memories, which use a floating gate, and ferroelectric memories offer promise. Flash memories rapidly accelerate electrons, and can trap them indefinitely. Drawbacks include that while data can be quickly read from the chips, it takes a long time to erase and record, and the chips can slow down after a few hundred cycles of erasing and recording. In ferroelectricity, the counterpart of ferromagnetism, ceramics align their electric charges when exposed to an electric field. The positive charges point in one direction and negative charges in the other, and alignment can be reversed. Thus, such materials can store a zero or a one. Flash memories and ferroelectrics are likely, in the beginning, to steal business from E-squared PROMs. (Extracted from New York Times, 23 March 1988)

Market for hospital information systems

The US market for hospital information systems will be $6.2 billion by 1992, against $3.5 billion in 1987, according to a Frost & Sullivan study, "The Market for Hospital Information Systems". The market will get a boost from the development of voice recognition technology for hospital operations. There will be market opportunities due to the increasing complexity in private hospital operations, e.g., mergers to provide shared services and joint ventures to achieve economies of scale. By sector, the patient-care market will total $1.9 billion in 1992, against $806 million in 1987. The financial management sector will show sales of $2.4 billion in 1992, against $1.7 billion in 1987. The pharmacy segment of the market will produce revenues of $605 million in 1992, against $332 million in 1987. By product, the market for in-house systems will reach $4 billion in 1992, against $1.6 billion in 1987. The turnkey systems market will reach $311 million in 1992, against $244 million in 1987. Another segment of the market, the outside service approach of total system management by the vendor, will account for revenues of $1.7 billion by 1992, against $1.5 billion in 1987. (Extracted from EDP Weekly, 7 March 1988)

Market for mini-supers

Severe price cutting and the market clutter created by many new products have slowed growth in the mini-supercomputer industry, which many analysts had thought could achieve $1 billion in sales in 1990. Although demand continues to rise and sales hit $300 million last year, these experts now think the industry will not reach the $1 billion mark until 1992.

Meanwhile, the emergence of a new class of desktop supercomputers meant for individual users is likely to leave some potential buyers confused and take away a significant part of the lower end of the mini-supercomputer market.

So far, seven companies have dropped from the mini-supercomputer race, which began five years ago.

The most logical and widely anticipated competitor, Digital Equipment Corp., has been slow to join the fray. With $10 billion in sales, Digital is dominant in the market for the conventional but slower minicomputer, but it has lost some ground to those who created the mini-supercomputer.

Their machines in some cases are 10 times faster and cost half as much as Digital's aging models, priced at $800,000. Analysts said Digital's response, called Pegasus, could be in production late this year. Few details about that machine's speed and price are known.

Cray Research Inc., whose supercomputers are priced from $5 million to $20 million, sells mainly to large corporations, universities, and government agencies. It is not expected, by choice, to be a factor in the broader, mini-supercomputer field. Cray's strategy is to build faster, more complex machines that inevitably have a limited market because of their multi-million-dollar prices.

That means Convex and Alliant Computer Systems Corp. of Littleton, Massachusetts, are likely to maintain their positions as sales leaders, at least until Digital enters the market. (Extracted from International Herald Tribune, 28 March 1988)

Advances in CAD and CADD

Advances in CAD and drafting (CADD) have made many new programs available to the engineer, according to M.K. Parfitt of Parfitt/Ling Consulting Engineers (State College, PA). There is now rising interest in integrating CADD for the engineering and architectural facets of a project. Larger mainframe and minicomputer packages often use input pre-processors that are mainly menu driven or similar to spreadsheet pages. A major advantage of using this format type is that it makes it easy to develop a graphic interface to the engineering design data for CADD system vendors attempting to

integrate mechanical and electrical design into drafting and modeling packages. Automated Procedures for Engineering Consultants (APEC) has been involved with developing an integrated CADD/engineering environment that will allow the ready exchange of data between APEC programs and various leading CAD systems. Several vendors have adopted APEC SUPER-DUCT as the number-crunching part of their duct design and drafting packages. While it is hard to forecast the future of mechanical and electrical design software, the first steps apparently are being taken towards true CADD-engineering integration. Support is also mounting for engineering computation and CADD on PC-based systems. (Source: Technology Update, 9 May 1988)

Academics caught in computer crossfire

Academic users of computers have joined the throng of dissent over the way manufacturers are trying to dictate how customers use computer systems.

Users both in universities and in business are worried about the future of the Unix operating system, following the recent formation of the Open Software Foundation by several companies. Unix is important to users because it is expected to form the foundation of a move towards "open" systems, where software from any vendor will run on any computer.

The creation of the OSF threw into disarray the prospects for Unix. The new group unites seven of the largest computer manufacturers, and aims to develop a new version of Unix.

In a display of political manoeuvering, the foundation has polarised the industry into two factions. One of the factions now backs AT and T, the American telecommunications company that invented Unix and defends it jealously.

The new groups includes IBM, DEC, Hewlett-Packard and Honeywell Bull. Its members have become so exasperated with what they see as AT and T's attempt to exclude them from Unix that they plan to develop their own strain of Unix based on IBM's AIX version.

Sunil Gas from the City University in London, and head of the Unix user group in Britain, has spoken out against the new group. He fears that the manufacturers may jeopardise the needs of users in order to keep political face. He dismisses this historic grouping of former rivals as little more than "big multinationals posturing against each other". But he says that the new group must not be allowed to make the interface to their new operating system so different from current standards that it prevents consumers from using the software they need. He is to write to the European Unix user group to urge it to speak up for consumers as the new Unix emerges. (This first appeared in New Scientist, London, 26 May 1988, the weekly review of science and technology)

Potentials of CIM

The potential benefits of computer-integrated manufacturing (CIM) include a 10 per cent rise in output/average workhour, 5-20 per cent lower personnel costs and a 10-15 per cent drop in production costs, according to G. Garner of M.W. Kellogg. CIM can also reduce inventories by up to 20 per cent, cut inventory shortages and late shipments by 80 per cent, reduce scrap by 10 per cent and reduce order lead times by 50 per cent. CIM is finally entering the chemical process industries. Several plants based on CIM have been built and others have been retrofitted with computerized systems. Instead of optimizing certain features of a process or business, CIM aims to combine all elements of a manufacturing operation. CIM has become possible due to the advent of less costly but more powerful computers linked to new distributed control systems. More advanced software and hardware for quality control, inventory, maintenance and scheduling have also been introduced.

The chemical industry will spend $1.5 billion on data processing in 1988 and $2.5-3 billion in 1992, according to Digital Equipment. Digital Equipment is the leading company in terms of marketing integrated software and computers for CIM business and management applications. The oil and gas industry has been buying CIM-based systems. Digital Equipment has joint marketing agreements with Honeywell Industrial Automation Systems, Combution Engineering and Bailey Controls for CIM hardware and agreements with Setpoint and Biles & Associates for software. M.W. Kellogg has supplied a $120 million lube-oil packaging line based on CIM for Shell's (UK) Stanlow, England, plant, which produces 700 blended lube oils. (Extracted from Chemical Engineering, 28 March 1988)

Film recorders

Film recorders were flying their colours in March at the National Computer Graphics Association (NCGA) show, as several vendors displayed new products.

Business audiences are no longer impressed by - or even satisfied with - informal slides hastily churned out by managers under the gun. As corporate America's tastes become more sophisticated, users increasingly are demanding products that let them make high-quality colour slides at their desks.

Some vendors are rising to meet the challenge. On the software side, graphics packagers have begun bundling slide-making services into their products. In hardware, slide-production systems, known as film recorders, have come to roost on the desktop. The film recorders use software to read files generated by graphic packages, together with a 35 mm camera to produce the slides. (Reprinted with permission of DATAMATION® magazine (c), 1 May 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Hardware slows, software up

The results of the 15 February DATAMATION/Price Waterhouse IS Trend Survey indicated the spiraling recession that was curtailing many organizations' information technology budgets had come to an end. The decision to spend more freely on hardware and software has been confirmed by the most recent follow-up survey, based on the responses of over 2,250 information systems executives on the Price Waterhouse International Panel of Information System Executives in Australia, France, Japan, the UK and the US. Information technology budgets have been increased over a wide range, varying from 9 per cent in the US to 38 per cent in Australia, where the recession had cut most deeply.

It is significant to note that while, overall, the budgets for information technology spending are up, the amount that is expected to be spent on

computer hardware is declining in the US, France, and Australia, remains roughly the same in the UK, and is increasing slightly - by 4 per cent - in Japan.

The focus of most of the world's IS executives is now on the software that makes the hardware run effectively. This trend confirms what many industry observers have predicted about a maturing computer processing environment: reduced spending on computer hardware accompanied by increased spending on software acquisition, development, and implementation. This is a sign that MIS is able to provide more computing facilities to end users at a lower cost.

The survey indicates that spending on software is increasing over 1987 levels in all the countries studied, except for France and the US. In France, the total expecting to increase software purchases has dropped to 52 per cent from the earlier survey's 64 per cent. France's software acquisition, development, and implementation activities may be awaiting decentralization to lift the tight security on software expenditures.

Japan's increased reliance on IS is confirmed by Japanese IS executives, 72 per cent of whom expect to spend more on software acquisition and development. By comparison, only 39 per cent of their US counterparts expect to increase the amount that they spend on software.

Over 50 per cent of Japanese IS executives expect to provide salary increases under 5 per cent, while over 90 per cent of US executives expect to limit salary increases to 10 per cent or less. US firms planning raises of over 10 per cent are becoming very hard to find - down to 1 per cent in the latest survey from 5 per cent last quarter. France is the most tightfisted when it comes to salary increases: 70 per cent of French IS executives surveyed have indicated they expect to limit salary increases to under 5 per cent.

There is a considerable difference between the countries surveyed when it comes to the controversial issue of decentralization, the swing to more user power and more end-user control of IS resources. Australian installations, where decentralization is up by 14 per cent, show an increasing tendency to favour "user power". In the US, however, where decentralization is down by 7 per cent, companies seem to be drawing in the reins.

IS executives from all over the world - except in Japan - confess that developing and implementing applications processing systems on time, within budget, and in accord with either vaguely stated or changing user requirements is still a nagging management problem. Despite new methodologies for systems development that rely on CASE (computer assisted software engineering) tools, the low level of their current utilization (about 5 per cent of US installations and less than 1 per cent in other countries) means the industry has yet to solve this major problem. (Reprinted with permission of DATAMATION[r] magazine (c), 1 June 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Open systems

The frantic pace of mergers and acquisitions in the global business marketplace, the competitive necessity of tightly integrating all business functions, and the proliferation of PCs and workstations on desktops, benchtops, and factory floors, has made multisystem communications a way of organizational life. This connectivity, once a technical objective of IS professionals, today is demanded by the people who run the organizations that IS pros support. To meet this demand, a host of new technology suppliers has challenged the established order of computer and software companies that derive their strength from proprietary solutions.

IS executives are expecting growth of 5 per cent or so in traditional "back-office" applications, the domain of existing, closed architectures. But now a new wave of automation - of "mission critical" applications - is consuming most of their time and dollars.

Back-office systems for general accounting (accounts receivable/payable, payroll, etc.) are concerned almost exclusively with internal data, and are the bedrock on which IS organizations and data centres have been built. The new, so-called mission critical applications involve customers, suppliers, regulators, lawmakers, and others external to the organization. Such relationships demand open, multivendor solutions.

The upshot of open systems and the corresponding automation wave could be a dramatic increase in IS investments by US user organizations.

The growth of Unix and DOS (and projected growth of OS/2) - the operating systems that have become synonymous with open systems - is nearly as dramatic. By 1991, nearly half of the $54 billion of computer hardware sold in the US will be machines that primarily use such operating systems, according to research firm International Data Corp., Framingham, Mass. Unix and DOS accounted for merely a third of US hardware shipments in 1987, IDC estimates. OS/2, which began shipping late last year, was not yet a factor.

Riding this growth are relatively youthful suppliers such as Compaq Computer Corp., Microsoft, and Sun Microsystems. Their revenues, driven by sales of open systems products, have climbed as those of some traditional vendors of proprietary systems have stalled.

A recent DATAMATION/Cowen & Co. survey of more than 2,200 IBM and IBM plug-compatible sites in the US showed that teleprocessing costs will be the fastest-growing budget item this year, up more than 8 per cent. Other mission critical support elements, such as PCs and software packages, were next at 7.3 per cent and 6.3 per cent, respectively. (Reprinted with permission of DATAMATION[r] magazine (c), 1 June 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

The goals of X/open

It has been five years since five disgruntled European vendors, each devastated by IBM in its home market and frustrated by bureaucratic standards bodies, decided to take their futures into their own hands. The group they formed, now known as X/Open Inc., Bracknell, UK, has since grown into a formidable international organization of hardware suppliers, software firms and major users.

X/Open now has 13 corporate members: DEC, AT&T, Unisys, NCR, Hewlett-Packard, Bull, Siemens,

Nixdorf, Philips, Olivetti, Ericsson, ICL and Sun. It has 13 software advisers, including Oracle, Informix, RTI, Unify, Sybase, and Cullinet and 12 major user advisers.

Its goal is global support for a practical set of operating system guidelines that incorporate existing and de facto standards for hardware, software, and networking. Based on Unix System V, it is called the Common Application Environment (CAE), and it aspires to extensive applications portability and full connectivity. That open systems philosophy, the members believe, will become the IS creed in the decades ahead. (Reprinted with permission of DATAMATION[r] magazine (c), 1 June 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

The demand for data PBXs cools as users look for speed

As PCs supplant dumb terminals and increasingly are configured in local area networks, distributed computing is gradually overtaking data switching technology. Demand for data PBXs is cooling: in fact, Gandalf Data Inc., the Wheeling, Ill., vendor that introduced the data PBX in 1972 and dominated the market until 1985, has dropped the term data PBX from its marketing literature.

Gandalf is joining the trend to market products that integrate data PBX capabilities with other network controller capabilities. It has done so to such an extent that it is arguable whether it still markets data PBXs as such.

The data PBX is a classic solution to the problem of having more dumb terminal users than the host has ports. When the ports are all busy, the data PBX informs users trying to get access and permits them to wait for access in a queue. The data PBX also may be programmed to grant access on the basis of a user's privilege level.

With distributed computing, each LAN station can be a powerful multitasking PC, participating in the execution of LAN system software that performs a port contention selection function that is transparent to the user. In fact, the distributed computing user may not know or care whether his or her display shows the progress of applications executing at his or her desktop or at a host computer thousands of miles away.

User sites that are heavily standardized on IBM equipment generally lack data PBXs. Timeshared IBM computers support synchronous communications and handle port contention selection through communications processors and matrix switches.

Micom Systems, Simi Valley, Calif., and Gandalf between them have nearly two thirds of the world data PBX market. With $44 million of data PBX sales in 1987, Micom is by far the world leader, having eclipsed data PBX pioneer Gandalf three years ago.

The need for higher-speed data transfers will make the phaseout of data PBXs inevitable. Still, data PBX has a low per-unit cost and a phaseout would entail a staggering amount of rewiring and disruption of work.

David J. Farber, a University of Pennsylvania professor of both computer and information sciences and electrical engineering, also sees the dumb terminal heading the way of the dinosaur. He warns that some IS managers may fear replacement of their dumb terminals, "which cause very little trouble", and that they will cling to data PBXs as a symbol of the old order. Networked PCs raise issues of data security and integrity, and support and training. In addition, PCs diffuse points of control over computing and cut the demand for the host systems, which are the IS Manager's prime turf.

But the tide is not likely to be stemmed. In fact, Farber adds, to survive, IS managers must become communications managers "in the broadest sense". Top management will view IS management's mission, Farber says, as facilitating organizational communication. Technologically, "the communications revolution will make the VLSI revolution look like child's play", he predicts. (Reprinted with permission of DATAMATION[r] magazine (c), 1 May 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Supercomputer trends

Supercomputers are proliferating all up and down the price and performance spectrum, in essence redefining the nature of supercomputing. The field now spans a range from single-user systems that may deliver nearly the full power of the first modern supercomputer, the Cray-1, to machines with almost 25 times the Cray-1's power. New circuit technology, as well as advances in hardware and software architecture, is driving prices down, making it easier for those who want a supercomputer to buy one. For under $1 million, users can buy a machine with the same performance of the previous generation's largest supercomputer. So the installed base is exploding as potential users realize that the number-crunching function of supercomputers can be applied beyond scientific and military applications: to product design, business, and much more.

The number of supercomputer suppliers is exploding, as well. The pace of new product introductions has been furious in 1988's first quarter, and applications are taking off as software, much of it based on the burgeoning number of parallel- processing architectures, becomes available.

But as good as the news is, some analysts are cautioning that there are so many companies scrambling in the minisupercomputer and midrange market that a shakeout may occur. It could even be under way. The spectre of Japanese competition in the world market also hangs over the US supercomputer industry. Although a trend to parallel architectures is clear in the US, the Japanese are sticking to single-processor technology. In the US, the Japanese have not jumped the hurdles necessary to make inroads and even on their home turf. Cray Research Inc. of Minneapolis still holds its commanding position.

Japan is not the only threat to the supercomputer market's upstarts, however. Everyone is waiting to see what the two largest US computer companies, IBM Corp. and Digital Equipment Corp. are going to do in supercomputers. How the marketing pie is eventually divided will depend on many factors, including how the spate of available technologies and systems eventually match up to application areas.

One way to look at the computer spectrum is as a triangle with three layers, says Steven Chen, founder and president of Supercomputer Systems Inc., Eau Claire, Wis. Supercomputers are at the apex,

mainframes in the middle, and work stations - the broadest market and most competitive - at the bottom. "Historically, as supercomputer vendors have extended the tip of the triangle further and further, technology developed at the top invariably moves down into the broader marketplaces below", Chen says. "What happens [in high-end supercomputers] tends to indicate the direction of the whole [computer] industry. When we move the tip, it creates a vacuum in between." It is this gap that is attracting minisuper makers, he adds.

The supercomputer market itself is segmenting into three levels - based primarily on price and performance. A new segment, single-user supercomputers, or the "supercomputer on a desk", is expected to match or exceed the growth of the other supercomputer categories. The two existing segments, high-end supercomputers and midrange superconputers, are also expected to grow considerably faster than the overall computer market - 40 per cent as opposed to the 10 per cent growth for computers on the whole.

Growth at the high end of the supercomputer market and in high-end work stations are both continuations of trends.

In the US, high-end suppliers have watched over their shoulders to see where the Japanese are heading. The three big Japanese computer companies, Fujitsu, Hitachi and NEC, have built very fast supercomputers using impressive hardware but they have not been able to sell more than a handful in the US, largely because of the federal government's actions to prevent the purchase of non-US supercomputers.

The supercomputer company with the most weapons to fend off Japanese companies is Cray, with more than 60 per cent of the world market. To stay ahead, Cray is keeping up its frenzy of new product developments. Cray's approach, however, is that it takes more than just hardware to be successful.

IBM is one of the two dark horses in the supercomputer race; DEC is the other. Supercomputer industry experts have been expecting DEC to introduce a vector-processing VAX machine to compete in the midrange supercomputer marketplace. IBM, on the other hand, has been offering a vector processing add-on to its top-end mainframe computers, the 3090 line, for two years now with considerable success.

Most US supercomputer companies have turned to a low level of parallel processing to increase performance. In most of these systems, the maximum number of processors is four. However, the trend is upward. For example, there are eight central processing units in the new Cray Y-MP and in the two biggest ETA machines, the top two Alliant models, the Gould NP-1, and the forthcoming Cray-3 has 16 processors.

However, these numbers are small compared to the number of processors typical in another class of machines, the highly-parallel computers. Many machines in this category are still considered research machines, although some, such as those from Sequent Computer Systems of Beaverton, Ore., and Encore Computer Corp., Marlboro, Mass., are strong in the commercial sector. Most of the other makers of so-called massively-parallel machines have added vector-processing capability or at least beefed up the floating-point performance in order to go after part of the supercomputer market. On at least some problems, they can boast very high peak performance.

The most massively-parallel computer, with 65,536 processors, is the Connection Machine from Thinking Machines Inc. This unusual machine has been reported to attain up to 7 billion instructions per second doing some specialized tasks, such as those where the same tasks are to be performed upon large volumes of data. However, such blinding speeds are not available for other applications until complex parallel programming is developed.

Another highly-parallel computer is the Butterfly GP1000 built by BBN Advanced Computers Inc. of Cambridge, Mass. It features up to 256 32-bit microprocessor-based CPUs in a multiple-instruction, multiple-data parallel architecture.

One of the pioneering companies in the midrange of supercomputing, Floating Point Systems Inc., in Beaverton, Ore., had been quite successful in offering attached array processors to computer vendors and embedded-systems manufacturers and then graduating to stand-alone minisupercomputers.

Superfast simulators make it a lot easier to skip prototyping

The day of the prototype is almost over. Computerized simulation is coming into its own. The few integrated-circuit designers and many circuit-board designers who continue to build prototypes will soon gain a new level of confidence in simulators. They will find more and better models, running faster and representing both analog and digital circuits.

These changes already are reflected in a burgeoning market for simulation products, spurred on by the nightmare of having to design higher-quality products in less and less time. In fact, the San Jose, California, consulting firm Dataquest Inc. expects that simulators will be the fastest-growing segment of the overall design-automation market, with growth exceeding 15 per cent while the rest of the market stays between 10 and 15 per cent.

Both logic and fault simulators are feeding this growth, and both are providing the models needed to perform effective multiple-chip simulations. Models are coming from various sources: the simulator supplier, who builds models for his own library; third-party suppliers such as Logic Automation and Quadtree; and computer-aided-engineering vendors, who offer physical models for complex circuits.

Suppliers are reducing the time it takes for a simulation to execute. New-generation logic and fault simulators, from Gateway Design Automation, for one, cut computation times by more than an order of magnitude. On top of that, hardware accelerators, especially the Daisy Gigalogician, reduce the simulation run time by several orders of magnitude.

Simulators are improving in other areas too. Newer ones handle logic and analog circuits, and the latest versions of Spice allow designers to perform circuit optimization more easily.

With so much new capability being added to simulators, it is no wonder that the market for these design tools is beginning to take off. The market for total simulators will more than double this year over last, growing from 41,943 units in

1987 to 84,220 in 1988, according to Cindy Thames, vice president at the Technology Research Group, a market research firm based in Boston. She says that unit shipments will grow 70 per cent in 1989 and 36 per cent in 1990, at which time a total of 192,842 units will have been shipped. The market for simulators is about half of the total CAE business.

One reason for this increased demand for simulation is the growth in application-specific ICs. ASIC design starts are going from 12,000 starts in 1987 to 50,000 starts in 1990, and the average size of those ASICs is growing. Their increasing complexity is motivating designers to simulate ASICs in the final system environment to eliminate costly design iterations.

In recent months, there have been efforts by most simulator vendors and third-party model suppliers to provide extensive model libraries. For example, GenRad Corp.'s new System HILO has extensive modelling support. These libraries are starting to contain models of even the newest VLSI chips.

Semiconductor vendors have recognized that early design wins depend on getting models to the designer as soon as the chip becomes available. Another requirement for multiple chip simulation is to be able to model the connections between chips on a board. That is the only way to achieve a true representation of how a design will operate. Silicon Compiler Systems Corp. of San Jose, California, in February announced one such behavioural-modelling capability for wires. (Reprinted from Electronics, 26 May 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Optical storage technology

Optical storage technology will account for 25 per cent of the $71.7 billion US information storage market by 1991, against a 4.6 per cent share of the $36.6 billion market in 1987, according to Electronic Trend Publications. The optical storage market will be driven by write-once, read-many times (WORM) disks, CD-ROM, video disks, and erasable optical disks. Regarding WORM developments, IBM is offering a WORM drive for its PS/2 family of personal computers; Maxtor (San Jose, CA) and Ricoh Systems (San Jose, CA) are jointly offering an 800-Mbyte, 5.25-inch WORM drive. IBM will be a major force in the optical storage market; however, it is taking a wait-and-see attitude about entering the market, watching the developments of other companies, e.g., Wang Laboratories with its Wang Integrated Image System. Optical storage market growth is based on advantages it offers over paper storage, such as higher storage capacity. In banks, 5.25-inch WORM drives are replacing paper storage for signature verification; 12-inch WORM drives are being used to automate insurance industry transaction processing. (Extracted from MIS Week, 4 April 1988)

Three new models from AT&T

AT&T has unveiled three faster models of its 80386-based 6386 WorkGroup System (WGS). Designed to compete with IBM's PS/2 Model 80 and Compaq Computer's Deskpro 386/20, the new Models 373, 374, and the floor-standing 376 come with an 80-, 135-, and 300-Mbyte hard disk, respectively. All three new 25-MHz models include a 3.5-inch, 1.44-Mbyte floppy-disk drive. The Models 373 and 374, which can support as many as 20 users, will be shipped in August 1988. The Model 376 can accommodate as many as 32 users, and will ship in September 1988. AT&T has also introduced upgraded versions of its existing 16-MHz Models 61, 62, and 75. (Extracted from PC Weekly, 17 May 1988)

Users backing Motorola's 88000 chip join the RISC battle

A powerful contingent of users is lining up behind the newest reduced-instruction-set-computer architecture. Started by early users of Motorola Inc.'s new 88000 RISC microprocessor chip, the organization was quickly backed by the chip maker as a way to build support for its processor - and to throw down the gauntlet to the two other major RISC camps pushing devices from Sun Microsystems Inc. and MIPS Computer Systems Inc.

The goal of the 88open group is open standards for all hardware and software system vendors using the Motorola RISC-chip family. The 88000 is not even out of the starting gate - official introduction is scheduled for 18 April. But the user group is set to formally announce the formation of a consortium to work together on such issues as binary compatibility, hardware compatibility, and a common version of the Unix operating system for the RISC chip set.

Tektronix Inc., one of the first companies to reveal that it was designing with the 88000, was instrumental in setting up 88open.

The 88000 chip set will go head-on in the market against the Sparc chip designed by Sun and made by several foundries; the R3000 chip set offered by MIPS and its foundries; and a few others such as Intergraph's Clipper, AMD's AM29000, and Apollo's Prism. But it is the big three - Sun, MIPS, and now Motorola - that are fighting to line up enough system vendors behind their designs to make them industry standards.

There is no doubt that the 88000 consortium will help get Motorola's entry off to a fast start. Officially called the 88open Consortium Ltd., the group signed up 17 members at its second charter meeting in Chicago in April. (Reprinted from Electronics, 14 April 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Why DG is teaming with Motorola on RISC

Motorola Inc. has teamed with Data General Corp. to jointly develop an ultra-high-speed version of the 88000 implemented in emitter-coupled logic.

The deal is a coup for Data General. The Westboro, Mass., company simply volunteered to design the five-chip ECL set which is intended to operate at more than 100 million instructions per second in a single-processor configuration. (The initial CMOS 88000 is rated at 14 to 17 mips.) It was an offer Motorola was more than happy to accept, given Data General's ECL expertise.

Data General regards the 88000 family as a crucial ingredient in its important transition from a solely proprietary computer architecture to Unix-based industry-standard platforms for the 1990s.

Data General has evaluated all available RISC microprocessors and even built a few to see how fast they would run in a system. The CMOS 88000 will probably debut in Data General systems in a year or more.

The ECL chips defined to date are an instruction- set processor, including the floating-point function; a memory-management unit; a cache controller; a system controller that may incorporate the system timing; and a system bus-interface device. The ECL design team has been in place for some time and the design is well under way.

Motorola holds the basic patents on ECL and has been the leading producer and advocate of the high-speed bipolar logic since the 1960s.

The ECL 88000 design will initially be aimed at applications in superminicomputer, mainframe, and supercomputer systems, Data General says. (Reprinted from Electronics, 28 April 1988, (c) 1988 McGraw-Hill Inc., all rights reserved)

Siemens and Philips pool research resources

After five years of feverish and costly joint research, Siemens AG and Philips NV are poised to market large quantities of a new generation of "submicron" chips.

The FRG and Dutch electronics companies - Europe's largest - hope to start commercial submicron production by the middle of next year, putting themselves in a position to prevent Japan and the United States from totally dominating this strategically important new market.

Philips and Siemens, normally competitors in the field of integrated circuits, decided in 1984 that they would have to pool their research resources if they wanted to catch up with efforts by Japanese and US competitors to build submicron chips.

When Philips and Siemens began their joint research, they were estimated to be as much as two years behind in submicron technology. Now, towards the end of a research effort costing about 1.5 billion guilders ($759 million) industry sources estimate that this time lag has been reduced to a year or less.

Although the two European partners may still find that a Japanese or US competitor beats them to the market, Philips and Siemens believe their own chips will be ready in time to profit from the high prices that the chips will command in their early years in the 1990s.

The submicron chip, which is also known as a megachip, is based on submicron technology. In other words, the size of each of its constituent parts is smaller than a micron, which in turn is equivalent to one-thousandth of a millimetre or one-hundredth the diameter of a human hair.

The megachip itself is slightly smaller than a human finger nail, contains six million to eight million transistors and can store enough information to fill six pages of newspaper text.

Under the terms of their chip partnership, Siemens and Philips are working closely together on the scientific and research aspects of submicron technology, but they will go their separate ways when they reach the production and marketing stage.

In fact, the two companies are actually concentrating on two distinct kinds of chips. Philips is working on a one-megabit chip with a static random access memory (S-RAM) that will be used mainly in consumer and car electronics and in telecommunications. Siemens, on the other hand, is developing a four-megabit chip with a dynamic random access memory (D-RAM) that has applications mostly in data processing.

Although the Philips/Siemens partnership will formally end when commercial production of one-megabit and four-megabit begins next year, it is likely to be extended in some other form to include, perhaps, other European companies. (Extracted from International Herald Tribune, 16 March 1988)

Philips is ready with dual-wavelength optical cable

Production of fibre-optic cables using a novel monomode fibre that transmits light pulses at two wavelengths - 1,300 and 1,550 nm - is set to begin at Philips Kommunikations Industrie AG, a Cologne, FRG, subsidiary of the Dutch electronics giant. Based on technology worked out at the Philips Research Laboratories in Eindhoven, the dispersion-flattened single-mode cable, as it is called, makes use of the fibre's second and third optical windows, where dispersion and attenuation values are at their lowest. With the glass fibre, PKI hopes to bridge repeaterless wideband transmission distances of up to 50 km, a big increase over the 30 km common now. Production of the cable will start when the firm gets sufficient orders. (Reprinted from Electronics, 17 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Philips and European silicon structures strike a worldwide ASIC deal

Fast-turnaround prototypes of CMOS application-specific integrated circuits are now available to customers of Philips, following an agreement between the Dutch company and European Silicon Structures. ES2, a specialist in ASICs, will apply its proprietary electron-beam direct-write processes for fast prototyping to Philips' standard 1.5-μm dual-layer- metal CMOS technology. When a customer is satisfied with the prototypes produced at ES2's factory in France, Philips can then produce the devices in volume at five plants in Europe, the US and the Far East. (Reprinted from Electronics, 17 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Philips sells chip-production gear to Soviets

Philips emerged from two years of negotiations with its first industrial deal ever with the Soviet Union - a $13.6 million contract to supply Russia with semiconductor production equipment and know-how. The equipment - for consumer-type circuits destined mainly for colour TV sets - will most likely be installed at a plant in Tomilino, near Moscow. The contract must be approved by the Netherland's Government, but the Eindhoven company foresees no problem. They stress that no sensitive technology that would violate export regulations of Cocom, the co-ordinating committee for multilateral export controls, is involved. (Reprinted from Electronics, 3 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

TI and Apple are expected to offer a low-end AI product

Market analysts who follow artificial intelligence are convinced that Apple Computer Inc. and Texas Instruments Inc. will soon announce an artificial-intelligence link-up. Dallas-based TI is an established player in the high end of the AI market with its Explorer machines, introduced in

1984. But a deal with Apple, of Cupertino, California, would provide TI with a low-end machine - the Macintosh II - to run a TI Lisp-processor board and AI software. The resulting product should cost less than half the $35,000 entry price for current AI machines. (Reprinted from Electronics, 3 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Intel gets a jump on the auto multiplex market

As electronics systems proliferate in cars, chips to support multiplexed vehicle-bus schemes are expected to be one of the next big markets for automotive circuit makers, exceeding $100 million annually by the mid-1990s. And by getting out with silicon early, Intel Corp. is hoping to snatch a dominant position.

Intel plans to roll out its 82526 automotive-networking integrated circuit. The part is the first IC to implement the high-performance Controller Area Network (CAN) protocol developed by FRG's Robert Bosch GmbH, with whom Intel is working.

The 82526, built in Intel's 1.5-μm CHMOS-III process, integrates 30,000 transistors and meets the 1-Mbit per second requirement of so-called Class C automotive networks. Class C nets are aimed at critical applications found in powertrain and vehicle- control subsystems, such as brake signals, which require real-time interrupt-driven performance.

The 82526 works as a peripheral, offloading message-handling tasks from a host microcontroller. Intel says the chip will go on sale by the third quarter of this year.

Meanwhile CAN is gaining momentum in Europe. The International Organization for Standardization is very near the adoption of CAN as a standard. Bosch has already signed chip-licensing agreements with Philips of the Netherlands and more recently with Motorola Inc.'s European operations. Intel says it already has orders, and that the chips could start appearing in production cars as soon as the model year 1990.

Still, Intel and Bosch face an uphill road at best in their drive to establish CAN as a worldwide standard.

Intel has another ace up its sleeve: a lower-cost BasicCAN. The chip will be optimized for use in Class A networks, and also work for some Class B and C applications. The company plans to introduce its first BasicCAN chip by early next year. (Reprinted from Electronics, 3 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Siemens is first in Europe to produce 1-Mbit DRAMS

Siemens AG is now churning out well over 100,000 1-Mbit dynamic random-access memories each month, making it the first European firm to go to market with the devices. Despite a delay of more than half a year the Munich firm managed to get into production at an auspicious time - just when there is a worldwide dearth of memory chips and prices are stable or even rising. Siemens has set its production target for the chips, produced from 6-inch wafers at its plant in Regensburg, FRG, at four million units for the rest of the year. Siemens says it is right on schedule with its 4-Mbit DRAMS and will get them into volume production next year. That would put the German company on a par with most Japanese and US memory makers. (Reprinted from Electronics, 3 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

A new transputer design from FRG startup

In one of the first supercomputer efforts to emerge from Europe, Parsytec GmbH is taking a good idea and expanding on it. The Aachen, FRG, company is building its Megaframe Supercluster around the 32-bit transputer from Inmos Ltd. By clustering transputers and tying them together with the transputer's communication channels, the company's system reaches data-exchange rates fast enough to give it a supercomputer's level of performance.

The Supercluster uses interprocessor communications to split a computing task into many parallel subtasks. These subtasks exchange data and control information over a large number of dedicated, point-to-point communication channels, thereby avoiding the bottlenecking inherent in a bus architecture. The architecture is modular, so more clusters can be added, increasing the system's speed.

The Supercluster is based on the Inmos T800 transputer, which has four communications channels. The transputers are grouped in clusters of 16 and linked through a network-configuration unit. Each cluster has a pair of 16-channel communications lines. The clusters, in turn, are grouped in units of four, linked through two network-configuration units, to make the basic 64-processor Supercluster.

Each unit has work-station interfaces and a system services cluster, which houses the disk-drive filing system, host facilities, and some application- specific modules. Larger superclusters can be formed by connecting two or more basic units through the communications channels emanating from the basic cluster's two network-configuration units.

The basic concept is borrowed from Parsytec's original product, a family of board-level products called the Megaframe-Target series. That product also used transputers in a communication-oriented parallelism, a concept the company is exploiting with considerable success.

In addition to its virtually unlimited expansion capability, the Supercluster has built-in host facilities making it independent of front-end computers. Also, standard work stations may be connected to a Supercluster via fast communication channels so that each work-station application can get access to a user-defined partition of the system.

The fast growth of Parsytec GmbH makes it look like a Silicon Valley company. A year ago, almost no one outside its hometown had heard of it. Today, it is a solid organization known throughout Europe, with sales topping $1 million in the first four months of this fiscal year.

The company's confidence in a new parallel processing concept pushed it up quickly from a precarious launching. In the fiscal year ending 30 August 1986, Parsytec had sales of exactly zero. A year later, sales reached $700,000, and it looks as if the company is set to take off in 1988 with the introduction of its new Megaframe Supercluster.

Like many US startups, Parsytec has a small staff of young employees with a common background.

The average age of the 23 computer scientists, electronic engineers, and mathematicians is 27, and they are all from Aachen's prestigious Technical University. The company also started out as the same kind of shoestring operation as a lot of Silicon Valley firms that opened in garages, but there is an important difference, however, between most US startups and Parsytec. Soon after the latter was founded, it got government backing. The FRG's Ministry for Research and Technology granted the firm 1 million DM - about $600,000.

But the real key to its success so far is Parystec's use of the transputer, made by the UK's Inmos Ltd. The transputer is based on a busless parallel processing concept that allows virtually unlimited system expansion. Parsytec - it takes its name from parallele systemtechnik, German for parallel system technology - implemented this busless concept in its first product, the Target series of board-level computers. A typical module, containing four transputers and 256 Kbytes of random-access Memory on a 220-by-100-mm board, provides computing power of up to 40 million instructions per second. A conventional system would need three modules about the same size to get the same performance. (Reprinted from Electronics. 3 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Sparc vs. Sparc

The Sparc campaign is entering a new phase as the chip houses that have enlisted behind Sun Microsystems Inc.'s reduced-instruction-set microprocessor prepare to battle each other. That is a major change; up to now, the chip makers concentrated on capturing individual pieces of the speed spectrum as they worked to develop and promote their own versions of Sparc - Scalable Processor Architecture.

Fujitsu Ltd. - currently the only supplier of circuits for Sparc systems, with chips rated at 10 million instructions per second - now has a product road map leading straight to 40 Mips by mid-1990. That will put it head to head with the Sparc chip due from Bipolar Integrated Technology Inc. of Beaverton, Ore., in early 1989. The territory in between - 30 Mips - is occupied by the Sparc chip coming from Cypress Semiconductor Corp. of San Jose, Calif.

Managers at Fujitsu's Advanced Products Division, which recently moved to San Jose from nearby Santa Clara, are pressing the new-product strategy because they say Sparc has gained momentum faster than they expected since they introduced their 10-Mips 20,000-gate-array-based product last summer.

Full-custom design of a new integer unit is underway, and Fujitsu is planning CMOS microcores for semicustom processors, a powerful new 64-bit Sparc- oriented floating-point unit, and a memory-management unit.

Fujitsu's broadened commitment is not the only indication of a new Sparc era. It comes on the heels of LSI Logic Corp.'s decision to become the fourth firm to back Sparc (while also embracing a competing RISC design from MIPS Computer Systems Inc.). The Sparc backers are fighting for what is still a tiny segment of the 32-bit microprocessor market, but one that is about to explode.

Dataquest Inc., the San Jose-based market research firm, estimates that all the RISC camps combined will account for 20 per cent of the roughly 27 million 32-bit processors that will ship in 1992.

LSI Logic plans within 18 months to have a 40- to 50-mips Sparc processor made with biCMOS. The company will start in mid-1988 with a 1.5-μm drawn gate CMOS product offering 15 Mips, and increases in performance are likely every 6 to 12 months.

Fujitsu, meanwhile, is gearing up to reach 40-Mips performance in three stages, starting in July with a 1.3-μm standard-cell-based integer unit. With a Sparc-specific floating point controller, it will run at 15 Mips. The new part, to be called S-25, will be housed in a 179-pin plastic pin-grid array and is expected to cost less than the current 256-pin 10-Mips part, which requires a separate 20,000-gate array floating-point controller unit. Fujitsu plans to introduce a 20-Mips three-chip set, running at 33 MHz, in March 1989. Susan Mason, marketing development manager for the product, says the process will be 1-μm CMOS. (Reprinted from Electronics, 31 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

IBM wins contract

IBM has a contract to provide an optical-based document image processing system for the United Service Automobile Association (San Antonio, TX). IBM won the bidding over nine vendors. Its Federal Systems Division will be tne integrator for the system, which will have a storage capacity of 3.5 Tbytes (3,500 Gbytes), or 300 million pages, of image data over 1,000-plus terminals used by 2,000 users. IBM will be a systems integrator rather than turnkey producer, because it markets only the Matsushita-manufactured 5.25 inch write-once read-mostly optical-disk drive. IBM will write the image software for the system; the USAA will write the host software. Non-IBM hardware contained in the system will include FileNet jukeboxes. The USAA's computer output and mail is about 1.78 million file folders worth in one year, requiring 39,000 sq. ft. of office space. A warehouse is needed to store six years worth of mail. Article describes the USAA's history of document image processing research and use. (Extracted from MIS Week, 15 February 1988)

Plessey aims at becoming main UK semiconductor company

Plessey is using two means to become the UK's leading semiconductor company. Plessey also estimates it is eighth among chip companies worldwide, and is using acquisitions and alliances to boost this level. One way is the development of a computer-aided design system, Shade, that cuts microchip design costs (currently estimated at about ,000, expected to rise as the number of gates/chip is moving towards 100,000 plus from 10,000) by 90 per cent. The other way is to create chips that work 10 times faster than current ones for a slight increase in power use. Plesssy already is a leading supplier of chips except for specialty chips. The integrated circuit worldwide market is estimated at $28 billion, according to Dataquest (US), expected to reach $58.8 billion by 1992. Bi-polar and CMOS chips, the two most common types of application specific integrated circuits (ASIC), account for about $7 billion currently. Dataquest, however excludes application specific standard parts (ASSP), which Plessey estimates at 50 per cent of

the bi-polar and CMOS level for a total market ASIC level of $10-11 billion. (Extracted from Financial Week, 3 February 1988)

Sun, Stratus project gains

A year after Sun Microsystems and Stratus Computers announced their plans to develop and market products jointly for financial, telecommunications and CIM applications, the project may show a payoff. Soon, stratus is expected to announce support on its systems for Ethernet and Sun's Network File System. Until now, Stratus had not fully supported them, and the two had been sticking to limited joint marketing, primarily to Wall Street brokerages. Active joint marketing is expected to ensue shortly, which is about one quarter behind the companies' original schedule. (Reprinted with permission of DATAMATION® magazine (c), 1 April 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Apple and Digital Equipment to jointly develop products

Apple Computer (Cupertino, CA) and Digital Equipment (Maynard. MA) are jointly developing computer products for engineering and manufacturing uses, with the firms predicting that products would be ready for shipment in the third quarter of 1988. The partnership at first will focus on technology development, with joint marketing and product licensing as possible expansions of the accord. Digital said the development work thrust will be on software and networking links for end-users of Apple's Macintosh personal computers, integrating the units with Digital's VAX minicomputers that control factory- floor equipment. Development efforts will stress distributed uses methodology, file sharing, document interchange, printing, terminal emulation, electronic mail, conferencing, database management, networking and network management.

Moving very tentatively into parallel processing, Digital Equipment Corp. says its newest VAX 8800 Series multiprocessors work best in a multiapplication, multiuser environment. The company still plans to release a parallelizing VAX FORTRAN along with version 5.0 of its VMS operating system. Support for a parallelizing VAX Ada compiler is also being considered for future release. (Extracted from Metaiworking News, 21 March 1988 and Datamation, 1 April 1988)

Apple to evolve Macintosh system

Apple Computer has informed developers of its plans for evolving the Macintosh operating system. The company will implement a set of functions called interapplication communications (IAC) before adding increased multitasking, which will come in the form of interprocess communications sometime in 1989. Developers compared IAC's functionality with Microsoft's Dynamic Data Exchange, which dynamically links applications. Also, with System 7.0, Multifinder will become the default Mac operating system, supplanting the existing Finder, or "Unifinder". At that point, 2 Mbytes will probably be the standard minimum configuration. The Mac line will be extended upwards and downwards, including 68030-based systems. Two systems will be released per year. System 6.0 will ship within the next few weeks, offering Quickergraf, a performance upgrade to Quickdraw; Notification Manager, offering a way for background applications to give status signals to the foreground; and Macro Maker, a new keyboard macro program. System 7.0 will probably implement IAC, although an exact timetable has not been provided. (Extracted from Informatic World, 2 May 1988)

PS/2 clone on the way?

Dell Computer Corp., maker of PCs Limited's personal computers, may be the first to market with a PS/2 clone incorporating IBM's Micro Channel architecture. Word from insiders at Dell is that they have agreements with IBM that will allow Dell to build a PS/2 clone and avoid the legal problems that could send other players out of the game with severe injuries. IBM's comment is that it is standing by its statements that it has patent licensing agreements with several manufacturers and will issue only utility patents for its Micro Channel architecture, not for Micro Channel as a whole. Another batter from the Texas league is Tandy Corp., which is to use its board layout along with Chips and Technologies Inc.'s Micro Channel-compatible chip set in its PS/2 clone. Tandy will ship the machines to its Radio Shack stores as early as mid-April for display only to gauge the degree of interest before going into full production. (Reprinted with permission of DATAMATION® magazine (c), 1 April 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

How Rosenbaum is fixing scientific computer systems

The future of Scientific Computer Systems Corp. looks bright again. The key move in bolstering the San Diego minisupercomputer maker came when a founder of Convex Corp., Barry Rosenbaum, was persuaded to take over the privately held firm last year.

Industry observers consider the SCS-40 computer, a 64-bit system that executes 44 million floating- point operations per second, a superior piece of technical work based on solid technology. So SCS's troubles, which came to a head in 1987 after the company was in business for four years, did not stem from a below-par product. In the opinion of insiders, SCS had fallen into a common trap that often snares startups: it did not have a decisive executive with a strong business background at the helm.

The SCS strategy is to build small supercomputers fully software-compatible with machines from Cray Research Inc. That means plenty of software is always available. SCS also sells its machines at well below the price tags on the Crays.

The SCS line falls in the class of machines called entry-level supercomputers. The SCS-40's performance is equal to 30 per cent of a Cray X-MP. But with a price tag of $595,000, it costs only one-tenth as much. Users can also turn to the SCS-30, a 33-megaflops machine that starts at $371,000.

A big challenge facing Rosenbaum is the company's response to new machines from Alliant, Convex and Multiflow that are faster and more versatile than the SCS-40, and are staking a claim to the minisuper market's upper end. But these new minisupers face a major software-development hurdle that has been neatly sidestepped by SCS through its

compatibility with Cray machines. The SCS-40 machine executes the X-MP instruction set, and runs under the Cray CTSS and COS operating systems. It uses the Cray compilers, so application programs can be up and running fast.

The SCS machine derives its performance largely from a unique high-speed bus structure designed to efficiently combine vector and scalar processing. The bus system will support major speed upgrades in the future, and for the present makes possible an attractive price-performance ratio by wringing maximum performance from relatively low-cost components - standard emitter-coupled-logic gate arrays. (Reprinted from Electronics, 3 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

IV. APPLICATIONS

Laptop has the power of an 80386-based PC

Zenith Data Systems' new portable computer is the first battery-operated laptop to offer the power of an 80386-based desktop personal computer. In addition, the company says its Turbosport 386 is the only portable that can operate for up to two hours on battery power with no degradation in system performance.

To provide this high performance in a battery-operated system, the Turbosport features extensive power management capability, especially to cut power consumption in the liquid-crystal display and disk drive - the highest power consuming components of a laptop.

Innovations in the Winchester disk drive contribute the most to conserving battery power. It has four power modes: standby, idle, seek and read/write. The first consumes a mere 0.5 W; the second, 2.0 W; the third, 2.8 W; and the last, 4.2 W. Power-management controls on the disk drive let the user increase battery life beyond two hours by reducing the system's performance.

As it rolls out this newest line of portable computers, comprising a 286-based line called Supersport and a top-of-the-line 386-based product called Turbosport, Zenith is in a good position to capitalize on this expanding market. The new line, which has just begun reaching dealers, consists of the Supersport 286 model 20, Supersport 286 model 40 and Turbosport 386. At the top of the line, the Turborsport 386 - which sells for $7,999 - does not require ac power to operate its high-resolution LCD, 40-Mbyte Winchester disk drive, and 12-MHz 80386 microprocessor.

Operating at 12 MHz with no wait states on battery power, the Turbosport 386 outperforms 16-MHz 80386-based desktop computers that require one wait state. The relationship between the two is that the Zenith chip operates at both 12 and 6 MHz. At the faster 12 MHz speed, it outperforms a 16-MHz chip. The user can switch the microprocessor from 12 MHz to 6 MHz to accommodate software written for the slower clock speed and to extend battery life beyond two hours.

The system comes with 2 Mbytes of random-access memory, which can be expanded to 3 Mbytes. All RAM above 1 Mbyte adheres to the expanded-memory specification developed by Intel, Lotus, and Microsoft. The system comes with MS-DOS 3.21 software, but users can operate with OS/2, Xenix, or Windows 386.

The computer comes with a capability called intelligent power management (IPM) which provides the user with two power control modes - session and dynamic. In the former, the user calls on a set-up menu before beginning a computing session to tell the laptop which subsystems to power up during the session. For example, the system has an optional internal modem which the user can choose not to power so as to conserve battery life. IPM switches power to the user-chosen components.

Under dynamic control, the user can change previous power arrangements. For example, he can change the clock speed of the 80386 microprocessor or reduce the brightness of the backlight. Besides these manual changes, the IPM can also automatically control power to individual components.

The IPM automatically removes dc voltage when a component has not been used for a period of time specified by the user. This conserves the Nicard battery pack powering the system. Components or functions that can be controlled dynamically include the communications ports, backlighting of the LCD, modem, disk drives, and processor speed. (Reprinted from Electronics, 28 April 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Optical disk drives finally get a controller chip set

Since the advent of optical storage technology, one of the biggest barriers to building commercial disk drives has been the lack of both a standard controller format and the silicon to make it work, but now optical drive makers can buy a controller that meets proposed standards from Western Digital Corp., a seasoned controller supplier. The company's key accomplishment is an encoder/decoder chip, the WD60C31 Endec, that fills the last socket of an optical- controller architecture the firm has designed over the past several years. Western Digital now has in hand the five proprietary devices necessary for an integrated-controller chip set, including its WD60C80 error-detection-and-correction chip, which was unveiled late in 1987.

Because of Western Digital's involvement with standards activities, the new controllers fully satisfy requirements of the ANSI format. Prospective users have approved the standards and they will be sent later this year to be acted upon by the International Standards Organization.

With the integrated chip set in hand, Western Digital can sell the devices either as a unit or with an additional licence for the source coding and formating. But buyers are likely to go for the new WD1008-OPT board, which contains the error-detection- and-correction devices and the three other chips: the WD33C93 Small Computer Systems Interface controller, the ADS3570 buffer manager, and the WD10C00 disk controller. The board bundles a number of features into an optical-memory prototyping tool for developing and debugging firmware and hardware. It supports up to four drives, and has sustained 1:1 sector interleave and built-in diagnostics, along with either dynamic random-access memory or static RAM track buffer and limited defect mapping. The WD1008-OPT has a 5.25-inch footprint and runs from a single 5-V dc supply.

Both the board and the chip set support the SCSI protocol and the modified Extended Small Disk Interface. SCSI features include ANSI X3.131 performance, arbitration, disconnect/reconnect, and a common command set for optical applications.

Asynchronous data transfer is at 1.8 Mbytes per second, and synchronous transfer at 4 Mbytes per second. Modified ESDI transfer speed is up to 15 Mbits per second, with optical commands and programmable format plus interleave. (Reprinted from Electronics, 28 April 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Fujitsu's bipolar array boasts 100-ps delays

By implementing its 10,000 gate bipolar gate arrays in an advanced bipolar ECL process, Fujitsu Microelectronics Inc. engineers are delivering unloaded gate arrays that outperform the competition by a factor of three.

The ET10000H boasts 100-ps unloaded gate delay at 2.44 mW and 180 ps at 1.22 mW. Loaded gate delay is 400 ps per gate at 2.44 mW. Keying the performance is the company's three-level-metal self-aligned emitter base process that incorporates polysilicon electrodes and resistors and combines groove isolation with more traditional field oxide isolation.

The process features 0.5-μm emitters using a 1.0-μm mask, 2-μm channel lengths, and 4.5-μm metal pitch on the interconnections. The polysilicon-emitter-based self-aligned structure makes possible extremely shallow active areas resulting in a significant reduction in parasitic capacitance, allowing the gates to run faster with less power.

A thick oxide layer also contributes to reducing the parasitic capacitance of the resistors and the wiring channels. And the use of the grooved isolation structure reduces collector substrate capacitances. In the case of the collector base structure alone, a 30 per cent decrease in capacitance results in a 10 per cent improvement in gate delay.

Compatible with both 10K and 100K ECL circuits as well as mixed ECL-TTL, the arrays offer 25, 50, or 100Ω ECL output options. ECL input/output delay, including that of the package, is 950 ps, input buffer delay is 1.0 ns, and output buffer delay is 3.5 ns.

The ET10000H contains 9,856 equivalent gates in the internal array and up to 200 gates in the I/O section. These gates are organized into 1,792 basic cells that are capable of toggle rates up to 1.1 GHz.

The arrays are designed using Fujitsu's integrated design system, which is available on several popular computer-aided-design work stations, including Daisy Systems Corp., Mentor Graphics Corp., and Valid Logic Systems Inc., in conjunction with an Amdahl Corp. 5840 mainframe computer. (Reprinted from Electronics, 31 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Intel's first flash EEPROMs make in-circuit reprogramming easy

Intel Corp.'s first flash electrically erasable, programmable read-only memories boast access times as low as 150 ns and incorporate special circuitry to make reprogramming easier in embedded applications where physical access is difficult.

In addition to the conventional programming mode with an external PROM programmer, the 64-Kbit 57F64 provides an on-board mode that maintains supply voltage at 5-V. The chip-enable and output-enable signals are maintained at standard logic levels. As a result, devices socketed or soldered to circuit boards can be erased and programmed via an edge connector to a PROM programmer or board tester.

In the 256-Kbit devices - the 27F256 and the 28F256 - new command-register circuits have been implemented that are directly compatible with the write interface of most microcontrollers. In this approach, a 12-V signal applied to the programming pin can access all functions associated with altering memory contents via the command register. Commands are written using standard microprocessor write timings.

As a group, flash devices target embedded control applications where the system central processing unit provides occasional code updates over the lifetime of the product. Intel's devices offer 100-cycle programe-and-erase endurance rates. Reprogramming failure is less than 0.01 per cent. A device capable of 10,000 reprogramming cycles is under development.

By combining the hot-electron writability of ultraviolet erasable EPROMs and the tunnelled cold-electron erasability of traditional EEPROMs, flash devices deliver both high density and in-circuit electrical erasure and reprogramming. Intel's method for providing these basic features is primarily its use of proprietary EPROM tunnel-oxide technology.

To further enhance their use in embedded applications, the flash devices incorporate proprietary high-speed programming and erase algorithms. Using a new Quick-erase algorithm, the contents of the flash devices can typically be erased in less than one second, compared with the 10 to 20 minutes required for UV erasibility. Using the Quick-pulse programming algorithm, the devices reprogram in less than four seconds. (Reprinted from Electronics, 14 April 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

High-performance super minicomputer

Hitachi Ltd. has put on the market two high-performance super minicomputers - the HITAC Model E-7700H (high-speed model) and the HITAC Model E-7700D (standard model), which are designed for high-speed data processing of 8.1 million instructions per second (1 MIPS = 1 million times of instruction processing per second).

User needs for minicomputers are undergoing rapid diversification, raising user demands for software which can be used commonly between systems and equipment made by different manufacturers as well as sytems and equipment capable of using terminal equipment made by other manufacturers in linkage. To meet these diverse demands, the company has been engaged in intensive research to develop high-speed, large-capacity super minicomputers which are designed to introduce a wide range of international standards and specifications.

The new super minicomputers use super high-speed LSI's normally employed in super large-capacity computers, by which they have attained the world's highest-level processing performance of 8.1 MIPS.

These super minicomputers introduce international standards and specifications which are being accepted popularly today in the fields of engineering computer languages and communications.

More specifically, for their operating system, they adopt the most updated UNIX OS version system VR 3.0 that is being accepted worldwide. Thus, it is now possible to shift with ease to existing software operating on system V. In addition, the adoption of the LAN system and support with various kinds of versatile interfaces conforming to Multibus or IEEE 802.3 specifications now enables easy interconnection of these super minicomputers to peripheral systems and terminal equipment made by different manufacturers. Further information available from Hitachi Ltd., Public Relations Secretary's Office, 6, Kanda-Surugadai 4-chome, Chiyoda-ku, Tokyo, Tel: 03-258-1111, Telex: J22395. (Source: JETRO, March 1988)

New simulator turns up faults in a hurry

Complex application-specific integrated circuits and printed-circuit boards containing them are the cause of many a testing nightmare. One reason is that fault simulators - programs intended to dig out potential problems in chip-design programs - are neither sophisticated nor fast enough to handle them. In addition, fault simulators are not well integrated with logic simulators, the programs that help ensure chip functionality. Or they lack a sophisticated hardware-description language and are difficult to use, as a result. Finding a way out of this maze of difficulties is troublesome, but Gateway Design Automation Corp. of Westford, Mass., says its Verifault-XL fault simulator can end such testing nightmares.

Intended to replace the company's first-generation TestGrade fault simulator, the Verifault-XL simulator runs at least an order of magnitude faster than its predecessor and competitive products. The speed improvement comes from two areas. The Verifault-XL simulator employs an algorithm already used in the company's sister product, the Verilog-XL logic simulator. Also important is the ability to perform concurrent fault simulation of behavioural (high-level) models. Another speed advantage is that the Verifault-XL is the first simulator that can simulate faults over a local-area network.

What's more, the company's fault and logic simulators both speak the same hardware-description language. Other vendors' products do not, the company says. The common language is terse, yet produces large amounts of stimuli with relatively few input statements. So closely are the two simulators allied, that Verifault-XL and Verilog-XL will be sold together. The software runs on a variety of hardware platforms, including systems from IBM Corp., Digital Equipment Corp., Sun Microsystems Inc., and Apollo Computer Inc. Gateway says it will begin shipping in July. (Reprinted from Electronics, 26 May 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

"Desktop" supercomputer

Interest has been building in recent months over the imminent arrival of a new class of supercomputer, called the "supercomputer on a desk" or the single- user model. Apollo Computer Inc. is launching a new work station that racks up an impressive list of industry firsts as it puts supercomputer power at the disposal of a single user.

The new series 10000 is built around a reduced-instruction-set architecture that the company calls Prism, for parallel reduced-instruction-set multiprocessor. Among other things, the Prism design makes the 10000 the first RISC system to hit an execution rate of more than one instruction per cycle. The 10000 executes 1.2 to 1.3 instructions per cycle. The RISC systems currently available, from companies such as Hewlett-Packard, MIPS Computer Systems, and Sun Microsystems, strive for one cycle per instruction but so far need two or three cycles.

The 10000 has also racked some other firsts. It is the first work station with a true 64-bit system architecture, including central processing unit, floating-point unit, and system buses. It is the first work station to use scan path technology, which provides a built-in system for testing dense VLSI arrays. Finally, the new machine scores a breakthrough in its Linpack benchmark performance: $10,000 per megaflop, compared with about $100,000 per megaflop for conventional supercomputers.

The 10000 is also one of the two first single-user supercomputers; the other is Ardent Computer Corp.'s Titan. Apollo expects to ship two versions of the 10000 in the third quarter: a server system without a display, which will sell for just under $70,000, and a computational work station offering 1,024-by-800-pixel-by-8-plane graphics, priced just under $80,000. However, the 10000's three-dimensional-graphics subsystem will not be available with the first models. Design work on the subsystem started after the CPU design, so the subsystem will ship a few months later. (Reprinted from Electronics, 3 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Open network architecture

Network Systems Corp. has announced a new network architecture that is media- and protocol-independent. The Hyperchannel DX product line will be built around a central adapter, based on Motorola Inc.'s 68020 chip and equipped with 1 to 16 Mbytes of memory, that will handle processing for a variety of standard protocols, input/output buffering, diagnostics, and network management. Hyperchannel DX will work initially at speeds up to 100 Mbits per second - twice as fast as The Minneapolis company's 11-year-old Hyperchannel line. The system will accommodate the emerging 100-Mbit per second Fiber-optic Distributed Data Interface standard, and will eventually handle higher speeds. Hyperchannel DX will work with systems equipped with direct-memory-access channels. (Reprinted from Electronics, 28 April 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Data compression

Although "data compression" may be a tiresome trick for everyday reading-matter, it is a crucial one for computer scientists and generals. Traditional methods can yield compression ratios of up to 10:1 (compared with 35:20 for our opening sentences), which is not bad. One application of the emerging science of fractal geometry lets you squeeze 10,000 - perhaps even 1 million-computer "words" into one.

The first application of this almost-magical trick is for computer-stored pictures that have been translated into digits. Dr. Michael Barnsley and Dr. Alan Sloan, at the Georgia Institute of Technology in Atlanta, are working on compression techniques that could be used to store, transmit and analyse images sent down from satellites.

The way it is done can best be understood through the two backbones of fractal geometry - the concepts of self-similarity and of fractal dimension. A self- similar image, or piece of data, is one in which an enlargement of a part looks like the whole. Since the smaller part is identical to the whole, the whole can be rebuilt from a part. Thus, the data used to describe the whole can be compressed. By how much depends on its fractal dimension.

The extreme compression which fractal geometry makes possible should let small computer systems wield enormous amounts of data. Given 10,000-fold compression, anybody with a home computer could store all the main encyclopaedias, a half-century of newspaper and magazine back-numbers, plus a lot more, on a single laser-read disc that costs $6 to produce.

How soon fractal data compression enters the marketplace will depend largely on computer speed. The huge number of calculations required to compress or blow up data makes it too cumbersome a process for today's personal computers. (Extracted from The Economist, 21 May 1988)

Multimeter dances rings round the rest

A digital multimeter from Hewlett-Packard Co., Palo Alto, Calif., makes measurements far faster than any other, yet is as accurate as the best of them. It takes readings at speeds one to two orders of magnitude greater than its nearest rival, while being nearly as accurate as the best voltage standards.

The 3458A multimeter makes 100,000 readings per second at 4-1/2-digit resolution and 6 per second, or 360 per minute; at 8-1/2-digit resolution. Just 10 readings per minute at 8-1/2-digit resolution is the most the next fastest multimeter can do - the Datron 1281 by Wavetek Corp., San Diego, Calif.

Even more important, the 3458A can change function and range setups at a rate of 200 per second, or quadruple the rate of previous HP meters. The advance means the bottleneck in automatic test applications may be the computer, rather than the multimeter.

The 3458A measures dc voltages with an accuracy of 0.5 part per million in 24 hours and remains stable to 8 ppm over a year, or to 4 ppm with the high-stability option. In other words, it is more accurate a year after calibration than most DMMs are 24 hours after calibration. The meter employs auto calibration to an internal reference or, for tracking to a national standard, an external 10-volt dc reference and 10-kilohm reference resistor. (Extracted from IEEE Spectrum, April 1988)

NEC has charge-coupled sensor for high-definition TV in sight

NEC Corp. will have charge-coupled-device image sensors suitable for high-definition TV on the market in about two years, squeezing vacuum tubes out of yet another application. The interline CCD devices pack 1,920 cells horizontally by 1,035 vertically on a 16.5-by-10-mm chip, for a total of almost 2 million pixels in an area equivalent to a 1-inch camera tube. Effective imaging area is 14.0 by 7.8 mm. For maximum resolution, three imagers would be used in a camera, one for each primary colour. The aspect ratio is 9:16 - the wide screen favoured for HDTV - but the imagers should also find applications in other new media using HDTV standards and in office automation gear. A vertical-drain design of a type used earlier by NEC in other CCD imagers suppresses blooming. (Reprinted from Electronics, 3 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Clear digitizing pad cuts price by half

A thin film of proprietary resistive material deposited on a transparent glass substrate is the key technology in Ovonic Imaging Systems Inc.'s digitizing pad for direct entry of handwritten information into a computer. And at $110, the versatile pad costs about half the price of competing systems.

When the user writes or draws with a conductive stylus on the company's E-Z Image pad, an image of the inscription appears on a computer display in bit-mapped form. Simple circuitry around the edges of the pad senses the location of the stylus.

The pad is compatible with IBM Corp.'s Personal Computer family. Since it is transparent, E-Z Image can be used as an overlay for tracing drawings, maps, and photographs. It can be placed over a light box, CRT screen, or flat-panel display. Another use is as a direct-entry notepad in applications such as filling out forms electronically, or in signature-verification systems for security purposes, banking and credit-card transactions.

The system offers a versatile, simple-to-use approach to computer entry that requires no special training.

The E-Z Image pad with a 7-by-8-1/2-inch active area is available complete with stylus and interface card. (Reprinted from Electronics, 17 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

VMEbus board delivers 16 million colours

A series of single-board bit-map display controllers from Univision Technologies Inc. delivers true colour performance for VME-based Sun Microsystems work stations. Yet at $8,000, the controllers cost about a quarter of the price of the high-end systems that offer true colour, but also incorporate much higher vector performance than many users need.

The UDC-3400 series supports 60-Hz non-interlaced monitors and can handle 16.8 million colours with 34-bit/pixel graphics resolution. Eight bits each are used for red, green and blue signals, eight for indexing/tagging, and two for overlay. The controllers target applications such as computer-aided design and image analysis. The series has not been fully benchmarked, but the 20-pixel horizontal-vector line drawings are done at a rate of 50,000 per second.

The UDC-3400 series gets its performance by combining a 20-MHz Intel Corp. 82786 display controller with up to 9 Mbytes of dual-ported video memory. That combination allows high-speed operations, such as polygon and line drawing, bit-block transfers, and multifont text generation.

The dual-ported memory also gives fast access to the host bus, while an optional external VSB-standard bus interface provides access to

very-high-speed processing by means of an outboard array processor or coprocessor at a transfer rate of 10 Moytes per second. A 512-Kbyte display-list memory allows users to store primitives, such as circle arcs, commands and text.

The series is available now. (Reprinted from Electronics, 17 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Floating-point milestone: single-chip processors

Single-chip technology has caught up with standards for the 64-bit floating-point arithmetic set by the Institute of Electrical and Electronics Engineers, and the timing could not be better. Floating-point markets are about to be propelled beyond the traditional technical markets by the explosion in reduced-instruction-set computer architectures and powerful work stations and the accompanying growth of numerically intensive applications.

Floating-point units are suddenly finding work where once only data-processing software had been employed. Bankers, economists and stock brokers are buying technical work stations to automate business forecasting and model global financial markets.

"Floating-point has turned out to be a lot broader market than people thought it would ever be", says industry analyst Will Strauss of Forward Concepts in Tempe, Ariz. He estimates market growth at a healthy 36 per cent annual rate. The merchant market for floating-point processor chips and chip sets stood at $25 million worldwide in 1987, Strauss says, and will grow to $64 million in three years. About 90 per cent of the floating-point market is expected to comply with the IEEE standards set in 1985.

What's more, the floating-point niche is an area where US chip makers appear to have a decisive edge over rivals in Japan. This advantage exists because of the software-intensive nature of the business and its current small size.

Until now, the IEEE's standard for binary floating-point arithmetic was supported only by multiple chip sets that work together to support most, but not all, of the spec's operating modes or required accuracy. New 1-µm CMOS technology has given chip makers enough integration power to pack double- and single-precision math units onto one chip.

With that breakthrough in hand, the battle is turning to the development of innovative architectures for parallel operations, new embedded algorithms for higher accuracy in rounding off results, and hooks to make the IEEE-standard parts easier to use in a growing number of systems.

At least three US competitors are aggressively launching single-chip floating-point units. Advanced Micro Devices Inc., Texas Instruments Inc., and Weitek Corp. are aiming at driving down costs and raising performance of systems conforming to the IEEE standard. AMD, of Sunnyvale, Calif., plans to take that goal two steps further, by also conforming to other formats created by IBM Corp. and Digital Equipment Corp. The AMD chip also is a top performer in both scalar and vector operations. (Reprinted from Electronics, 17 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

How to choose an expert systems tool

The marketplace is full of functional PC expert systems tools; the trick is to find the ones that best fit the requirements of intended applications and that suit developers' preferences. Several factors determine the appropriateness of an expert systems development tool: ease of use, knowledge representation and inferencing, to name just a few, and tool selection cannot be performed without gauging user requirements.

One of the most important questions is how the knowledge can be represented. This can have a critical effect on whether a specific application can be built. Current PC tool capabilities range from simple rules to frames - a technique that organizes representations into hierarchical structures and maintains relations between classes of objects - with or without inheritance - the feature that allows frames to "inherit" the attributes from frames above them.

Other PC products feature the ability to "induce" rules from examples; these inductive tools may be appropriate for certain classification problems. There are many possible combinations of these representation mechanisms in currently available tools.

Also of vital importance is how the knowledge will be acted upon. The tool's inference engine may be primarily backward chaining, forward chaining, or a combination of both and the different methods may suit certain applications better than others. For example, backward-chaining systems appear to be well suited for diagnostic applications, while forward-chaining systems are well suited for data analysis and configuration systems (although these are not rigid guidelines). The performance of a tool is significant when processing time is a factor, and rule limitations may be a problem if the knowledge base is to be very large.

The ability to access external data is also vitally important. Many packages, while offering basic interfacing ability for Lotus 1-2-3 or dBase, may still require considerable effort from users to get that data into the expert system. For applications in process control, the ability to interface to sensors is also important.

Although difficulties with connectivity issues may be unavoidable, users should try to minimize the time required for interfacing and maximize knowledge engineering - the heart of any expert system. Some users may want their development systems to be expandable, so that additional functions can be added by the user and connected via external interfaces.

The quality of the user and developer interfaces is another key concern. Even the most powerful tools may not find acceptance among developers if the tools are too forbidding to employ. The current range of tools has a particularly wide variation in this regard. Some of the PC tools with the most power (including the language-level tools) require familiarity with the underlying languages and may require some ramp-up effort. Other tools may provide sufficient ease of use but fall short of the requirements of specific applications. Most development packages have a facility to examine an expert system's line of reasoning; this may be provided in graphical form

or as a simple list of rules that were invoked to reach the system's conclusion.

For those users desiring to install a package among many individuals, the vendor's policy for run-time software may be particularly significant. Some vendors practically give them away; others may seek a hefty percentage of the development price. Of course, it is critical to judge carefully the prospects and track record of the tool vendor.

The presence of alternative platforms also can be a consideration. Some vendors now offer development tools on a number of computer lines; the ability to migrate to more powerful hardware may be desirable if the expert system is liable to grow. (Reprinted with permission of DATAMATION[r] magazine (c), 1 April 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet, all rights reserved)

Suppliers of PC expert systems tools

The following is a selection of currently available expert systems development tools for PCs. All operate on IBM and compatible PCs, except where noted.

Languages:

Computer *Thought Corp., Plano, Texas: OPS5+.
Coral Software Corp., Cambridge, Mass.: Allegro CL (Macintosh)
Expert Systems International, Philadelphia: Prolog 2
Expertelligence, Santa Barbara, Calif.: ExperCommon Lisp II, ExperProlog, ExperOPS5 (Macintosh)
Franz Inc., Berkeley, Calif.: Allegro Common Lisp
Gold Hill Computers Inc., Cambridge, Mass.: Gold Common Lisp
Logicware Inc., New York: MProlog
MicroProducts Inc., Boca Raton, Fla.: PowerLisp
Sapiens Software Corp., Santa Cruz, Calif.: Star Sapphire (Lisp)
Soft Warehouse Inc., Honolulu: muLisp

Development Tools:

Aion Corp., Palo Alto: ADS
Expert Systems International, Philadelphia: ESP Frame Engine, ESP Advisor
Expertech Inc., Redwood City, Calif.: Xi Plus
Exsys Inc., Albuquerque, N.M.: Exsys
General Research Corp., McLean, Va.: TIMM
Gold Hill: Gold Works
Human Edge Software Corp., San Mateo, Calif.: Expert Edge
Information Builders, New York: Level5 (Insight)2+
IntelligenceWare Inc., Los Angeles: Intelligence/Compiler
KDS Corp., Wilmette, Ill.: KDS3
Knowledge Garden, Nassau, N.Y.: KnowledgePro
Logicware Inc., New York: Twaice
Neuron Data Inc., Palo Alto: Nexpert
Paperback Software, Berkeley, Calif.: VP Expert
Programs in Motion Inc., Wayland, Mass.: First Class
Radian Corp., Austin, Texas: RuleMaster 2
Software Architecture & Engineering, Arlington, Va.: KES II
Technology Applications Inc., Jacksonville, Fla.: Keystone
Teknowledge Inc., Palo Alto: Copernicus
Texas Instruments, Personal Consultant
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Parallel thinking - the transputer takes the risk

Until recently computers have been designed as serial machines: they perform one operation at a time, regardless of its complexity. The virtue of performing these operations electronically is speed - hence the industry's fascination with MIPS and MegaFLOPS.

Complex problems are broken down into many simple steps that are then executed extremely quickly by the central processor. Even "multi-processor" computers are essentially no more than two or more serial computers sharing a memory and a single set of peripheral devices for input, output and storage. But they are a poor representation of real parallel processing.

Parallel processors, capable of performing many functions simultaneously, have been postulated for some time. Their attraction has been likened to a game of bingo in which all the numbers are selected and announced at the same time: games would be over in no time at all.

A new era of applications is demanding sophisticated high resolution graphics, the use of artificial intelligence techniques and ever more complex computing. Parallel processing has the potential to provide the power for these very cheaply.

The Inmos transputer is no more than a VLSI (Very Large Scale Integration) chip which packs RISC (Reduced Instruction Set Computing) and a limited amount of RAM (Random Access Memory). The latest transputer, the T800-20, can execute a nominal 10 million instructions per second (10 MIPS) and can perform 1.5 million "floating-point operations" per second (1.5 megaFLOPS - "floating-point operations" are used to manipulate very large or very small numbers). That kind of performance alone would make the T800 a smart product.

There are now plenty of RISC processors on the market: the transputer is special because it was the first to be designed from the outset for parallel processing. It retains this advantage.

The transputer has four high-speed communication links. These can pass 10 million bits per second (Mbits/s) in both directions and they enable transputers to be inter-connected in powerful arrays. The links enable programs and data to be distributed throughout the array and they allow processors to synchronise their activities.

Most existing multi-processor computers use a common communications channel, or "bus", for interconnection. But as such systems grow, the capacity of the bus becomes a limiting factor in overall performance. Transputer systems can avoid this limitation by using the links. As each transputer is added to an array, the capacity for intercommunication also increases automatically by a nominal 80 megabits/s.

The modularity of transputer arrays makes the technology suitable for a much wider range of problems - you cannot have a "small slice" of a traditional supercomputer like a Cray-1. At one end of the scale, transputers can be used to solve "bottleneck" problems on interface boards that link, for instance, a computer and a laser printer. At the other extreme, they can be assembled in large arrays to provide "supercomputer" power.

The challenge facing system designers and programmers lies in the formulation of a problem so

that it lends itself to parallel processing. But during the three-year infancy of the transputer, many top researchers and product developers have embraced the superchip and the technology is now stretching out into the market in effective and affordable packages. (This first appeared in New Scientist, London, 28 April 1988, the weekly review of science and technology)

Parallel processing to study CFM/CSM

The use of parallel processing to computational fluid mechanics (CFM)/computational structural mechanics (CSM) is being studied at NASA Lewis Research Center. To promote the study of algorithm-architecture interactions and software, a reshaped hardware test-bed is being set up. NASA is setting up an altered version of the hypercube architecture, the hypercluster. The hypercluster keeps the hypercube's network structure between processor nodes, but each node comprises many processors communicating via a shared memory. The hypercluster supports tightly coupled interprocessor communication via shared memory and loosely coupled communication via the hypercube network. The NASA Lewis D-2 hypercluster includes three Nodes with a vector personality and one node with a scalar personality. Each vector node uses four board-level vector processors, and the scalar node uses four general-purpose microcomputer boards. The uniting of vector processors is vital to study CFM/CSM algorithms, many of which have large arrays of independent computations best handled by a vector architecture. (Extracted from Mechanical Engineering, May 1988)

Photo realism on an interactive system

Hewlett-Packard Co. has produced a work station performing 14 million instructions per second, with three-dimensional graphics that look as real as photographs. The system, which offers interactive capabilities as well, draws images up to 10 times faster than previous top-of-the-line HP work stations.

HP's technical computer group in Ft. Collins, Colo., is introducing the model 835 TurboSRX as the new high end of its HP 9000 work station line. The 835 refers to the new 14-MIPS precision-architecture processor; the new high-performance graphics component is called TurboSRX. A second model, the HP 9000 350 TurboSRX, mates the new graphics subsystem with HP's MC68020-based work station. Prices start at $91,500 and $70,000, respectively - comparable to other high-end graphics work stations.

The TurboSRX systems are the first to offer a new hardware-assisted rendering technique called radiosity, which models the way light reflects between all surfaces of a displayed image. The result is a rendered object, with the photorealism of ray tracing, which can be viewed from any angle. Ray tracing, which the TurboSRX offers as a software utility, requires a complete rerendering of the object for each new view - radiosity does not.

These work stations are also the first to offer sixth-order non-uniform rational B-splines. Affectionately called Nurbs in the graphics world, these B-splines deliver faster graphics interactivity on the HP work stations than any competitive system can provide, the HP designers say.

The model 350 TurboSRX and model 835 TurboSRX are especially good for such scientific and design applications as molecular modeling, solids modeling, animation and imaging. The model 835 system, which is scheduled to ship in October, will compete directly with high-end graphics work stations and desk-top supercomputers offered by Apollo, Ardent, Raster Technologies, Silicon Graphics, and Stellar. In the midrange of performance, the model 350 TurboSRX, with the same graphics performance but lower computational performance than the 835, will compete with products from Apollo, Silicon Graphics, Sun Microsystems, and Tektronix. The 350 TurboSRX will ship in late June. (Reprinted from Electronics, 17 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Bearing from superconducting ceramic

Cornell University engineers machined a bearing from a block of superconducting ceramic, setting the stage for possible development of ultrafast computer disk drives, high-speed cameras and gyroscopes. The bearing is an offshoot of the discovery of high-temperature semiconductors. When the bearing is cooled with liquid nitrogen it repels a magnetized rotating shaft, virtually eliminating friction between the parts. This action is based on the so-called Meissner effect: Since superconductors repel magnetic fields, they will float above the magnet. Bearings based on repulsion between conventional magnets reach speeds of 100,000 rpm and over in a vacuum but require control systems to maintain stability. The superconducting bearings should eventually operate at 300,000 rpm (possibly one million rpm in a vacuum) and will not require stabilizers because the levitating effect is self-stabilizing. (Extracted from the 28 March 1988 issue of Business Week by special permission, (c) 1988 by McGraw-Hill Inc.)

Super high-speed, large-integration CMOS gate array family

NEC Corporation has developed and put on the market a CMOS gate array "CMOS-5 Family" and a "CMOS-5A Family" which feature both super high-speed operation and large-scale integration.

These new products consist of 11 products belonging to the "CMOS-5 Family" containing from 2,016 to a maximum of 24,000 gates in 2-input gate equivalents and two products belonging to the "CMOS-5A Family" containing from 30,600 to a maximum of 45,012 gates, for a total of 13 products.

With both these families, the standard inner gate delay time is 1.0 ns (fan out 3, wiring length 3 mm), and with high-speed products the power gates feature a delay time of 0.65 ns (fan out 3, wiring length 3 mm). They display super high-speed operation comparable to ECLs, while the resistance to the latch-up phenomenon (the phenomenon of a large current flow when the transistors of both n and p channels are arranged in proximity to provide the effect of a thyristor) has been increased to over 1 A. The result is that latch-up free operations are possible with respect to virtually all applications.

Incidentally, this is the first time in the world that a channel type CMOS gate array of 45,000 gates has been commercialized. It has been accomplished by drawing on the company's advanced CMOS 1.2-micron two-layered wiring technology (CMOS-5 Family) and three-layered wiring technology (CMOS-5A Family). Further information available from NEC Corporation, Public Relations Office, 33-1, Shiba 5-chome, Minato-ku, Tokyo, Tel: 03-454-1111, Telex: TOK J 22686. (Source: JETRO, April 1988)

Semiconductors strip the pump for fridge of the future

A small French company may be the first to market an electronic refrigerator without a pump or any other moving part. The new fridge relies on the Peltier effect, which is brought into play when a current is fed through two different metals or semiconductors. One of the junctions will generate heat and the other absorb it.

The Peltier effect is well known, and electronics companies have often toyed with the idea of building refrigerators which rely on the phenomenon.

Francealpha, of Brittany, has developed two fridges. One is a large cabinet, which holds over 50 bottles of wine. A semiconductor junction keeps the wine chilled, and because there is no pump or motor there is no vibration to disturb sediment. But at around £500, the system is too expensive to have popular appeal yet.

Francealpha's other idea is more hopeful. The Peltier junction is built into a small drawer for a kitchen cupboard. The current through a semiconductor junction sucks heat from the drawer, keeping the temperature constant at around 6°C.

Cooling a drawer with conventional refrigerating techniques is impractical. Even the smallest drawer would still need a pump and coils for the cooling fluid. (This first appeared in New Scientist, London, 2 June 1988, the weekly review of science and technology)

Squeezing IBM PC power into a book-sized unit

By combining the latest commercially available memory chips with state-of-the-art packaging technology in its RHC-88 handheld computer, Paravant Computer Systems Inc. has squeezed the functionality of an IBM Corp. Personal Computer into a rugged, book- sized box.

The company uses four 1-Mbit dynamic random-access memory chips to implement the RHC-88's 512-Kbyte operating memory. Because the ruggedness standard demanded by the Department of Defence's MIL-STD-810D rules out moving-disk storage, designers opted for battery-backed 256-Mbit static RAMs that delivery 512 Kbytes of secondary storage.

The RHC-88 also has two internal expansion slots, giving users the option of adding up to 1.5 Mbytes of storage. For easy memory expansion, the system will accept 1-Mbit SRAMs when they become readily available, thus boosting secondary "disk" memory to 8 Mbytes.

Paravant's designers also integrated 192 Kbits of erasable programmable read-only memory into the RHC-88 to handle application-specific functions. An original-equipment manufacturer adapting the computer for a specific application, for example, might use the EPROM to store an expert-system or graphics program.

The company has targeted four broad application areas: government, specifically military; manufacturing control; field maintenance, where tutorial programs can direct technicians toward troubleshooting solutions; and gas and electric utilities for logging data.

Communications are handled by a 19.2 Kbit per second RS-232-C serial port and an optical port for downloading data. It runs on rechargeable NiCad batteries, or on ac current with an adapter. Five alkaline batteries can be used in a pinch.

Its liquid-crystal diode screen measures 5-by-2-3/4-inch - about one-third the size of a typical desktop PC. It is backlighted and offers 256-by-128 pixel resolution. The nonstandard keyboard has 52 keys and is waterproof.

The RHC-88 measures 9.4-by-6.4-by-2.6-inch and weighs 4 1/2 lbs. Because it uses Microsoft Corp.'s MS-DOS 3.2 operating systems, the computer is compatible with virtually all software written for the IBM PC. Data acquisition boards can be plugged into its expansion slots. (Reprinted from Electronics, 31 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Publishers read the future with compact discs

The technology that recreates an orchestra in the living room could also open up a reference library on a computer screen. CD ROM, compact discs that can be read but not altered, are emerging as an alternative to paper now that the computer industry has set software standards.

Although Philips and Sony set a standard for CD ROM, the wording was left vague so that publishers could develop their own software for finding text on the disc. One group of manufacturers called the High Sierra Group found their way out of the chaos by setting their own standards.

The result is that any CD ROM which sticks to the format laid down by the group can be played on any IBM-compatible personal computer when it is connected to any CD ROM drive. This keeps down hardware costs to around £3,500.

The British Library pioneered work on CD ROM and has been working with Blackwell Scientific Publications on a two-year experiment called Adonis. Articles from more than 200 biomedical journals are published on CD ROM each week. Libraries will print out articles from the disc on request. By 1990, 50,000 technical articles should be available from discs. (This first appeared in New Scientist, London, 5 May 1988, the weekly review of science and technology)

Clones launched with English/Japanese language capabilities

Microsoft (Japan) has launched the AX/PC project to develop IBM PC/AT clones with English- and Japanese-language capabilities. The need for such a project became apparent following the slump in personal computer exports to the US, sparked by the imposition of a 100 per cent US import duty on Japanese-made personal computers, the rising appreciation of the yen and growing challenge from the Asian NICS for the US market. The realization of such a machine would allow hardware vendors to combine their separate domestic and export production lines, with no additional capital investment. Some 40,000 titles of IBM PC/AT-based software packages would also become available, helping both Japan-based multinationals and foreign-capital companies in Japan. The basic design centres around hardware and software interface specifications initiated in the spring of

1987 by 11 firms supporting AX development. The resulting machine will have Kanji-handling capabilities and be able to run all US PC/AT software and satisfy international standards. Sanyo will introduce the first AX/PC followed by Mitsubishi, Toshiba, Oki, Seiko-Epson, Canon, Minolta, Kyocera, Sharp, Alps Electric, YE Data and AI Electronics. (Extracted from EDP Japan, 1 February 1988)

Computer rescues "noisy" classics

Philips has released compact discs of historic recordings of music which have been salvaged using a new computer system called NoNoise. The system, developed by Sonic Solutions of San Francisco, can remove surface noise and irritating clicking and scratching sounds from old tapes and discs.

To prove the point, Philips has brought out recordings from as early as 1928 of Maurice Ravel and Sergei Prokofiev conducting their own works. The recordings were so poor that no record company could reissue them on compact disc.

Conventional cleanup uses analogue techniques, while NoNoise is digital. The original sound is converted into digital code and stored on hard discs with a total storage of 1,400 megabytes, enough for two hours of digital stereo. To remove the clicks, the computer identifies and slices out transient noises. It then synthesises a brief burst of sound to bridge the gap.

Unwanted background noise, such as hiss, is removed by the computer which analyses the sound from a short length of the recording where there is no music. The sound spectrum of the background noise is split into 2,000 separate frequency bands, and each one is measured. This produces an audio "fingerprint" of the noise.

The next step is to split the music recording into 2,000 bands and compare them with the fingerprint. When unwanted noise dominates the music, it is removed. When music dominates noise, it is left untouched.

The computer would have to make 53 million separate computations every second for it to work in real time, and even a minicomputer cannot work fast enough. So the system works overnight, taking eight or 10 hours to process one hour of music.

Record companies pay Sonic Solutions $85 per minute of recorded sound processed. But a cheaper system is currently being developed in Britain at the National Sound Archive. CEDAR (computer-enhanced digital audio restoration) also removes clicks but uses a different trick to get rid of background noise. It compares two different versions of the same original sound, and continually chooses the cleanest signal at any given moment by either tracking a mono groove with a stereo pickup, or, if two alternative pressings of the same record are available, comparing the same music played from both. (This first appeared in New Scientist, London, 28 April 1988, the weekly review of science and technology)

Modelling takes strain out of dentistry

Researchers at the University of Minnesota have created software that translates pictures of teeth into 3-D computer images. Exact measurements can be made for replacement teeth, for the software also uses information about adjoining teeth. The design, through the use of CAD/CAM technology, is then 'converted into an array of paths for a milling machine', according to D. Rekow, the research group leader. The crown would then be shaped in less than an hour, ending the need to cast crowns. The system will be commercially available within a year. For those individual dentists who cannot afford the initial cost of $150,000-200,000, a specialized camera lens could be purchased. Pictures can then be sent to a dental laboratory equipped with the CAD/CAM system. (Extracted from Wall Street Journal, 17 March 1988)

New laptop computer for the blind

A new laptop computer for the blind that uses a speech synthesizer instead of a screen has been developed by M. Hudecek, a Czech electronics engineer, with help from the Royal Victorian Institute for the Blind (Victoria, Australia). The new 1.5-kg Eureka A4, which is 25 mm wide and the size of an A4 sheet of paper, can be used as a word processor or a note taker. It includes a Braille keyboard, a special version of Basic for programming, and a calculator that features scientific and statistical functions. Metric conversions can be performed with the calculator. Downloading data to an IBM PC is possible through use of software also included with the Eureka A4. (Extracted from Asian Computer Market, April 1988)

Computer keeps an eye on cataracts

A computer analysis system is holding out fresh hope for the 16 million people around the world who cannot see properly because they have cataracts.

For the first time, hospitals can collect reliable images of the eye very quickly and cheaply. Ophthalmologists can use these images to grade the severity of a cataract and monitor any improvement or deterioration over several months. This lets them compare the performance of different drugs and change treatments if necessary.

The system was developed by Oval Research, which has written software and modified a personal computer to do the job. The system costs ,500 and has already won orders from Moorfields Eye Hospital in London and the Nuffield Laboratory of Ophthalmology in Oxford. (This first appeared in New Scientist, London, 26 May 1988, the weekly review of science and technology)

Screening out damage

Novices and those who mistrust computers are often told not to worry about making mistakes while learning their way around a system, since nothing they type can damage the machine. While the spirit of the advice may be laudable, it is not absolutely true. But a new monitor has removed one of the last avenues for damage to system hardware.

In many computers, the display is the prime candidate for damage from the software. Some video controller chips that send analog information to a monitor are designed to be reconfigured for several horizontal and vertical scanning rates, so that they can drive monitors of different resolutions. The programmer just changes bits in a register to alter the scanning rate.

Most monitors, however, are designed only for one rate. If the number of horizontal cycles per second is set too high, the flyback transformer, which controls the position of the electron beam on the screen, will overheat and burn out. Last year's introduction of the NEC MultiSync, which analyses

and adjusts to different scan rates, removes that possibility.

More than one early attempt at machine-language coding for the IBM PC is said to have ended in a shower of sparks as a bug took control and set the fatal bits. Several PC clones are so compatible that they fail in this way, too. Even worse, for the maker's convenience, some PC video cards use the same plug and socket for both monochrome and colour monitor cables, which virtually invites catastrophe. (Source: IEEE SPECTRUM, December 1987)

Computer-vision auto takes a road test

The Federal Republic of Germany's experimental autopilot car is hitting the road: in recent tests on public roads over stretches of more than 12 miles, the "Autonomobile" got up to 60 miles an hour, changed lanes, passed cars, and avoided obstacles - all without a human at the wheel. Under development at the Armed Forces University in Munich, the autonomous vehicle is built around a real-time image-processing computer that uses the input from two road- and traffic-scanning video cameras to calculate and generate the signals for the vehicle's steering, throttle, and braking systems. The long-range goal is to develop an auto-pilot that can relieve a human driver during arduous trips or warn him of critical traffic situations. (Reprinted from Electronics, 26 May 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

CARIN - the compact disk navigator

A system which may mean the end of the road for road maps should be on the market by the end of this year. CARIN (Car Information and Navigation System), a brainchild of the Philips electronics company, has been on trial in trucks and vans since 1985 and was recently demonstrated successfully in a car. Based on a compact disk, CARIN (claim the manufacturers) can easily store the names and navigational co-ordinates of every road, street and alleyway in the UK. All the driver has to do is to place the disk in the dashboard disk drive, key in the details of the starting point and destination, and let the computer do the rest. The system will act as a talking map, telling the driver, via a voice synthesizer, which way to go.

The system works by comparing a car's speed with the information on the compact disk, which comprises a detailed map. The mapped route is compared with the car's actual route using CARIN's memory, which is updated three times per second. Philips state that the system will be available for commercial users at the end of 1988 at a price of £1,500. (Information source: Information Media and Technology, Volume 21, No. 1, January 1988)

Computerized quarrying system

E.L. Smidth (Denmark) offers a computerized system for planning, optimizing and integrated control of quarry operations, raw meal output and clinker quality. The FLS-CombiLogic, used internally by Smidth in recent years, is a tool that ensures that the most economical plant design can be found. The system can benefit present plants by simulating how the remaining and at times misused quarry can be used most economically. CombiLogic helps solve problems with difficult raw materials and sometimes expand the lifetime of quarries by implementing the required number of output simulations. Hardware in the system includes an Apollo type DN 3000 or DN 4000 computer with colour screen monitor, size A0 digitizer table, colourscan printer for A3 size, and laser printer for A4 size. Modules comprising the FLS-CombiLogic applications software include FLS-GeoLogic for computerized data administration and map drawings, FLS-MassLogic for optimization of output stategy, FLS-MineLogic for optimal quarry design, and FLS-SimuLogic for optimal output tactics. (Extracted from World Cement Technology, April 1988)

PLC's cut power plant costs

Pennsylvania Electric's installation of programmable logic controllers (PLCs) over the last 10 years has cut operating costs and increased performance at its Conemaugh coal-fired steam electric power plant, which now operates 18 PLCs. Coal and ash handling is a phase that lends itself to PLC control. Conemaugh gets up to 1,400 tph of coal by conveyor belt directly from a deep mine 1 mile away. The coal contract is $150 million plus per year and specifies coal quality in such terms as BTU value, percentage ash and percentage moisture. To allow for testing and analysis, Conemaugh maintains an ASTM qualifying coal-sampling system. Mud fouling heat exchanging surfaces of the condenser causes losses of millions of dollars per year in excessive maintenance and forced load reductions via condenser back pressure. Conemaugh in 1980 thus put in service a makeup water treatment plant designed to prevent the losses. The plant uses inclined plate separation technology to attain an under one NTU effluent turbidity at a 21,000 gallons per minute flow rate. The PLC-based control system handles such phases of the operation as pH control, polymer feed rate, level control, sludge wasting and alarming. (Extracted from Power Engineering, March 1988)

V. COMPUTER EDUCATION

New teaching aid for electronics

Two electronic engineers in Co. Mayo have invented an electronics blackboard which is exciting a lot of interest among teachers and which is designed to help in the teaching of electronics in post-primary and third-level schools. It can also be used in training institutions and industry.

Michael Barrett, an Electronics Engineer, and Joe McAndrew, who teaches the subject, at Moyne College Ballina, came up with the invention of the 'blackboard' simply because they recognized how difficult it could be for teachers to explain and students to understand the complex electrical and electronic principles.

The easily manipulated board allows the pupils to understand the principles in a practical way.

The present model covers all the second-level courses and the system perfected by the two engineers electrical and electronic circuits to be constructed quickly without the necessity for wire, soldering or screwdrivers; in fact, the circuit diagram can be drawn on the board and the practical circuit built to correspond exactly.

The invention, which has attracted much attention from people involved in education, has been successfully patented. At present, they are being produced to order and according to Joe McAndrew, they are doing a market survey at present and future production plans will depend on this.

The invention is a universal circuit board and it consists of a large four foot by three foot electronic blackboard for use in second and third-level colleges with a smaller version available for individual students. The Schematic circuit diagram can be drawn on the blackboard or projected onto it using an overhead projector and the circut can then be built to follow the diagram exactly; there are no wiring connections behind the board - the entire circuit is built up on the front without the ambiguity associated with conventional wiring systems; the connecting system is a quick connect 'push on' system; it is a universal circuit board and not limited to any particular circuit. This means that the board can accommodate all basic electrical and electronic circuits; metres can be placed in circuit at any point where it is necessary to measure parameters either in a vertical or horizontal position; the unit is completely self-contained having its own battery supply. This also means that it is completely safe for use by students. The system comes complete with a comprehensive manual which gives details of thirty experiments. Ordinary components can be used and do not have to be modified; this system enables students to understand electrical and electronic principles.

Most importantly for schools, the second-level package covers all the Intermediate and Leaving Certificate ordinary and higher level courses. (Source: AMT, March 1988)

Remote instruction

Optel has developed a modem and software to allow for interactive computer-based remote instruction. The system would allow an instructor to remotely control what appears on a student's screen. The modem can transmit voice and data simultaneously. Each student would have a previously prepared floppy disc. A remote site needs equipment costing $9,000 for the modem, software, a personal computer and a large-screen display. This is still cheaper than sending a professor to remote sites. It also allows teaching at several remote sites simultaneously. (Extracted from "New Scientist" London, 18 February 1988, the weekly review of science and technology)

VI. SOFTWARE

Software firms tap into VAX market

Many large independent mainframe software companies have watched revenues shrink over the last couple of years, in part because IBM's ubiquitous DB2 has eaten away at their DBMS market share. Has a push into the DEC VAX market, holding the promise of replacing at least part of those lost revenues, been the fix for these companies?

It may be a little too early to tell. Most companies have only recently begun to pursue the VAX market aggressively. There is no doubt that the markets for DBMS (and, to a lesser extent, applications software) for the DEC environment are ripe for the picking. Whether they are the panacea for the independents is questionable. Granted, however, it is one area where they will not have to worry about competition from IBM.

VAX installations are growing at a healthy 28 per cent a year and many users are moving traditional mainframe business applications such as DBMS and financial analysis onto their VAXs. And, with a few exceptions, DEC users are relying heavily on third parties, as opposed to DEC itself, for software. Many of the large independents have had VAX platforms for a few years now (some have offered software for DEC environments for several years), but those companies so far have not made a dent in the market. Very few companies can claim that sales of VAX products contribute to a significant portion of total revenues.

In DBMS, accounting, applications development, pay-roll, and other applications areas, the independents are virtual no-shows. Just 24 per cent of VAX users in the commercial market have installed a DBMS, says market researcher Computer Intelligence, La Jolla, Calif. The number for engineering users is 30 per cent. This leaves a lot of ground wide open for the DBMS vendors, if they can attract the DEC users that have not already committed to DEC, Oracle, or Relational Technology.

As far as applications software goes, office automation is the leading installed software, at 22 per cent of VAX sites, followed by graphics, CAD/CAM, and data analysis, with an average of 14 per cent of VAX sites. Spreadsheet, accounts payable/receivable, and general ledger are next, installed at 10 per cent of VAX sites.

Topping the list of planned software acquisitions for VAX sites is network communications control (37 per cent), followed be DBMS (19 per cent), office automation (14 per cent), and applications development (7 per cent). Around 7 per cent of VAX sites plan to install financial analysis, accounting, and spreadsheet software. (Reprinted with permission of DATAMATION[r] magazine[c], 1 May 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Divided search for a common system

An operating system is a critical piece of software that manages the running of applications on a computer, such as a program for graphics or for accounting.

Over the past 12 months, users of computers increased the pressure on manufacturers to produce a single operating system which will run on all computers.

This means that software developers will have to write programs that will work with a universal operating system. Users will then be able to buy whatever software they need.

Unix, the operating system invented by AT and T of the US in its Bell laboratories, is generally accepted as the best suited for this role.

Since then, other manufacturers have taken Unix and devised their own versions, each with subtle differences.

Late last year, AT and T went ahead on its own. It signed a deal with Sun, an American manufacturer of workstations, to develop its newest version.

Last week, the consortium of rival companies countered this by announcing plans to develop their own version of Unix, based on IBM's brand, AIX. (This first appeared in New Scientist, London, 26 May 1988, the weekly review of science and technology)

Are computers headed for panic in the year 2000?

A time bomb is ticking in thousands of mainframe computers that toil for many of America's biggest corporations. Programs in those machines usually represent calendar dates as five-digit numbers: two digits for the year and three for a day within that year. Thus 1 April 1988, the 92nd day of this year, is expressed as 88092.

The trouble is that many programs, as currently written, are not set up to deal with dates beyond 31 December 1999. In the five-digit scheme, the numbering of those days will begin with 00001. To the literal-minded computers such low numbers will signify days from the year 1900, and that could gum up many calculations. Because the five-digit dating scheme is so pervasive among computer programs, and they have no room for an extra digit or two, fixing the problem will not be easy.

Rising to the challenge, however, is the Software Maintenance Assn., a society of professional programmers who will try to defuse the situation for their employers. The group will meet in New York to share ideas about how to update programs that were written as long as 30 years ago, when the millenium seemed far away. (Reprinted from the 4 April 1988 issue of Business Week by special permission, (c) 1988 by McGraw-Hill, Inc.)

Practical way to run DOS code under Unix/80

Until now, a user of a time-shared computer terminal or a work station who wanted to run an MS-DOS application program on a Unix system had two choices: use third-party software that emulated the MS-DOS application in the workstation or computer's UNIX environment, or buy an add-in board to plug into the computer backplane. The former usually turned out to be very slow; the latter, very expensive.

But Hunger Systems Inc., a Mountain View, Calif., third-party software supplier, has solved the dilemma with a new software product, XDOS. Unlike a software emulator, XDOS converts the binary code of the MS-DOS application into binary code that can run on a 68020 central processing unit under the Unix operating system. It is being licensed to computer original-equipment manufacturers and has a suggested price of between $425 and $2,000, depending on system size - a far cry from the costs of providing each computer or workstation with its own $2,500 add-in card. And like any Unix application, it can be shared by any number of users.

A front-end processor in XDOS performs a global-flow analysis - a method of learning and then imitating logical operations - to determine how an MS-DOS application uses the operating system and hardware environment. It then converts the MS-DOS progra into a Unix application, which can run on the target system as fast as or faster than the original MS-DOS program would on a personal computer. The converted application is passed to a back-end processor, which executes the program in the Unix environment. Because the program has been converted into a Unix application, it can be shared among any number of users.

Back-end processors use a library of system functions that emulate in the Unix environment the operating system features of the MS-DOS environment. So XDOS supports different 68020-based Unix systems; in the future, it will support several different reduced-instruction-set processors running on Unix. XDOS has only one complex front-end processor and several simpler back-end processors, keeping the cost to modest levels with a potentially large market in the installed base of Unix systems. (Reprinted from Electronics, 31 March 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Graphical front ends for SQL may help MIS control PCs

Relational databases and Structured Query Language (SQL) are both currently being positioned to control the swollen rivers of data that every IS shop has to contend with. On the horizon are dozens of packages that will thrust SQL - the powerful but obtuse data manipulation languge - into a pivotal role in helping contain the data flow. However, this deployment in an end-user role is one SQL was never intended to fill, and some believe it is a role that it may be ill-equipped for.

At the heart of its soon-to-come transformation from programmer tool to end-user tool is the development of graphical front ends that mask the syntactical language from users. The graphical layer will enable users to initiate data base activities that incorporate the same data manipulation and control facilities that programmers do, supporters say.

Such strategies are apparent in the scramble among Ashton-Tate Corp. (Torrance, Calif.), Lotus Development Corp. (Cambridge, Mass.), and Microsoft Corp. (Bellevue, Wash.) to field a DBMS that includes an easy-to-use SQL separated from the database. Front- and back-end components such as these are paving the way to planned workstation-server databases, which are expected later this year.

These vendors' SQL will wear an interface developed from IBM's Presentation Manager, graphics, and windowing software, and will be geared to PS/2 and workstation environments.

The emphasis that vendors place on these interfaces has prompted many to concentrate internal development on the tools. The core database technology is another story.

Ashton-Tate and Microsoft, for instance, plan to incorporate a relational database technology from Sybase Inc., Berkeley, Calif. Lotus will use a relational database developed with Gupta Technologies Inc., Menlo Park, Calif. Ashton-Tate separately acquired concurrency technology from Interbase that enables multiple users to access a record simultaneously.

If, as promised, these efforts produce an SQL appropriate for novice users and experienced programmers alike, it may help bring out-of-control PCs back under the influence of MIS. At stake are issues as simple as user access to corporate data and as complex as the integrity and security of that information, say users and consultants.

As part of the workstation-based ADP Financial Services Partner scheduled to be installed beginning next year, the SmartWare package from Informix Software Inc. (formerly Innovative Software), Lenexa, Kansas, was selected to provide a common user interface. SmartWare's graphical front-end will bridge office applications, market-specific applications and stock market data.

Eventually, the standardization will lead to distributed databases connected by a LAN. At that time, a user request for data will be passed

automatically to any SQL-supporting database on the network without the user ever needing to know on which database the information resides.

Although SQL represents a common language, there are enough differences in the various implementations of it for applications developers to be concerned. The more powerful versions employ extensions that are not yet widely accepted.

With a lack of specific knowledge of which extensions are supported, developers are likely to use garden variety SQL. (Reprinted with permission of DATAMATION[r] magazine[c], 15 April 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Different vendors, different approaches to structured query language

Although each of the big three microcomputer software vendors - Microsoft, Lotus and Ashton-Tate - has embraced workstation-server database strategies, their servers reflect divergent philosophies over the way to handle differences in SQL.

When Lotus DBMS is released in the autumn, its workstation component will work with Lotus' and others' server databases, including IBM's DB2. Conversely, Ashton-Tate and Microsoft Corp. advocate a standard server based on the Sybase database alone; they are recruiting other developers to write applications compatible with that server.

The differences in SQL implementations have a lot to do with the two approaches. The differences also speak volumes to the opposing views of the database environment. Sybase, which supplies the technology in Microsoft's SQL Server, says that connecting to other vendors' SQL databases is not a priority. (Reprinted with permission of DATAMATION[r] magazine[c], 15 April 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

The CICS community resigns itself to IBM's upgrade delay

IBM has taken its share of knocks for less-than-stellar performance in software development and it appears that it is up for a new round of bruises. With its workhorse transaction control system, CICS, facing another upgrade delay, competitors are gloating, customers are guessing at availability dates, and third-party applications vendors are just sitting in the background.

IBM says that CICS/MVS version 2 release 1 has slipped from fourth quarter 1987 availability to an unspeficied date. Further information on timing will be provided sometime this quarter. Among the features to have been included were XRF (Extended Recovery Facility) capabilities, which allow one CICS system to monitor another and to take over in the event of problems. IBM previously had to overcome delays in providing XRF for its IMS database program; it is only now being made available to customers. Both IMS/XRF and CICS/XRF were originally announced in 1985.

In February of this year, IBM finally unveiled MVS/ESA and new models of the 3090 and 4381 families.

Among the capabilities hoped for in the new release is the ability to utilize multiple processors in a single CICS region.

There are approximately 27,000 CICS licensees world-wide. Upgrading such a mature program while maintaining backwards compatibility presents many stumbling blocks for IBM and may be more of the problem, other observers say.

Despite the number of users, CICS has its weaknesses, particularly if an application requires any measure of fault resistance. Other companies, most notably Cupertino, California-based Tandem, have been helped by the delays in recovery and multiple region functions.

One other major piece soon to be made available is CICS for VM. A preliminary release is expected from IBM by next month with full-blown releases ready by the first quarter 1989. (Reprinted with permission of DATAMATION[r] magazine[c], 15 April 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Software meters

The illegal use of computer programs is an expensive problem with many solutions, few of which work. A small software company in Scotland is trying a new approach that should make some software both harder to copy and cheaper to use - thus reducing the incentive to steal it in the first place. It has invented a software meter.

Because software companies sell ideas, they have a hard time keeping tabs on their products. Once a program has been written, it is (in theory) just as easy to make pirate copies of it as legitimate ones. A British organization, the Federation Against Software Theft, reckons that software worth 0 million is used illegally in Britain every year. According to America's International Trade Commission, American software companies lose between 5 and 10 per cent of their $35 billion of revenues to theft. It reckons that around two thirds of this theft happens because of laziness or ignorance of copyright law; the rest is the work of malevolent pirates.

Traditional software defence has two prongs: dongles and key discs. Dongles are pieces of hardware that plug into the back of a computer. Each program comes matched to its own dongle and must be routed through it for the program to work. For instance, one sort of dongle is interrogated by its program. If it does not give the right answers, the program will not run.

Key discs are pieces of software that rely on the authenticity of a signature. Software firms put their programs on discs with a signature on them. The signature is written in the usual computer alphabet of ones and noughts, but the digits are grouped in an unorthodox way. It is as though the signature were written in a typeface that a normal computer can read but not copy. When the program is loaded onto a user's machine the computer is told to look at the signature. It will work only if the signature it finds matches one written in the normal typeface elsewhere in the program. Copy the program without special equipment and the signature with the unusual typeface is lost. The would-be pirate is left with a useless disc.

The new idea, which comes from Run Time Innovations, based near Glasgow, is to take a key disc and make it behave like a meter. The meter is an abstract thing, just a pile of random numbers. Each random number acts as the key disc's special

signature, but only for a limited time. The program will work only if the right random number is typed into the computer at the beginning of a session. When all the time allocated to one random number has ticked away, the user has to move onto another one in the pile by paying the software producer to tell him what it is.

The company says that its meter will let small firms rent expensive programs and pay only for what they get. The meter can tick away either in seconds, or by the number of key-strokes, or the amount of information being processed. As well as making costly software less tempting to copy, Run Time Innovations hopes the meter will increase software houses' sales by putting complex programs within the reach of small companies. (Source: The Economist, 5 March 1988)

European firms expand to US

Watch for a combined push into the US software engineering market over the next few months by FRG software house Softlab and Dutch electronics giant Philips. Spearheading the marketing drive is the Maestro computer-aided software engineering system developed by Softlab and running on Philips minicomputers. With 20,000 workstations around the world already linked to Maestro systems and a user list that includes the UK's Inland Revenue, the Dutch Shell group, Boeing, and the State of Colorado, the two European firms believe they have a base strong enough for US expansion. (Reprinted with permission of DATAMATION[F] magazine[C], 1 June 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Silverlake stirs pricing debate

Many software developers are confronting the issue of whether or not users should pay a fee for transferring System/36 and 38 applications to IBM's soon-to-be-released System/3X follow-on, the so-called Silverlake mid-range family that is expected next month.

Beyond the issue of charging for transferring applications is the issue of establishing a pricing policy that not only satisfies existing customers, but also fairly anticipates a raft of newer models. So, while the developers may be pledging "no new taxes", they may have "tax reform" in mind instead.

The System/3X merger is prompting software houses to adopt tiered pricing to cover the expected breadth of the new mid-range line. When initial models are unveiled next month, analysts expect to see machines with performance extending from about the middle of the existing System/36 line to nearly twice the current System/38 Model 700.

Generally, developers have followed IBM in charging fixed prices for applications in each of the separate lines.

Tiering, a common method of pricing software among minicomputer developers, does not provide any measure of machine utilization, user activity, or competitive issues. As a result, developers such as Software 2000, Hyannis, Mass., are saying they will not address the full breadth of the new System/3X line, concentrating instead on one end of the spectrum. Others are looking for a repeat of the repackaging gymnastics that accompanied the debut of the IBM 9370 to span the line.

The varying price tactics that are emerging suggest it will not be easy for users trying to sort through the new price schedules. What is more, the acceptance of tiered pricing and the success or failure of the new line now look inextricably linked. That may not be in IBM's interests. Thus far, graduated pricing - initially introduced with the 9370 more than a year ago (see "Making Waves", 1 December 1986, p. 44) - has not been a stunning success.

The historically fixed prices for System/36 and 38 applications also promise to make tiered pricing a bitter pill for users to swallow.

IBM declines to address questions on pricing direction. Asked about any revisions to existing System/36 and 38 packages, an IBM spokesman says, "We'll cross that bridge when we come to it".

Should IBM fail to make the crossing or larger software houses fail to endorse tiered pricing for the lines, the unanimity now in evidence may prove to be temporary.

Analysts expect IBM to employ tiered pricing for the new operating system for the System/3X follow-on, widely referred to as XPF, and for its popular MAPICS manufacturing software. Yet, as committed as IBM may be to tiered pricing, its past practices have not lent themselves to helping applications vendors. (Reprinted with permission of DATAMATION[F] magazine[C], 15 May 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Global databases

The International Geographical Union last week agreed to take the first steps towards establishing a co-ordinated international strategy on the gathering, handling and dissemination of information on global processes. More than 50 experts from a dozen countries, including the United States, the Soviet Union and China, met in Hampshire, England, to discuss how the international scientific community can best use the huge quantities of information being generated through techniques such as remote sensing by satellite. Computerized databases have already been established by several international agencies, but more thought is needed about how best to go about setting up and exploitng databases if the international community is to derive the maximum benefit from them. The union concedes that the problems associated with setting up internationally accessible global databases are immense, but have to be tackled.

Following the five-day meeting last week it was agreed to establish a working group to consider the legal issues of control, ownership, liability and copyright regarding the construction, maintenance and use of global databases. Efforts will also be made to develop standards for interchange of databases between scientists and international agencies in the areas of data quality and formats. The union will start to identify what moves will be needed to improve accessibility to global data and its usefulness to people working in programmes related to the global environment. (Source: Nature, Vol. 333, 19 May 1988)

Software to aid plant engineers

Computer-aided engineering and design got their start in the aerospace and automobile industries,

pushed largely by outside companies that had the know-how to create drawings on a computer. Engineering and construction companies in the process industries were quick to put that know-how to work and add their own dimensions. Now, some of the engineering and construction companies are beginning to compete with the original innovators.

Combustion Engineering (C-E) is the latest to enter the fray, with a package called PASCE, an acronym for plant applications and systems from Combustion Engineering. "It is a suite of integrated software products that automate the engineering, layout, construction and operation of industrial facilities", says Richard J. Carell, marketing manager of the Pasce Group (Berkeley, California).

C-E's new products are the result of a corporate project that got started in 1984 to develop a plant design system for internal use. Duke Power, a North Carolina utility, agreed to help in the development effort based on software licensed from Imperial Chemical Industries.

The C-E system integrates three-dimensional plant modelling with an interactive engineering database of component and material specifications, industry standards and individual design and analysis modules.

The PASCE database foundations enable owners to maintain data in a consistent manner throughout the plant life cycle, reflecting modifications as they become known.

A movement in the suite of C-E's software packages costs $50,000. The whole suite comes to $500,000. The payoff comes from minimizing the cost of correcting mistakes and from reducing construction delays caused by material shortages. In existing practice, mistakes creep into the hundreds of manual drawings needed in process plant construction, even though each is reviewed. The mistakes that are not caught on paper are caught in the field when one part does not fit with another, as the drawing says it is supposed to. Catching those mistakes at the construction stage is costly. Experts say that 10 per cent of the cost of a construction job can be spent just on fixing them. On a recent cogeneration project where PASCE was used, piping rework was held to under 1 per cent.

Creation of a single database should reduce the number of such mistakes sharply. By calling the latest version of the design, a designer will be able to tell immediately whether a newly-added piece of pipe or equipment will interfere with existing structures - without going to the construction site to find out. Because the database is accessible to all design disciplines, the shared knowledge can help to avoid conflicts and misunderstandings. Since the location of the various components is recorded in the database by x-y-z co-ordinates, one observer says "you do not put the piping where the other guy has his columns".

The system really pays off five years down the line when the plant undergoes major modifications, according to Carell.

The new system also promises to make the job of design improvement better and quicker. Often a design is improved on from one job to the next. The newest designer on the job looks at the last drawings and tries to make the design better. With the new system, the designer has more time to try different size pipe, for example, to see how it will affect the overall cost of the plant. Once the design is stored in the computer, it can be recalled to design subsequent plants.

The cost of the hardware used to implement the system is dropping. Five years ago, specialized CAD workstations, averaging about $100,000/terminal, were needed to support similar engineering applications. PASCE runs on the entire Digital Equipment Vax minicomputer line and uses low-cost, general-purpose IBM PC-ATs or Vax2000 Workstations.

PASCE's suite of software products includes Plant Schema, a logical modeler for piping and electrical schematic drawings; and Plant View, a physical modeler used to create three-dimensional plant drawings. Other integrated software modules include: Plant Draft, a general-purpose CAD system to generate construction drawings; Plant Pipe, for pipe stress analysis; and Plant Steel, a structural frame analysis program.

So far, C-E has used the system on a number of its own projects, including the design of two 28-megawatt co-generation facilities. It has supplied units to two major chemical companies - Dow Chemical and 3M. (Extracted from Chemical Week, 2 March 1988)

VHDL: the lingua franca of design?

The Pentagon for years has wanted a standard hardware description languge and it even designed one - VHSIC Hardware Description Language, or VHDL. There was only one catch: potential users did not adopt VHDL, because they did not want to take the time to learn it. But now that attitude is changing as the arrival of practical tools permits even those who do not understand the language to use it.

In fact, VHDL could "become the lingua franca of electronic design", says Larry Saunders, an advisory engineer at IBM Corp.'s Application Business Systems Division in Rochester, N.Y.

The reason is that with VHDL, a design specification expressed in multiple levels of abstraction can be written in a form readable by both human beings and computers. The design can then be verified through simulation before hardware is constructed. VHDL also provides a vehicle for accurate, systematic design documentation.

The key that opens that door is a set of sophisticated "what-if" simulation tools for VHDL from Vantage Analysis Systems Inc. The Fremont, Calif., start-up has developed the Electronic Design Spreadsheet, VHDL-based design tools that fit seamlessly into the window-based Mentor Graphics Corp. design environment and make the little-known language disappear from view. This is a distinct advantage, because only a handful of VHDL experts understand the language and can read and write hardware descriptions expressed in it. With Vantage, the VHDL component remains in the background, transparent except when models not already in the library must be written.

The Electronic Design Spreadsheet thus makes a ready vehicle for defense-contract design, the first tool to do so within the context of a complete, integrated design environment. It also utilizes the performance advantages of highly integrated design tools and the behavioural-level simulation made possible by the presence of a library of VHDL models. A designer can check out the functionality

of his board or semi-custom-chip design through simulation very quickly. He can make incremental changes in his design and get it back into simulation almost as fast as a financial spreadsheet can be rejiggered and recalculated. The developers say the tools make the design environment three to ten times more productive.

This marks a major change for electronic design simulation, which exists almost exclusively in a batch-oriented environment requiring a long sequence of steps before a changed design can be simulated. In batch-oriented environments, the schematic is checked; the netlist is expanded, generated, translated and compiled; and the simulator is initialized and set up. Only then can simulation begin, often hours or even days after the design change was made.

The time lag is reduced to one or two minutes by Vantage's software. The designer can see a waveform-based simulation display reflecting the results of a change made at the schematic-entry level almost immediately.

VHDL is an offshoot of the Pentagon's Very High Speed Integrated Circuit project; its goal is a standard to supersede the Babel of hardware-description languages used in the design of military electronic systems. (Reprinted from Electronics, 12 May 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Software to experiment with

The two-step process of designing an experiment and then interpreting its data is no easy task. In designing experiments, researchers often rely on intuition or even an inherited design. And to interpret data, a strong background is generally needed in statistical analysis, which crunches raw data into more meaningful information.

However, now computer software - known as experimental design software - that designs experiments and uses statistical analysis to interpret results is gaining acceptance. The software aims to ensure that experimental design collects data that gives the most information, while statistical analysis extracts the most information from that data. The payoff is savings in both cost and time.

BBN Software Products (Cambridge, Mass.) is one of a number of companies, including CompuServe (Colombus, Ohio) and Expert in a Chip (Hockessin, Del.), that are active in experimental design software. Later this year, BBN will bring out an updated version of its software, RS/Discover. About 200 copies of RS/Discover already have been installed, says BBN, a number of them by companies in the chemical process industries. Licensing fees for RS/Discover range from $13,000 to $140,000.

Operating experimental design software is relatively straightforward. A researcher defines the problem to be solved. For example, the researcher might seek conditions under which a reaction has optimum yield. If he believes that yield might depend on three parameters - say, temperature, pressure and humidity - the possible ranges of those parameters are fed into a computer. The software then selects an experimental design that will solve the problem with the minimum number of runs.

A crucial feature of the software is that it takes into account the interaction among those parameters. For example, with humidity constant, a change in pressure at low temperature might have a different impact on product yield from that of a change in pressure at high temperature. The software accounts for that probability by varying both temperature and pressure - instead of only one of the parameters - from one experimental run to the next.

Narrowing the parameters and their interactions to those that actually affect the process often requires two stages of testing. The software uses data from the first stage to screen out parameters - for example, humidity - that do not affect yield. It then designs a second testing stage for the remaining parameters, in this case temperature and pressure. Graphs are made that visualize the impact of different temperatures and pressures on yield. The researcher can then determine optimum temperature and pressure.

Undoubtedly, the use of experimental design software is catching on. Du Pont, for one, uses the software to teach experimental design not only to in-house researchers but also to researchers outside the company. (Extracted from Chemical Week, 2 March 1988)

Built-in thermal analysis program

Mentor Graphics (Beaverton, Or.) has introduced electronics design software that includes a built-in thermal analysis program that checks a design as soon as completed by the engineer. Because computer failure commonly resulting from the excessive heat generated by some microchips can often be solved by rearranging the components on a printed-circuit board, Mentor Graphics has designed software that includes a built-in thermal analysis of a circuit design. Mentor is also working on other circuit design problems such as electromagnetic interference. (Extracted from the 21 March 1988 issue of Business Week by special permission, (c) 1988 by McGraw-Hill Inc.)

Control development

Computer graphics at the person/process interface is the growing tip of process control development. Recent introductions of control software for the IBM PC promise drastic reduction in the costs of automation without severe compromises. Software and systems can be appraised on three independent scales: level of monitoring/control capability made available, distance up the management ladder from the control room at which the system can/should be used, and ease of use of the system (typically varying 'inversely with its age'). Products of 15 suppliers are examined, providing an exploratory trip through this 3-parameter 'space'. (Source: Technology Update, 7 March 1988)

Digital paper

ICI Electronics has introduced the world's first flexible optical data storage medium. The digital paper, based on a polyester substrate coated with a dye polymer, is able to store 1 Mbyte at a cost less than a penny, making it cheaper than any other storage medium on the market. It can be used in disk or cassette form, and is easily transportable. Data recorded on the disk are

permanent, although ICI is trying to develop an erasable form. The paper consists of a polyester substrate 25-75 microns thick, coated with an infrared absorbing dye, which is covered with an overcoat. The longevity is rated at 15-25 years. Data are both stored and read by lasers, and the high density of data results in quicker recall than other systems. Creo (Canada), an optical drive specialist, has developed a drive which can read a tape with 1 terabyte (1 mil Mbytes) of information. (Extracted from Chemical Industry, 7 March 1988)

New service offered to software makers

Copyright Clearance Center (Salem, Ma.) will offer a service to software makers to help recoup royalties lost to illegal copies. K.A. Walsh, director of trade group Software Publishers Association (Washington, DC), estimates that two copies are made for each software package sold. As a result, software manufacturers are losing hundreds of millions of dollars each year. Under the Copyright Clearance programme, corporations would sign annual licensing agreements with the firm. Each time a copy of a program is made, the company would send a royalty payment to the Center, which would collect a commission and pass on the rest to the software developer. Though copying would still occur, software companies would be able to collect more of what is owed them. (Extracted from the 25 April 1988 issue of Business Week by special permission, (c) 1988 by McGraw-Hill Inc.)

Organic chemists have designs on databases

Pharmaceutical companies will be able to design and synthesize drugs much more efficiently and cut costs, using a commercial database containing chemical reactions. The database has been designed by chemists at the University of Leeds.

Peter Johnson and a consortium of academics have built a knowledge-based system called ORAC, which contains thousands of reactions abstracted from the chemical literature. Organic chemists will use ORAC to choose the appropriate chemical reaction for a particular step in a synthetic strategy, without having to spend hours searching through the library.

The consortium has compiled the database over several years and has now set up a company to sell it and the software to chemical companies. Nine companies, including ICI, Pfizer, Smith, Schering, Firmenich, Sandoz and Agfa Gaevert have already bought ORAC. The business is now worth several million pounds.

Companies are interested in computer-aided synthesis because it is extremely expensive to develop biologically active materials. Designing from readily available raw materials the synthesis of drugs and other compounds that have a complex molecular structure may involve many chemical transformations. Choosing the right reaction to carry out the transformations is vital in terms of efficiency and economics. Until now, the chemist has had to rely on a wide knowledge or organic reactions combined with an intuitive feel for synthesis.

Some organic chemists are now supplementing this traditional approach with computer-aided methods, not only for selecting from among the many reactions but for designing synthetic strategies, which also requires experience and imagination.

Johnson and his colleagues have also developed an expert system to help in the design of synthetic strategies. The work is an extension of a program called LHASA that was created by Eli Corey at Harvard University in the late 1960s. Johnson hopes to build a software link between LHASA and ORAC, so that ORAC would pull out a series of reactions, which the LHASA program could then use to work out the best suggestion for a strategy. He also wants to modify LHASA to look for raw materials that are cheap and readily available. (This first appeared in New Scientist, London, 28 April 1988, the weekly review of science and technology)

Software that judges you by your handwriting

Handwriting analysis reveals so much about personality that some companies have used it for years to screen job applicants. Now, Handwriting Resource Corp. in Phoenix has computerized the process with a program that analyses a writing sample and prints out a detailed report within two hours.

The program uses formulas derived from a database of 50,000 samples to match handwriting characteristics to personality traits. An analyst examines each sample and enters in the computer the answers to 300 questions about the handwriting. Within seconds the program goes through 500,000 calculations, fitting the sample to its formulas. When the task is completed, the computer prints a report charting the intensity of 130 separate traits as revealed in the handwriting. Then a psychologist adds an assessment that relates the results to the type of job the applicant is seeking. The service costs $185 per sample. (Reprinted from the 4 April 1988 issue of Business Week by special permission, (c) 1988 by McGraw-Hill Inc.)

IBM delays CICS and NetView products

IBM has quietly "deferred" the release of two software products, CICS/MVS 2.1 and NetView Network Definer. Both were originally scheduled to be available by the end of 1987. Now IBM plans to release further details on availability in the second quarter of 1988. CICS/MVS 2.1 was announced last February. The NetView product was unveiled last June as an easy-to-use program to help create a network of 9370s. (Reprinted with permission of DATAMATION[r] magazine[c], 15 March 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Users create their own solutions

Instead of waiting for a DB2 data dictionary and a central repository to come from IBM, users such as Bell Atlantic Corp. are coming up with their own solutions. Last year, Bell Atlantic developed its own DB2 data dictionary, now being marketed under the name Migradata by New York consulting firm Computer Horizons. Bell Atlantic, in conjunction with Computer Horizons, has also developed a methodology for migrating flat file data to a relational environment. Now in use at Bell Atlantic, the methodology - called Migramet - is designed to help speed the path towards a central repository, which IBM has been talking about since

1986. Migramet is being marketed as a service by Computer Horizons. The company has not officially announced the product, but it is currently negotiating with a few companies to install it. (Reprinted with permission of DATAMATION[F] magazine[C], 15 March 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Standard windowing

Even as a standard windowing environment moves closer to commercial reality with this month's release of the MIT-developed X-Windows System software, the lack of a standard user interface is placing a new hurdle in the way of a standard environment for workstation users.

Recently, one of the original backers of the X-Windows System, office automation software developer Applix Inc., Westboro, Mass., unveiled a new version of its Alis package with a proprietary user interface. Applix decided to write its own user interface rather than having to face a need to write separate interfaces for each of the workstations it supports. (Reprinted with permission of DATAMATION[F] magazine[C], 15 March 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Aston-Tate delivers the long awaited dBase IV

Ashton-Tate's microcomputer database management system, dBase IV, has been released.

Designed for both OS/2 and MS/DOS, the long awaited new version features a redesigned user interface that the vendor says will make program development and data management simpler for non-programmers. The interface includes a new applications generator and a program compiler, which Ashton-Tate claims is 10 times faster than the previous version, dBase III Plus.

Other enhancements offered in dBase IV include increased networking capabilities and a new dBase/SQL language, which integrates IBM's Systems Application Architecture (SAA)-compatible Structured Query Language.

Ashton-Tate has also brought out the dBase IV Developer's Edition, a $1,295 programming environment for applications developers. ASHTON-TATE, Torrance, Calif. (Reprinted with permission of DATAMATION[F] magazine[C], 15 March 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Managing IS

If Europe's instrument makers, Japan's machine tool producers, America's automakers, and the thousands of other manufacturers and service companies worldwide are to survive in this new era of globalisation - a time when no supplier is too distant, no customer too foreign - they must rid themselves of the informational chaos endemic to international operations. But how? The answers may be enlightened management, effective use of information technology tools and standards, such as electronic data interchange (EDI) and structured query language (SQL) and enterprise-wide alliances.

Although many will insist that computers and information are inseparable, data spewed out by legions of mainframes should not be confused with information. IS groups that do not understand this distinction and have not found out what data client organizations really need will simply print everything out. And the result? Data overload.

User managers - division and department heads who bear functional (as opposed to IS) titles - are already attempting to protect themselves from a torrent of useless data (not just from their own systems organizations) by erecting specially designed software screens and filters. These programs take the form of preference profiles, which rank incoming data and voice messages by order of importance. Such programs are the forerunners of future expert systems and currently are being embedded in computer networks so that they function automatically.

For their part, IS managers are embracing EDI and SQL as the means by which to create information. EDI describes a standardized way of using computers to transmit and receive business documents, such as purchase orders. SQL, on the other hand, is a standard means of accessing database management systems that are shared by different architectures. (Reprinted with permission of DATAMATION[F] magazine[C], 1 March 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Viral threat to computer security

Normally malicious in origin, and as contagious as their biological counterparts, computer viruses (first treated at length in computer literature in 1987, but known about by experts since the early 1980s) may be the most serious threat yet to computer security. In the last year, computer viruses with the capacity to subvert, alter or destroy computer programs have been planted in PC programs in companies and universities in several countries.

Computer viruses are a special class of self-reproducing computer program, which insert copies of their code into other programs without damaging the consistency of those programs' data format. From this point on, prior to executing, the "infected" program will execute a copy of itself which has been corrupted by the virus, giving the virus the opportunity to spread exponentially within the constraints of the user's data rights. The situation becomes even worse if the virus infects a program with the data rights of the system administrator, because with this authorization a virus can easily take over an entire computer system. The hazards arising from computer viruses are not so much based on their mere ability to reproduce themselves, but on the actions or subroutines they carry with them, which may be time-triggered or activated at random.

Viruses can also be transmitted between computers over telephone lines. In fact, anywhere information can go, a virus can follow. Worse still, while recent outbreaks have been among personal computers, research carried out in the USA has shown that most mainframe computers can be cracked open within an hour. Networks - even the largest, with thousands of computers spanning continents - can be opened up by the determined intruder within days.

The threat is compounded by the ability of viruses to evade the normal barriers set up by computers to control access to information. Furthemore, while it is possible to reinforce a computer's defences against invasion from outside, securing a system against those who have legitimate reasons for working on it is a larger problem.

The destructive power of the cleverest viruses is so great as to arouse fears of their use by terrorists, possibly on computer-run military defence systems. A troubling report highlights the potential dangers which can occur when computer viruses are used as instruments of political protest. A university student was alerted, via a malfuncioning personal computer, to a viral "time bomb" which, on a certain politically-strategic date, would have caused corrupted computer programs to erase all his university's stored files. However, the threat from computer viruses is stimulating research - both into products which aim to "cure" infected computer systems by identifying and removing viruses, and into ways of using hidden viruses for constructive purposes. (Information sources: Hoffman, Frank. An Approach to Defend Computers Against Computer Viruses. University of Dortmund, 1987; International Herald Tribune, 1 February 1988)

IBM fails to quash "virus" scare

IBM appears to have jumped the gun in its attempts to dismiss the threat from the virulent software virus known as "Brain" to its two million personal computers.

In a statement recently the company claimed that researchers at an American university had developed a "search and destroy" antidote program. In any case, IBM said, the virus is not really harmful and will not destroy computer data. But enquiries at the University of Delaware, named by IBM, suggest that both points are some way off the mark.

The Brain virus, believed to have originated in Pakistan, is probably the most serious of the recently publicized viruses. It has already hit IBM PCs at a number of universities on the East Coast of the US. According to Alan Solomon, chairman of the IBM PC user group, Brain has also been detected at a university in the West Midlands.

Brain appears to be a particularly insidious program. It hides in the boot sector of the disc which is normally invisible to the user, since it simply instructs the machine to load the disc itself.

According to Ann Webster, assistant manager of user services at Delavare, Brain can damage data in two ways: it can use up disc space in order to copy itself, and it can jumble file directories, making it difficult to locate files. IBM's claim that it is not harmful appears to stem from a belief that it occupies only vacant disc space. But if the disc is full it can write over existing data.

Webster says the university has cleaned up its systems by piecemeal examination of infected discs. She describes the virus as "serious but not disastrous" and said that PC users still have to check for abnormalities every morning.

Systems and Software, of Amersham, Buckinghamshire, is offering a program which will counter virus programs, for only £10. The "antivirus" is cheap because it works very simply. The remedy should be effective because it recognizes a weakness inherent in virus programs.

Viruses spread by copying themselves from a floppy disc to the machine's hard disc and from there to other floppy discs. The antivirus temporarily write-protects the hard disc whenever the computer user tries out a new program on a floppy disc. If the new program attempts an unexpected write to the hard disc, it fails. At the same time, the user is alerted to the risk. (This first appeared in New Scientist, London, 14 April 1988, the weekly review of science and technology)

VII. COUNTRY REPORTS

Australia

Computer R&D partnerships

A partnership for development for computer R&D has attracted the participation of seven major firms, which will increase their R&D spending in Australia to A$145 million by 1994 and will increase exports of products made in Australia to A$720 million. The Government expects at least six more firms to join, bringing R&D spending to A$200 million/year by 1994. The partnership agreement lets the Government waive all previous financial obligations made on foreign companies if they agree to invest 5 per cent of Australian turnover on R&D. Exports must rise to at least 50 per cent the level of imports. Foreign firms participating in the partnership will also be able to compete for government contracts on the same basis as local firms. The Government says the agreements will reduce Australia's information technology trade deficit, but some industry executives say the agreements will hurt local firms. The Government also lacks any power to enforce the agreements. (Extracted from New Scientist, London, 14 April 1988, the weekly review of science and technology)

Australian CAD

Computer-aided design (CAD) is enabling Australian researchers to create new products or components for the country's chemical industry. Much of this research is being done by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), and the Victorian College of Pharmacy, where trials are in progress on the molecular modelling of drugs, pesticides, herbicides, acaricides and fungicides.

Using CAD principles, CSIRO has already created a pesticide known as Cycloprothrin, currently being manufactured by Japan's Nippon-Kayaku. Cycloprothrin is a chemical hybrid, combining the features of DDT analogues and pyrethroids, the two families of molecules on which the pesticide was modelled.

These CAD chemicals will also form the basis of an Australian enterprise to manufacture agricultural chemicals for worldwide distribution and a CSIRO commercial company - Dunlena Ltd - has joined with DuPont (Australia) to establish a manufacturing plant. (Source: Manufacturing Chemist, April 1988)

Austria

Siemens of FRG opens new chip factory in Austria

Siemens has established the largest development centre for microelectronics in Central Europe. This think tank is designed to ensure the success of the current campaign to restructure production of less profitable mass-produced memory chips in favour of

highly intelligent electronic applications. As their showpiece, Siemens developers intend to introduce a new chip that will revolutionize heart pacemaker technology.

The worldwide market for memory chips is currently under extreme pressure, and consequently Siemens started to restructure production in the Villach (Carinthia) component plant some time ago. It employs 1,750 workers, books sales of 1.7 billion Austrian schillings per year, and is 75 per cent owned by Siemens AG of the FRG and 25 per cent by Siemens Austria. The component plant remains the second-largest manufacturer of memory chips in the world, but only 40 per cent of Villach's production volume is dedicated to the inexpensive chips. The rest is already dedicated to "intelligent" electronic components.

As a basis for this restructuring process, Siemens Villach has constructed a new development centre for microelectronics at a cost of 95 million schillings. The centre provides space for 100 highly qualified engineers together with the necessary infrastructure. (Extracted from Die Presse, 19 January 1988)

Brazil

USSR advocates joint ventures with Brazilian software firms

The Soviet Union is interested in co-operating with Brazil in the field of software, chiefly in connection with data base management systems for computer networks, intelligent systems and voice processing systems. In exchange, it is offering the entire East European market to Brazilian firms which accept its proposals, according to FINEP (Funding Authority for Studies and Projects).

The Soviet interest in co-operating both in microelectronics research projects and in the establishment of joint software marketing ventures with Brazilian firms was expressed recently at a trade fair sponsored by the Ministry of Foreign Affairs. The Soviet Union made two specific proposals. One for the establishment of joint teams of Brazilian and Soviet researchers to develop research projects in areas of mutual interest. The second calls for the establishment of joint ventures in which the Soviets are prepared to take a 51 per cent interest, but they are demanding open technological packages. (Extracted from Jornal do Brasil, 11 November 1987)

Brazilian 'Minisupercomputer' to be ready in 1988

The prototype of the first Brazilian minisupercomputer, built by the Integrated Subsystems Laboratory at the University of Sao Paulo, should soon be ready. Subsequently, the USP team plans to develop the first Brazilian supercomputer, the prototype for which should be ready by 1989.

The project co-ordinator, Joao Antonio Zuffo, explained that the first Brazilian minisuper will have a capacity equivalent to one tenth that of a Cray supercomputer, and will cost about $100,000. The minisuper, called the MS-8701 (87 stands for the year in which it was developed, and the 01 for the fact that it is the first of a series), will have a modular structure, and the ability to solve scientific problems that involve vector processing techniques. It can also be fitted with a disk memory system for commercial use. (Extracted from Jornal do Brasil, 14 November 1987)

Côte d'Ivoire

Status of information technology, networks

In an effort to apply information technology in schools, community management, agriculture and health care, the Côte d'Ivoire plans to increase its computer base to 12,000 units by 1990 and to launch a software industry. Further, Côte d'Ivoire scientists will now be able to query data bases in 19 countries, including Israel, through their linkup to the international computer network EARN (European Research Network). On a continent that represents less than 0.5 per cent of the world information technology market, the Côte d'Ivoire looks like the promised land. Despite the crisis it is going through, it will devote more than Fr 1 billion to information technology in 1990.

The Fourth African Information Technology Meeting enabled the African states to judge the gap that separates them from the industrialized countries. The lecture topics chosen by the organizers presented the role of information technology in the schools, its integration into community management and agriculture, or its contributions in the health sector. It was an opportunity for the representatives from neighbouring countries to think about the paths to follow to integrate this technology in the economic development process of the continent. The meeting was an opportunity to inform and increase awareness of visitors to the exhibition, which was held simultaneously with the various symposia.

In view of the results already achieved by the Côte d'Ivoire, it would appear that the country is on its way to achieving success in its computerization.

Two plans have been launched since 1981. The first, also called "the plan for emergence and awareness of the computer phenomenon", covered the period up to 1985. The ambition of the second plan is to achieve mastery by Ivorians of data processing, and its generalized use in all sectors. The national data processing pool was composed of 1,550 computers in 1985, compared to only 254 in 1980. This total should reach more than 2,000 units in 1990, including some 100 large systems and a thousand minicomputers.

The first part of the plan showed the essential character of computerization in the development process. It reflects the will of the leaders to raise the country to a higher stage of computerization, while preserving the independence of its strategic choices. The Côte d'Ivoire has a very advanced information technology compared to many developing countries. It devotes more than 1 per cent of its GNP to it, compared to the 0.5 per cent average for the other countries in this category. Yet this figure is still far below the 5 per cent of the industrialized countries. This progress is the result of a policy decided at the government level in the 1970s.

Indeed, information technology is a very good means to combat unemployment. Graduating classes of analysts-programmers coming out of Ivorian schools find a job without difficulty, and the same will be true for future classes of engineers from INSET (National Higher Institute for Technical Education). Information technology is also helping local governments. The representatives of Ivorian communes want to computerize, and the report on management of the city of Paris opened their eyes to the possibilities available, on their scale of course.

The city of Abidjan, with its 2 million people, is far from having a budget comparable to that of Paris, which in 1987 spent almost Fr 200 million for its computerization. The introduction of information technology has already made it possible to double the budget of some districts by facilitating registration of land properties. This result exceeded all expectations and is even more convincing than the introduction of data processing in health services.

The dream of awarding to a local industry the manufacture of a new generation of computers adapted to the African environment has fizzled out. The project has been replaced with another that has received the support of the National Commission on Information Technology. The birth of a software industry with the purpose of gaining a position in the Francophone market of Africa is in fact the latest aspiration expressed by the commission.

It was the initiative of IBM France, which made the commitment to provide technical and financial support to the project until December 1987, that made possible the first African connection to the international data processing network. After having been temporarily installed in the IBM facilities, the data processing centre became a reality during the summer of 1987. The network, which was inaugurated in its premises located in the heart of the administrative area, should become the centre of a veritable data processing web designed to promote African scientific co-operation, and this is what the Côte d'Ivoire hopes to achieve.

Established in February 1984 by nine European countries, the EARN network is open to universities, major schools and research centres of Europe, Africa and the Near East equipped with different types of hardware. Managed by an association of the 1901 law type, the EARN network is administered by a council composed of one representative of each member country and one director of the CERN (Nuclear Studies and Research Centre in Geneva. At this time, there are more than 500 computers connected and 330 associations involved. There are more than 50,000 users spread among 19 countries.

The centre will enable African scholars to query the data banks of 19 countries, including Israel. This is undoubtedly an achievement of vital importance to this region of the globe, where agriculture, processing of raw materials, and mastery of energy resources play a dominant role. The progress of the economy depends on mastery of science and technology, and, thanks to computers, dialogue with research centres throughout the world will be easier. (Extracted from Zero un Informatique, 22 February 1988)

EEC

ESPRIT research budget to double

The European Strategic Programme for Research and Development in Information Technology (ESPRIT) was originally launched in 1984 to help overcome a number of problems, including the lack of co-operation between academics and industrialists, and fragmented national markets. Set up before the current program to create a genuine common market, ESPRIT has become all the more relevant in the light of 1992.

Of 1.5 billion ECUs (some $1.88 billion) found for the initial 1984-1988 phase, half came from the community and half from the participants themselves. The fact that each ESPRIT project has to include more than one EC country, and at least two direct competitors, is a guarantee that the benefits of the research are not restricted to a single EC country.

An indication of the program's success is that on 11 April, EC research ministers gave the final go-ahead to doubling its budget for the second five-year phase to 3.2 billion ECUs (some $4 billion). Over the full ten year period, ESPRIT will therefore become the single largest R&D program the EC has ever undertaken, enjoying a total budgetary envelope of no less than 4.7 billion ECUs (some $5.88 billion).

ESPRIT's second phase is due to concentrate on application technology and technology transfer, with particular emphasis on advanced components technologies and tools for systems design, computer integrated manufacturing (CIM) and the broader integration of IT applications. Moreover, whereas the first phase of ESPRIT was restricted to companies based in the EC, the second phase of ESPRIT will also be open to firms from the EFTA countries.

The deadline for proposals under ESPRIT II was 12 April. The Commission's evaluation of them is due to be completed by the second half of May and the first projects are expected to start in late summer 1988. The response from industry has been even more enthusiastic than expected.

In terms of industrial impact, 111 projects out of a total of 227 in the first phase of ESPRIT have already produced significant results, even though few of them have been in existence for the full five years of the project. They include 28 major results in the field of international standards, which is of particular concern to European companies striving to break IBM's hold on de facto standards.

One of the best examples of a successful project is "Supernode". This project is concerned with the development of hardware, software and applications for a wide range of scientific and engineering problems. The objective is to match the performance of a supercomputer but at a fraction of the cost.

The system's basic building block, the T800 model of the INMOS floating point transputer, packs the performance of an entire computer into a single chip. To give some idea of the degree of miniaturization involved, if each of the transistors in the transputer were as large as a pinhead, the chip itself would be the size of a soccer pitch.

The project is being led by the UK's Royal Signals and Radar Establishment (RSRE). Other participants include the Thorn EMI Central Research Laboratory of Hayes (UK), the French hardware and software company APSIS of Grenoble, the University of Grenoble, Southampton University (UK), the French minicomputer manufacturer Telmat S.A. (based at Saultz near Mulhouse), and British chip manufacturer INMOS. The marketing of a software package based on Supernode has recently been announced by Thorn EMI and Telmat.

Working models that can derive graphic images from relief map data are already available. Methods of implementing neutron absorption algorithms on the Supernode are also being studied, as are means of mapping quantum mechanical problems. For the computer-aided design of integrated chips, APSIS has

developed its LUCKY LOG logical simulator to run on the Supernode, and is field testing the system with a view to a commercial launch in the near future.

Cathedral, another project dedicated to the development of hardware and software for the computer-aided design of state-of-the-art CMOS digital signal processing chips, has also exceeded its original aims.

The 11 ESPRIT projects concerned with office systems are making a major impact on more than 16 standards or standards-working groups in the area of open distributed architecture. The newly adopted ISO standard on Office Document Architecture (ISO 8613) for handling texts and pictures was first prepared in an ESPRIT project called Herode. The Herode project leader, Siemens AG of Munich, worked with TITN of Paris and the Centre de Recherche Informatique de Nancy (France).

The original partners have now been joined by Bull (France), Olivetti (Italy), ICL and Queen Mary College Interactive (UK) and the Service d'Etudes Communes des Postes et Télécommunications (France) to work on a project called PODA. The project aims to develop practical applications for the ODA standard, which is competing with IBM's DCA/DIA standard, and to further develop the ODA standard itself. A first demonstration of document exchange using the ODA standard took place in 1987. Products should be commercially available in the 1990s. (Extracted from International Herald Tribune, 26 April 1988)

EC prepares information technology standards program

The Conformance Testing Service (CTS) program promoted by the EC Commission provides for the establishment of a series of laboratories to test product conformance to international standards (ISO [International Standards Office], CCITT [International Telegraph and Telephone Consultative Committee], and ENVS) for information technologies. The CTS program falls within the framework of the EC standardization policy aimed at the elimination of technical barriers hindering the free movement of goods, in preparation for the single, customs-free market to be achieved by 1992 under the Consolidation Act.

The CTS program is particularly important from a political viewpoint, given that a decision made by the European Council on 22 December 1987 will come into force in February 1988. This decision requires member States to buy only computer material conforming to European or international standards and preferably accompanied by a certified document of conformance.

One of the essential elements in the product certification process is the stage in which conformance to the official standards is actually ascertained. Obviously, this requires the existence of adequate centres or test laboratories technically equipped to carry out specific tests on given kinds of products and recognized by the bodies responsible for issuing conformance certificates (on the basis of test reports provided by the centres themselves). A peculiarity of these centres is that they are independent of both manufacturers and users.

The first stage of the program (CTS-1) began in 1985 and covered the following technical areas:

- Protocols for network services concerning both local and geographic networks (OSI - Open System Interconnection - protocols);
- OSI-based applications (Message Handling, Teletex, and File Transfer);
- Compilers for standard programming languages (Cobol, Fortran, Pascal and Basic);
- Graphical kernel system.

The most important sector, referred to as CTS-WAN (Conformance Testing Services-Wide Area Networks), includes four contracts regarding test services for the following:

- OSI protocols from levels 1 to 4 transport service;
- Teletex (TTX);
- Message Handling System (MHS);
- File Transfer, Access, and Manipulation (FTAM).

The major objective of the CTS program is the development or acquisition of instruments for the establishment of European laboratories, in order to make conformance testing services operational and available to the general public both within the European Community and outside. Furthermore, these centres must have reciprocal recognition on the part of the largest possible number of States.

Accordingly, conformance test sequences must be unified and brought into alignment by all the laboratories offering the same kinds of services and must be based on common reference standards. The result will be the establishment and opening of the laboratories.

Another essential objective is to have maximum technical guarantees that, once approved by the laboratories, products from different manufacturers are truly interconnectible and can therefore be sold freely on all markets. From a commercial viewpoint, this guarantee constitutes a considerable advantage.

The whole program will cost around 11 million ECU's, 6.5 [million] of which is provided by the EC, while the remaining portion comes from the parties involved. (Extracted from Il Sole 24 Ore, 4 December 1987)

Egypt

Computer models aid energy policy decision making

Natural gas and petroleum play a central role in the Egyptian economy. These energy sources are both an internal source of energy for Egyptian industry, transportation and household use, and a source of foreign exchange. Sound management is required so that the country's scarce resources are optimally utilized. A joint CU/MIT research team developed computer models of energy policy/economy interactions to help guide important decisions regarding Egypt's energy future.

Three computer models were created to analyse policy issues in the supply and demand sides and the tradeoffs and implications of options in the overall energy "mix" of the Egyptian economy. Among the policy issues investigated were identifying appropriate domestic petroleum price strategies, managing the potential macroeconomic impact of a reduction in petroleum use, developing incentives for interfuel substitution, expanding export earnings as a vehicle for sustained growth, and specifying the rate at which reserves need to be

developed. The Egyptian Petroleum Model (EPM) simulates the impacts of investment and extraction decisions on oil production. The Egyptian Natural Gas Model (E-GAS) helps identify the socially optimal uses and prices of natural gas. The third model, called the Short-Run Energy Macro-Economic Model for Egypt (E-MACRO), can help analyse the ways in which policies in one sector can affect other sectors and influence their overall output in the short term.

The EPM is based on a set of simulation tools developed at MIT for analysing production possibilities in oil exporting countries. Initialized with data on Egyptian geology and petroleum production, EPM generates predictions of Egyptian oil production. The estimates of future production and export are based on predicted domestic and international crude oil prices. Since future oil prices are difficult to predict, "high" and "low" price scenarios are run to get a range of possibilities. Besides specific predictions, several useful general principles emerge. The study found that Egyptian oil production does not depend too much on world prices, however, the level of exports is extremely sensitive to world oil prices. The analysis also concluded that exports may decline dramatically or disappear, unless domestic consumption is curbed.

E-GAS is a linear programming model of the natural gas industry in Egypt that can aid decision-making about the allocation of natural gas and its domestic price. Its purpose is to determine the best use of natural gas to improve Egypt's foreign exchange position and to identify the price that should be charged to users. The optimal price reflects the "shadow price", or scarcity value of natural gas, given the objectives of the economy. The natural gas model tries to minimize foreign exchange costs to the economy by choosing fuels for use in production in such a way as to improve Egypt's foreign exchange position. There are constraints to this fuel "switching" since natural gas cannot substitute entirely for oil. In some applications, such as in the iron and steel industry, natural gas use is not economical. E-GAS reveals that the most important and economical applications of natural gas are in the manufacture of cement and fertilizer.

Immediate, short term economic consequences of energy policy decisions are the focus of the Egyptian Macroeconomic Model (E-MACRO). The model is built around a social accounting matrix (SAM) for the Egyptian economy and incorporates a complex set of general equilibrium interactions in the price and quantity-clearing sectors of the commodity market. Its short term focus is in contrast to the long run analysis generated by the Egyptian Petroleum Model.

Since the petroleum sector does not exist in isolation from the rest of the economy, the analysis of its effects on other sectors takes into account the strong two way linkage with the economy. The crucial policy issue addressed is the immediate impact of changing energy costs, including a change away from an entirely administered price policy, on other sectors of the economy. If energy costs rise, the model predicts price-induced conservation. But this reduction in consumption would impose serious adjustment problems for the economy in terms of an increase in inflation, fall in the share of wage income, and sharp output losses. An increase in aggregate demand through expansionary government expenditure policies might restore some of the lost income and stimulate the economy. (Source: Technology and Development (MIT), Spring 1988)

CAE system adapted for Egyptian sugar industry needs

As part of a larger effort to improve the engineering capabilities of the Hawamdia Equipment Factory of the Egyptian Sugar Company, MIT researchers proposed a Computer-Aided Engineering (CAE) system, tailored to the Egyptian environment, to help company engineers design spare parts and new equipment more quickly and efficiently.

The Egyptian Sugar Company is seeking to reduce its reliance on external consultants and imported spare parts. They hope to develop their engineering capabilities to undertake design and engineering services needed in the development of renovation projects using modern rational methods of project engineering. The MIT researchers are focusing on CAE capabilities for the design of low-pressure vessels. These components are essential to sugar processing and readily designed via CAE systems.

Current design practice at the plant is the basis for the system design research. The sugar industry provided examples of the documentation which rationalizes their designs. Emphasis is being placed on creating a "user-friendly" system which can mimic current standard practice, but provide more powerful and accurate engineering analysis tools in cases where their use seems warranted. Every effort is being made to use existing, commercially available software. The analysis packages will be selected and integrated into a system which suits the design efforts of the sugar industry. The Computer-Aided Engineering system selected and modified will use software which replicates the processes currently used in the design group at Hawamdia Factory. The system will be designed to automatically produce the type of design documentation which is now produced by hand whenever possible. Such a record should reduce the time and effort required to verify each engineer's work and should provide a basis for design of similar devices in the future.

Special attention will be given to the applicability of new techniques such as artificial intelligence, variational geometry, and computer-aided conceptual design. Only part of the knowledge base used in the design of low-pressure vessels in the Egyptian sugar industry will be computerized during this project. However, the system can grow as the engineers expand their use of the system. It is hoped that eventually, whole machines could be manufactured according to Egyptian redesigns, may be even whole new processes, and the machines which they require could be designed and built. (Source: Technology and Development, (MIT), Spring 1988)

Federal Republic of Germany

FRG to focus on supercomputers, AI for year 2000

The FRG computer industry can look forward to a new financial shot in the arm. The FRG Government intends to draft a subsidy program extending to the year 2000 designed to provide new impetus for domestic computer science.

According to Guenter Marx, head of the Committee for Information Processing in the Research Ministry, an initial draft program should be available by the summer. Various federal ministries are responsible for working out the project. However, it is already certain the FRG will heavily support the development of supercomputers with extremely high computing power as well as AI

performance and application software. The full extent of support funds has not yet been made public.

The FRG is already investing DM 100 million in Suprenum, a supercomputer for numerical tasks, on which the Society for Mathematics and Data Processing is working. Developers claim that by 1990, they will be able to process at least a billion floating decimal operations on this computer model. The Suprenum is primarily intended for use in basic research in chemistry and physics, as well as climatography and astrophysics. However, according to Marx, this computer model will also be used later for new developments in the automotive and aircraft industries. (Source: Computervoche, 22 January 1988)

Plastics performance database

For leading FRG plastics manufacturers, BASF, Bayer, Hoechst and Huls, have set up a data base on disc to provide customers in the plastics processing industry with easily comparable information on product performance.

The initiators of the system, called CAMPUS (computer-aided material pre-selection by uniform standards), say that it can be used with IBM-compatible PCs operating on the MS-DOS system and can be printed out by computers with a compatible interface. It will be provided to customers free of charge. The purpose of the new set up, according to the plastics manufacturers' association, VKE, is to avoid perpetuation of the confusion currently prevailing because of differentiating methods for defining the characteristics of the various plastics.

Each of the participants in the new computerised system has produced its own disc listing product information defined according to a new standard, based on the FRG industry's DIN 'Guidelines for the Charaterisation of Thermoplastic Compounds.' According to VKE, new international standards now being developed for the European plastics industry by a British-French-German Tripartite Forum are likely to differ little, if at all, from the DIN Guidelines. (Source: Manufacturing Chemist, April 1988)

France

New EUREKA project for optical inspection of submission ICs

The Imagia (Inspection Machine for an Automated and Genuine Intelligent Analysis of Semiconductors) project was assigned the EUREKA label during the European research ministers conference held recently in Madrid. With a total of Fr 100 million Imagia should market by 1992 a system capable of optically checking integreted circuits; the system would function automatically thanks to AI techniques in particular. This project, which is the result of French-Swiss co-operation, unites the CSEM (Swiss Centre for Electronics and Microelectronics) and the Wild Leitz group with two French companies, Bertin and Electronique Serge Dassault.

To identify elements with the submicron dimensions of tomorrow's integrated circuits, the system will need the most advanced means of image acquisition. The image will then be processed electronically before being intepreted by an expert system which will have to sort out the acceptable from the unacceptable according to experimental criteria.

The expert system will operate using computer data from the CAD system which helped to design the circuit. The system will thus be particularly adapted to ASIC inspection, a rapidly expanding market which presents unique checking and testing problems due to the small production runs. The consortium has been structured to include the various and complementary skills required. The Swiss CSEM company, which designs and manufactures ASICs, is the project leader. The optical part is in the hands of the Wild Leitz group - specialists in industrial optics - and the Bertin company is in charge of image processing. Electronique Serge Dassault is in charge of artificial intelligence. (Source: Electronique Hebdo, 10 December 1987)

France develops superfast image processing system

With the system Morphopericolor, the French company Numelec in Le-Mesnil-St-Denis is introducing a computer-supported morphometric image processing system that is supposed to be able to operate at an extremely fast processing speed. Sensing, processing and analysing of an image takes less than one second, reports the French Information Center for Industry and Technology. Automatic object separation and grain-size measuring takes 950 milliseconds, and to inspect a screw thread for absence of defects takes 200 milliseconds.

Morphometry, whose mathematical foundations were laid down 20 years ago at the French Ecole des Mines in Paris, pertains to a series of non-linear transformations for converting into gray values or binary values, which allow further processing of the picture information. These transformations are said to be a part of the permanent program within the image processor of the Morphopericolor. Moreover, the system is also said to have a flexible 16-bit parallel architecture to permit simultaneous measuring and analysis.

In its standard form, Morphopericolor is equipped with four inputs for video camera or CCD cameras and with a plug-in card for video data logging in real time with simplex and double resolution (256 times 256 and 512 times 512 picture elements respectively). Available for graphic representation are 256 gray values and 256 color tones. It is said, in addition, that Morphopericolor proves to be particularly efficient in the processing of complex picture contents, for example, in connection with optical sensors for the new generation of industrial robots or with three-co-ordinate measured-value transducers. Thus, for processing there are various functions available such as reduction of picture information, skeleton creation, convolution, histogram creation, gradient analysis, or the measuring of curve lengths and areas.

The system is controlled by an IBM-PC-compatible personal computer using the operating system MS-DOS. The functional parameters of the image processor can be written in the programming languages of Forth, C, or Pascal. Together with the user program, a number of typical application examples are furnished, which extend from measurements of grain size distribution to the geometric checking of profile tolerances and positional tolerances. (Source: Frankfurter Zeitung, 6 January 1988)

German Democratic Republic

CAD/CAM markets in Western Europe beckon GDR equipment

The GDR's data-processing-equipment organization, VEB Kombinat Robotron, intends to make its mark in Western European markets with its

computer-aided design and computer-aided manufacturing systems. The Dresden-based, State-owned combine scored sales of $25 million in the FRG last year, mainly from measuring equipment and office gear such as electronic typewriters and printers, and is now convinced that it can move upscale to CAD/CAM systems with competitive hardware and an extensive repertoire of software. Robotron shipped well over $1 billion worth of data-processing equipment to the Soviet Union and may take on an FRG partner to launch its computer sales there. Robotron, a 70,000-employee organization, runs 20 manufacturing facilities across the GDR. (Reprinted from Electronics, 12 May 1988, c 1988, McGraw Hill Inc., all rights reserved)

India

ICIM manufactures mainframe computer

India's first indigenously manufactured mainframe computers are now rolling out of International Computers Indian Manufacture Limited (ICIM). The company has already delivered the first three mainframes to Bombay-based Grindlays Bank plc and to Delhi-based RITES (Rail India Technical and Economic Services). The fourth system will shortly be exported to Iraq.

The cost of series-39 mainframes, being made at ICIM's manufacturing facility at Pune, in technical collaboration with ICL (International Computers Limited), ranges between Rs 80 lakhs and Rs 2.5 crores. It has a main memory of 16 megabytes and a secondary memory of 100 megabytes.

While ICIM has begun on a positive note by introducing its mainframes there is a decided dampner from the department of electroncis (DoE) which, according to the ICIM management, is trying to make public sector undertakings buy mainframes from the State-owned Electronics Corporation of India Limited (ECIL), which has a collaboration agreement with the Control Data Corporation (CDC).

The need for a computer at the corporate level played a major role in the introduction of S-39. A mainframe computer at the corporate level is required not only to manage large data bases and cater to the needs of a large number of users, but also to act as a host to a wide range of computers at different levels in an organization. Major users would include large public and private sector undertakings, banks, insurance companies and defence organizations.

With all products conforming to open systems standards (OSI), ICIM would now be in a position to integrate into its networks specialized solutions from other vendors.

ICIM, in its S-39 uses the latest C8K chip by ICL in collaboration with Fujitsu of Japan which has been described as "three years in advance of anything in the USA". ICIM had also opted for fibre optic technology which vastly improved the speed of transmission.

Mr. Arun Tolani, general manager, said ICIM has over 600 computer professionals engaged in customer support, R&D software development and manufacturing spread over 80 locations in the country. He added that last year ICIM had entered the software export business and achieved revenues of over Rs 50 lakh. (Extracted from The Telegraph, 15 February 1988)

Funding for superconductivity research

At a high-powered meeting held in February, the Prime Minister's Secretariat to decide on the priority programmes and resource allocations in this rapidly developing area funding to the extent of Rs 15 crores has been accepted by the Government. This was the money recommended by the co-ordinating committee for research in superconductivity under the chairmanship of Prof. C.N.R. Rao, who is also the Chairman of the Science Advisory Council to the Prime Minister (SAC-PM). This decision comes more than a year after the achievement of the major scientific breakthrough of High-Temperature Superconductivity (HTS).

In the hierarchy of bodies set up to formulate and implement a co-ordinated programme of research since the first efforts of the Indian scientific community produced results in HTS, the highest is the Apex Body (AB) headed by the Prime Minister, Mr. Rajiv Gandhi. The AB includes the heads of various government departments and bureaucrats from different ministries as well as Prof. Rao and other scientists. The AB expresses the political will of the Government actively to support R&D in HTS. Under this AB is Prof. Rao's co-ordinating committee, called the Project Management Board (PMB), and has as its members representatives from the various institutes, industries and agencies involved in HTS research. The PMB functions under the aegis of the Department of Science and Technology (DST).

Given the mandate of the PMB to identify areas of R&D in HTS and make recommendations on the funding patterns for a national action plan to the AB, the board had in turn constituted two task forces, one on basic research and the other on technology applications, with experts in the field drawn from various institutes actively engaged in research in the field. The task force for basic research is headed by Prof. R. Vijayaraghavan of the Tata Institute of Fundamental Research (TIFR), Bombay, and has Prof. T.V. Ramakrishnan of the Indian Institute of Science (IISc), Bangalore, as the co-chairman and that on applications is chaired by Dr. P.K. Iyengar, Director, Bhabha Atomic Research Centre (BARC), and co-chaired by Dr. Virendra Mohan, Chairman, Semiconductor Complex Ltd. (SCI), Chandigarh.

The task forces, after several meetings, had presented their reports to the PMB in December 1987. The required funding estimated by the task forces for carrying out significant research was of the order of Rs 30 crores over a period of three years.

On the applications front the areas identified are thin films, ceramic-based electronic materials, Josephson junctions and Superconducting Interference Devices (SQUIDs), development of superconducting wires and VLSI designs based on these new superconducting materials. Some of the institutions which have made proposals to the task forces are the BARC, the TIFR, the IISc, the IIT Madras and the National Physical Laboratory (NPL), New Delhi, in basic research and the Bharat Heavy Electricals Ltd. (BHEL), the BARC, the IIT Delhi and Kharagpur, the TIFR, the IISc, the Nuclear Fuel Complex (NFC),

Hyderabad and the Central Electronic Engineering Research Institute (CEERI), Pilani, in technology applications.

Prof. Rao said four centres had been identified to conduct work in the area of thin films, SCL for electronic applications, the NFC and the NPL for wires, the BHEL for making prototype generators and several places for material synthesis and preparation. The Indian Rare Earths Ltd. (IRE), Alwaye, has been given the charter of providing rare-earth materials in sufficient quantities to carry out a sustained programme of R&D.

Apparently, the University Grants Commission (UGC), one of the agencies represented in the PMB, has already provided seed money - of the order of a few crores apart from the expected direct money from the Government - for a broad-based funding to support training in the science, engineering and technology of superconductivity, which forms a component of the co-ordinated programme, either at the Ph.D. or at the post-doctoral level research. (Extracted from The Hindu, 5 February 1988)

Italy

Research consortium established

A microelectronics research consortium has recently been established in southern Italy, on the southeast coast of Sicily. This joint venture is expected to bring together the high tech resources of the University of Catania, the semiconductor manufacturer SGS, and a new firm called Innovative Silicon Technology.

The consortium intends to work on projects of the next generation and plans to build a state-of-the-art laboratory for this purpose. The proposed research programme will focus on VLSI technologies for low-level signals and heavy duty semiconductor circuits, which include simpler and intelligent technologies as well as programmable and standard logic circuts.

When finished, the laboratory should be one of Europe's leading microelectronics research institutions. About $75 million in investments and a further $44 million for ongoing projects are planned from 1987 through 1989. (Source: Markt und Technik, 25 September 1987)

Development of Italian OSI project

The first stage of the OSIRIDE (Open System Interconnection for Italian Heterogeneous Data Network) project launched by the CNR [National Research Council], has been completed.

The results have confirmed the validity of this initiative promoted by the CNR with the aim of developing an interconnection system among different makes of computers.

The problem - felt primarily in technologically more advanced countries - of how to overcome dialogue difficulties generated by the incompatibility of computers is not a recent one, having emerged at the time when this country started to have a substantial number of data-processing systems.

At the international level, the ISO (International Organization for Standardization) defined an OSI (Open System Interconnection) model arranged in seven communication levels (from pure transmission to the dialogue among application programs); the network architecture of this model was such that it could act as a reference point to all the leading computer manufacturers, particularly those of large computers.

Italy acted on the initiative of the CNR, which aimed to develop a heterogeneous network consisting of different makes of computers used by the CNR, universities and Italian research centres. In this way, the OSIRIDE project, originally intended to rationalize and optimize the exchange of information in the research world, was transformed into a nationwide initiative. The second stage of OSIRIDE is to create an authentic exchange of information and messages among computers. (Extracted from Media Duemila, December 1987)

ESPRIT HUFIT information technology project reviewed

As part of the EC's ESPRIT program, HUFIT (Human Factors in Information Technology) was set up to identify the most significant human factors in man-machine interaction, and then to "humanize" software products as much as possible. As part of the New Technologies show in Turin, HUFIT was introduced for the first time in Italy.

The project is directed by two specialized university centres (Stuttgart's Fraunhofer Institute and London's Loughborough University of Technology). Five European industries are also participating in the project: Bull-Transac (France), ICL (Britain), Olivetti (Italy), Philips (Netherlands), and Siemens (FRG).

HUFIT, launched in 1984, is now four years old. Its main objective is to give the European data-processing industry the standards necessary for it to develop products that meet the requirements and expectations of a wide range of users. In other words, it is the designer who has to adapt himself to the customer, and not the other way around.

A study carried out on a large bank analysed the effective use of the functions in an interactive information system for customers. Of the 36 commands available for retrieving information on checking accounts, 75 per cent of the users used only four commands.

This is only one of the possible examples demonstrating that software is often left in the drawer in spite of the investments made to develop, produce and introduce it into offices and corporations. There are two consequences of this: a wealth of information and resources is wasted, and often the technology itself is not understood at all.

HUFIT is based on the assumption that the human factor must be taken into account by design methodologies. This project is intended to promote, co-ordinate, and implement a branch of scientific activity which, in Europe, is more theoretical than applied in nature, even though it has the highest number of researchers.

The human factors involve a wide range of activities and behaviour, such as cognitive processes and the operational interactions among the various roles.

The HUFIT program is subdivided into three sections. The first section handles the problem of the conception, design, and installation of computer products so that they take man into consideration. The second section studies the advantages and disadvantages of the various types of man-machine communication (talking, direct graphic manipulation, command languages, etc.). The third sector attempts to increase the awareness of the European information technology sector concerning human

factors. Olivetti is working in the first area. The EC assigned this company the task of co-ordinating the study on the "usability" of products, or in other words their appropriateness for efficient and easy use. This requires manufacturers to follow certain standards in all phases of work, from product conception to the training of users.

The low level of "usability" found in certain products was seen to be the result of the distance between the place where it was conceived and developed, and the place of use. Under these conditions, the designer tends to be guided by technology. He has a vague, hazy picture of the user, of whom he constructs a model based on his own capabilities and culture. This is the typical defect of "technicism." No appropriate scientific methodology exists yet for the evaluation of just how "usable" or "unusable" a technology product is, and an urgent need for this is starting to be felt. This is where HUFIT's strategic nature comes in. Olivetti has set up its own in-house team, trained in psychology, data-processing systems, ergonomics, and organization for the execution of a research program. The team has been at work for about one year now. (Source: Media Duemila, December 1987)

Joint venture

Italy's Olivetti has set up a joint venture called Pegasus with Japan's Y-E Data to develop and produce low-cost, portable personal computers. The first machines are expected to hit the US and Europe by the end of the year. Sales will be handled by Olivetti. In Europe, Olivetti already markets its M15 portable, which was launched last May. Olivetti's US partner, AT&T, which did not take on the M15, is now evaluating the forthcoming Pegasus models. (Reprinted with permission of DATAMATION[r] magazine[c], 15 March 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Japan

March hastens towards 'human' computer

The team developing Japan's fifth-generation computer promised to unveil a prototype "thinking machine" by March 1995. The announcement will be seen as an attempt to shore up the credibility of the 10-year national project, now in its final phase.

Japan's Ministry of International Trade and Industry has tried since 1981 to develop a computer with true artificial intelligence.

However, the MITI said that its Institute for New Generation Computer Technology would have a computer capable of understanding natural language and human-like reasoning by the end of the 1992-1993 financial year. The computer will consist of 1000 central processing units connected together in a parallel network. So far, the Institute has linked 61 processors together. (This first appeared in New Scientist, London, 19 May 1988, the weekly review of science and technology)

Sixth generation program

Japan's sixth generation computing program will focus on fundamental issues in artificial and natural intelligence, according to K.T. Shah, consulting scientist in artificial intelligence, Toronto, ON. The MITI will spend $32 million in 1986-1996 for at least part of the sixth generation program. The program's research will include study of the human thinking process, focusing on the disciplines of physiology, psychology, linguistics, and logic, and related technologies, eg. pattern and speech recognition, learning, natural language processing, and deductive, analogical and inductive inference. (Extracted from Canadian Data, March 1988)

Experimental neurocomputer has associative image memory

A Japanese government-sponsored research project is developing an experimental optical neurocomputer said to be the first to use learning to improve its ability to recognize images. The optical associatron, as it is called, is still in an early stage of development at the Ministry of International Trade and Industry's Industrial Products Research Institute, Tsukuba, which is working with Hamamatsu Photonics K.K., Hamamatsu. The system uses optical analog calculation to implement an associative image memory, a type of content-addressable memory. One key part of the system is a microchannel spatial light modulator. This device, developed by Hamamatsu Photonics, transforms an incoherent-light input image striking a photo cathode into a charge image on a lithium-niobate plate. The charge image can be read out by a helium-neon laser as a coherent image using the Pockels effect (changes in a crystal's refractive properties that are proportional to the strength of an applied electric field). Feedback that corrects the charge distribution on the lithium-niobate plate constitutes a form of learning. Researchers expect to increase memory capacity by improving the resolution of the microchannel spatial light modulator. (Reprinted from Electronics, 31 March 1988, c 1988, McGraw Hill Inc., all rights reserved)

An optoelectronic IC replaces hybrids for LANS

Researchers in Japan have come up with optoelectronic integrated circuits that could replace the hybrid circuits now in use and make optical local area networks easier to implement. The researchers - working at NEC Corp.'s Optoelectronics Research Laboratories - have demonstrated that their long-wavelength devices can communicate reliably up to 52.5 km at 1.2 gigabits/s.

NEC's new entry consists of a transmitter chip with an indium phosphide laser and metal semiconductor FET drivers, as well as a receiver chip based on an InP photodiode. Commercial products should become available in about two years. (Reprinted from Electronics, 31 March 1988, c 1988, McGraw Hill Inc., all rights reserved)

Sampling set for 32-bit TRON family

Japanese microcomputer makers can now plan to market 32-bit engines based on a native Japanese architecture - TRON, the real-time operating-system nucleus. In July, Hitachi Ltd., which developed the first TRON chip, Fujitsu Ltd., and Mitsubishi Electric Corp. will offer samples of the processor for about $1,150. Peripheral integrated circuits such as direct memory-access controller, a high-speed tag memory, and an interrupt controller will be ready at the same time. Fabricated in 1.0-μm CMOS, the 20-MHz version of the microprocessor runs at 7 million instructions/s, nearly one-and-a-half times the performance of Intel Corp.'s 80386. Mass production is scheduled to begin in December; there are no plans at present to

market the chips in overseas markets. (Reprinted from Electronics, 26 May 1988, c 1988, McGraw Hill Inc., all rights reserved)

New prototype computer

A prototype non-von Neumann computer with a maximum speed of 170 million floating point operations/sec and 250 million instructions/sec has been developed by the Agency of Industrial Science & Technology's Electrotechnical Laboratory. The machine has 128 parallel processors. It is not faster than existing supercomputers, but will pave the way for the development of new machines not based on the traditional von Neumann architecture. The prototype, called Sigma-1, eliminates the need for special parallel programming methods. (Extracted from Asian Wall Street Journal, 28 March 1988)

New keyboard developed

NEC (Japan) and a science agency in China have developed a computer keyboard that enters data in Chinese characters more quickly. The amount of keypunching is reduced by 30-40 per cent against conventional models. It can be used on typewriters, telex machines and word processors. Chinese characters consist phonetically of a consonant and a vowel. On the new keyboard, consonants are represented by alphabetical scripts on the right. Vowels are represented in a similar manner on the left. To input, the user alternately types consonants and vowels. Some 180-200 words per minute can be punched in. (Extracted from Asian Wall Street Journal, 22 February 1988)

Toshiba goes to sea

The Japanese Ministry of Transport and Foundation for Shipping Advancement have for 23 years been paying Toshiba to try to develop a "high speed dream ship", powered by a superconducting electromagnetic thruster.

A coil of niobium titanium alloy is cooled with liquid helium to -260°C. Like a marine version of a magnetically levitated train, the dream ship propels itself by thrust developed from electromagnetic repulsion between the magnetic flux created by the superconducting coil and an electric current conducted through the water surrounding the ship. When the coil flux and water current are at right angles to each other, a jet of water is pushed through a duct and this drives the ship forward.

Toshiba claims to have built a working prototype, 2 metres long, which drives a jet of seawater at 2 metres a second.

The dream ship will be fast, silent, cheaper to run and with fewer moving parts than a conventional propeller craft. Toshiba admits it has yet to solve the problems of keeping the coils cool, increasing the magnetic flux strength sufficiently to power a large vessel and then protecting passengers and electronic equipment on board from the flux. (This first appeared in New Scientist, London, 7 April 1988, the weekly review of science and technology)

Japan gears up to test superconductors

The Japanese Government has increased its already impressive research on high-temperature superconductors by announcing a new programme costing 2 billion yen (_million). The Science and Technology Agency said that it would spend the money on developing equipment to test materials with superconducting properties.

The agency said that the programme, the Multicore Project for New Superconduction Materials Research, will be Japan's first attempt to co-ordinate research on new materials that superconduct at temperatures high enough to be of practical use. It will involve scientists from seven research establishments. Mike Hattori, the director of the agency's office of materials science, invited foreign scientists to join the project.

The new initiative will escalate the Science and Technology Agency's rivalry with the Ministry of International Trade and Industry, which is promoting research on superconductors in industry. The Ministry of Education also sponsors research in universities.

Officials say in public that the departments are creating an atmosphere of healthy competition in the race to develop practical superconducting materials. Privately, concern is mounting about the lack of any agency to co-ordinate research. (This first appeared in New Scientist, London, 2 June 1988, the weekly review of science and technology)

Japan's superlattice device R&D

A superlattice is a new material structure having a longer lattice period than that of natural semiconducting crystals. Thin films with only one hetero-interface are also included in this category. The superlattice gives more freedom in the material design for high mobility, high quantum efficiency and tailored band structure than conventional mixed crystals. Molecular beam epitaxy (MBE) and metal organic chemical vapour deposition (MOCVD) techniques for III-V compound semiconductor materials have made the fabrication of superlattice realistic, and a lot of new devices have been developed in the past few years. In order to develop superlattice devices, the development of a growth method for precise compositional control and interface abruptness will be indispensable.

A research project to develop a new functional device with a superlattice structure has been selected as one of the themes in the Project for Developing Basic Technology for Future Industries.

According to the basic plan, the purpose of the R&D project is "to establish fundamental technologies relating to superlattice devices featuring superhigh-speed information processing functions by controlling the structural composition and distributions on the atomic scale".

In the project's first phase of four years from 1981, research was stressed on the crystal growth technology for monoatomic layer-growth control in AlGaAs/GaAs and InAs/GaAs systems by MBE and MOCVD techniques. During the project's second phase, which ran from 1985 to 1987, the unique properties of the superlattice and the fundamental work principles of superlattice devices were investigated. From the third phase, that started in 1988 and will run to 1991, emphasis is being placed on the performance of the superlattice device as a functional logic gate element, and on new compositional superlattice systems including InGaAs and GaSb.

Research on this new theme is being conducted by the Electrotechnical Laboratory representing

Japan's national research institutes, with the co-operation of four private corporations: Fujitsu Limited, Sumitomo Electric Industries, Ltd., Hitachi, Ltd., and Sony Corporation under management by the R&D Association of Future Electron Devices. (Extracted from JETRO, March 1988)

Korea

Korean semiconductor exports double

The Korean semiconductor industry is confident of success this year in developing 4-megabyte DRAMs, and has set a semiconductor export target of $880 million, twice the value of exports for last year. In addition, around ten semiconductor manufacturers are planning investment of 470 billion won, and so the country is entering a "semiconductor industry golden period".

According to related sources, the major semiconductor manufacturers, including Samsung Semicondutor And Telecommunication Co. Ltd., Goldstar Semiconductor, Ltd., Hyundai Electronics Ind. Co. Ltd., and Daewoo Telecom Co. Ltd. are aiming for exports of semiconductors worth $885 million this year. This represents an increase of 102 per cent over last year's performance, when the value of exports totalled 439 million won. These companies are also planning to sell semiconductors worth 120 billion won on the Korean domestic market, which is a 44 per cent increase over the 8.35 billion won gained from domestic sales last year. Combining both exports and domestic sales, the total sales target amounts to 780 billion won, which is a big increase of 77 per cent over last year's figure of 440 billion won.

The Korean semiconductor industry has set such optimistic sales targets because a rapid increase in world semiconductor demand has made prospects for exports look bright, and also because preparations have been completed for the mass production of one-megabyte DRAMs, in addition to the 256-kilobyte DRAMs which have been the main product up until now. Also export of 4-megabyte DRAMs will become possible next year, and so the Korean industry is catching up to the United States and Japan on the technological level.

Samsung will begin trial production of 4-megabyte DRAMs in the second half of this year, and is also planning to begin mass production of 1-megabyte DRAMs. Goldstar Semiconductor Ltd. will be making an effort to diversify its product line and increase the percentage of local content, and Hyundai Electronics is aiming to greatly increase sales. Daewoo Telecom will also be carrying out full scale production from this year, and so preparations by the industry for "take-off" have been completed. (Source: Journal of Asia Electronics Union, AEU No. 2/1988)

Mexico

Japanese manufacturers flock to Mexico

Japanese companies are rushing into Mexico to take advantage of cheap labour and other favourable economic factors that make it among the world's cheapest manufacturing places. The boom along the US border is expected to grow even more as other Pacific Rim countries build and expand plants.

Companies such as Sanyo, Hitachi and Matsushita are leading the Japanese incursion. Growth is most rapid south of San Diego, Calif., particularly in the Otay Mesa section of Tijuana, although activity is apparent all along the boundary.

The investment growth rate by the Japanese in the area is 25 per cent annually, according to the San Diego Economic Development Council. The council, instrumental in attracting such investment, says that the latest surge began late 1986 when the yen gained strength against the dollar. The net effect forced Japanese firms to shift high-priced domestic manufacturing offshore to less expensive locations.

An even stronger investment wave may be in sight, says a consulting firm that offers services in establishing start-ups in Mexico. Enrique Esparza, president of AIM Inc. in Chula Vista, Calif., predicts that companies from Korea, Taiwan and Hong Kong will intensify the boom.

In fact, the first major Korean investment surfaced a few weeks ago. Seoul-based Samsung Group, the consumer electronics firm, announced it will start doing sub-assemblies for its television sets in Tijuana later this year. The company plans to expand later into other goods.

Mexican plants are attractive because of hourly labour rates of $1.00 to $1.25 - about one-seventh the level of the US and other industrialized nations. US electronics companies in California have taken advantage of the disparity since the 1960s by establishing plants under what Mexico calls its maquiladora programme. The plants assemble components shipped south from the US and send back finished products; taxes are levied only on the value added.

Not all companies may qualify for the maquiladora programme's tariff advantages that are available. But even then there are other enticing reasons to build large plants, sources say. In addition to the cheaper labour, reasons for shifting production to Mexico include the low cost of the infrastructure needed to manufacture products as well as the proximity to US markets. (Reprinted from Electronics, 31 March 1988, c 1988, McGraw Hill Inc., all rights reserved)

The Netherlands

Philips, Siemens in 64 Megabit "Megaproject"

Philips and Siemens expect this year to reach agreements with the FRG and Dutch Governments concerning extensive government support for a new chip project involving an investment of DM 3.5 billion. The Dutch Government is considering contributing between 250 and 300 million guilders.

The main part of the project will be carried out by Philips, Siemens and if possible two scientific institutes. In the FRG, the institute is the Fraunhofer Gesselschaft, and in the Netherlands informal contact has been sought with the Delft Institute for Microelectronics and Submicron Technology (DIMES). In three smaller parts of the new chip project, participation will also be open to companies and institutes in other parts of Europe, within the framework of the EUREKA technology programme.

The new project by Philips and Siemens will focus on developing the technology that is needed to make chips two generations further, says a spokesman from the FRG's Ministry for Research and Technology. Such a 64 megabit chip can hold more than 64 million units of information, or the text on 3,200 pages of A4 paper. Attention was given to the possibility of allowing more European companies to participate within the framework of the EUREKA European technology programme. However, Siemens in

particular continues to be less willing to share know-how with other European partners.

According to a spokesman for the FRG Ministry for Research and Technology, it is intended that more European companies and institutes be involved in three other elements of the project, under the auspices of EUREKA. These areas involve the further development of process technology, the development of design instruments for users and basic research. (Extracted from MRC Handelsblad, 8 February 1988)

Sweden

Sweden developing 'supercircuit'

Researchers at the University of Uppsala in Sweden have perfected a new technological concept which could lead to the manufacture of silicon integrated circuits with an integration density superior to that of VLSI [very large-scale integration], and a consumption which is a hundred times less than that of CMOS [complementary metal oxide semiconductor] IC's.

This technology - of which at present only the name is known: CMES or complementary metal semiconductor - would also have far less sensitivity to radiation and electrostatic discharges. In particular the absence of an oxide layer should minimize the very important hot carrier phenomena in submicro technology.

According to Swedish researchers, it would by the same token be easier to produce than current technologies. For the time being the concept exists only in theory and one will have to wait at least another year before the first concrete results are available. (Source: Electronique Hebdo, 17 December 1987)

United Kingdom

New initiative furthers molecular electronics research

Molecular electronics, one of five new scientific initiatives launched by the British Government under its Link scheme, could be the pathway to an entirely different kind of computer in the 21st century.

This could be a chemical or biochemical computer that organizes organic molecules - even living ones - to process information. Above all, such a machine could breach the heat-generation barrier which threatens someday to limit the power of computers based on transistors.

Just how ambitious the thinking is may be gauged from the fact that the UK's Alvey programme of research on supercomputers has paid little heed to molecular electronics. Yet an expert committee claims Britain is a "centre of excellence" in most branches of this science.

A team of industrial and academic scientists sought to structure an assortment of very disparate lines of research, to show where they might lead, given greater focus, a better sense of direction and the will to collaborate.

It defined the ultimate goal as a computer free from the restrictions of silicon chips; restrictions on sequentiality, programmability, efficiency and sensitivity, as well as the problem of heat dissipation. It called its vision the supermolecular information processor (SIP).

The trend is already to design organic materials with just the properties needed.

The team had to put some boundaries round a subject which sprawls widely across so much of science. It identified nine fields of scientific activity relevant to molecular electronics. Two, however, have been omitted from the Link initiative, leaving seven sciences: Liquid crystals, Langmuir-Blodgett films, organic conductors, photochromic and electrochromic materials, pyro-electric and piezo-electric materials, non-linear optics and chemical and biological sensors.

The two sciences omitted were designated "passive" uses of organic chemistry, whereas molecular electronics is seen as harnessing "active" molecules. The technologies abandoned were micro-lithographic resists, important for micro-fabrication of electronics by planar techniques and metal organic chemical vapour deposition (MOCVD). They are more appropriately labelled "chemtronics", and are already embraced by other initiatives of the Science and Engineering Research Council.

Under the Link initiative, molecular electronics has been newly defined as "the systematic exploitation of molecular, including macro-molecular, and bio-molecular, materials in electronics and related areas such as optoelectronics".

Hybrid technologies envisaged within the next ten years are those where a device is based partly on conventional solid state materials and partly on molecular electronics. An example might be a chemical sensor which tunes into a specific chemical species by molecular electronic thin film material on an otherwise conventional chip.

Beyond the hybrid is believed to lie radically new types of device for storing, processing, transmitting and transducing data, and wholly derived from molecular electronics. The science will also provide power supplies in the form of thin-film batteries as an integral part of the chemical chip.

One of the most exciting ideas was first reported over 50 years ago. Irving Langmuir and Kathleen Blodgett, working in US General Electric's laboratories, published in 1935 a way of making films of chemicals only a single molecule thick.

Recent interest in the possibility of using such films made from "active" molecules was stimulated by academic work in France and Britain. Close co-operation between physicists, chemists, biologists and electronic engineers has perfected the tricky progress of depositing Langmuir-Blodgett (L-B) films.

At least nine organizations in Britain are believed to be studying L-B films: ERA Technology, GEC, ICI, Kodak, Plessey, Thorn-EMI, Unilever, 3M and the Royal Signals and Radar Establishment.

In the vanguard is a joint laboratory in the engineering department of Oxford University, financed by Thorn-EMI and specializing in L-B films under the aegis of Roberts. It collaborates closely

with other Oxford departments, especially with Professor Sir David Philips in biophysics. Its researchers spend one day a week in Thorn-EMI's central laboratories.

The beauty of the L-B film lies in its promise for self-assembling molecules into precisely specified structures. Roberts's team identified four ways in which L-B films might advance electronics. One is through their non-linear properties, inherent from the unique way in which they are made.

Another is as a micro-lithographic resist for future generations of chips. The third is as tunnelling spacers, by taking advantage of the fact that their thickness can be held to as little as one nanometre (one thousandth of a micron).

The fourth way is in sensors, particularly biosensors composed of enzymes or antibodies. For example, such a sensor might be able to monitor immunological response. It might even open the way to a bio-computer harnessing living organisms.

As Forrest L. Carter, a US enthusiast for molecular electronics, has pointed out, transistors typically dissipate 100m times as much heat per programming step as an enzyme, while enzymes can perform in one step recognition tasks that would tax any digital computer. (Source: The Financial Times, 4 February 1988)

British company to build government data network

The Government has announced that the UK will have a huge computer network owned and operated by the private sector, but carrying personal information on almost the entire population. A British company, Racal-Scicon, will build and operate the Government Data Network (GDN) for an undisclosed fee.

Racal-Scicon will run the network privately, and the Government will pay for services as the sole customer. The Police National Computer, run by the Home Office, may use the system, along with the hundreds of computer systems being installed in central government. Data will pass between offices of a government department, and between offices of different departments. What sort of personal information will flow around the network "is a matter for the departments themselves".

Racal-Scicon won the contract in competition with Cable and Wireless, ICL, Computer Science Corporation and British Telecom. A testing of the service will take place by the end of the year, and a full network will be operating by 1989. (This first appeared in New Scientist, London, 26 May 1988, the weekly review of science and technology)

Researchers develop computer toxicity test

Researchers at the University of Surrey, Guildford, have developed a rapid computer screening test which they say predicts whether or not a potential drug or chemical will prove toxic.

The test is being developed for commercial purposes by Food and Veterinary Laboratories Ltd. (FAVL), an independent company, although linked to the University. The test has been developed only in the past year by Prof. Dennis Parke, David Lewis and Costas Ioannides of the Department of Biochemistry.

Dr. David Lewis said that so far over 300 different chemicals have been screened, mainly drugs and environmental chemicals such as DDT, benzpyrine, etc: "we assess the likelihood of toxicity on a scale of toxicity which we have devised from computer graphics. There is a threshold level above which a compound is likely to be toxic or carcinogenic". As well as screening compounds for potential toxicity, FAVL says it can offer a consultancy service for drug design, incorporating drug-receptor docking studies, conformational analyses and proposed routes of synthesis. The design service can enable selection of the most efficacious and least toxic/carcinogenic analogue of a series of structurally related chemicals.

Companies interested in finding out more about the screening test and the drug design service should contact Ian Measures, sales and marketing manager, Food and Veterinary Laboratory Ltd., 25-26 Frederick Sanger Rd., The Surrey Research Pk, Guildford, Surrey GU2 5YD; Tel.: 0483-300443. (Extracted from Manufacturing Chemist, April 1988)

Accountants find fault with Alvey programme

An independent auditing body has said that Britain's largest collaborative research effort in information technology, the Alvey programme, has failed to meet some of its key objectives.

In a report published in April, the National Audit Office said that the Alvey programme suffered from poor financial control and inadequate funding. The result was inadequate monitoring of progress and delays to many of the programmes. The report also said that the rate at which industry had exploited the fruits of the research had been "below that expected by the Alvey committee".

The Government set up the Alvey programme in 1983 to rival Japan's plans for developing a fifth generation computer. A committee chaired by John Alvey recommended a programme costing 50 million over five years that would unite researchers in academia and industry. Funds from the Department of Industry, as it was then called, the Science and Engineering Research Council and the Ministry of Defence would be administered by a separate body, the Alvey Directorate.

One of the main areas from which the Alvey committee expected most exploitation was software engineering, the report says. The committee's aim was to complete the first generation of advanced software tools by 1985, and to make second- and third-generation tools in successive years. The auditors found that not even the first generation of tools had been developed. Another criticism of the programme was that it failed to attract small companies.

Five large electronics companies dominated the programme; between them they accounted for almost half of the 428 research projects. These problems arose, the auditors pointed out, because the programme had inadequate resources and insufficient experience in co-ordinating three government departments, industry and academia. Delays occurred in setting up collaborative deals between those participating in the research programmes because lawyers were inexperienced in drafting such agreements.

The findings of the NAO seem to back Lord Young's decision not to continue with the Alvey

programme. Those involved with the Alvey programme, however, believe that the auditors misjudged the programme by examining the wrong parameters. (This first appeared in New Scientist, London, 14 April 1988, the weekly review of science and technology)

UNITED STATES OF AMERICA

MCC superconductivity programme starts

Thirteen companies will participate in the first phase of the Microelectronics and Computer Technology Corporation's research programme to study the electronic applications of high-temperature superconductors. MCC is a co-operative research venture conducting research in microelectronics and computer technology.

The 13 participants are Bellcore, Boeing, Control Data, Digital Equipment, E.I. du Pont de Nemours, Eastman Kodak, General Electric, Harris, 3M, Motorola, NCR, Rockwell and Westinghouse.

Work thus far has focused on modelling superconducting interconnects for computers and comparing their performance with that of chilled copper. Medium-thickness films of the superconductors have also been prepared.

Future research activities will include experiments, demonstrations of thin film preparation and patterning and analysis of a hybrid (semiconductor-superconductor) system.

A company may participate in the program for $100,000. Membership in the MCC Associates Program costs $25,000 annually.

Results of the program are communicated to participants through reports and technical meetings. Companies can also send personnel to MCC on temporary assignment.

MCC management and participants will evaluate experimental and study results and determine priorities for follow-up efforts. If promising electronic applications are identified, phase two of the program will probably begin in 1989.

MCC is located at 3500 W. Balcones Center Dr., Austin, TX 78759-6509; (512) 343-0978. (Source: Computer, April 1988)

National Science Foundation proposes $2.05 billion budget for fiscal 1989

Citing a need to stimulate research and education programmes in the light of growing international competition, the US National Science Foundation is requesting a $2.05 billion budget appropriation for 1989, more than 19 per cent above its 1988 budget of $1.72 billion.

The budget request reflects a proposed rate of growth that would double the NSF budget over the next five years.

NSF's category for Computer and Information Science and Engineering would receive a 20.3 per cent funding boost to $149.126 million in 1989 if the full budget is approved.

Within that general category, Networking and Communications Research and Infrastructure would receive $6.123 million, a 53 per cent increase over 1988; Computer and Computation Research would receive $2.35 million, an 11.8 per cent increase; Information Robotics and Intelligent Systems would receive $2.04 million, an 11.5 per cent increase; Microelectronic Information Processing Systems would receive $2.765 million, a 20.9 per cent increase; Advanced Scientific Computing would receive $11.465 million, a 25.9 per cent increase; and Cross-Disciplinary Activities would receive $465,000, a 2.7 per cent increase.

The foundation said it will continue to focus on three themes in 1989: education and human resources, disciplinary research programmes and supporting facilities and science and technology centres and groups.

Requested funding for disciplinary research and facilities is $1.2 billion - 83 per cent of the budget for research and related activities. Among the facilities to receive a substantial increase in financial support are the National Supercomputer Centres, which would benefit from a $11.3 million rise in funding to $64 million. Also, the National Science Foundation Network (NSFNET) would get a $5.9 million boost to $13.6 million.

Funding increases within disciplinary research are also sought in the areas of materials chemistry, including superconductivity, materials with designed properties and processing of advanced materials for information storage and handling; manufacturing, including intelligent manufacturing systems and novel engineering materials and processing technologies; biological communication, including studies aimed at neurosciences, human immunology and plant defence systems; and cosmology, including attempts to discover more information about fundamental forces, the history of the universe, and possible new particles.

The proposed budget for centres and groups alsoincludes $150 million for initiating a new Science and Technology Research Centres programme, which would feature upfront funding of 12 to 15 centres for periods up to five years.

The National Science Foundation's $1.72 billion budget for fiscal 1988 was reduced from a proposed appropriation of $1.89 billion. An NSF spokesman said attempts by Congress to adhere to balanced-budget legislation were partially responsible for the $170 million difference between the proposed and actual budgets. NSF expenditure in 1987 totalled $1,627 billion. (Extracted from Computer, April 1988)

Associations join efforts to strengthen industry

The American Electronics Association and the Semiconductor Industry Association have agreed to pool efforts to strengthen the US semiconductor industry. The agreement is seen as a way to resolve conflicting views on US trade policies. The SIA has agreed to delay demands for trade sanctions against Japan until the threat of a computer chip shortage lessens. The group also joined the AEA in urging the Commerce Department to avoid use of anti-dumping procedures in ways that could create shortages of the devices. In return, the AEA agreed to support the SIA's call for a fair share of the Japanese semiconductor market, and to encourage US producers to enter into long-term purchase agreements with US semiconductor suppliers. Such agreements would in effect warn potential Japanese competitors against trying to capture the increased demand, SEA officials believe. The agreement was worked out in

a meeting of 14 chief executive officers of companies representing both sides of the issue. (Extracted from Wall Street Journal, 4 March 1988)

Government-sponsored research project

The United States Government sponsored Mach research project at Carnegie-Mellon University (CMU) may emerge as the turning point to the commercial future of parallel processing. The new Mach operating system, which is primarily financed by the Defense Advanced Research Projects Agency (DARPA), is already being used by a number of firms, including Encore Computer (Marlboro, MA), AT&T, Sun Microsystems (Mountain View, CA), Digital Equipment, and IBM. Its virtual memory design and secure communications concepts are being implemented in the existing Unix-based operating systems of various suppliers. The recent Sun-AT&T development deal is urging Mach and Posix, the proposed uniprocessor Unix government computing standard, which both are becoming the Unix standards of the early 1990s. Encore Computer, the first firm with a supported version, chose Mach because of its potential as a standard. Mach ports to new architectures are easier to achieve than Unix System V or Berkley Unix ports, according to CD Howe, development manager, BBN Advanced Computer (Cambridge, MA). DARPA information science and technology office assistant director S. Squires said Mach will probably emerge as the nucleous for good performance, good portability and effective power for solving problems in the commercial environment. (Extracted with permission of DATAMATION[F] magazine[C], 15 February 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

UNION OF SOVIET SOCIALIST REPUBLICS

Wise computers leapfrog the East-West divide

The Soviet Union wants to buy sophisticated Western technology that comes equipped with its own expert computer systems. Soviet engineers could then fix faulty equipment without the need of help from engineers from the West. The idea is that the Soviet Union would become less vulnerable in the future to trade embargoes that could hamper maintenance of sophisticated technology sold to the Soviet Union from the West. The Soviet Union also wants expert systems to distribute knowledge and practical know-how from its centres of excellence and expertise to remote factories and co-operatives.

The Soviet Union also has home-grown expertise that it would like to sell to the West. For instance, the Soviets have pioneered a number of techniques in eye surgery that Western surgeons could learn by consulting an expert system primed with the knowledge of Soviet eye doctors.

Expertech, a UK company, will sign a contract with the Soviet State Committee for Computers and Informatics for the supply of an expert system worth just over £3 million. The contract is part of a joint venture between the Soviet Union and a Finnish company, Open Systems, to develop expert systems in medicine, agriculture, education and mechanical engineering. The products of the joint venture will be sold on both sides of the East-West divide. (This first appeared in New Scientist, London, 12 May 1988, the weekly review of science and technology)

PC co-ordination

In May, the chief architects of the Eastern Bloc's PC revolution met to decide how the socialist countries should co-ordinate PC production and the development of 32-bit machines. Despite the Bloc's well-publicized plans to develop hardware and software, progress is still slow in most countries, particularly in the USSR.

A year ago, an offer was made to link up with Western companies as a way of accelerating the use of PCs in the Soviet Union to help meet the nation's goal of 1.1 million machines installed by 1991. Despite proposals from 10 Western companies to set up joint PC production plants in the country and some approaches from Western software companies, nothing has come to fruition so far.

The only confirmed joint production line is a spin-off from a truck venture called Kamaz in the town of Naberezhnyye Chelny; the machines are destined for internal use only.

In the meantime, the socialist countries are aiming to work together more closely to fill the production gap. Currently, there are around 12,000 imported Western PCs in the Soviet Union from the US, Japan and Europe. In addition, a recent deal with Yamaha involved 15,000 micros based on the MSX operating system to be delivered over the next year.

The USSR has its own 8-bit and 16-bit machines in production and also imports systems from other socialist bloc countries. Robotron, for example, confirms that it is shipping around 20,000 machines a year to the Soviets. Half of all the PCs now are destined for education, a priority in the USSR. However, changes in the economic mechanisms of the Soviet enterprises necessarily increase the demand for office and production automation. Considerable efforts are being made to meet this demand.

Of course, office and production automation is heavily software-based and this is where much of the USSR's attention is now being focused. Nevertheless, the software industry as the West knows it does not really exist in the Eastern bloc.

For both the socialist and the Western countries, a more co-ordinated and effective PC strategy among the socialist nations may be the best thing to happen to East-West trade in years. (Reprinted with permission of DATAMATION[F] magazine[C], 15 April 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

VIII. FACTORY AUTOMATION

Probe manipulator to assist nuclear power industry

Risley Laboratory of United Kingdom's Atomic Energy Agency Inspection Validation Centre ordered a Sonomatic (Warrington, England) MAXYM fully programmable, dual axis, ultrasonic probe manipulator to help in the complex task of validating inspection equipment and methods in the nuclear power industry. The MAXYM will help to supply a standard to assess the adequacy of inspection equipment and methods at first for the Sizewell "B" nuclear power plant's reactor pressure vessel and ultimately the full pressurized water reactor program. Certain models will be inspected at the centre using MAXYM to get a fingerprint model. Each operational inspection is then compared with the centre model to prove the inspection equipment and methods. (Extracted from Metal Form, April 1988)

The integrated European factory

The FRG's technology ministry is spending 50 million Deutsch Marks between 1988 and 1992 to

promote factory automation in FRG. "We want to show small- and medium-sized companies how they can use modern technology and we want to familiarize them with CIM", says Hellmuth Bertuleit, head of the manufacturing and processing technology department at the FRG technology ministry in Bonn.

Alongside the ESPRIT program, an additional 185 million ECUs are being spent on industrial research and manufacturing technology pilot projects under the EC's BRITE (Basic Research in Industrial Technology for Europe) program.

For the factory of the future will not only be automated, it will be integrated. To do this involves a vast array of equipment, ranging from precision machinery to software, computers and automated handling systems. The purpose of CIM - or computer integrated manufacturing - is to tie them all together, so that electronic information can flow in an unbroken stream from the customer to the company, and from the drawing board to the loading bay.

Computer based equipment is already a way of life for most large companies, but many smaller firms are overwhelmed by the cost involved and uncertain as to how to approach advanced technology.

Experts say that, as yet, only a handful of companies around the world have completely implemented CIM. Instead the market is expanding for equipment and services that automate parts of factories and warehouses and transmit information from the shopfloors to other departments of the company with links to production.

Meanwhile, as production systems become more complex and rely more heavily on computers and sophisticated software, competition from Japan and to a lesser extent from the US grows. But American manufacturers are still coming to Europe to buy advanced machinery for their factories. Trips across the Atlantic and fairly steep prices are no deterrent, as many highly specialized machines are either not available in the US or cannot match European quality. However, the depreciation of the US dollar - more than 50 per cent against the Deutsch Mark since 1985 - and Japan's push for a bigger share in the industrial machinery market have made life much tougher for the Europeans.

Companies, Governments and the European Community are pumping large amounts of money into research, development and training to keep Europe in the forefront of computer integrated manufacturing.

Siemens, Europe's market leader in automation technology, recently showed how it can be done. The company set out to conquer a larger share of the US market by signing a joint venture deal with Westinghouse Electric Corp. of the US. The biggest of the three joint projects will involve the manufacture, sale and servicing of automation systems in the US.

Industry experts are optimistic that European manufacturers will continue to defend their leading position.

In addition to boosting the research funds of individual companies, BRITE and ESPRIT have also helped launch major pan-European projects. Five leading European computer companies - Groupe Bull of France, the British International Computers Ltd. (ICL), OCE of the Netherlands, Olivetti of Italy, and the FRG's Siemens AG - have received some 40 million DM (192.64 million ECU) from the ESPRIT budget since 1986 to develop special software that makes possible the transmission of office documents between computer systems from different manufacturers. European standardization efforts are of particular importance since incompatibility of different computer systems often stands in the way of connecting islands of automation into a unified production system. (Extracted from International Herald Tribune, 26 April 1988)

UK survey notes prospects for computer-aided manufacture

The proportion of large British companies in the processing industry which use computer-aided manufacturing processes will increase from the current level of 15 to 30 per cent in 1995 and to 50 per cent by 2010. This estimate was made in a study carried out by the Information Technology Commission of Britain's National Economic Development Office (NEDO).

The British budget envisages that, by 1995, there will be a 50 per cent rise in the value of durable capital goods, a large share of which is represented by electronic equipment. Also, the survey estimates that, by then, 25 per cent of the British budget will be used for interactive communications sytems such as videotext or connection to ISDN (Integrated Services Digital Network). This figure could reach 50 per cent of the budget by the year 2000 according to the study.

Also, with the development of information technology, NEDO expects an increase in the components market for integrated circuits, optoelectronic equipment, new processing and storage techniques as well as new transmission systems. This would pave the way to the institution of "Information highways".

According to the study, the demand for skilled personnel in information technology outweighs the supply. Accordingly, the NEDO survey asks for further government subsidies for the training of experts in order to intensify research in information technology and in the electronic information industry as a whole. (Extracted from Markt und Technik, No. 43, 23 October 1987)

AI and the concepts of future factories

The major concepts involved in the factory of the future will be affected by artificial intelligence methods and concepts, according to R.A. Herrod of Texas Instruments. Knowledge-based planning and scheduling systems and natural language machine programming will help supply the flexibility needed for just-in-time and point-of-use output and for easy reconfiguration. Smart networks and interfaces and extensive knowledge bases will help in integrating the plants and in the intelligent management of plant-wide communications. Expert systems that can run in real- time, along with distributed knowledge bases, will help place the right amount of control where necessary. On-line expert and handheld portable systems coupled to large knowledge bases that can be stored on laser disks hold promise in attaining a zero downtime goal. (Extracted from Auto Engineer, March 1988)

EUREKA's 'FAMOS' FMS projects approved

The meeting in Madrid of the Fifth Ministerial Conference of EUREKA coincided with the celebration of Tecnova 87. One of the items on the agenda was the approval of seven FAMOS projects, chosen from the 100 already submitted, that have gone beyond the analysis stage and are now definite FAMOS projects.

Dedicated to the improvement of European technology in the field of flexible automated assembly, FAMOS has become the most important group of projects within EUREKA.

The ministerial conference in Madrid formally approved seven projects that are already on the way to realization and subsequent evaluation.

Federal Republic of Germany: Robert Bosch Ltd.

With the collaboration of the Italian firm B. Ticino, Robert Bosch has embarked on a project that should be in operation within four or five years and whose approximate cost has been estimated at 10.6 million ECU (European Currency Units).

Its aim is the development of components of flexible assembly systems through CIM (Computer Integrated Manufacturing) with the purpose of reducing stocks and the volume of the jobs in process. The pilot plant that will emerge from the project will incorporate automated assembly cells and will improve the areas of manual assembly and the flow of information as well as materials.

The main technologies to be developed are: the implementation of robotics and automated plants in general; ergonomical and efficient arrangement of the necessary manual operations; disposition of products by means of intelligent systems of transportation; control and information networks employing artificial intelligence packages.

Spain: Standard Electrica, S.A.

This is one of the projects in which the directing company is Spanish. Principal collaborators are Alcatel, Taylor Hitec and Centunion, the latter also Spanish. The implementation period in this case is 25 months, with a cost of 3.5 million ECU.

The project is very specific: the objective is to produce a flexible manufacturing cell for the assembly of telephone devices. Very advanced models of digital telephones will be manufactured in an integrated manufacturing plant that will receive the components for the devices and install them in automated assembly lines and in manual assembly areas. The entire process will be strictly controlled by a network compatible with MAP (Manufacturing Automation Protocol), optimized with intelligent systems for simulation and disposition of parts.

France and Spain: Philips and Fagor

This is a case in which two competitive firms are collaborating, inasmuch as Philips as well as Fagor are engaged in producing white line household appliances. It is a very ambitious project, from which a factory for automatic washers should emerge. Due to its complexity, the period of execution is divided into three separate vaguely defined terms estimated to last from two to four years. The cost, originally calculated at 406 million ECU, has been increased subsequently. Primary collaborators will be Ikerlan of Spain, Dea of Italy, the well known institute IP of Stuttgart, and the British engineering firm Systems Designers.

Due to its magnitude the project has been divided into four subprojects that correspond to assembly lines for the production of sub-assemblies which will be combined to form the washer: the first will manufacture the frames and covers from sheet metal; the second will produce the washing the wiring and the last corresponds to a continuous visual inspection line. Robotics, automatically guided vehicles, sensors and communication networks are the main technical aspects to be developed in this project.

France: Merlin Gerin

The objective in this case is the integration of high-velocity automatic assembly machines, which should be carried out within a four- or five-year period and for which 7.9 million ECU will be invested. Two Spanish firms will be collaborating: the above-mentioned Centunion, and Serra Soldadura; also participating are the French firm ITMI, the Italian Nesarteam and, singularly, Isemca, a company of Switzerland, a country outside the group comprising FAMOS.

The purpose is to develop new assembly lines for automatically placing small parts in electrical units of various sizes while maintaining high productivity. The first application will be in the production of switches at Merlin Gerin factories, including those in Spain. For this, technical problems relating to soldering, automatic insertion, vision systems, automatic laser tests, local networks software protocols and communication systems will have to be solved.

United Kingdom: Perkins Engines Limited

The British motor manufacturer Perkins enjoys the collaboration of three other British firms: Istel, IBM and P.A. Technology, and that of the Italian firm Babcock Fata. It is estimated that the project will take three years to complete, with an estimated cost of 10 million ECU, and that the final results should be a flexible installation of large capacity, highly diversified in regard to the products to be assembled and adequate for motors and transmissions.

The objective is very interesting: 80 per cent of the company's present production, 600 motors daily, falls in the medium-size range. Each client requires slight variations, sometimes strictly cosmetic, and to economically satisfy those demands, Perkins has proposed to automate the incorporation of such adaptations, which must be carried out while working at high speed. For this it has already gained experience in its own plants, but now it must pursue broader and more difficult objectives, mainly through the use of automatically guided vehicles (AGV), by automating the selection, supply, location and assembly of mechanical components, and the creation of a complex system for the management of machines, cells, and lines relying on artificial intelligence for its control.

Italy: Telettra S.p.A.

Once more a case of collaboration between companies that are at least partially competitors, since Telettra's collaborator here is Plessey, the British firm whose specialty is telecommunications. The project has a budget of 34.5 million ECU and the completion period is four years.

Telettra also operates in the field of telecommunications and produces millions of printed circuit board assemblies per year. Like Plessey, Telettra is already using automatic assembly machines. CAD (Computer Aided Design) and management systems connected to central computers, and other advanced technologies. Nevertheless, it is now trying to go one step further with the integration of the various systems, which involve the above-mentioned technologies of robotics, vision, sensors, automatic manipulation and transport, local networks, communication protocols, etc.

Italy: F.I.A.R.

Along with two other Italian firms, Prima Industry and Zanussi Electromeccanica, the Swedish Electrolux and the Austrian Verdichter O.E., this Italian manufacturer of compressors for refrigerators has obtained approval for a project valued at 15 million ECU that must be completed at the end of three to four years. It is very experienced in this field, inasmuch as it participates in various European CIM projects and has developed robots and vision systems to fulfill its own needs. Now it is trying to produce a flexible cell for the complete assembly of its refrigerators.

The main difficulty arises from the narrow tolerances that apply to the working elements of the compressors, which are installed by selected pairs for economic reasons. Hence the need for a system to monitor and control the flow of parts in real time. This necessitates having an on-line inspection system connected to an intelligent central control. Therefore the technological priorities of the projects are for advanced sensors, artificial intelligence and communication network systems.

The FAMOS of the 90s

It is clear that one of FAMOS' key words is collaboration. Collaboration among companies and institutes from various countries and even among competing enterprises.

For the seven cases described, as well as for those that will be approved, the next phase is the establishment and evaluation of the systems during production. From 40 to 50 advanced assembly systems should be distributed throughout Europe, for which it is calculated that no less than 645 million ECU will be needed. It is expected that other countries participating in EUREKA will join FAMOS, so that the large-scale application of its results - since the idea is not to keep only the simple installations that are the immediate results of these projects - will permit facing the competition from outside Europe. It is evident that Japan and the United States are working in the same direction and perhaps with even more effort. But it is no less evident that this is the only type of option left to Europe. (Extracted from Revista de Robotica, October 1988)

Living with smart machines

The first generation of robots was brought into car factories about a decade ago to replace workers and cut costs. These automatons repeated one or two tasks on a single car on one long production line, endlessly and flawlessly. Ten years later the most advanced robots are capable of lots of tasks; they operate in parallel, switching from one model to another as different cars flow down the production line.

These machines have increased skills all round: all workers have to know how their robots work. This, in turn, has meant upgrading the jobs of workers and a blurring of the distinction between unskilled and skilled. At one of the world's most automated car factories - Fiat's Cassino plant, where robots carry out 55 per cent of the final assembly of the new Tipo car - each worker has had at least 200 days' training.

The second feature of the new machines, however, is that they are not so labour-saving as the old ones. In Fiat's factories the first generation of automation cut manning levels by half; in the second generation - the move from semi-automated factories to complete automation - the manning level fell by only 20 per cent. If this is a good guide to the future of manufacturing work, then the often-expressed worries - that robots will take over factories, leaving a few computer scientists in charge and the rest of the workforce unemployed - are too pessimistic. As automated factories become more complex and more reliant on computers, the quality of the staff, rather than cuts in their numbers, emerges as the vital issue.

Mr. John Krafcik, of the Massachusetts Institute of Technology, has made a comparative study of the effects of automation in 31 car plants in Europe, America, Japan, Brazil, Taiwan and South Korea. His remarkable conclusion is that "levels of technology have nothing to do with productivity". His proof lies in the reasons behind the big exception to the rule: Japan.

The Japanese plants included in his survey had twice as many different models flowing down their production lines as their American and European rivals. Mazda's main plant at Hiroshima, for example, makes four completely different models on one line. In contrast, factories in Europe and America fitted with state-of-the-art manufacturing equipment use them to make only one or two models.

The Japanese companies make more models because they give workers more responsibility for production decisions. They learnt to do so when they first introduced their "just-in-time" system of inventory control. This keeps costs down by making warehouse managers keep track of every item in stock and know exactly how much to order when.

In the same way, flexible manufacturing systems work at full capacity only if production workers are able to take complex scheduling decisions about which car they (or rather their robots) should work on at any one time. Japanese workers are expected to move among a number of machines and work stations. Union-set demarcations are non-existent.

Japanese workers have adjusted to the idea of fully automated plants much more easily than workers elsewhere. The Japanese say this is because their consensus-seeking management style has long encouraged workers to take responsibility for what they are doing. (Source: The Economist, 21 May 1988)

New robot for the apparel industry

Tsubakimoto Chain Co. Ltd. has come out with a robot designed to gather commodities for use in the apparel industry and is presently conducting a monitoring experiment subsequent to delivering the first fabricated system to a leading supermarket.

This robot system automatically picks out vinyl- packaged clothing articles such as shirts and T-shirts, from baskets lined up on an accommodating rack, with the aid of a computer system. A six-axes manipulator is used and the accommodation rack is arranged with 10 baskets horizontally, six baskets vertically and four baskets depth-wise.

The robot moves along the rack with an empty basket and picks up the necessary clothing articles with a suction pad equipped at the tip of the manipulator. Its operation speed is 5.3 sec/item on the average, and the filled basket is emptied out automatically onto a conveyor.

In concert with the growing market trend to sell diverse commodities in small lots, the

distribution circle is being faced with the need of quickly supplementing only the quantities of commodities that are sold. Therefore, when supplementary orders are received in the evening, the work of collecting the items is completed during the night to permit deliveries the following morning. The distribution system is linked closely to market needs and is becoming an automated round-the-clock system. The development of this robot has made the realization of this automated distribution system much more realistic.

Meanwhile, as for supermarkets, the plan is to link this robot system to a host computer with the aim of eliminating cumbersome paperwork. Further details available from Tsubakimoto Chain Co. Ltd., Public Relations Department, 17-88, Tsurumi 4-chome, Tsurumi-ku, Osaka, Tel.: 06-911-1221. (Source: JETRO, March 1988)

MAPcon takes on factory network configuration

If the Manufacturing Automation Protocol is ever to catch on as a mainline factory-networking scheme, users will not only need MAP products - they will also need tools that can help them with the complex task of MAP-network system integration and operation. That is the rationale behind MAPcon, an expert-system network configurator from the Industrial Technology Institute in Ann Arbor, Mich., for use with the forthcoming version 3.0 of the MAP specification. The final version of MAP 3.0 is expected to be released this summer.

A tool like MAPcon will be a virtual necessity for MAP-network designers. Products that are built to the full seven-layer MAP 3.0 specification will typically require users to specify 62 separate parameters for each station on the network in order to link that station to a MAP network. "Some of these parameters are hard to set. Some of them are pretty trivial", says Andrew H. McMillan, director of the Institute's Communications and Distributed Systems Laboratory.

MAPcon queries the user on about a half-dozen key parameter settings for each network station. Then it graphically constructs the remaining parameter settings. Alternatively, if a particular set of devices cannot be configured together, MAPcon alerts the user and suggests alternatives.

The MAPcon package features an icon-based user interface and is implemented in Knowledge-Craft, an integrated set of software tools from Carnegie Group Inc., Pittsburgh, for rapid construction of knowledge- based systems. It currently runs on a Texas Instrument Inc. Explorer Lisp Machine. The package will be adapted for use on Sun work stations and eventually it will be joined by an entire suite of MAP network-management tools that are now in the works at the Institute. All of the tools will ultimately be spun out as commercial products. Although the Institute is a not-for-profit corporation, it plans to enter partnerships with vendors who will develop the tools into products. But the Institute also plans to provide early availability of prototype versions of MAPcon and other tools through a low-cost industrial-partnership program that begins in June.

MAPcon, under development for about two years, is the first of several knowledge-based modules for use with MAP 3.0 networks. All are planned to attach to the Institute's network-manager platform. Unlike the modules, the network manager will not employ artificial intelligence. But it will provide users with analysis tools for performing configuration, fault and performance management based on human direction. The MAPcon module will automate the configuration portion of the network management task and subsequent AI-based modules will automate other portions.

A prototype version of the network manager - with an attached MAPcon module - will go into beta test at an unnamed industrial site in November. The Institute is currently talking with several potential industrial partners about converting the prototype network manager into product form, and is also looking for partners to commercialize MAPcon.

The network manager will be available as a commercial product from at least one vendor by this year's fourth quarter, or next year's first quarter. MAPcon itself will come later, followed by a second knowledge-based module called MAPfam, which will automate the fault-management portion of the task. The Institute's plan calls for a working MAPfam prototype by March 1989. Formal work has not yet begun on a third module to automate performance management. (Reprinted from Electronics, 14 April 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Surface mount technology

Surface mount technology (SMT) enables electronic circuits to be made more cheaply and smaller with improved reliability, according to D. Boswell, of the National Physical Laboratory's Surface Mount Club. The new robotic assembly technique allows electronic components and connections to a supporting printed wiring board to appear on the same surface of the board instead of having component leads enter through holes in the board and solder joints conduct tracks on the opposite face. By revolutionizing the way circuits containing silicon chips and other components are assembled, the new technique also allows faster computer performance and has applications to car phones and radios, hand-held and laptop computers, guitar synthesizers and medical electronics equipment. In the UK, the approach is being used for cost effective miniaturization in industrial control, military, computer and telecommunications applications. Successfully introducing SMT into a factory affects almost all departments and requires rigorous training. (Extracted from British Business, 5 February 1988)

Robots plot their escape from factory boredom

The British Government is about to set up a research centre that could help robots to emerge from the factory and into the everyday world. The Advanced Robot Research Centre will be based at the University of Salford, backed by £5 million from the Department of Trade and Industry and matching funds from 16 industrial sponsors.

While the centre will not build a complete robot, it will produce seven demonstrator systems. These will be based on research into improved sensors, navigation, guidance and control.

Last year, the number of robots at work in Britain went up by some 30 per cent. There were 4,303 robots in factories by the end of 1987, according to the latest figures from the Robot Association. The comparatively low figures go with a small research base. This, in turn, means that progress is slow in all areas of robotics.

At present, most factory machines depend on a programmer to supply them with instructions. This is why they have been confined to mundane tasks, such as welding and paint spraying, that do not require the robot to make sense of its surroundings. The developments at Salford and also at Hatfield Polytechnic, where researchers are building an assembly robot that responds to voice

commands, are among the early steps towards a new generation of robots.

Personal Robots, a small British research company, has been working on a robot lawnmover and robot security guard for some time. The problem with both machines is to get them to move around easily. The security robot, called Roboguard, gradually builds up a map of its surroundings by working out which readings from its sensors are reliable.

Sensor information can be very misleading. For example, infrared beams will bounce back from a flat surface far more quickly than from a dark, rough surface which diffuses the signal.

The closer to the floor that objects in a room are, the more likely they are to move about. So, the security robot takes its bearings from high up the walls of a room, while watching out for objects in its path.

Robots may also be able to move into cleaner service jobs. The switch to white-collar work, however, calls for cleverer robots able to move about, recognize objects, manipulate them and make decisions.

In America some 1,400 robots are already overseeing tests and performing simple experiments in scientific laboratories. Transition Research is being sponsored by six American companies to work out whether it is feasible to build an electronic "maid on wheels". Engelberger's firm has already produced a prototype that is working in a Conneticut hospital. The robot might also do household chores, serve meals and help elderly or disabled people. Further in the future, transition research's machines may be used in hotels, cleaning baths and helping out with room service. (This first appeared in New Scientist, London, 5 May 1988, the weekly review of science and technology).

Automatic dairies

A group of Dutch agricultural engineers called "Farm 2000" have produced the first fully automated dairy, in which cows are caringly milked, monitored and generally made a fuss of by an impersonal-looking array of computer-controlled arms and electronic sensors.

A prototype of the system was unveiled at an agricultural-engineering conference in Paris. The robot-cowshed consists of a set of stalls in which cows are both fed and milked. When a cow enters a stall, ultrasound sensors automatically scan its teats and find out where and how large they are. That information is used to produce an image of the teats in the central computer, which serves to guide a robot arm.

This arm then attaches teat cups to the cow. A conventional vacuum system, like those used in today's less sophisticated automatic milkers, coaxes the milk from the carefree cow. Once the suction has begun, the robot, which can attend to several animals at once, is then free to start work on another cow.

This does not all happen willy-nilly. Mr. Wim Rossing, the project's engineer at the Institute of Agricultural Engineering in Wageningen, insists that the robot will keep milking only if it thinks the time is right. It takes decisions after considering information from a range of monitors and sensors that measure everything from the yield, temperature and composition of the milk to the cows' movements and general state of health. Mastitis, for example, can be diagnosed from the milk's conductivity.

The robot can also find out if the cow is in its fertile period or not. It does this by measuring the amount the cow has been moving around - all the cows have counters on their legs which record their movements - and measuring its temperature. The computer spots cows in oestrus with an accuracy of 93 per cent.

The cows might be forgiven for feeling rather alienated by all this - but the central computer does contrive to treat them all as individuals. Each cow is identified by a miniaturized transmitter worn on its neck, and information about it received during a milking is automatically compared with records. When measurements vary too widely from their expected values, the computer singles out that particular cow for investigation or treatment.

The computer also provides tailor-made meals for its bovine guest. When a cow steps into the stall its favoured menu is identified from the information contained in its collar-mounted transmitter. A carefully balanced helping of weighed forage is mixed with the right amounts of various concentrated foods. The meal is dumped in a small bunker which is guided along a rail to the appropriate stall; there the mixture is dished up to the waiting cow. There is, of course, a good commercial reason for such pampering. Different cows need different balances of roughage and concentrate to optimize their milk yields.

Combining the use of feeding boxes with milking stalls lets the cows be milked several times a day, at the most opportune moments. During an 11-week trial period some 20 cows were milked in such a shed. The cows, which turned up for food an average 5.4 times a day, were content to be milked four times a day. The greater number of milkings (cows are usually milked twice daily) stimulated the cows' capacities for production; average yield on the automatic system was 14 per cent higher.

The frequent milkings, says Mr. Rossing, do not improve only the milk yields; they also improve the cow's well-being. Cows milked twice a day are sometimes compelled to stagger around with their udders filled to near bursting point. Emptier udders reduce the chances of cows injuring themselves.

The present prototype system is estimated to cost about F,000 for an average-sized dairy. At the Paris meeting FRG, French and British delegates agreed to co-operate in the production of a cost-effective model to be fully tested at the end of 1989. They will be seeking support from the EEC's ESPRIT programme. (Source: The Economist, 23 April 1988)

II. STANDARDIZATION AND LEGISLATION

Top computer and communications firms join OSI endorsement parade

A dozen of the world's biggest computer and communications companies have joined in a resounding endorsement for the Open Systems Interconnect networking protocols. The adoption of the seven-layer OSI standard for managing multivendor networks will mean users can give greater weight to performance - and less to compatibility - in purchasing decisions, says Murray Weidenbaum, who heads the Centre for the Study of American Business in Washington and is the former chairman of the President's Council of Economic Advisers. He predicts customers will see productivity gains of about 30 per cent as a result of the agreement.

Now, instead of competing with proprietary systems, the dozen companies will form alliances among themselves and compete on the "eighth level of OSI" - how to most efficiently manage distributed computer systems - says Wim Roelandts, vice president of Hewlett-Packard Co.'s Networked Systems Group. The 12 companies read like a who's who in computing: AT&T, Control Data, Data General, Digital Equipment, Hewlett-Packard, Honeywell-Bull, IBM, Sun Microsystems, Telenet Communications, Unisys, Wang Laboratories, and Xerox. The 12 companies account for 80 per cent of US computer and telecommunication sales. (Reprinted from Electronics, 12 May 1988, (c) 1988, McGraw-Hill Inc., all rights reserved)

Can broadcasters break the standards barrier?

The proposed unified Europe of 1992 already exists in some markets. There are no physical or technical borders, for example, for users of many professional data bases. And satellite television will continue to flourish on a pan-European basis whether or not targets are met for the barrier-free internal market represented by "1992".

"Frontiers simply do not exist in Europe for the exchange of data between many computers or the transmission of video programs and information by satellite", explained Pierre André, director of Télésystèmes, whose data processing centre offers both Europeans and non-Europeans access to over 100 data banks. "But 1992 will help Europeans create continent-wide standards and technical norms that will speed up the use of these services, encourage new developments and improve opportunities for European products in international markets".

Demand by professional users and information-hungry consumers has created a market momentum that should propel technological development faster than any political blueprints drawn in Brussels. The principal challenge for European manufacturers, however, is to create standards for high-tech innovations so that they can be adopted and implemented on a global basis.

High-tech professional and consumer products and services could benefit from a number of 1992-related goals. A truly pan-European market, for example, will certainly encourage Japanese and American companies to be more conscious of creating and designing products for European users. Jean Caillot, the president of Thomson International, feels the harmonization of value-added tax rates throughout Europe and the resulting decline in taxes on consumer products will also encourage consumer demand.

But it is agreement on pan-European standards that is the key to further development of national, pan-European and international consumer products and services in areas like videotex, satellite television programming and high-definition television (HD-TV).

The adoption of standards results in lower development costs, economies of scale, lower prices, better marketing possibilities and a quicker delivery of a single technology to the consumer. The nation or company creating standards often dominates the marketplace.

Some European manufacturers note that their efforts to create standards in areas like HD-TV, which puts double the amount of video information on a wide television screen, might just have a global impact.

The result of agreements on standards for different products would be a shot in the arm for European consumers and manufacturers alike.

The burst of more programming, an increase in the number of pan-European satellites and established standards might even revitalize the European consumer electronics market. This accounts for about 20 per cent of the total electronics equipment market and currently suffers from saturation, overcapacity, price wars and resultant slow growth in product areas like colour television.

Renewed demand will obviously benefit European manufacturers like Philips and Thomson, who together supply 70 per cent of Europe's televisions, as well as companies that manufacture satellite antennas or develop new services.

But these and other commercial goals associated with "1992" will, to a great degree, be determined by European success in creating technical standards that will be adopted on a global basis.

It will not be easy. There is still, for example, a lack of clarity regarding transmission standards for HD-TV. (Extracted from International Herald Tribune, 26 April 1988)

American court case raises software alarm

Concern over the quality of the software in use in some of the world's most vital computer projects has come to a head with a court case now under way in the US. The British Government will be watching its progress with interest as it studies two major reports on software quality.

The case has been brought against Unisys, the second largest computer company in the world, by one of its ex-employees, over the quality of the software it developed for the shuttle programme. The employee claims this was not properly checked for errors.

The reports, by Logica and Price Waterhouse, look at the issue of how to ensure software quality. They estimate that poor software costs Britain billion a year. The reports recommend that everybody in a company should be made responsible for maintaining a high standard for the software the company produces. They also recommend the adoption of a single British standard, which could form the basis of European legislation.

Mike Hennell, a specialist in software quality at the University of Liverpool, claims that complacency over software quality will only be removed if the Government backs up words with legislation.

According to Hennell, one of the main problems about developing software is that it is too easy to introduce errors or bugs by incorrect coding. A small syntax error in a general-purpose programming language such as Pascal, or in a defence language such as Jovial, may stay hidden in the program until an unusual set of circumstances combine to make it appear. A recent failure in the computer software at the West Drayton air-traffic control centre was attributed to a 20-year old bug.

The issue of reliability, and what constitutes adequate software quality, has been further complicated by recent changes to the Consumer Protection Act in Britain. This means firms may be liable for law suits caused by a software failure, if they are not seen to have tried to ensure

software quality. (This first appeared in New Scientist, London, 19 May 1988, the weekly review of science and technology)

NFAIS approves a code of practice on gateways

The USA's National Federation of Abstracting and Information Services (NFAIS) has approved a Code of Practice on Gateways identifying the rights and obligations existing among participants in a gateway arrangement.

A developing technology, gateways are a means of broadening dissemination of the world's information. At the same time, by making access to databases easier, they have the potential to weaken agreements already existing among the owner of the database, the host system and the information user.

The Code of Practice defines rights and responsibilities and distributes them according to the participant's role in the gateway process. Developed by an NFAIS task force, it is to be distributed to both online systems and gateway organizations. (Information source: Bulletin of the American Society for Information Science, October/November 1987).

ISONET

By the end of 1987, the work of the International Organization for Standardization (ISO) had produced 6,600 international standards, spanning almost every aspect of human activity. This figure, in addition to another several hundred thousand standards and technical regulations in use throughout the world containing special requirements for particular countries or regions, makes providing information on standards a complex task. ISONET, ISO's information network, was established to make rapid access to standards information possible.

ISONET has co-operatively developed a system within which its members in different countries act as "specialized enquiry points" in the dissemination of information and in identifying the relevant sources of information for solving specific problems.

Enquiries from national organizations including government departments, commerce and industry, universities and individuals, should be addressed in the first instance to the appropriate national ISONET member. International governmental and non-governmental organizations may apply to the ISO Information Centre, ISO Central Secretariat, Case postale 56, CH-1211 Geneva 20, Switzerland. (TP+41 22 34 12 40; TX 41 22 05 iso ch).

Court says copying software is legal

In a decision quite without legal or other precedent, the Federal Republic of Germany Supreme Court has announced that software copying is legal and there is nothing companies can do to change that.

Herr Riessenhopper, the judge at the centre of this sensation, said that "there is no bearing on the intellectual property of the owner of software after sales. Since a person actually purchases the software, he should be able to do what he wants with it, short of becoming a company and selling the product".

The decision, which stirs up the old copy protection controversy, has been taken seriously by several companies which have already removed copy protection from their products. (Source: Micro, Vol. 5, No. 10, April 1988)

American court says IBM owns the floppy

A federal judge in the United States has ruled in favour of IBM in a patent dispute over the floppy diskette. The judge decided that Nashua Corporation had infringed on IBM patents for more than six years, and he ordered the New Hampshire company to pay IBM royalties estimated at several million dollars. Nashua say the disks in question account for only about 5 per cent of Nashua's sales, which totalled $865 million last year.

However, IBM may be about to make quite a lot of money from royalties and patents for its Microchannel architecture in the PS/2. Reports suggest that several companies, including [illegible]ith, are interested in entering into deals with IBM to license the technology.

This is a policy which IBM has long used to its advantage in the mini and mainframe markets, and personal computer manufacturers could find that such agreements are costly. (Source: Micro, Vol. 5, No. 10, April 1988)

Apple-Microsoft suit raises issue of vague copyright laws

It took many in the industry by surprise, but may be it should not have. Apple Computer Inc.'s lawsuit charging Microsoft Corp. and Hewlett-Packard Co. with violating Apple's copyrighted user interface seemed to come from nowhere and as a shock.

Beneath the surface, however, there lies a legal virus that has infected the relationship between the two companies and for which there is no cure in sight. The virus, now spreading throughout the industry, is the ambiguity of US software copyright law, aided and abetted by a host of contradictory decisions by US courts over the last few years.

The debate focuses on several points of software copyright law, including the so-called "look and feel" issue and what is known as "substantial similarity".

Software development chill?

For IS management, the key questions involve the lines of demarcation surrounding this issue and whether the problem of ambiguous copyright laws - including, specifically, the questions raised in the Apple suit - may intimidate or chill both commercial and in-house software development.

In its suit, filed in US district court in San Jose, Apple charges both Microsoft and HP with breach of contract and copyright infringement. The suit alleges that the "artistic, aesthetically pleasing" visual displays and graphic images generated by the Macintosh were protected works under copyright law.

To experts in computer law, phrases such as "substantial similarity" are difficult to define, but considerable precedent exists to lead to some possible definition. The "look and feel" issue, on the other hand, is considered much harder to define because of the lack of precedent.

These problems can be traced to the unsettled legal status of software copyright law. The question of whether a program's look and feel should be subject to intellectual property protection, and, if so, to what extent, has produced a host of lawsuits among program owners and developers and a

corresponding number of contradictory decisions by the courts.

In the case of the current suit, some fear the consequences if Apple should win. If it prevails on copyright grounds and the result of the suit is taken as a signal by developers that all user interfaces have to be different, continued confusion could result for the IS community.

Apple officials, while not commenting directly on the suit, say through a spokesperson that the suit is directed towards Microsoft and Hewlett-Packard, not towards the developer community. (Reprinted with permission of DATAMATION [r] magazine [c], 15 May 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Developments in copyright law

Companies who have been making use of the Irish Copyright Act to protect industrial products could find this more difficult from now on. In December last the Oireachtas passed into law the Copyright (Amendment) Act, which had been first introduced in 1984 but had lain dormant for some time.

This had originally been mooted as a means of dealing with the growing trade in pirated video films and many of its provisions are aimed at this. However, the Act in its final form also has a section which addresses the question of copyright in three dimensional objects of a functional nature, i.e. many industrial products. It aims to reduce the level of protection which successive court decisions had awarded to such products under the original Copyright Act of 1963.

Successive court decisions in Ireland and in the UK, where the law is substantially similar, had found that not only did copyright subsist in two dimensional engineering drawings of a product, but also in the three dimensional object itself. Thus a firm which copies a product without ever copying, or indeed even seeing, the drawing could be guilty of copyright infringement.

The amendment to the law in effect seeks to abolish this provision. It will no longer be infringement of copyright in a drawing to reproduce the object in three dimensions provided that:

- The features, that are copied are really only functional and
- The product has already been manufactured in some quantity (at least fifty items) by the copyright owner or a person authorized by him or her.

The aim appears to be to get back to the situation that most people had assumed to be the legal position before the various cases came to court. It had generally been accepted that if one slavishly copied another person's drawings then there should be some redress through copyright. However, if it was a case of simply copying a product that one had seen on the market or in photographs in a magazine then it was felt that the situation was different.

If the product was not covered by a patent or a registered design, i.e. it was a purely functional one with no claims to inventiveness or aesthetic merit, then it was generally felt that producing a similar item to carry out the same functions should not be seen as infringing any rights. The courts thought otherwise and in various cases ruled that such copies did infringe copyright. With the amendment such protection for functional items disappears.

The provision relating to the number of items produced by the copyright holder arises from the need to legislate for a spare parts situation.

Under the orginal Act there had been cases where a company having made and supplied a piece of equipment could seek to prevent other firms making spare parts for it unless they paid a licence fee. This, it had been argued, amounted to an unfair monopoly. The new amendment seems to have accepted this view. Once the original manufacturer has made and sold fifty machines, it seems they will not be able to stop other firms making spare parts for them.

How the amendment will work in practice remains to be seen. As with any legal provision it has to be interpreted in the courts. One cannot predict what cases might come forward or all the legal or technical arguments that might be made. Also there are no transitional provisions in the amendment. Certainly it would still seem unwise for any firm to decide that they could proceed with copying without taking expert legal advice in advance.

There had been general agreement that some revision of the law was necessary. The situation was that a manufacturer of a product, which was not inventive enough for a patent (protection, 16-20 years depending on the country), and not aesthetically attractive enough for a registered design (protection 15 years), could nevertheless claim copyright protection which would run for the life of the designer plus fifty years. This seemed almost to be a Gilbertian form of justice. However, to leave such a manufacturer without any effective recourse to law if his product is flagrantly copied would also seem harsh. It appears to some that the new amendment could do this and that a more studied approach might have been more equitable.

Irish and British law have to date been very similar in these areas and it is interesting that the UK parliament are adopting a different approach. There the whole matter of copyright and designs law has been under review for some time. An expert committee under the chairmanship of Mr. Justice Whitford was set up by the Government in 1973 and reported in 1977 with detailed recommendations for revision of all aspects of the law.

Out of all the debate the Whitford and other reports had engendered has come a new UK Copyright, Designs and Patents Bill which was published in October last. This replaces their 1956 Copyright Act and alters provisions of other Acts in the patents and designs field.

Its solution to the copyright problem is to deprive industrial (i.e. non artistic) articles of copyright protection but to introduce a new "unregistered design right". This can given ten to fifteen years protection for industrial items. However, copying will be permitted where it is necessary and so far as it is necessary, for a spare part to fit or match. There is also an out for "innocent infringers" who "had no reason to believe" they were infringing.

It also tidies up some other matters such as where an artistic work with copyright protection is used as the basis for industrially produced items. In such a case copyright would cease after twenty-five years. The bill also addresses some other thorny problems such as copyright for computer programmes. (Source: Technology Ireland, March 1988)

MAP is finally settling down to become a standard

It looks as if the Manufacturing Automation Protocol is finally ready to settle down and become a reliable standard. At least, some 50 exhibitors who showed MAP products at the Enterprise Networking Event in Baltimore from 5 to 9 June think so. They point to a series of developments that are boosting acceptance of the factory automation protocol.

First, MAP/TOP 3.0, the latest version of the protocol and its companion Technical Office Protocol, includes a stability statement intended to dispel fears that changes in MAP will render earlier versions incompatible with newer ones. Second, MAP's promoters promise that Version 3.0, unlike earlier versions, has undergone extensive conformance testing. Finally, and most important, MAP's protocols have been tied tightly to the Open Systems Interconnection model.

Some vendors are still taking a wait-and-see attitude before they commit themselves to building and selling MAP-compliant systems. Some users are equally wary about buying any such systems. But MAP's backers feel sure the doubters can be won over.

Those backers point out that the stability statement guarantees the vendors, essentially, that what they see in this edition of MAP is what they will continue to get. The statement guarantees that no incompatible additions will be adopted for at least six years.

Furthermore, the MAP promoters say, the conformance testing that preceded and that will follow the Enterprise show should help convince vendors and factory-automation-product users to forget the painful experience of the 1985 Autofact show. At that show, prototype systems built around MAP/TOP Version 2.1 went on display, but then production versions bogged down in conformance testing and later were shunned by potential users - they saw Version 3.0 on the horizon and balked at installing a soon-to-be-obsolete system.

This time, Version 3.0 is undergoing a $20 million shakedown, says Charles J. Gardner, manager of Standards and Protocols for Eastman-Kodak Co. and chairman of the MAP/TOP Users Group Steering Committee. Half of the testing is being done by the Corporation for Open Systems and the other half by a European consortium, Standards Promotion Applications Group. The European input is particularly significant; the major vendors all take a global perspective of the networking market.

However, neither the stability statement nor the conformance testing answers the biggest question the doubters have. That concerns OSI. While a dozen computer vendors endorsed OSI in a pre-Enterprise news conference in May, they pointedly omitted an endorsement of MAP/TOP.

Recognizing that fact, the MAP/TOP Users Group has proclaimed its willingness to guide MAP and TOP by the OSI's seven-layer networking model. Nevertheless, quesions remain about the stability of MAP's OSI connection. In particular, MAP/TOP Version 3.0 has enhanced its functionality in the OSI's network-management layer. But the OSI standard for the network-management layer is still incomplete, and there is no clear assurance that its final version will conform with MAP/TOP's implementation. (Reprinted from Electronics, 26 May 1988, c 1988, McGraw Hill Inc., all rights reserved)

Users to get prototyping preview

On the agenda for the May meeting of the IBM International User Group Council, which consists of the presidents of the seven largest IBM user groups, will be a new international joint project covering prototyping for office applications. If the new project, suggested by an IBM executive in February, is accepted, it will involve IBM developers testing office systems prototyping techniques and ideas on a group of key users from around the world well before the ideas are developed into products. This is the kind of prelaunch user contact that the IUGC has been striving for throughout its two-year history, and it will give IBM some invaluable early feedback on its future product plans. IBM's users may be jumping for joy, but its competitors, Amdahl Corp. in particular, are not thrilled. Amdahl claims this practice could put it and other competitors at a disadvantage. The IUGC must work out how the project will be funded and who should be involved. (Reprinted with permission of DATAMATION [r] magazine [C], 1 April 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

I. GOVERNMENT POLICIES

Panel set to push for changes to US-Japan trade pact

The two major wings of the electronics industry are joining forces in an elite task force that is trying to bridge the rifts between them caused by the US-Japan semiconductor trade agreement. Top executives from both the semiconductor industry and the system houses that buy its chips have been meeting since early this year to thrash out their differences. So far, they have come up with the basis for a nine-point agenda on trade that has already won wide-ranging industry backing.

The immediate point of contention the panel is addressing is a long-standing complaint by the system manufacturers. They argue that the trade pact shifts onto their shoulders the chip makers' burden, forcing them to pay higher prices for chips. But the panel's ultimate aim is broader - it wants to reconcile all the factions of the electronics industry so that it presents a united front on trade. Once that is achieved, industry representatives would press the Federal Government for modification of the 1986 trade agreement, based on the consensus among all parties.

The panel's activities are coming to light now as the rift is threatening to widen into a chasm, with system makers facing a severe shortage of dynamic random-access memories that is driving prices even higher. Ironically, the panel's call for action is coming just as the end of that shortage appears, at least to some observers, to be on the horison.

With or without a DRAM shortage, the panel - officially, the American Electronics Association Semiconductor Policy Task Force - has plenty of work to do. It is set to take up a number of proposals based on the nine points. The most pressing of these deal with the system houses' dissatisfaction about the way the trade pact sets semi-conductor pricing. The panel wants to ward off any attack on the price-setting mechanism, but at the same time respond to the complaint of the system makers that they were not consulted when the pact was constructed.

The rest of the proposals, which are still being ironed out, include some ideas that could over the long term have radical impact on the industry. Among these is a call for customer consortia that would be committed to buying chips made in the US.

The panel's first task was to lay out its position. To do that, it started work on what became the nine points. The test will come when the panel starts fleshing out its ideas. In addition to the plan to set up chip-buying consortia - for which antitrust exemptions would probably have to be sought from Congress - the joint task force will consider these pioneering proposals:

- Modify the trade agreement's procedure for setting fair market values by excluding products that have no current or potential US production base.

- Postpone price floors on semiconductors whenever prices climb and shortages occur because demand outstrips supply. When prices reach a certain percentage of the fair market value, the pricing system would kick in again.

- Support long-term semiconductor purchase arrangements.

- Encourage individual Japanese companies to comply with the intent of the trade agreement by lifting sanctions on those buying more components from US manufacturers.

(Reprinted from Electronics, 17 March 1988, c 1988, McGraw Hill Inc., all rights reserved)

FRG telecom-deregulation law goes to debate

The FRG parliament started debating a bill in April that would deregulate the country's terminal-equipment markets and communication services such as telex, telefax, data transmission, videophones, and mobile and satellite communications. The law, drafted by the Bundespost - the state-run communications authority - could be enacted in about a year, if the parliament approves. The draft law leaves untouched the Bundespost's monopoly over the core telephone service itself, but it would finally open many parts of the big FRG communications market to foreign suppliers. As a demonstration of the fact that it is serious about market liberalization, the Bundespost has started seminars in the US, where potential telecom suppliers can learn how to do business in the Federal Republic of Germany. (Reprinted from Electronics, 31 March 1988, c 1988, McGraw Hill Inc., all rights reserved)

Japan fears US outcry over worsening trade imbalance in chips

Japanese officials trying to soothe trade frictions are biting their nails over new figures showing a much worse US-Japan semiconductor trade imbalance last year. They fear an escalation of US complaints about the imbalance. The 1987 Japanese surplus of semiconductor exports over imports from the US grew only 4.4 per cent in terms of units, but in terms of dollars, the surplus balloons to $585.9 million, a 41.4 per cent increase. Blame for the big jump centres on shifting currency-exchange rates and the higher prices charged for Japanese chips under the guidance of Japan's Ministry of International Trade and Industry. Another factor is the fair market values set by the US Department of Commerce. Integrated-circuit exports to the US in 1987 totalled $1,503 million, a 19.2 per cent growth over 1986, while imports amounted to $917 million, only an 8.3 per cent increase. The rapid increase in the demand for ICs in the US market also made things worse, a MITI spokesman says. (Reprinted from Electronics, 3 March 1988, c 1988, McGraw-Hill Inc., all rights reserved)

European complaint could upset the US-Japan chip trade accord

The US-Japan semiconductor trade agreement could be endangered when representatives of the 95 signatories to the General Agreement on Tariffs and Trade met in Geneva on 22 March. A GATT panel, formed in response to European Communities' charges that the chip pact allows the US and Japan to fix chip prices, has at last produced a report. The confidential study is now being reviewed by the EC, the US and Japan. The US Trade Representative's Office in Washington believes that the EC's problem can be ironed out between the GATT panel and Japan's Ministry of International Trade and Industry, without abrogating the current agreement. If so, the solution may involve little more than changing Japan's procedures for preventing the dumping of Japanese chips. If not, a new round of negotiations involving the EC, the US, and Japan may be needed. Solving the EC's complaint could be tough: the EC is not just concerned with the fixing of prices in world markets, but also with the pact's mandate for US access to Japan's chip market, which is not shared by EC members. (Reprinted from Electronics, 17 March 1988, c 1988, McGraw Hill Inc., all rights reserved)

II. RECENT PUBLICATIONS

Information networking in population education

A rapid expansion in population education programmes has meant a corresponding increase in population information. For example, in the 1970s, only six countries implemented population education programmes on a national scale. Today, 15 countries in Asia and ten in the Pacific are implementing national population education programmes, with funding support from the United Nations Fund for Population Activities (UNFPA) and technical assistance from the United Nations Educational, Scientific and Cultural Organization (UNESCO).

The UNESCO Principal Regional Office for Asia and the Pacific has produced a 98-page manual aimed at creating among national population education authorities (a) a favourable attitude towards the use of information and (b) an understanding of how a system of information networking and resource-sharing can facilitate the flow and use of information for the improvement of population education programmes. It provides guidelines and procedures for establishing an information network on population education and describes various networking activities which can be implemented to promote the use of information at a national and regional level.

Information networking in population education is available, is hard cover, free of charge from the following address: UNESCO Principal Regional Office for Asia and the Pacific, P.O. Box 1425, General Post Office, Bangkok 10500, Thailand. It is also available on microfiche (price FF 30) from the UNESCO Press, 7, Place de Fontenoy, 75700 Paris, France.

Databases in the humanities and social sciences

Two volumes recently published by Paradigm Press contain a number of reports which may be of interest to readers. They are: Data bases in the

humanities and social sciences 2, edited by Robert Allen, and Data bases in the humanities and social sciences 3, edited by Thomas F. Moberg. Each volume costs US$43. and No. 2 is also available in a hardback version for US$64. Orders should be sent to: Paradigm Press, P.O. Box 45069, Sarasota, Fl., USA. (TP+1 34277 4069; TX 813/922-7666).

Subject guide to publications of the International Labour Office, 1980-1985

Derived from the LABORDOC database of the International Labour Office (ILO), this bibliography lists the more than 2,700 English language publications issued by ILO between 1980 and 1985. It includes bibliographic references to sales publications, technical reports, conference and working papers, and other documents, listed under subject categories taken from the ILO Thesaurus. The 614-page guide is indexed by author, corporate author, country or area, and title. ISBN 92-2-106076-4.

Priced at CHFR 30, copies can be obtained from: ILO Publications, International Labour Office, 1211 Geneva 10, Switzerland.

Local networks in practice

Based on an extensive study carried out in the USA and FRG by the Battelle organization, this 120-page paperback compares attitudes to computer networks in the two countries, and highlights significant differences in outlook. Chapters consider such areas as: classification of private networks; local networks in use; centralization versus decentralization; economic aspects, and local networks in FRG. Published in 1987 by Online Publications, Local Networks in Practice (ISBN 0-86353-113X) costs GBP 36/US$60, and should be ordered from the following addresses: Online Publications, Pinner Green House, Ash Hill Drive, Pinner, Middlesex HA5 2AE, UK; or (for readers in North America) Online Publications, 540 Barnum Avenue, Bridgeport, CT 06608, USA.

Encyclopedia of legal information sources

The recently-published first edition of this Encyclopedia, compiled by a team of noted library scientists, covers more than 12,000 live and print sources, including publications, professional societies and databases. Containing 500 subject sections, the 450-page Encyclopedia (ISBN 0-8103-0245-4) costs US$140 and is available on 60-day trial from the publishers, Gale Research Company, Book Tower, Detroit, MI 48226, USA.

Guide to MINISIS in the ILO library

Produced by the Central Library and Documentation Branch of the International Labour Office (ILO), this 23-page booklet is an introduction to the uses made of MINISIS in the ILO Library and in bibliographic applications elsewhere in the Office. The Guide also contains a section describing the main features of the software. MINISIS, a package designed for the management of bibliographic databases, runs on a mini-computer and was produced by the International Development Research Centre (IDRC) in Canada.

Copies of the Guide are obtainable, free of charge, from: ILO Library, 1211 Geneva 22, Switzerland (TP+41 22 99 86-75).

The telecommunication industry - growth and structural change

This study, published by the secretariat of the United Nations Economic Commission for Europe (UN/ECE) describes and analyses developments and prospects in the telecommunication industry, which has emerged from a period of stable and predictable growth to become a highly dynamic sector with an economic growth rate matched by few other industries.

The Telecommunication Industry - Growth and Structural Change. Economic Commission for Europe, United Nations, 1987, ECE/ENG.AUT/30-UN Sales No. E.87.II.E.35. Price US$50.

What is hot in superconductors

Did the Japanese really find that a niobium compound had zero electrical resistance at 320 Kelvin (117° Fahrenheit)? That and other questions are explored in The Cambridge Report on Superconductivity, a new monthly newsletter on the much-publicized research efforts and their commercial applications.

The publication, which was launched in October and costs $245 annually, investigates advances made by Japanese, European, and Israeli as well as US researchers. It also looks into what start-up companies are doing to make the technology commercial.

David Gumpert, the newsletter's editor, was an editor at The Harvard Business Review and a reporter at The Wall Street Journal. Stanley Rich, the publisher, is an electrical engineer and former Gordon Professor at the Massachusetts Institute of Technology. Contact: The Cambridge Report on Superconductivity, One Kendall Square, Cambridge, Mass. 02139; 800-527-0230.

ACCIS Guide to United Nations Information Sources on Trade and Finance

Compiled by the Advisory Committee for the Co-ordination of Information Systems (ACCIS).

Anticipated publication date: August 1988. ISBN: 92-1-100340-7. UN Sales No.: GV.E.88.0.2. Price: US$25. Available from: United Nations Sales and Publications, Room DC2-853, New York, NY10017, USA Telephone: 963-8392. Cable: UNATIONS NY Telex: 232422; United Nations Sales and ations, Palais des Nations, CH-1211 Geneva 10, rland. Telephone: 34-60-11. Cable: UN GENEVA. Telex: 289696.

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