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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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I. NEWS AND EVENTS

Network information processing systems

A Symposium on Network Information Processing Systems, sponsored by IFIP's Technical Committees on Data Communication (TC6) and Information Systems (TC8), was held in Sofia, 9-12 May 1988. Nearly 200 registrants from 22 countries heard the two invited papers and 44 submitted papers that were presented (chosen from 93 submitted papers). Selected papers from the Symposium will be published by Elsevier/North-Holland.

The first plenary paper, on Integrated Services Digital Networks (ISDNs) was delivered by Dr. Ronald Uhlig (USA), chairman of TC6. He presented an analysis of the development of communication-oriented computers and the future of ISDN. The second plenary paper, Computer Networks for Information Systems, was presented by Dr. Dipak Khakhar. He examined questions related to building communication links in information networks and described the necessity for developing functional standards. Information was presented about the status of these standards.

A panel discussion treated three basic subjects: ISDNs, Local Area Networks (LANs), and Office Automation. As to the choice between ISDN and LAN, two opinions were given. One, backed by Dr. Uhlig, was that the future belongs to ISDN, with a cost only 20 per cent higher than LAN, in the USA. The other point of view, supported by Prof. André Danthine, former chairman of TC6, was that ISDN is too expensive and does not ensure a sufficient bandwidth. According to him, the cost would be about 50 per cent higher than for LAN, bearing in mind that the bandwidth proposed for ISDN is not sufficient. He underlined the necessity for workstations to be more intelligent and to use less communication, but with more purpose. He expressed the opinion that with ISDN, the interface was very well defined, as opposed to the services. All speakers predicted an increase of bandwidth requirements in the next five years.

Another question debated was who should be the leading force for defining standards - users or industry. The unanimous opinion was that the latter would play the leading role - first, because they have a forceful standpoint, and second, because the users are not able to state their wishes clearly.

The Symposium was closed by Prof. Kiril Boyanov, chairman of the International Program Committee, who presented a short analysis of the work described. (Source: IFIP Newsletter, September 1988)

MEDINFO 89 planned for Beijing

The sixth World Congress on Medical Informatics (MEDINFO 89) will be held in Beijing 16-20 October 1989. This Congress, sponsored by the International Medical Informatics Association of IFIP (IMIA), will cover all aspects of health care computing from countries and regions the world over.

The technical programme will consist of lectures, demonstrations, workshops, Meet the Expert sessions, tutorials, and video presentations. In addition, there will be technical and commercial exhibits, vendor demonstrations, visits to universities, hospitals, research institutions, and libraries. Participants will also be able to learn about traditional Chinese medicine and health care delivery in China.

The opening ceremony will be held in the Great Hall of the People.

Contributions to the MEDINFO 89 programme due 10 January 1989, are solicited in the following four categories:

- Research Papers
- Descriptive Papers - descriptions of innovative systems of general interest
- Opinion Review or Analytical Papers - reviewing topics or analysing trends in the field
- Scientific Demonstrations - summaries of systems suitable for demonstration at the Congress

The Scientific Program Committee is headed by Dr. Phil Manning (USA); the Organizing Committee is headed by Mr. Ouyang Zhineng (PRC). (Source: IFIP Newsletter, September 1988)

Human-computer communication

IFIP's Working Group on Computer System Interfaces (WG2.7) is planning its next Working Conference for September 1989 in California. The title will be Foundations of Human-Computer Communication. The organizers want a broad spectrum of participants who can provide insights into the problems of human-computer communication and the management of these problems.

Topics will include:

- Interface design - examples of system interface designs that advance the state of the art
- Interface design tools and techniques - tools and techniques that advance the technology of human-computer interaction, including
  - User interface tool kits
  - Adaptive systems
  - Intelligent interfaces
- Aspects of distributed systems that bear upon the user interface, including
  - Co-operative work
  - User perceptions of distribution
- User models - models of user characteristics, performance, and perception

For further information, contact:

Prof. Dr. C. Unger, Fachbereich Mathematik und Informatik, Fern-Universität Gesamthochschule, Feithstrasse 140, D-5800 Hagen, Federal Republic of Germany. (Source: IFIP Newsletter, September 1988)

Manufacturing system design

The International Working Conference on Modeling and Simulation for Optimization of Manufacturing Systems Design will provide an international exchange of experience about the outstanding developments in the comprehensive integration of the functions and activities (including people) within a manufacturing enterprise. Sponsored by IFIP's Working Group on Computer-Aided Manufacturing (WG5.3), it will be held from 8-10 November 1989 in Tempe, Arizona, USA. It will bring into focus critical issues, strategies, and decisions that go into the selection and design of manufacturing systems. Attendees - both academics and practitioners - will share the latest results of research and practice in this area, as well as assess future trends.

For further information, contact the International Program Committee chairman: D.L. Shunk, Director, Center for Automated Eng. and Robotics, Arizona State University, Tempe, Arizona 85287, USA. (Source: IFIP Newsletter, September 1988)

Computer hardware description languages

The Ninth International Symposium on Computer Hardware Description Languages and their Applications (CHDL '89) is to be held from 19-21 June 1989 in Washington, D.C. Sessions at the Symposium will focus on hardware description languages and their use for synthesis, simulation, verification, and testing, and as parts of design systems. Emphasis will be on the challenges in these areas in the years ahead, and how coming changes will influence future CHDLs.

The Symposium is held every other year and is sponsored by IFIP's Technical Committee on Computer Systems Technology (TC10), in co-operation with the Association for Computing Machinery (ACM) and the Computer Society of the Institute of Electrical and Electronics Engineers (IEEE).

For more information, contact: Dr. John A. Darringer, CHDL '89 Chairman, IBM Research Division, P.O. Box 218, Yorktown Heights, New York 10598, USA. Tel. (914) 945-1018 or Prof. Dr. Franz J. Rammig, CHDL '89 Program Chairman, University of Paderborn, D-4790 Paderborn, Federal Republic of Germany. Tel. 05251-602069. (Source: IFIP Newsletter, September 1988)

XI World Computer Congress

Details announced

Congress '89, the 11th World Computer Congress, will take place on 28 August - 1 September 1989 in San Francisco.

The list of invited speakers is now complete. It comprises "superstars" from the world of information processing, including a Nobel laureate. There are 37 invited speakers from 13 countries, with the largest number coming from the USA., Federal Republic of Germany, France, and Switzerland. "Respondents" have been invited to present different viewpoints following each talk.

The first submitted papers have been received by the International Program Committee

In addition to invited speaker, panel and submitted paper sessions, there will be sessions in which speakers from the European Community, Japan, USSR and USA. describe the world's major technology programmes.

Prof. Gerhard Ritter (USA) has been appointed as editor of the Congress proceedings.

In addition to the technical programme there will be technical visits to seven sites. San Francisco and the Silicon Valley, with one of the densest concentrations of computer research and manufacturing facilities in the world, offer unparalleled opportunities for attendees to see, first-hand, the American information processing industry. Technical visits to manufacturing facilities and research laboratories before and during the Congress will supply a stimulating supplement to the technical programme for Congress delegates.

For further information, contact: 11th World Computer Congress, Convention Service Center Inc., P.O. Box 18-P, Denver CO 80218, USA. Tel. (303) 831-6338. Telex: 168184SVCCTR UT. (Source: IFIP Newsletter, September 1988)

Call for Papers: IFIP WG 8.1 Working Conference on Information System Concepts - An In-depth Analysis, 18-20 October 1989, Namur, Belgium

Background and theme

Progress and communication in the information systems field is hampered today by the lack of an agreed terminology. The problem appears to be caused by the diversity of methodologies based upon different paradigms and views of the world. They give rise to concepts that are often fuzzy and ill-defined. The use of partially different concepts for different kinds of information systems, such as fact retrieval systems, document retrieval systems, planning systems, decision support systems, real-time information systems, office information systems, knowledge-based systems, aggravates the problem. By introducing precise definitions for information system concepts, communication among information systems scientists, practitioners and users will be improved.

This conference will be a forum for an in-depth discussion of the conceptual foundations of information systems. The aim will be to examine all the major views and paradigms, exposing their root concepts. Where substantive differences exist, they can be clarified, and where differences are merely terminological, they can be recognised and may even be removed.

One conference is too short to tackle all the concepts and terms in present use. Attention will be restricted, therefore, to the following:

- Concepts used to describe the general architecture of information systems on the conceptual level (thus abstracting from the implementation level), and the embedding of information systems in organizations. Those concepts are used to specify the components of information systems and their environments, as well as how these components relate to each other. Typical terms referring to those concepts are: Information system, Organization and Environment themselves; and terms like Universe of discourse, User, Information processor, Conceptual schema, Data base, etc.

- Concepts used to model and specify parts of the real world for the purpose of the information system. Typical terms referring to those concepts are for example: Entity, Relationship, Fact, State, Event, Activity, Process, Time, Message, Document, etc.

The following topics, relating to the above theme and scope, are not meant to be exclusive:

- In-depth comparison of systems of concepts used by two or more information system methodologies. The methodologies should use partially the same terms/concepts, and/or partially different terms/concepts. They should also cover partially different perspectives of information systems, such as the data perspective, process perspective, and/or behaviour perspective (in the sense of IFIP WG 8.1 TG CRIS).

- Investigation of the key concepts for modelling or architecture. Which concepts should be fundamental or key concepts, to be used to derive (all) other concepts?

- Investigation of the question as to how the design process influences the choice of an adequate system of concepts.

- Approaches to axiomatization of systems of concepts for modelling or architecture.

- Operational semantics of systems of concepts for modelling or architecture.

- Investigation of the problem of semantical equivalence of models which were specified using the same or different systems of concepts.

- Synthesis of existing systems of concepts into a well-defined reference system of concepts, covering the data, process and behaviour perspectives in an integrated way.

Papers

Original papers of up to approximately 7,000 words in length, fitting into the theme and scope are invited. They may cover one or several of the mentioned topics, but are not limited to these topics. To submit papers, send five (5) copies of your manuscript in English to the Program Committee Chairman by 17th February 1989: Eckhard D. Falkenberg, University of Nijmegen, Dept. of Information Systems, Toernooiveld, 6525 ED Nijmegen, The Netherlands.

II. NEW DEVELOPMENTS

Semiconductor devices from polyacetylene

Semiconductor devices made from polyacetylene, a conducting organic polymer, have been developed by University of Cambridge researchers. The polyacetylene diodes and transistors are several orders of magnitude more efficient than other similar materials, according to D. Bloor of Queen Mary College. The researchers bypassed the problems associated with incorporating polyacetylene, a rigid polymer, into electronic devices by dissolving a precursor polymer in 2-butanone and depositing it as a thin film. When the film is heated, a chemical reaction occurs that converts the film to polyacetylene. The diodes and transistors are ordinary in design, except that a polyacetylene film replaces crystalline silicon. Because the molecular and electronic structure of the polymer is different from that of silicon, the new devices operate in a unique manner. The polymer chain buckles and kinks when a charge is applied, causing a change in the polymer's infrared absorption. The new polymer semiconductor devices probably will not replace conventional inorganic semiconductors, except in cases where existing devices are not effective. The research was supported by British Petroleum.

In 1987, Mitsubishi Electric developed a transistor made of polythiophene, a conductive polymer. (Extracted from Chemical and Engineering News, 12 September 1988)

New semiconductor etching method

A method that removes multiple masks during semiconductor etching has been unveiled at Sandia National Laboratories. Using accelerated ions to alter electronic behaviour and mask areas of the semiconductor, the method permits improved control of compound semiconductor output. The mask is stripped away and the semiconductor put in a chamber with such a reactive chemical as atomic chlorine. A laser bathes the semiconductor in strong light to produce free electrons or holes that drive the chemical reaction between the semiconductor and the encompassing chlorine gas. Areas with high amounts of 'free carriers' are etched at will, while those with few will slow or prevent the reaction. Sandia said the method, which has had success on gallium arsenide and gallium arsenide phosphate, can be used on any kind of semiconducting material. (Extracted from Design News, 6 June 1988)

MBE growth of gallium arsenide on silicon

Gallium arsenide (GaAs) was grown on silicon (Si) using molecular beam epitaxy (MBE) in work performed at SGS-Thomson in France. Results were presented at a recent meeting in London, organized by the British Institution of Electrical Engineers. Discussion included results on MESFET structures, the integration of MOSFET and MESFET devices on the same Si substrate and the realization of optical waveguides on Si. The experiment is relevant to the future of GaAs on Si, which is based on the monolithic integration of GaAs and Si devices.

It was concluded that the GaAs on Si quality is suitable for MESFET devices. It is expected that the MESFET performance as power devices will be better than that of GaAs on GaAs MESFETs, due to the lower thermal resistivity of the Si substrate relative to GaAs. (Further work will investigate this.)

MOSFETs were fabricated on half of a 2 inch silicon < 001 >, 4°-misorientated substrate and covered in SiO_2. The sample was chemically prepared before MBE, and GaAs MESFETs were grown on the substrate. The MESFETs were tested, the SiO_2 removed and the MOSFETs tested again. Both device types showed good performances. No degradation of the MOSFETs was found after the MBE growth. (Extracted with permission from Semiconductor International Magazine, June 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, Il., USA)

Single-junction GaAs solar cell developed

Varian Associates has developed a single-junction gallium arsenide solar cell with a 28.1 per cent conversion efficiency, the highest ever achieved by a GaAs solar cell. In 1986, Varian produced a single-junction GaAs solar cell with 26.3 per cent conversion efficiency. The new GaAs cell could be used in terrestrial power systems and orbiting satellites. Small improvements in efficiency can significantly reduce operating costs. A 1 per cent increase in efficiency can boost the number of communication channels on a satellite, while lowering construction costs by millions of dollars. Silicon cells currently being used on satellites have conversion efficiencies of 14 per cent. The GaAs cells also are more resistant to radiation in space vs. silicon cells and have a 50 per cent lower temperature coefficient, resulting in better performance at increased temperatures. GaAs cells could be used to generate electricity during peak demand periods in isolated areas, such as the southwest US desert. Varian expects to begin producing the new solar cells in early 1989. (Extracted from Chemical and Engineering News, 6 June 1988)

Arsinogallane reduced to gallium arsenide

Semiconductor films of gallium arsenide (GaAs) are deposited by reacting trimethylgallium with the highly toxic gas arsine (AsH_3) at elevated temperatures. Many research groups are searching for milder, safer routes to this potentially important semiconductor. Now, a group at Cornell University has prepared the first monomeric gallium-arsenic compound and converted it into gallium arsenide at ambient temperature. Erin K. Byrne, a former graduate student working with assistant professor of chemistry Klaus H. Theopold, reacted $Li(THF)_2As-(SiMe_3)_2$ (where THF is tetrahydrofuran and Me is a methyl group) with $[(C_5Me_5)_2GaCl]_2$ in pentane solution to give $(C_5Me_5)_2Ga-As(SiMe_3)_2$ in 63 per cent isolated yield. The X-ray crystal structure of this compound, determined by visiting scientist Laszlo Parkanyi, indicates that it is monomeric, unlike all other known arsinogallanes. Treating this compound with tert-butyl alcohol causes reddish GaAs to precipitate from solution. The arsinogallane probably is not volatile enough to be useful for chemical vapour deposition of GaAs, Theopold says. But this approach may lead to more useful precursors for GaAs-type semiconductors. (Source: Chemical and Engineering News, p. 23, 25 July 1988)

GaAs yields catching up on silicon

Triquint Semiconductor, the former gallium arsenide technology division of Tektronix, claims that it is acnieving yields on gallium arsenide which approach those of silicon.

Triquint says it has two sources of ' inch diameter gallium arsenide wafers which have considerably improved defect densities (under ten defects per square centimetre) compared to the usual 3 inch diameter wafers.

According to Paul Martin of Triquint, the move to 4 inch wafers is the first commercial use of the larger wafer size anywhere in the world. The company has announced availablility of a mixed analogue/digital GaAs process and a 6,000 gate gallium arsenide gate array offering a toggle rate of 2GHz.

The gate array and the digital part of the mixed array are fabricated using an 'enhanced mode' process in which half the transistors are turned on and half turned off. In the traditional 'depletion mode' process they are permanently on and are turned off to make a switch. Enhanced depletion processes therefore use less power.

Triquint expects to offer a depletion mode microwave process with frequencies over 20GHz for the custom and semi-custom requirements of its customers later on this year. (Extracted from Electronic Weekly, 6 July 1988)

Light sensitive semiconductor superlattice developed

A light sensitive semiconductor superlattice of gallium arsenide and gallium-alluminum arsenide has been developed by researchers at the University of Southern California (Los Angeles). Hetero NIPI is a sandwich of layers, named N, I and P. The N layer holds negatively charged electrons. The P layer has holes to which the electrons would naturally migrate. The I layer is an insulating layer. The electrons are trapped in the layers, and hence can move in only two dimensions. This makes them more susceptible to light at 830 nm (near IR). Hetero NIPI could be used as a photosensitive switch for optical computers. Although the material is one hundred times more sensitive to light than existing semiconductors, it is also one hundred times slower. Meanwhile, AT&T Bell Laboratories has developed a gallium arsenide/gallium aluminum arsenide crystalline superlattice for detecting IR radiation. The material could be used in night vision or other infrared detection systems, which now use difficult-to-make mercury cadmium telluride semiconductors. The new superlattice has 50 units, each of which is a 40A-wide quantum well with sides of aluminum gallium arsenide. At the bottom of each well are electrons. Photons entering the well excite electrons, which can then travel through the superlattice. (Extracted from Science News, 13 August 1988)

User-configurable logic device from Ga

Gazelle Microcircuits has introduced a user-configurable logic device made from gallium arsenide that could raise workstation and computer performance by 25 per cent. The GA22V10, which contains TTL-compatible inputs and outputs, is 100 per cent pin and function compatible with a standard silicon 22V10. The new device, which includes 500-800 gates of logic, can pass a signal from an input pin to an output pin in 10 ns or less. GA22V10 includes a 3.5 ns setup time and a 7.5 ns clock-output time, making it feasible to design circuits running at up to 90 MHz. Operating at twice the speed of the 22V10, the new device is the integrated circuit sector's first logic device produced from GaAs. (Extracted from Machine Design, 11 August 1988)

Advances in molecular electronics

Researchers are near producing prototypes of computer chips whose working parts are individual molecules. By clumping thousands of molecules together, ways have already been devised to get the chips to record data and perform the basic logic operations necessary for use in computers. Though such advances are not yet single-molecule computing, they could push miniaturization far ahead of current chip technology. The research could also boost development of neural-network computers - which can nearly imitate certain functions of the brain - and lead to advances in robotics, computer vision and other fields. The most recent advance in molecular electronics was at the Jet Propulsion Laboratory (Pasadena, CA). Researchers there proposed a blueprint for a molecular memory device that may be built with existing technology. By using electrons instead of molecular shapes to represent information, the memory device might be able to be merged with existing chips. The device would be made from special polymers that would contain electronics that would jump from one subunit to one next to it when hit by a laser. (Extracted from Wall Street Journal, 13 September 1988)

Low-voltage drive non-volatile random access memory

The Research Development Corporation of Japan has developed a "low-voltage drive non-volatile random access memory (NVRAM)" whose developmental research was initiated by Y. Hayashi of the Electrotechnical Laboratory and whose development was consigned to Seiko Instruments & Electronics Ltd.

Among semiconductor memories used in computers, those whose stored data are not erased when the power supply is cut off are known as electrically erasable programmable read only memories (EEPROMs) and those with high-speed data storage capability

but whose stored data are erased when the power supply is cut off are known as random access memories (RAMs). By combining these two kinds of memories, we get the non-volatile random access memory (NVRAM) that reduces the respective disadvantages of the two kinds of memories. NVRAM features excellent characteristics such as high- speed data storage and non-erasure of stored data by power cut-off, but since data storage is done at a high voltage, the circuit construction becomes complicated and an expansion of its memory capacity is difficult, with the result that the fabrication of only those of up to 1-Kbit capacity had been the limit.

With the new technology, an EEPROM and a RAM which introduce a new electron injection system are combined into a monoblock assembly to produce a NVRAM with large storage capacity capable of data storage at a low voltage, and whose utility value has been improved significantly. Incidentally, this NVRAM represents the world's first practical 16-Kbit element and features the world's largest storage capacity.

The EEPROM used for fabricating this NVRAM chip features an innovative method of injecting electrons into the floating gate (electron pool). Impressing a low voltage of 2 3 V on the selective gate near the floating gate rapidly generates a potential difference between a part of the source and drain electrodes. Accordingly, most of the electrons flowing in the interface between insulating film and wafer are temporarily embedded deep inside the wafer, then later directed vertically to the interface, passed through the insulating film and further into the floating gate. By introducing this new electron injection system, data storage is performed with much greater efficiency than before.

The introduction of this system enables data storage at a low voltage, and simplification of circuitry. In addition, the chip features an enormous coercive force providing a storage life expectancy of over ten years and enabling over 10,000 rewrites. (Source: JETRO, September 1988)

Molecular-scale memory device described

Molecules that can function as self-contained, electronic devices are still the stuff of science fiction, but scientists are trying to make them reality. One example of a molecular electronic device "that could actually be made" is described by John J. Hopfield of the California Institute of Technology and two co-workers. The device is a molecular shift register, a type of memory consisting of memory cells connected in a line. The memory cells consist of a chain of electron-transfer molecules with regularly repeating units. A "1" (or "0") is written by reducing (or not reducing) a unit, the researchers explain. Exposing the chain to a light pulse initiates electron-transfer reactions that shift the written state one repeat unit to the right. One of the polymer candidates that Hopfield's team describes consists of porphyrin and quinone groups linked together. The rates of electron transfer could be "tuned", they say, by varying the substituents on these groups or by changing the bridging groups. (Source: Chemical and Engineering News, 15 August 1988)

Molecules with electrical properties developed

Molecules up to 7.5 nm long with specific electrical properties have been developed by researchers at the University of Minnesota. The molecules could be used to carry current, and might be the basis of organic computers. Organic molecules might also act as switches in microscopic circuits, one thousand times smaller than computer chips of today. The new molecular 'wires' developed at Minnesota are based on polyacequinones and imides. (Extracted from New Scientist, London, 19 May 1988, the weekly review of science and technology)

New process to develop flat super-conducting thin films

Toshiba has designed a process to develop flat, uniform super-conducting thin films without annealing. The company has also found answers to the difficulties of deteriorating thin film surfaces. Toshiba was able to view the superconducting tunnel effect between two superconductors connected by an insulator. The article further details this superconducting tunnel effect experiment. These developments may lead the way for commercial use of superconductors in electronics. Usually thin films need annealing at 900°C to create superconductivity. However, this technology could lead to interdiffusion between the substrate and thin film. The company's new process employs yttrium, ceramic barium and copper, and metallic copper. The new technique produces the thin films by sputtering in a chamber that consists of oxygen and argon. The article further details the process of producing superconducting thin films. The article also details the other breakthroughs the company has discovered in superconductor technology. (Extracted from Jri Metals, August 1988)

Highest temperature for film deposited on silicon

General Electric has used a superconductive film deposited on a silicon substrate to attain superconductivity at -310°F, which is the highest temperature so far for films deposited on silicon. Using electron beam evaporation, General Electric placed the yttrium-barium fluoride-copper oxide film on silicon and silicon dioxide substrates. Done in a controlled atmosphere chamber, the method uses the high heat of an electron beam to vapourize the materials to be deposited. The vapours then condense in ultra-thin layers on a substrate mounted on the chamber's ceiling. Superconductors applied to microchips could cut time delays for electrical pulses that race within them, which could hasten the rate at which the devices process data. Meanwhile, it is reported that researchers at the University of Caen in France have found a way to apply superconducting thin films on silicon. Earlier attempts to apply superconducting thin films on silicon had failed due to many difficulties connected with diffusion between film and substrate. The researchers discovered that the use of metal nitride buffer layers could prevent the problems of diffusion. They found that they can apply a diffusion barrier of AlN, silicon nitride, or GaN on the silicon by reactive sputtering. The superconducting oxide layer is then added by pulsed-laser evaporation. (Extracted from Design News, 6 June 1988 and Ceramic Industries, August 1988)

Single-crystal superconductor thin film developed

Fujitsu Research Laboratories has developed a single-crystal bismuth-based superconductor thin film. The bismuth-strontium-calcium-copper-oxygen compound is superconductive at 80K. A magnesia single-crystal substrate is used and the superconductor is deposited by chemical vapour deposition at 825°C. A silicon substrate might also be used, and the researchers will also attempt to raise the superconductive temperature to 110K. (Extracted from Japan Chemicals, 26 May 1988)

Superconducting thallium compound thin films deposited

Researchers at Sandia National Laboratories, Albuquerque, New Mexico, have deposited the first thin films made up of the new thallium based superconducting materials. The films become superconducting at 97K, the highest critical temperature for any thin film yet made. In addition, the new films can carry current densities of 110,000 A/cm^2 without observable resistance. This current density is the highest obtained in an unoriented polycrystalline superconducting oxide thin film.

Tests indicate that the critical current has a much lower sensitivity to magnetic fields than previous polycrystalline materials.

High critical current combined with the weak magnetic field dependence is important because it suggests that the coupling within the superconducting grains in these new materials is significantly different from the yttrium-barium-copper oxide films.

The new films are made up of thallium-calcium-barium-copper oxide. The 7000 A think films are deposited by sequential electron beam evaporation under a partial oxygen pressure. The films are then subjected to two anneals, a crucial part of the process because the thallium content of the film must be controlled carefully.

The films have been deposited on several substrates, including sapphire, strontium titanate and silicon. The best results have been obtained with films deposited on single crystal yyttrium-stabilized cubic zirconia. Films deposited directly on silicon do not give as for both P and B. The P implants enhance reflow more than do B implants. The combination of both P and B was not as effective as P alone.

This same procedure was followed for the seven weight per cent PSG, with results similar to those using five weight per cent PSG. Greater than eight weight per cent PSG films have been recommended. Two samples of nine weight per cent PSG were implanted with 2 x 10^{16} ions/cm^2 P at 140 and 190 keV.

The best results were obtained using nine weight per cent PSG implanted with 2 x 10^{16} ions/cm^2 P at 190 keV and reflowed at 950°C in steam. The profiles obtained are reported to be the smoothest to date. (Reprinted with permission from Semiconductor International Magazine, June 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, Il., USA)

Scientists deposit superconducting thin films on silicon, SiO_2 and sapphire

Researchers deposited superconducting thin films on silicon, on silicon dioxide (SiO_2), and on sapphire substrates using an atomizer or a spin coater with a superconducting slurry. This development may eventually enable superconducting thin films to be used easily in the manufacture of ICs.

To accomplish this advance, the scientists deposited a thick film (20 ± 5 μm) and annealed it. They polished or ground some of these films to a thickness of a few microns. This unique method allowed the researchers at the Department of Applied Physics and Electrical Engineering at the Oregon Graduate Center Beaverton, Oregon, to precisely control the stoichiometry and purity of the films.

They prepared the superconducting powder of $Y_1Ba_2Cu_3O_{7-x}$(YBCuO) using conventional means. Following oxidation, the material was finely ground to approximately 3 μm and examined using X-ray diffraction. They pressed some powder into pellets to check the critical temperature (T_c). Once the desired superconducting properties were achieved, they mixed the powder with methyl alcohol to produce a slurry.

An atomizer or a spin coater applied the slurry to 3 inch substrates producing uniform films. Substrates used were silicon, SiO_2 (0.12 μm thick) coated silicon, and sapphire. Slurry consistency and the number of depositions controlled the film thickness. The scientists air dried the samples, which at this time were powdery in texture.

The researchers initially sintered the films using a conventional furnace in the presence of oxygen. This process produced superconducting films on sapphire (T_c = 96 K), but rather poor quality superconductors on SiO_2 or silicon. As a result, they investigated the rapid thermal anneal (RTA) process.

Samples were sintered in the RTA system in the presence of oxygen also. The Oregon researchers examined several temperature and time cycles. They found that for a given temperature, the superconducting behaviour varied with the film thickness and the thermal property of the substrate. In general, the best films were obtained when annealed at 940-1000°C. Below 940°C the films were powdery and above 1000°C they displayed semiconducting behaviour.

The scientists also tested the film adhesion. Adhesion improved at higher temperatures, especially over 970°C. They discovered that films heated to 980°C could only be scratched with a diamond scribe. This strong adhesion allowed them to grind the films down to a few microns thick.

Even though the films were superconducting following the RTA anneal, the critical temperatures shifted higher when the researchers oxygen annealed the samples in a furnace for 4-6 hours at 400°C and allowed them to cool down slowly.

Electrical resistivity measurements completed by them were typically 20-40 m Ω cm at room temperature. Films with higher resistivities were reportedly not superconducting. They found that these samples were either not sintered well or underwent a transformation to the non-superconducting phase.

The critical temperatures for silicon, SiO_2 and sapphire were found to be 70, 81 and 62 K respectively. However, the 6 hour anneal at 400°C in a furnace (in the presence of oxygen) shifted the T_c of silicon to 76 K, SiO_2 to 90 K and sapphire to 84 K, resulting in very sharp transitions from onset to critical superconducting temperature. They measured critical current densities of over 500 A/cm^2 in these samples.

Researchers at the Center continue to improve the process using a slurry consisting of very fine particles to deposit films 1-2 μm thick. They are also beginning to etch the films using laser technology. They point out that the technique shows promise of being transferable to the new improved superconducting compounds that will inevitably appear in the future. (Reprinted with permission from Semiconductor International Magazine, July 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, Il., USA)

Taiwan ceramic melts foreign resistance

Researchers in Taiwan claim to have discovered a ceramic that superconducts at 162 K - the highest temperature yet. The researchers, from the Materials Research Laboratories of the Industrial Technology Research Institute in Hsinchu, say that the compound contains one atom of thallium to every two of calcium, three of barium and four of copper.

So far, other researchers have failed to replicate their work with the compound. The record for the hottest superconductor has increased slowly in the past year from 90 K. R.S. Liu, P.T. Wu, J.M. Laing, and L.J. Chen from Taiwan report only one sample superconducting at 162 K. But at least five had zero resistance above 140 K. Superconduction at these high temperatures did not last, though some samples retained superconductivity above 130 K for more than one week.

The results follow what until recently was an expected trend: that superconducting temperatures increase as layers of copper oxide accumulate between layers of thallium oxide. Now, some leading researchers have modified this theory. In previous experiments, researchers made compounds containing up to three layers of copper oxide. The group in Taiwan claims to have increased this to four.

They report a composition suggesting that one layer of thallium oxide divides the copper oxide layers, but they give other measurements that cannot be valid unless the layers of thallium oxide are "double deckers". Compounds with two dividing layers of thallium oxide superconduct at higher temperatures.

Bill Giessen, Robert Markiewicz and Pradeep Haldar at Northeastern University in Boston made a four-layered compound independently that conducts at 122 K. A group at the Electrotechnical Laboratory of Japan led by Hideo Ihara, and supported by the Ministry of International Trade and Industry, reports identical results to the group at Boston.

Both groups have superconducting compounds containing single dividing layers of thallium oxide, and compounds that contain three atoms of calcium and two of barium. The Taiwanese made compounds with two calcium atoms and three of barium.

Geissen says that the benefits of adding more layers of copper oxide are limited, because layers of thallium oxide appear to play a more critical role. He says that his team's results accord with those of the Japanese, which found that the five-layer materials superconduct at the same temperature as those with four layers. (This first appeared in New Scientist, London, 25 August 1988, the weekly review of science and technology)

High-temperature superconductor fibres developed

Fibres of high temperature superconductors have been created by researchers at Stanford University. The fibres are ...25 mm in diameter and 4 cm long. Further development could lead to the production of superconducting wires. The fibres are made of bismuth strontium calcium copper oxide, and are superconducting at 85 K. The fibres can carry 10,000 amps at 4 K. The fibres were produced with a laser heating technique developed for optical materials. (Extracted from New Scientist, London, 9 June 1988, the weekly review of science and technology)

Technique developed to make conductive polymers

A technique for making conductive polymers that may drastically change the use of plastics in electronics has been developed by M. Aldissi, a scientist at Los Alamos National Laboratory. Using a simple magnetic field, Aldissi discovered that he could align a polymer's fibres between its positively and negatively charged poles. Without alignment, fibres are dispersed, making it hard for electrical currents to jump from one fibre to the next. The magnetic field is applied while acetylene gas is sprayed into a liquid crystal bath. The acetylene forms long molecular chains characteristic of polymers, and the magnetic field aligns the chains. Lightweight and easily mouldable, the material could supplant copper and silver in such varied electrical uses as dime-size batteries and advanced electronics. Aldissi says that conductive plastics may ultimately be cheaper than copper. (Extracted from Design News, 23 May 1988)

Rubber becomes a conductor

A chemist in the US has turned rubber, one of the best insulators known, into a conductor of electricity. This development challenges modern theories on conducting polymers and opens up the possibility that many other useful materials may conduct electricity. Minal Thakur, of AT&T Bell Laboratories, in Murray Hill, New Jersey, has increased the conductivity of rubber by a factor of 10 billion by doping it with iodine.

Chemists previously though that, for a polymer to conduct, the atoms in the chain must be separated by alternate double and single bonds. This is called a conjugated system, and it has a reduced energy gap between those electrons which are bound to atoms and those which are free to move over the chain. This reduction in the gap makes it easier for electrons to jump from the "valence band" where they are free to move and carry an electric charge along the polymer.

When an electron does jump, it leaves behind positively charged "hole". Conduction comes about as electrons and holes travel along the polymer chain in opposite directions, jumping the spaces between chains. The energy in visible light is often enough to make the electrons jump from the valence band to the conduction band, and many conducting polymers with a conjugated structure absorb so much light that they are black.

When chemists made polyacetylene, a conducting polymer as conductive as copper, they found that most of the conductivity came from this hopping between chains. Chemists still thought that a conjugated system of double bonds was necessary for conduction. Most polymers, including rubber, have either no double bonds or isolated ones. Rubber is made up of repeating units with five carbon atoms in them. Each unit has only one double bond. Double bonds are more reactive than single bonds.

Bromine and iodine, two oxidising agents, will chemically attack rubber at its double bond. Thakur noticed that iodine turned rubber black and wondered whether it might also be increasing its conductivity. It did catapulting the conductivity of rubber up by 10 orders of magnitude.

Rubber does not have a conjugated system of bonds. Rather, the iodine pulls electrons from the isolated double bonds leaving holes that can leap from chain to chain. "This vast increase in

rubber's conductivity shows that the hopping mechanism is paramount in the conductivity of a polymer", says Thakur.

"Materials which were not conjugated used to be precluded from becoming conducting polymers, but now we have shown that, for electronic conduction, the requirements are much less than previously thought", he said. "We can now look at other polymers which have much less conjugation." Thakur stressed that there must be some double bonds - o unsaturation - in the material. "The more unsaturation there is, the better the chance of conduction, but it is not the sole requirement."

If Thakur's claims are correct then all the clever syntheses of new conjugated polymers could have been for nothing. The lower number of double bonds make rubber less rigid than many of the new polymers so it can be moulded and manipulated more easily. (This first appeared in New Scientist, London, 28 July 1988, the weekly review of science and technology)

New superconductor developed

A new kind of superconductor that includes no rare-earths or barium has been unveiled at the Royal Institute of Technology, Stockholm (Sweden). The material comprises bismuth, strontium, calcium, copper and oxygen. Tests have shown that the onset of superconductivity in the new material is 100K plus or 7K over the prior 93K peak. The nature of the charge carriers and their mobility differ from those found in rare-earth compounds, and the critical current is a bit larger. Full shielding is reportedly found over a wide range at low temperatures. Materials with bismuth seem to be easier to handle mechanically and are environmentally acceptable; their features are stable and reproducible and the ingredients are cheaper. (Extracted from Machine Design, 26 May 1988)

Superconducting electromagnet

Sumitomo Electric Industries (Japan) has developed a yttrium-based superconductive coil with magnetic strength of 64 gauss, higher than any previous superconducting electromagnet made from yttrium. Sumitomo's achievement is expected to help pave the way for the use of yttrium and other ceramic-type superconductors in practical magnetic coils for linear motor cars and superconductive electric power generators. (Extracted from Japan Economic Journal, 10 September 1988)

Practical bismuth superconductors

Bismuth superconductors now have high enough critical current densities for practical applications, says Sumitomo Electric Industries (Osaka). The company's thin films of bismuth-strontium-calcium-copper oxide have achieved a current density of 1.9 million amperes/sq.cm at 77.3 K (liquid nitrogen temperature). What is more, in a 1,000-gauss magnetic field the films have an adequate critical current density of 1.1 million A/sq cm at 77.3 K. The polycrystalline films, which are about 2,000 angstroms thick, are produced on magnesia substrates by high-frequency sputtering technology. Individual superconducting grains are neatly oriented, and X-ray analyses show the material to be single-phase, the company says. Japan's National Research Institute for Metals (Tokyo and Tsukuba) was the first to come up with the Bi-Sr-Ca-Cu superconductor, but its version included two phases. (Source: Chemical Week, 27 July 1988)

Hitachi marches on towards practical superconductor

The Japanese engineering giant, Hitachi, has reported another milestone along the road to finding a practical use for high-temperature superconductors. Researchers say they have pushed a record 3500 amperes of electric current per square centimetre through a thin tape of thallium-based superconductor.

The work is important because it paves the way for manufacturing superconducting electrical equipment capable of carrying very high currents. The superconductor is formed from a mixture of two parts each of thallium, barium and calcium to three parts of copper oxide. It superconducts 120 K, or -153°C.

The experiments used a silver-coated tape of material 0.1 millimetres thick, 5 millimetres wide and three metres long. Another Japanese company, Toshiba, said last month that it was coating yttrium-based superconductors with silver to protect their surfaces. The silver itself becomes superconducting through the so-called proximity effect.

Superconductors made with thallium are more difficult to engineer into useful shapes than yttrium materials, but work at higher temperatures. (This first appeared in New Scientist, London, 7 July 1988, the weekly review of science and technology)

Super circuit

Toshiba, the Japanese electronics and engineering firm, has unveiled a prototype superconductor circuit which it described as the first stage towards a new generation of electronic products based on the new high-temperature superconductors.

The circuit, an insulator sandwiched between a layer of high-temperature and a conventional lead superconductor, received star billing at the announcement of the first fruits of Toshiba's research programme on high-temperature superconductors.

The company's Advanced Research Laboratory in Kawasaki was set up in April this year with some 50 researchers split roughly equally between superconductor and molecular electronics.

The switching device relies on two new technologies. The group said it has developed a way to produce a thin film of superconducting material without damaging heat treatment. The process, called multi-target reactive sputtering, creates a superconducting compound by bombarding pieces of yttrium, barium and copper with a mixture of argon and oxygen. The result is a thin film of yttrium, barium, copper and oxygen compound 700 nanometres thick.

It becomes a superconductor at -193°C.

The team has also found a way of protecting the superconductor's surface with a coating of silver. Interestingly the silver itself becomes a superconductor thanks to the "proximity effect". It is the first observation of this effect in high-temperature superconductors.

The switch itself exploits a phenomenon called the superconducting tunnel effect, which causes electrons to flow through an insulator between two superconductors. This is useful because when the

flow reaches a certain level, an electrical resistance abruptly appears. The hope is that this abrupt transition between different states will store the basic digital information in tomorrow's microchip. Such circuits could be faster than today's semiconductor chips.

Toshiba admits that the tunnel junction has no immediate application "but we believe it is a very great step towards application of superconductivity in electronic devices". (Source: Electronics Weekly, 29 June 1988)

New organic material for multilayered wiring of VLSI

NEC Corporation and Chisso Corporation have jointly developed a new type of organic material named "siloxane denatured polyimide" that ideally lends itself to producing multilayered wiring when manufacturing next-generation LSIs.

The new polyimide film is produced by chemical bonding a polyimide resin and siloxane (SiO), an inorganic substance. As contrasted with conventional types of polyimide films consisting solely of organic substances, this new film consists of a three-dimensional network structure generated by Si-O bonding, with the result that (1) it features an excellent compatibility with inorganic insulating films such as silicon nitride (SiN) films and silicon dioxide (SiO_2) films, making it easy to introduce into existing LSI manufacturing processes; (2) its co-efficient of thermal expansion being small, its insulation property is not deteriorated even at a temperature as high as 200°C (generally regarded as the upper limit working temperatures of various kinds of devices); (3) it enables the stepped parts of submicron metallic wirings to be filled in completely to provide an excellent surface evenness, and (4) insulating films of high reliability levels can be formed by simply coating and hardening.

This new resin features a small dielectric constant and is capable of minimizing electrostatic capacitance that is the source of noise generation. It also enables the formation of a multilayered construction consisting of a lamination of more than five layers, and in addition permits the 0.5-micron stepped parts of printed circuit wirings to be filled in to a smooth surface.

NEC Corporation plans to introduce this new organic material for producing bipolar semiconductors and next-generation LSIs such as 16 Mbit DRAMs. (Source: JETRO, September 1988)

Visible light breaks out of the solid state

Researchers at Japan's largest consumer electronics company, Matsushita Electric, claim to have developed the world's first solid-state laser to emit visible light. This could mean laser discs, such as compact discs, will be able to store up to four times as much data. It will also open up a range of possible applications, such as flat-screen colour televisions with the cathode ray tube replaced by lasers.

Laser engineers have always found it hard to produce semiconductor lasers which operate in the visible region of the spectrum. Devices that need blue light in particular, such as medical instruments, optical measuring equipment, and full colour displays, are forced to rely on large argon-gas lasers. Matsushita's team has harnessed an effect called second harmonic generation, to convert a beam of infrared laser light to a blue beam with half the wavelength.

The infrared laser passes through a piece of lithium niobate, which resonates to produce a beam at the second harmonic, that is at half the wavelength, of the original light. Genji Tohmon, a research engineer on the team, said the device is very versatile because although it cannot be tuned to produce light at different wavelengths, it will work with many different types of diode lasers as inputs.

The breakthrough is in the design of the lithium niobate waveguide, which confines the optical beam. The waveguide is doped with extra hydrogen, and works at room temperatures, from approximately 15°C to 40°C.

The main limit to the amount of music, video pictures or computer data that optical discs can store is the size of the "pits" which represent the data. But the pits cannot be smaller than the wavelength of the laser beam that "reads" them. Today's optical disc players contain semiconductor lasers with wavelengths of between 780 and 840 nanometres. Matsushita's blue laser has a wavelength of 420 nanometres, so can in theory "read" pits that are half the size of those in today's discs. (Extracted from New Scientist, London, 21 July 1988, the weekly review of science and technology)

Make way for medical biosensors

Dr. Allen Hill, a lecturer in inorganic chemistry at Oxford University, describes his group's development of a disposable electrode that measures glucose in blood. This has been incorporated into a convenient pen-like instrument which diabetics can carry around, to take instant readings from a single drop of blood as often as needed. The electrode is based on an electron transfer reaction that occurs when glucose is oxidised by an enzyme, glucose oxidase, bound to the graphite surface of the electrode. The electron transfer is mediated by ferricinium ions, also adsorbed on the electrode surface.

Hill's team has also developed an enzyme-based electrode for cholesterol, which will be sent to the US Food and Drug Administration for trial later this year.

Hill's more recent (and still secret) research includes success in making biochemical electrodes which require no mediator to transfer electrons from the enzyme to the electrode surface. His group have also now developed 'dual microelectrodes'. These are paired microscopic electrodes some 10-50 μm apart, where one is used to detect the product of a reaction at the first.

This dual system could be used to detect very low levels of drugs by measuring the degree to which the diffusion of reaction products from one electrode to the other is inhibited by interaction with the drug. One or both microelectrodes can be coated with appropriate enzymes or antibodies.

The attraction of microelectrodes is that many of them could be located together on a microchip to enable tens of chemicals in the blood to be measured at once. Chris Lowe, director of the Institute of Biotechnology in Cambridge, said commercial microchip biosensors for medical diagnostics are about ten years away.

Lowe's group, working with Plessey, have already made microchip sensors that can detect two things at once, for example glucose and galactose. The enzymes used to detect the sugars are held

specifically to each electrode surface by a conducting polymer, polypyrrole. This is done by polymerising pyrrole, with a specific enzyme present, onto one electrode by passing current through it. The procedure can then be repeated with another enzyme and another electrode on the same chip.

Love is aiming to create a series of such chips, each having half a dozen electrodes for detecting analytes appropriate to a particular disorder, such as kidney failure. These biosensors will also be disposable, and work on a drop of blood, but would be used by doctors instead of the general public.

Both Hill and ... are still worried that British companies are not going to take advantage of the scientific advances now being made on their doorstep. It remains to be seen whether British industry wakes up before biosensor technology is exploited elsewhere. (Source: Chemistry and Industry, 19 September 1988)

Broader applications for FIB technology

Researchers at Micrion Corp. believe that focused ion beam technology (FIB) is now maturing for direct wafer modification, i.e., modifying metal or dielectric layers of an in-process or completed IC. "This technology is moving from the research arena to engineering applications and production", says Bill Ward, Micrion Vice-President.

Use of this technology could significantly shorten the design cycle of new ICs, removing the burden of traditional lithography methods.

Over the past few years, a variety of FIB instruments have been developed for applications such as direct write lithography, maskless ion implantation, secondary ion mass spectrometry and mask repair systems.

Ward notes that direct wafer modification has been used by device designers and failure analysis engineers to diagnose failures of completed or in-process devices. "In the past, a variety of methods have been used to reconfigure an IC, including scribers, lasers and metal lift-off. But these traditional methods have limited the use for today's VLSI circuits because they are most effective on large geometries and surface patterns.

On the other hand, the newer FIB systems can make precise circuit modifications by using a submicrometer diameter ion beam to cut conductors or deposit new ones. "This capability significantly shortens the design cycle for new devices by allowing rapid circuit debugging. In addition, such systems provide a unique and powerful instrument for failure analysis", says Ward.

A FIB process for direct wafer modification has been developed by Ward and a team of engineers at Micrion. The system capabilities include conductor removal by ion-beam sputtering, metal and insulator formation by ion-beam induced deposition, and endpoint detection by secondary particle analysis.

The new system has much in common with FIB systems that have been designed for lithography and mask repair applications, but particular attention has been directed at beam control, endpoint detection, metal deposition and operational software.

The ability to detect the interface between metal and insulator levels is another crucial element of the technique.

Many of the available endpoint detection schemes, including secondary ion emission from the sputtered substrate and total secondary ion flux, could not be used with all common semiconductor fabrication materials because of problems associated with charged particle detection. Accordingly, the Micrion engineering group developed a system that detects ion-induced photoemission from sputtered neutrals.

The software for the system was designed to facilitate both a high level of automation and the manual modification typically required by an engineering investigation. "Due to the complexity of the hardware and processes used in such a system, a sophisticated software package must be created to make FIB microcircuit modification practical", says Ward.

In tests, this system has shown SiO_2 etch rates of 0.45 μm^3/sec (using a 0.5 μm 1.6 nA beam). Registration accuracy has been tested to be typically less than $\pm$ 0.2 μm. (Reprinted with permission from Semiconductor International Magazine, June 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, Il., USA)

200 mm wafer manufacturing

Techniques for the manufacture of 200 mm diameter wafers are being pushed by the leading edge of IC manufacturing. The best example is the recently proposed wafer specification from Sematech. The specification calls, for example, for 0.3 μm local site flatness and > 30 μm warp to meet the 1990 goal of 0.5 μm CMOS design rules.

Local site flatness is important for wafers used with stepping projection lithography (steppers) and warpage control is important for CMOS technology because of the relatively high temperatures and long cycle times associated with doped-well drive-ins.

Dr. David Golland, manager of process research, Monsanto Electronic Materials Co. (MEMC), St. Peters, Mo., reviewed some of the progress in 200 mm wafer manufacturing research to attendees of the technical sessions held during Semicon/West.

For example, with proprietary polishing equipment MEMC has achieved a TIR (total indicated reading) flatness measurement of 1.2 μm (excluding a 3 mm edge) and a total thickness variation (TTV) of 3.8 μm.

For better control of warp, new techniques are being evaluated, including a promising approach in which the face of the ingot is surface ground before each slicing step.

In the future, manufacturers of silicon wafers may offer "controlled bow wafers"; bow could then be matched to cancel the warpage caused by deposited films, but more work needs to be done to understand the effects of aspect ratio (wafer thickness to diameter) and of oxygen precipitation uniformity on warpage of 200 mm diameter wafers. (Reprinted with permission from Semiconductor International Magazine, July 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, Il., USA)

.rocess to cut chip production time developed

LASA Industries (San José, California) has developed a process to cut silicon semiconductor chip production time to under 0.5 hours using a machine the size of a walk-in closet. A partial chip is produced by traditional methods with thousands of embedded transistors. A laser beam

deposits microscopic ribbons of tungsten on the chip to connect various transistors. A layer of silicon oxide is deposited as an insulator. The laser bores holes through the silicon oxide at points where a transistor is to be interconnected with subsequent layers of the chip, and deposits tungsten ribbons to further connect transistors. A cover then completes the chip. (Extracted from New York Times, 17 August 1988)

Microchip advance in Scotland

A microchip that can process visual images to a quality thought possible only with devices costing 10 times as much has been built by scientists at Edinburgh University. The low-cost vision chip will have a direct impact on a wide range of technology such as giving industrial robots the ability to see. Until now, the choice of a vision chip was restricted to either expensive, and very high quality, charge coupled devices (CCDs) or cheaper and relatively inferior CMOS photodiode technology. The quality of CCD is far above that needed for many purposes, so the Edinburgh team decided to find out how far they could push the cheaper CMOS technology. By using a fine beam of electrons to write the components of microchips directly onto silicon, the process does away with the need for very expensive photolithographic masks conventionally used. This makes the production of very low, even one-off, quantities of purpose-built chips economically viable. As well as having a lower manufacturing cost, the CMOS chips work out less expensive because of lower level of supporting hardware they need. (Extracted from The Times, 22 March 1988, p. 37)

New contacts may spell the end for silicon chips

A team of researchers in the US have made an important breakthrough which could lead to the increased use of a class of semiconductor which industry has not yet fully exploited.

In recent years, new compounds such as gallium arsenide have been catching up with silicon as the material used most widely in the computer and electronics industries. These compounds, called III-Vs because they are made of combinations of elements from groups III and V of the periodic table, have the potential to form far superior chips. But it is extremely difficult to make reliable metal contacts between them and the electrical circuits they sit in. A new type of contact, made from nickel phosphide by Murray Robbins and his team at AT&T's laboratory in New Jersey, was revealed recently at a conference on Solid Compounds of Transition Metals.

At the moment, contacts to III-V materials are made from alloys of gold, such as gold-germanium. The alloy is placed on top of the semiconductor, then heated to between 400 and 500°C to bind the two layers. This causes some of the second component of the alloy, in this case germanium, to mix into the surface and bond to it. Metal wires can then be "stuck" to the gold left on the surface.

There are several problems with this technique. The mixing is rarely even and it changes the chemistry of the semiconductor. This may even affect its ability to conduct electricity. Each of the different III-V semiconductors need different gold-based alloys to act as their contacts.

Robbins and his colleagues decided to try nickel phosphide because it contains phosphorus, a group V element, which they thought might react with the surface of the semiconductor and form chemical bonds. They felt this might form a contact without the intimate mixing of the old technique. The contacts proved to be very good, but it is not yet clear exactly how the bonding takes place. An important advantage for industry is that nickel phosphide seems to work well with a wide range of III-Vs, from simple compounds, involving only two elements, such as gallium arsenide, to more complicated semiconductors with up to four elements such as gallium indium arsenide phosphide. This last semiconductor has many properties which are important to industry.

One drawback is that nickel phosphide cannot be "dry-etched", the process used in industry to "cut" the contacts into the desired shape using reactive gases. An alternative technique, known as "wet-etching", where the reactions are performed in solution, can be used, but it is not popular. Robbins believes other compounds similar to nickel phosphide, such as a compound of tungsten and antimony may perform just as well but could be dry etched. (This first appeared in New Scientist, London, 11 August 1988, the weekly review of science and technology)

Intel develops flash chip

Intel has developed rapidly erasable memory chips that could displace 67 per cent of EPROM chips, which must be held under UV light for 20 minutes to be erased. The new chips use single transistor memory cells, as do EPROM chips, but can be erased as easily as EEPROM chips (which require two transistors per memory cell). The flash chip has a central processor that directs erasure and programming. The new chip can be erased in one second. It can be programmed in four seconds. Separate power supplies will be needed for erasing and programming. The whole chip must be erased at once, unlike EEPROM chips, which can be erased byte by byte. (Extracted from New Scientist, London, 16 June 1988, the weekly review of science and technology)

3-D chip produced

Hughes Research Laboratory reports it has produced a demonstration version of a 3-D chip. According to W. Strauss, a consultant with Forward Concepts (Phoenix, Arizona), the demonstration device, based on figures supplied by Hughes, is eight times faster than state-of-the-art chips. Present chips are currently flat silicon wafers with circuits running atop the wafer. Three-dimensional chips have circuits running throughout the silicon block, which allows for faster speed and more complexity. The 3-D chips are in effect formed by creating sandwiches out of more or less conventional chips. To overcome any possible misalignment problem that may occur between the wires, Hughes reports it has created a system of electrical contacts that overcomes any misalignments. Westinghouse Electric, which is also creating a 3-D chip, reported overcoming the misalignment problem by making the 3-D chip out of a material that does not shrink or expand with temperature changes. Hughes is currently working on a hockey puck-sized 3-D chip that would be three hundred times faster than current chips. The chip may be available in mid-1990. The 3-D chips are expected to be used mainly in applications requiring heavy number-crunching. (Extracted from Wall Street Journal, 7 June 1988)

New TTL-compatible ICs developed

Gazelle Microelectronics has developed new TTL-compatible digital GaAs ICs that are similar in

form and function to silicon bipolar and CMOS chips, but are two to three times faster. The company's initial device is the first programmable logic chip ever made in gallium arsenide. The new GA22V10, which is equivalent to Advanced Micro Devices' silicon bipolar 22V10 chip, has a clock rate of 90 MHz, as against 37 MHz for the fastest silicon model of the 24-pin 22V10 programmable logic function. The GA22V10's high performance is the result of the incredibly fast speed of its internal logic gates. For combinatorial propagation delay, the GA22V10 offers 10-ns performance, as against the fastest silicon speed of 20-ns. The chip's setup time for logic outputs is 4-ns, as against 15-ns for silicon chips. In terms of clock-to-output time for registered outputs, the GA22V10 has a speed of 7.5-ns, as against silicon's 12-ns. (Extracted from Electronic, June 1988)

Technology for mass production of indium-phosphorus wafer

Oki Electric Industry Co. Ltd. has developed a new method for stable growth of indium-phosphorus crystals on the surface of silicon wafer substrates. This technology lends itself ideally to mass production of large-calibre indium-phosphorus wafers and paves the way for the manufacture of quality components for use in semiconductor optical switches, longwave, wideband photo diodes and semiconductor laser systems.

Wafers made only of indium-phosphorus presently have sizes of only up to two inches and the material itself is rather brittle. On the other hand, silicon wafers are presently available in large calibres of up to eight inches, in addition to being strong, available at moderate prices and featuring an excellent thermal conductance. Therefore, the technology to deposit indium-phosphorus crystal on a silicon wafer enables the advantages of both silicon and indium-phosphorus to be utilized in combination.

Incidentally, both silicon and indium-phosphorus are semiconductors but their mutual adhesion is poor due to a difference in the lattice spacings of their crystals. To cope with the situation, the company adopted the chemical vapour deposition (CVD) process and synthesized a thin intermediate layer on the silicon, followed with indium-phosphorus superdeposition, by which a crystal of excellent properties was created.

The intermediate layer is a double-layered structure consisting of a gallium-arsenide layer and an indium-phosphorus layer, with the aggregate thickness running up to 40 nm. The difference in the lattice spacing between gallium-arsenide and silicon being as small as 4 per cent, it has the effect of alleviating the disparity in the lattices of both these substances.

Indium-phosphorus features excellent speed and radiation resistance, so great expectations are being placed on the substance together with gallium-arsenide as a next-generation integrated circuit material. However, the substance being very expensive, its independent use for wafers becomes uneconomical. In this respect, the company believes that using a silicon substrate that is inexpensive with excellent thermal conductivity will enable the commercialization of wafers in the four to eight inch diameter class. (Source: JETRO, August 1988)

Neuro computers based on analog technology

A new generation of neural network or neurocomputers based on analog technology is starting to solve the problems troubling digital computers. Neurocomputer designers are trying to develop a product that imitates a living brain as closely as feasible. To replicate the brain, neural network developers are striving to make machines that have several neuron-like devices that behave similar to real neurons. The problem is that no one can yet build anything similar to a neuron, the fundamental, functional unit of nerve tissue. Vital features of neural network programmes include their capacity to draw a general pattern from certain data and to learn by example. (Extracted from Metalworking News, 23 May 1988)

Neural network computers may better perform pattern recognition tasks

Neural network computers might be able to perform more like the human brain than conventional computers. If so, neural network computers might be better able to perform pattern recognition tasks needed for robotics, speech recognition and artificial vision. Each of the 10-100 billion neurons in the human brain connects to about 10,000 other neurons. Each of these connections apparently has a different weight. Neuronal systems apparently need only about 100 processing steps to perform a task (such as vision) that would take a conventional computer billions of processing steps. Neuronal network computers would not be programmed in the conventional way, but would be given series of patterns to build a data store. AT&T Bell Laboratories and CalTech have developed silicon chips with 50 or more artificial neurons. Some neurocomputers are already available (Thinking Machines' Connection Machine and Johns Hopkins' NetTalk, for example), and new applications will be found in many fields. (Extracted from New Scientist, London, 26 May 1988, the weekly review of science and technology)

Fifth-generation computer likely by 1995

A fifth-generation 'thinking machine' computer will be developed by early 1995, according to MITI. The machine will have 1,000 CPUs linked in parallel, and will be able to understand natural language and human reasoning. MITI's Institute for New Generation Computer Technology has so far linked 61 processors. (Extracted from New Scientist, London, 19 May 1988, the weekly review of science and technology)

New PHB material developed

Toray Industries (Japan) has developed a new material that displays the photochemical hole-burning (PHB) effect at a temperature of -193°C (80K). This is close to the temperature of liquid nitrogen. Existing PHB materials reportedly offer 1,000-10,000 times more memory density than optical disks, but require expensive liquid helium for cooling. Using liquid nitrogen can help cut costs and lead to practical applications. (Extracted from Japan Economic Journal, 11 June 1988)

Microcrystalline silicon-based HBT

A group from Tokyo Institute of Technology (TIT), led by Professor Seijiro Furukawa, has developed a prototype heterojunction bipolar transistor (HBT).

In conventional HBTs, the emitter component is fabricated from polycrystalline silicon. In the newly developed HBT, the emitter component is fabricated from microcyrstalline silicon, for improved current amplification.

The microcyrstalline silicon-based HBT is expected to contribute towards the future development of low power consumption, high speed BiCMOS and low power bipolar devices. (Reprinted with permission from Semiconductor International Magazine, June 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, Il., USA)

High-speed self-alignment type transistor

Mitsubishi Electric Corporation has succeeded in developing a self-alignment type (no masking necessary during manufacturing) transistor for use in LSIs equivalent to 16 Mbit DRAMs.

With this transistor, its MOS type source and drain electrodes are composed of multicrystal silicon and, compared with conventional counterparts, it features a working speed that is more than 20 per cent faster and a doubly thick packaging density. It is expected to lend itself to application to bipolar and bi-CMOS circuits as the basic element of LSIs with minimum processing wire widths of 0.5 micron level.

Regarding construction, its source and drain electrodes are made of multicrystal silicon and impurities are diffused from multicrystal silicon to wafer to comprise the impurity layer. At the same time, the source and drain electrodes are wired intact for utilization. In addition, titanium silicide is formed on the surface of multicrystal silicon as a means of lowering the resistance.

As a result, the domain for connecting the basic element and wirings has become unnecessary, the element's area has been decreased to one-third compared with existing counterparts. Spacing between elements has been decreased to less than 0.5 micron for the first time by implanting an insulation material between the multicrystal silicon patterns.

Since the impurity layer's depth can be reduced to less than 0.1 micron, the transistor functions with stability. The gate electrode is formed into a T-shaped construction together with the source and drain electrodes to give the gate electrode a wide width to lower resistance. With the test element, a working speed more than 20 per cent faster compared with conventional counterparts, equivalent to 86 psec/gate/stage, has been confirmed. (Source: JETRO, August 1988)

Gate array contains built-in 1M SRAM

Toshiba Corp. announced the development of a channel-less 72,000-gate array which contains a built-in 1M pseudo/virtual static RAM (SRAM) component.

The device has a gate delay time of 0.4 ns, and an access time of 60 ns in the pseudo SRAM mode. The company plans to commercialize the device by the end of next year. (Reprinted with permission from Semiconductor International Magazine, July 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, Il., USA)

Three-layered wiring technology for gate arrays

Toshiba Corporation has succeeded in raising the actual ratio of area usable for gates on a chip to as high as about 90 per cent in a gate array consisting of elements on the entire chip surface, and has established a three-layered wiring technology that enables greater large-scale integration than the two-layered wiring technology that is primarily being used today.

In concert with the performance improvement of computers and office automation (OA) equipment in recent years, a need has surfaced in connection with gate arrays to mount elements on the entire chip surface. Also to connect necessary elements as circuits, in order to form chips consisting entirely of elements on their surfaces for the integration of as many gates as possible on a given chip size with the aim of attaining high integration rates and high performances.

However, with conventional two-layered wiring technology, the maximum area actually usable for gate mounting runs up only to about 60 per cent at most, imposing a limit to the degree of integration that can be achieved. Against this backdrop, the development of chips with three-layered wiring construction enabling greater integration has been needed. However, various problems have been encountered, i.e., the surface unevenness is increased proportionally with each additional layer lamination to render multilayering impractical and, since the two-layered construction type microcell is already in popular use today, making a new series of three-layered type cells adequately available has been quite difficult.

The company successfully came out with the three-layered wiring technology by introducing a super fine, 0.1-micron etching technology and by making the second layer's surface very uniform by repeating etching two times. As a result, the chip's actual area usable for element mounting was increased to a maximum of 80 per cent to enable conspicuous high-scale integration. The three-layered chip construction also shortens the wiring length and increases the chip's working speed by roughly 10 per cent compared with two-layered wiring construction.

In addition, by giving the same design to the microcell library as that of the existing two-layered wiring cells which are primarily in use today, it will be possible (1) to discriminate the use of two-layered wiring design and three-layered wiring design by circuit characteristics; (2) to produce them in the same packaging sizes to enable simple chip replacement; and (3) to employ conventional computer-aided design (CAD) to further shorten time required for changing the design from two-layered construction to three-layered construction.

By utilizing this three-layered wiring technology the company is presently engaged in the fabrication of a gate array in which 173,000 gates are mounted on the entire surface of a chip (Source: JETRO, August 1988)

New phase for circuit boards

An unusually inert liquid polymer being developed by the chemical company Hoechst in Frankfurt, Federal Republic of Germany, promises electronics companies a breakthrough in soldering components onto printed circuit boards.

For some time, manufacturers have been searching for a liquid with exactly the right properties to be used in "vapour phase" soldering. This is a very precise soldering process in which

the board is suspended in the vapour from a liquid which boils at about 10°C above the solder's melting point. Solder is an alloy of tin, lead and silver with a melting point of about 200°C. When the boiling liquid evaporates, it gives off an even amount of heat, enough to melt the solder without burning any of the electronic components.

This approach is far better than other processes, such as soldering with infrared radiation which melts the solder, but can burn any black electronic components on the board which absorb too much heat.

Hoechst's new compound is ideal for vapour phase soldering. It boils at 216°C, and is extremely inert. It is an "oligomer", with between four and eight units of carbon, fluorine and oxygen atoms - a perfluoropolyether. It acts as a heat transfer agent, allowing just the right amount of heat to reach the solder, which then connects electronic components to wires on the printed circuit board.

The liquid is extremely insensitive to electrical currents and radiation, as Hoechst demonstrated recently at an exhibition by submerging a working television in the liquid. It is very dense and does not mix with either water or oil. It is also clear when it is in crystalline form. The only drawback of the material is its cost. At nearly 100 pounds sterling per kilogram, electronics companies will have to recycle it after use.

Hoechst plans to set up a pilot plant to produce the compound, and other companies, including Philips and Siemens, are also looking at possible uses. (This first appeared in New Scientist, London, 7 July 1988, the weekly review of science and technology)

New circuit board with heat sink

Furukawa Electric's (Japan) new printed-aluminium circuit board has an aluminum heat sink that reduces the possibility that logic circuits will fail due to overheating. It gets rid of heat 20 to 30 times faster than conventional equivalents. Logic circuits and power transistors can therefore be mounted on a single board, and more circuits can fit in a smaller area. The aluminum heat sink is overlaid with an epoxy resin that conducts heat and functions as an electric insulator. A separate aluminum plate onto which the circuits have been printed is placed over the epoxy layer. Furukawa Electric says it will sell a version with two printed-aluminum circuit boards and two levels of insulating epoxy to the auto industry. A similar board has already been used in automotive fuel-injection systems and in power modules, according to the company. (Extracted from Asian Wall Street Journal, 20 June 1988)

Aluminum nitride substrate with excellent thermal conductivity

Tohoku Metal Industries Ltd. has commercialized an aluminum nitride substrate featuring a high thermal conductivity about eight times that of an alumina substrate, and has started distributing samples.

The newly developed substrates are designed for semiconductor heat sinks and high-powered applications. The substrate for semiconductor heat sinks is coated with a titanium (Ti)-platinum (Pt)-gold (Au) metallic film using thin film technology. The substrate for high-powered applications is made with copper measuring 100-micron thick using a plating technology and can be etched with much finer circuit patterns compared with the conventional DBC substrates.

The new substrate features excellent thermal conductivity and heat radiation, while its coefficient of thermal expansion is close to that of silicon. This characteristic enables its direct mounting onto large-capacity silicon chips. It also excels in electric insulation and has a low dielectric constant. Thus, it has been recently attracting attention as an ideal material for producing semiconductor devices such as LSIs.

Beryllia, which has high thermal conductivities, has been available for ceramic substrates, but it is not being produced domestically due to its toxity. Therefore, it is expected to be increasingly replaced by aluminum nitride in the years ahead.

The company plans, for the time being, to replace the larger portion of beryllia ceramic demand with aluminum nitride and, in the future, to commercialize the aluminum nitride substrate as a ceramic substrate for use in high-powered modules, HICs and for fabricating multilayered substrates. Further details available from Tohoku Metal Industries Ltd., 5-8, Kita-Aoyama 2-chome, Minato-ku, Tokyo. (Source: JETRO, June 1988)

Design method for application specific DRAMs

Sharp Corp. has developed a method for designing application specific DRAMs in half the time of conventional design methods.

In the new method, a 1M DRAM cell array is used as a memory core, and peripheral circuitry such as timing generator circuits and address counters are automatically designed and wired above and below the core.

The company plans to use this design method to manufacture future customized IC memories such as SRAMs, mask ROMs and EPROMs. (Reprinted with permission from Semiconductor International Magazine, July 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, Il., USA)

Interlaced diamond-like networks formed

Federal Republic of Germany chemists have created mutually interlaced diamond-like networks consisting of tetracarboxylic acid molecules whose carboxyl groups are tetrahedrally directed and hydrogen-bonded in a pairwise fashion to other carboxyl groups. Otto Ermer and Andreas Eling of the University of Cologne have produced two types of extended structures: the building block adamantane-1,3,5,7-tetracarboxylic acid forms five mutually interpenetrating "diamondoid" networks, and 3,3-bis(carboxymethyl)glutaric acid ("methanetetraacetic acid") forms three such interlocked networks. The large cavities in each network are filled as a result of the interpenetration of several such networks. The Cologne workers note that these kinds of molecular arrays are candidates for host structures in solid-state inclusion compounds. Furthermore, they say, materials with diamond-like structures could exhibit interesting ferroelectric and piezoelectric properties. (Source: Chemical and Engineering News, p. 23, 25 July 1988)

Slip-free rapid thermal processing

A serious problem, known as slipping, can occur during rapid thermal processing (RTP). A slip is

created when there is a temperature gradient across the wafer. Slips generally occur at the edge of the wafer because heat is released from the top, the bottom, and the edge. This causes the edge to be cooler than the rest of the wafer, where heat is released only from the top and the bottom. According to Dr. Jaim Nulman, manager of process technology at AG Associates, Sunnyvale, California, "The slip occurs due to the stress created in the different silicon planes in the wafer. The planes will slip with respect to each other. If there are micro-defects at the edge of the wafer, slips can begin there". These slips cause damage to devices and thus yield loss.

AG Associates has developed a proprietary dynamic edge temperature control that enables the wafer edge to remain at the same temperature as the rest of the wafer within 1°C. This temperature control virtually eliminates the problem of slipping. The process optically extends the edge of the wafer so the edge does not appear to be the edge. Temperature at the edge is compensated for. This compensation must be different for each temperature at which the process is run.

Applications for this process are varied. But generally, it will be applicable to any high temperature process. With AG's RTP process, the temperature may extend as high as 1300°C before slipping occurs, whereas conventional RTP processing can only extend as high as 1150°C before the problem begins. The slip-free process is also reported to be time independent. (Reprinted with permission from Semiconductor International Magazine, July 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, Il., USA)

Tiny silicon motors fabricated

A microscopic electric motor, shown in an electron micrograph with a silicon rotor with a diameter of about 60 μm is driven by electrostatic forces has been developed by Richard S. Muller, a University of California, Berkeley, professor of electrical engineering and computer sciences, and co-workers. It was produced by variations on the techniques of semiconductor manufacturing, demonstrating the feasibility of mass-producing the micromachines. To make the motor, polycrystalline silicon is deposited in the shapes desired on a silicon dioxide support that is subsequently etched away, leaving the parts of the motor. What such micromotors might be used for is not completely clear yet. But a recent report on a National Science Foundation workshop on the subject suggests that the motors could be used in instruments to perform intricate surgery or delicate laboratory manipulations, or as miniature assembly-line tools. (Source: Chemical & Engineering News, 8 August 1988)

Listening computers broaden their vocabulary

Three laboratories in the US have recently completed speech recognition systems that can each identify about 1,000 words spoken without long pauses between them. IBM says it is nearly ready to release a system called Tangora, which fits into its personal computers.

The most advanced of the new systems - called Sphinx - was developed at Carnegie Mellon University (CMU) in Pennsylvania by Kai-Fu Lee, a graduate student in the computer science department. Lee's system is based on a technique called the Hidden Markov model - a statistical model that recognizes and generates speech. The model represents sound in a digital form, and also forms the basis of the other American systems.

Speaker independence means that there is no restriction on who is talking. Speaker-dependent models require the system to be programmed or "trained" to recognize one or a few speakers.

In a simple task of recognizing words Sphinx achieved an accuracy of 96 per cent. Earlier, in a task that was rated as three times harder, Sphinx had an error rate of 10.1 per cent, compared with 13.6 per cent by a system developed at the Lincoln Laboratories at the Massachusetts Institute of Technology.

In the second test the MIT group achieved an error rate of 5 per cent, with a speaker-dependent system, but error-rates will have to be reduced to less than 2 per cent if commercially useful products are to be developed.

John Makhoul, from Bolt, Beranek and Newman, a private research laboratory in Cambridge, Massachusetts, is developing another 1,000-word system, and he expects to achieve an error rate of 2 per cent or less within two years.

Makhoul is developing a "speaker adaptive" system that is trained to recognize one voice in about 30 minutes, and subsequent voices in about two minutes.

IBM's system, Tangora, has a 20,000-word vocabulary and will produce typescript from dictation with around 95 per cent accuracy. The company is testing the system with two customers and could be selling a product within two years.

Tangora, which contains a purpose-built processor for manipulating streams of speech, uses statistical routines to match patterns of sound, syntax and grammar. The project has involved analysing 25 million words of office correspondence to decide the probability that a given word will appear in a particular context.

The system, which requires operators to pause slightly between each word, takes 20 measurements from incoming speech, each one-hundredth of a second and compares them with a set pattern stored in its memory. A machine that recognizes spontaneous, unrestricted speech is still between 10 and 30 years away, according to scientists at CMU.

Some speaker-independent systems are already being used over telephone lines. Bell Laboratories in Murray Hill, New Jersey, has a system that will make airline reservations between Newark and 50 cities in the US. Speaker-dependent systems based on discrete utterances - a pause between words - are also becoming more common. (This first appeared in New Scientist, London, 4 August 1988, the weekly review of science and technology)

New data-flow-type parallel processing computer developed

A new data-flow-type parallel processing computer has been developed by the Industrial Technology Agency's Electrotechnology Laboratory. Touted as the next-generation supercomputer, the new Sigma-1 splits complex scientific computation into several parts, and generates an answer at up to 640 Mflops (about 1.7 times faster than the average supercomputer). Conventional von Neuman-type computers perform one process at a time. Sigma-1, which features 128 microprocessors and 128 arithmetic processors, will be commercially available via telephone lines following one year of evaluation tests. (Extracted from High Technology Business, July 1988)

New Josephson 4-bit microprocessor developed

Fujitsu (Tokyo, Japan) has developed an experimental Josephson 4-bit microprocessor, which operates at 770 MHz, with a 5 mW power consumption. Using a modified variable threshold logic (MVTL) gate, Fujitsu transformed a Josephson device from a 2-terminal element to a 3-element; the need for a complex latch circuit was eliminated through the use of a 3-phase power source system. The microprocessor's specifications include a 2.5-micron design rule, 5 sq.mm chip size, 1,841 gates, and 5,011 Josephson devices. (Extracted from New Technology Japan, May 1988)

New diskless PC from IBM

IBM will introduce a new 'diskless PC' as part of a strategy to restructure its PS/2 microcomputer line. The new PS/2 line, which will debut in summer 1988, will also consist of a new 80386-based PS/2 Model 80 that will act as a file server, a new 80386-based desktop Model 70, and a new P-9 chip-based Model 50 and 60. The new diskless PC will serve as an intelligent workstation, linking directly to IBM's Silverlake processor family in the SAA environment. The low-cost machine will share the applications processing load with the Silverlake. It represents IBM's attempt to make cloning more difficult. IBM will probably wait to unveil the new diskless PC with its SAA-based Office Products applications and the Presentation Manager in the third quarter of 1988. (Extracted from MIS Week, 23 May 1988)

Keyboardless computers demonstrated

IBM has demonstrated experimental technologies that could result in simple-to-use, keyboardless computers. Prototypes demonstrated at a recent briefing by officials from IBM Los Angeles Scientific Center and from IBM's Thomas J. Watson Research Center (Yorktown Heights, NY) in Los Angeles, California, included a speech-recognition system and a device featuring a transparent digitizing tablet directly over an LCD display, permitting operators to read and write on the same surface. Many of the demonstrated technologies will not be appearing in product form for up to a decade. Some could appear sooner. (Extracted from Information World, 23 May 1988)

Motorola unveils an ultrafast SRAM family

Ultrafast HCMOS static random access memories (SRAMs) with access times of 25 and 35ns have been introduced by Motorola.

The family incorporates both 16K and 64K densities, offering the MCM6268 organized 4K x 4, the MCM6287 organized 64K x 1 and the MCM6288 organized 16K x 4.

Fabricated in the same Motorola advanced wafer fabrication facility as the MC68030 32-bit microprocessor, these are claimed to be the first production SRAMs to use double metal, double polysilicon CMOS process with 1.5-micron design features.

The patented chip-enable speed-up technique used in these devices ensures that the chip select access time from the powered down state is as fast as the address access time. Fast entry into the low-power standby mode provides a standby current as low as 20mA at TTL levels (15mA full rail) without degrading access time performance.

The MCM6268, MCM6287 and MCM6288 all feature JEDEC standard pin-out. (Source: Electronics Weekly, 22 June 1988)

New roles for plastics

Plastics are bringing new features to electronic components, according to D.C. Frisch of Pathtek (Rochester, NY). Injection-mouldable plastics and novel metallization techniques are bringing a revolution in uniting structural and electronic functions. Highly mouldable plastics have permitted circuit boards to take on more complex multi-functional roles incorporating electrical and mechanical properties. The uniting of functions forms opportunities for cost savings at board and systems levels. A new generation of 3-D circuit boards has been introduced that unite the electrical, thermal and mechanical benefits of engineering thermoplastic polymers with the unique output benefits of high-volume injection moulding and selective 3-D additive plating technology. (Extracted from Material Engineering, August 1988)

New transistor for 3-D ICs

Toshiba Corporation's ULSI Research Center has developed a new transistor for three-dimensional ICs that is designed to conspicuously upgrade the degree of large-scale integration. It is a type of metal oxide film semiconductor (MOS) field effect transistor (FET) and enables the instability attending the operation of transistors, a factor up until now impeding the three-dimensional operation of ICs, to be eliminated. Incidentally, research on this transistor had been advanced as a part of the R&D Project of Basic Technology for Future Industries that is being implemented by the Ministry of International Trade and Industry.

The basic idea of the three-dimensional IC is to laminate several layers of transistors, wirings and other electronic circuits on a chip with an insulating film in between the layers to achieve a breakthrough of the lamination limitations placed on existing ICs. However, IC chips developed up to now have several problems which inhibit smooth operation of three-dimensional ICs, such as unforeseen changes in the current and voltage characteristics under unexpected circumstances and the generation of an excessive current flow when a voltage is impressed on the element which requires a great deal of time to regain IC stability.

The new MOS type FET has a construction in which extremely thin single-crystal silicon films with a thickness of 500 A are laminated on silicon oxide insulating layers. The thickness is only about one-tenth that of the single-crystal silicon films of transistors for conventional types of three-dimensional ICs. Incidentally, the research group discovered through model experiments with a computer that this construction enables the fabrication of transistors ideally suitable for three-dimensional ICs.

The research group fully corroborated that the transistors are capable of resolving the problems associated with conventional types of transistors. These transistors are observed to lend themselves to applications for the development of three-dimensional ICs capable of processing huge volumes of information simultaneously by parallel arithmetic processing, also for the development of multifunctional elements for incorporation into sensors.

Also, regarding the utilization of these transistors in ICs in general, it was confirmed that the computing speed is improved by 1.5 times, indicating that the new transistor can also be commercialized as a high-speed arithmetic element. (Source: JETRO, September 1988)

III. MARKET TRENDS AND COMPANY NEWS

Sunrise industries face progressive memory loss

The global shortage of memory chips, the workhorse components of microcomputers and an increasing range of electronic gadgets looks set to intensify. The shortage has already thwarted plans by manufacturers such as Apple, Compaq and Hewlett-Packard to release new computers. Research Machines, an educational computing company based in Oxford, estimates it will lose 3 million pounds sterling in production, almost a tenth of its annual turnover, because of the shortage. However, giants of the American computer industry, such as IBM and AT&T, and their Japanese rivals Fujitsu and NEC, say they are unaffected by the shortage because they produce their own chips.

Market research organizations blame the shortage of 256K and 1-megabit DRAMs on the agreement between the US and Japan in 1986 to prevent the "dumping" of memory chips. In the wake of the agreement, the suppliers of memory chips, mainly Japanese, cut back production.

In the first quarter of this year, however, demand soared. An industry body, the World Semiconductor Trade Statistics Council, forecast that demand for semiconductors will grow by just over 30 per cent in 1988 to give a market worth $42.3 million. Most in demand will be memory chips, with a market expected to grow by 59 per cent this year.

Companies in Silicon Valley in the US are trying to work out why the DRAM shortage occurred and what effect it will have.

Europe is unlikely to be able to supply its silicon requirements for this year or next, according to ICL's chip procurement boss Sadru Nanji.

Next year Nanji projects a European requirement of 80 million pieces of Megabit dynamic RAM and a total European capability of only 20 million towards supplying it. The resultant 60 million piece shortfall means European dependency on US and Japanese suppliers. European production of 256K DRAMs has been two years behind the market leaders, and European Megabit DRAM production is lagging by the same amount.

Although ICL has avoided supply problems by spotting the impending crisis early and firming up supply contracts before shortages hit, Nanji says that political interference has contributed to high prices.

Pressure is mounting in Japan to abandon the agreement on dumping chips, which has already come under fire from the EEC and the international trade body GATT. But American makers of semiconductors are determined to preserve it.

In Silicon Valley, the trade agreement is not seen as the main cause of the shortage. The Semiconductor Industry Association says Japan's Ministry of International Trade and Industry contributed to the problem, after the agreement was signed, because it imposed controls on Japanese chip makers.

One certain reason for the shortage is the difficulty the Japanese are having in switching from the production of 256K to 1-megabit chips. Defects are occurring in the chips. Instead of building the chip layer by layer like a sandwich, designers used a so-called trench capacitor in which the layers are forced into a hole so that they take up less room.

This technique has proved difficult, and the problems will take at least six months to rectify. Industry analysts expect it will take up to 18 months for the chip shortage to improve.

The shortage of DRAMs has highlighted a serious dilemma facing the American semiconductor industry. Before dumping, the US had seven companies producing DRAMs. Now there are two: Micron Technology in Idaho, and Texas Instruments in Dallas.

The high price of DRAMs - about four times what it was 12 months ago - and the uncertain supply suggests to many observers that two companies are not enough. Neither can keep up with demand.

Silicon Valley is divided over whether the US should return to the DRAM business. Some say the US cannot afford to stand by while the Japanese dominate the market. In the near future, many electronic products will require extra memory. If the US does not have a reliable source of DRAMs, then it will not be able to compete. Some believe the battle has been lost already. Companies that were once big players in the DRAM business, such as National Semiconductor, Intel and AMD are now at least a generation behind.

Japan's giant semiconductor companies, which dominate the world trade in memory chips, are investing more than $2 billion in plant to build 1-megabit DRAMs. They are also preparing to produce memory chips with capacities of 4-megabits, 16-megabits and even 64-megabits. In the wings, waiting for these chips, are products such as high-definition and holographic TV sets and cameras that store photographs on memory chips rather than film.

There are many other intricate components on the way. Toshiba, the world's largest maker of 1-megabit chips, says it is producing small quantities of 4-megabit DRAMs and aims to make engineering samples available by the end of this year. The company says it has developed the "basic technology" for 12-megabit DRAMs.

Matsushita, the electronics giant best known for its brand names National and Panasonic, says it has developed the world's smallest 16-megabit DRAM. The chip has 35 million active components on a surface just one and a half times bigger than a 4-megabit chip, the company says.

The supreme challenge is to produce such a chip in economical quantities. Even 1-megabit chips, which pack 2 million components into a piece of silicon 5 millimetres square, are taxing the ingenuity of the world's best production engineers.

Chips which pack in more than 4-megabits may also run into trouble with the laws of physics. Their components are so tiny that their behaviour becomes a matter of probabilities rather than

certainty. Going much smaller may require new technologies, which store the bits of binary information as minuscule bar magnets rather than as charged or uncharged capacitors.

Undeterred, Japan's largest computer maker, Fujitsu, is setting its sights even higher. The company says it has developed a chemical vapour deposition process which can make electrodes only 0.3 micrometres across, which the company describes as the key technology for 64-megabit DRAMs.

Motorola is interested and is reportedly negotiating with Toshiba in Japan for access to its 1-megabit architecture. Atari, a computer and video game manufacturer, wants to enter the DRAM business with National Semiconductor but so far National will make no commitment.

However the SIA believes that the arrangement being discussed by Atari and National could be a sign of what is in store. Users of DRAMs, such as Atari, could enter agreements with suppliers guaranteeing a market and supply. The US is also discussing the need for more diversified companies that would produce both memory chips and the products that use them, much like NEC, Hitachi, and others in Japan. (This first appeared in New Scientist, London, 23 June 1988, the weekly review of science and technology and Electronics Weekly, 13 July 1988)

New looks to lengthen lead in world ICs

NEC is extending its lead over the rest of the world in world semiconductor sales according to a new report.

Arizona-based market analysts Integrated Circuit Engineering (ICE) prematurely estimate that NEC's 1988 sales will rise 30 per cent to $4.175 billion, becoming the world's first chip company to break the $4 billion barrier.

NEC will also reverse the trend of the last few years of second place Toshiba relentlessly closing the gap. In 1986 Toshiba was $400 million behind but last year the gap had closed to $200 million.

Toshiba does have a lead in the largest product segment of the semiconductor market - dynamic RAMs - which would normally lead to overall market leadership. Toshiba is currently producing five million Mbits a month quantities compared to NEC's three million a month.

ICE estimates that while Toshiba will show growth of 23 per cent this year, NEC will have growth of 30 per cent. ICE says the highest growth rate of the top 10 chip companies will be recorded by Intel with 50 per cent growth this year, based on the phenomenal success of its sole-sourced 32-bit microprocessor - the 386. ICE sees Intel closing out the year on $2.2 billion which may be an underestimate as Intel has just closed its first six months with sales of $1.4 billion.

ICE reckons that Europe's only contender in the world top 10, Philips, will close the year above the $2 billion market for the first time. (Source: Electronics Weekly, 17 August 1988)

New call for chip price revolt

More than 150 electronic equipment makers in the US are being invited to join a new electronic equipment makers' association dedicated to removing the minimum prices for chips imposed by the US/Japan semiconductor trade pact.

The group is led by instrumentation giant Tektronix and currently includes Apple, Atari, Compaq, Hewlett-Packard, Tandem, Unisys and AT&T. They need to gather allies in order to increase their political clout and so change the trade pact.

The group aims to scrap the "fair market value" (FMV) system at the heart of the pact although it wants to keep the sections which guarantee US chip companies access to the Japanese market and punish Japanese companies which dump chips.

The group aims to create an international free market in chips and is hoping to enlist the support of European equipment makers who may be worried about a European version of the chip pact.

Meanwhile, two other industry trade groups, the Semiconductor Industry Association and the American Electronics Association (AEA) have jointly written to US Commerce Secretary William Verity proposing modifications to the FMV system which would alleviate the current shortage of DRAM memory chips.

According to AEA vice-president William Krist, the changes would remove FMVs from new Japanese products for their first six-months of production where there is no US competitor. Also FMV accounting procedures would be changes to encourage DRAM production by allowing companies to defer start-up costs and so lower FMVs. (Source: Electronic Weekly, 29 June 1988)

Industrial personal computer market expected to grow

US industrial personal computers are expected to make up 32.8 per cent of the market by 1991, as against 11 per cent in 1986, according to Automation Research (Medfield, MA). As prices fall more and graphics continue to improve, the use of PCs in such low-end factory uses as operator consoles are expected to rise. Meanwhile, the processing power afforded by 32-bit CPUs will bring such plant-management functions as engineering analysis and output reports, tools management, process and cell control, inventory monitoring and control, production resource planning, maintenance management, energy management and employee management. (Extracted from Mechanical Engineering, July 1988)

Time to embrace silicon compilers

Have silicon compilers come of age?

Several developments recently suggest that this neat idea may be closer to reality than many sceptics think.

Silicon compilers allow engineers to describe at a very high level the kind of electronic system they want. They enter a series of instructions written in a type of computer language which the compiler then turns into a chip design.

Special-purpose silicon compilers may prove successful. General Electric of the US recently launched a clever piece of code that designs very fast algorithm specific chips from instructions written in a special language.

Most silicon compilers are more general and aimed at systems engineers. They allow engineers who are not experienced in chip design to produce integrated circuits, which means that systems designers can specify the application specific integrated circuits (ASICs) that they want to include in their electronic systems.

A new silicon compiler was unveiled by Sagantec, a Dutch spin-out from the Eindhoven University of Technology. The company has launched what it calls a second-generation knowledge-based compiler.

Silicon compilers may lead to a boom in the ASIC market. At least, that is what fast turn-around custom chip start-up ES2 hopes. The company recently slashed the costs of its silicon compiler and made it available for people with AT personal computers.

But if systems engineers get into the habit of using high-level descriptive languages for ASIC design, they might just decide to cut out the chip houses altogether and squirt logic directly into programmable logic devices. (Source: Electronics Weekly, 6 July 1988)

RISC and Unix: transitional

The explosion of computing power that has been unleashed so far this year is, ironically, the product of a rapidly maturing industry. The awesome display of MIPS muscle flexing, which could take computer manufacturers and their customers to 100 MIPS commodity chips by 1991, has come about chiefly because of one architectural type and one operating system, namely, reduced instruction set computers (RISC) and Unix.

This rapid maturation has been fueled as much by customers as by technology. Users are insisting on standards in everything - from chips to operating systems to network interfaces - that will allow them to cut costs, get a fatter return from existing systems, and build integrated networks. Emerging industry forces, such as independent software vendors, systems integrators and value-added resellers, are similarly motivated.

Oddly enough, most users are not counting the days to the time they can get off proprietary systems. Most major organizations are clinging dearly to the proprietary systems on which their applications investments lie.

Some ISVs (independent software vendors), SIS (systems integrators), and VARs (value added resellers) even demonstrate abiding respect for closed systems. Witness their enthusiasm for IBM's AS/400, a proprietary mid-range system that drew more headlines than all the Unix introductions combined.

What are users to make of all these events? Should they expect the flurry of aggressively priced RISC products to hasten a general collapse in hardware prices? How are users to act when they have mixed emotions about proprietary systems as against their open systems successors? Should they be shopping for new systems vendors, sticking with their vendors, or leaping into the hands of systems integrators? And what applications should they build on open systems?

The answers do not come easy. The best that users can do is to attempt to understand where the industry is coming fro, where it is headed, why it is going in that direction, and what roles suppliers and users themselves will play in its destiny.

Several factors anchor users to proprietary technology. First of all, the largest installed base of computer customers, IBM sites, is more conservative and less technically-oriented than any other. Second, users remain loyal to those systems vendors that brought them into the twentieth century. Third, the expense of converting from IBM's VM or DEC's VMS to Unix is high.

A recent survey of 50 leading US companies by Wall Street firm, First Boston Corp., offers another reason why the longevity of mainframes and minicomputers is assured for a while. Portability, the vanguard of the open systems movement, ranks last among 16 user needs measured by the investment firm. Multivendor networking tops the list, with other connectivity needs such as systems integration running close behind. What the commercial sector really wants, concludes First Boston analyst Steve Milunovich, is "Unix layered with extra code to act as the glue between previously antisocial systems". The real driving force behind the standards movement, the "ideal" that corporations want to achieve, is to use proprietary systems for whatever they do well.

If, as Milunovich claims, Unix is more an "evolution than a revolution" in the commercial sector - his survey showed that only 15 per cent of respondents consider Unix strategic at this point - the same cannot be said of the rest of the user world. Unix and other standards are already a major force in government, education, and, increasingly, in manufacturing. US commercial users are also being indirectly affected by the standards movement. The movement could soon exert a more direct pressure on the commercial sector also.

Standards seem to be redrawing the map of the industry. More than anything, standards promise to be the "great leveler". Davids can emerge to take on Goliaths. Not only will the balance of power shift between corporations, a process already occurring through constant asset juggling, it will also shift between vendors, ISVs, SIs, and VARs, say observers.

The demand for connectivity is forcing vendors into unprecedented levels of co-operation and into (often uneasy) alliances. A new elite of systems integrators and resellers, third parties conversant with the customer and his or her business problems, has been created to fill the void.

Nearly one sixth of the $33.6 billion worth of hardware sold last year in the US was supplied to customers by third parties, according to International Data Corp., a market research firm in Framingham, Mass.

Standards are also shifting the balance of power between countries. Anetta Kunft, marketing manager of the Netherland's biggest VAR, Bann Info Systems, points out that US vendors (IBM and DEC especially) have created the dominant proprietary architectures. That dominance, in turn, has forced the rest of the world into alliances and the quest for alternative open standards.

US firms with smaller proprietary bases, especially the New England mini-makers, are seriously threatened by the open movement. One reason, for example, for Data General's ambitious shift into open systems and communications systems is that, by internal estimates, only about 3 per cent of the world's applications will run on DG's proprietary MV hardware by 1991.

The most immediate effect of standards is likely to be on the cost and pricing structure of the industry.

Users can also benefit from standards as a result of reduced development costs. Corporations

can cut their programming and operations costs - typically 50 per cent or so of their IS operations budget - since they can choose the system that performs their work most cost-effectively.

The great levelers though they may be, standards are unlikely to pose a major threat to the pricing structure of established vendors. A sizable number of customers, especially in the commercial arena both in the USA and overseas, have no immediate interest in Unix. IS organizations that try to plan ahead, however, should be aware that some sectors of the supplier spectrum will be more prone to pricing turbulence than others. (Reprinted with permission of DATAMATION[r] magazine[c], 1 September 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

DIY publishing is good news

Desktop publishing, it has been widely suggested, has been hyped beyond its real value, but users emphatically reject this charge.

A Computer Weekly/Absolute Research survey reveals that a massive 97 per cent of desktop publishing users feel their investment has probably or certainly been worth while, and that 78 per cent would recommend their system to others with a similar requirement. Seventy-five per cent of respondents feel they have improved their company image by producing professional-looking documents, and 57 per cent say they have reduced costs as a result of their investment.

Training is the one area where a significant number of users are dissatisfied. More than 40 per cent said supplier training was "not very good" or "poor".

More than 1,200 desktop publishing users have taken part in the survey over the last two months. Between them they have provided written answers to almost 70,000 questions on their use of desktop publishing systems. The companies' total investment in desktop publishing amounts to more than 8 million pounds sterling in hardware and software - an average of 6,500 pounds sterling a system.

As the popularity of desktop publishing grows, more and more users are buying from dealers, rather than direct from the hardware or software manufacturer, with smaller companies favouring Atari and Amstrad, and the larger companies favouring DEC Vax, and the IBM PS2. The use of colour monitors is increasing very quickly, from 25 per cent of the sample who purchased hardware before 1986, to 49 per cent in 1988.

In terms of output, 72 per cent of all users now use laser printers with Hewlett-Packard being the most popular choice, but 14 per cent of users are still managing with 9-dot matrix printers. Inkjets have not yet caught on for desktop publishing and only 10 users in the survey have plotters.

So what are the systems used for, and who operates them?

Whereas the early systems were bought mainly for technical publications, this reason for purchase has declined from 66 per cent pre-1986 to 37 per cent today. Marketing and sales documentation have come up to join technical publications as the most common areas of use and 23 per cent of users produce price lists on their systems. Only 29 per cent of installations have specialist desktop publishing staff, whereas 47 per cent of systems are used directly by managerial and executive staff, and 34 per cent by secretaries and typists.

In terms of publications produced, the most common application is in-house material, be it technical documentation or newsletters. External promotional newsletters and sales documents are produced by 36 per cent of users, and 37 per cent produce management reports. Twenty per cent of the companies who responded also use desktop publishing for their annual reports. The circulation size of desktop publishing documents varies from 15 per cent under 10 copies to 15 per cent over 1,000 copies. The average is around 125.

The three major benefits, apart from cost reduction, which users identify are an improved image, faster production of necessary documents, and the capability to produce material which would have been difficult before. Almost a quarter of those polled believed that desktop publishing actually improved their chances of making sales, so the return on investment may be higher than a simple cost/benefit analysis would show.

But the Achilles' heel of the industry appears to be training, or more accurately, the lack of it. There is a wide discrepancy between users' perception of training needs now, and the training which was taken at the time of installation.

In fact the training received has a direct bearing on a number of areas of user satisfaction. As an example, 60 per cent of those who were brave enough to train themselves from the help screens were unhappy with supplier telephone support, compared with 26 per cent of those who had external training. Nearly 31 per cent of all users had complaints about helpline availability, sometimes expressed as "what helpline?" or "it is a contradiction in terms".

In terms of acquisition methods 93 per cent of users purchased their systems outright, rather than renting, with the exception of Rank Xerox systems, which one third of their users polled were renting. Rank Xerox was also notable for dealing 100 per cent direct with end-users, providing hardware and software together, whereas 52 per cent of all systems were bought from dealers, and 65 per cent of users bought hardware and software separately.

Overall, users are pleased with their desktop publishing investment, so it really does look as though all the hype was justified, and a large number of future users will be able to reap similar benefits. Although all the gains of image improvement, increased chances of sales, and faster document production may not be strictly quantifiable, users are not regretting their investment.

Copies of the full 250-page report are available for 895 pounds sterling from Absolute Research, 73-75 Gammons Lane, Watford, Hertfordshire WD2 5HU. Richard Jones is chairman of Absolute Research. (Extracted from Computer Weekly, 22 September 1988)

Day of the optical disc is yet to dawn, says survey

Optical discs will not start replacing magnetic discs or even tapes for traditional data storage until well into the 1990s - if at all - according to a new survey of 124 users and suppliers worldwide.

The survey by the PA consultancy group says computing managers' investment in magnetic systems, plus their justified scepticism about suppliers' claims, mean manufacturers must create new applications and work especially through systems builders rather than directly with users.

Even so, PA says the market will grow "dramatically" in the 1990s, reaching between 600 and 700 million pounds sterling worldwide for drives and 15 to 20 million pounds sterling for discs by 1992. Europe will account for 30 per cent.

Early applications will be in the broad field of image storage as at present. Steve Bone, who did the survey, says the markets here range from computer-aided design to desktop publishing.

The study, covering erasable discs says there is "considerable hype" from manufacturers, and that some of their claimed benefits are in fact disadvantages.

"The fact that optical discs can be removed from the drives is not such a major advantage to the user as the industry believes," says Bone. "There are several managerial problems associated with portability of large amounts of data. For example, what if someone carrying a 1,000 Mbyte disc gets run over? This could create a new market for back-up systems.

"But at the same time the growth of networks linking workstations and mainframes reduces the need to remove data on a disc."

Bone says response times on optical discs mean they will not replace magnetic discs in standard online storage and retrieval applications "in the near to mid-term". But optical technology will not replace magnetic tapes for back-up in the near future, either, says PA. (Source: Computer Weekly, 4 August 1988)

Optical disk drive market

Shipments of optical disk drives will total 1.4 million units, worth about $1.5 billion, in 1991, against less than 100,000 units for computer applications in 1987, according to Disk/Trend. CD-ROM drive shipments will total less than 600,000 units in 1991, against 106,900 units projected for 1988; by 1991, read/write drives with under 1 Gbyte of capacity will account for 58 per cent of the industry's total shipments. Also by 1991, some 80 per cent of the read/write drives shipped that have less than a 1 Gbyte storage capacity will be erasable. Leading applications of optical disk drives include image processing and storage systems; cost improvements would help optical drives make an impact in the archival and save/restore markets. (Extracted from MIS Week, 12 September 1988)

Trends in GaAs IC market

The digital GaAs IC market will be worth $600 million in 1992, according to Dataquest. Mackintosh Consultants predict a market of $300 million in 1992, and GigaBit Logic predicts a market of $500 million + in 1992. Digital GaAs technology is beginning to challenge advanced silicon bipolar ICs for market share. Digital GaAs IC merchants are using new strategies such as second-generation digital GaAs processes, revamped market strategies, and new products to go after market share. Market players include startups such as Anadigics, Gain Electronics, GigaBit Logic, Tachonics, Triquint Semiconductor, and Vitesse Semiconductor. GaAs devices are also coming from Harris Microwave, Microwave Semiconductor, NEC, and Oki Electric. But importantly, electronics giants such as Honeywell, Texas Instruments, and Ford Microelectronics are holding back on commercial products, preferring to keep GaAs technology in the laboratory. The large firms' reluctance to develop commercial GaAs ICs is attributed to concern over the diversity of GaAs processes and products. For now, most of the large firms are sticking to developing GaAs ICs for the military market. (Extracted from Electronic, June 1988)

Understanding JIT in semiconductor manufacturing

Many realize that just-in-time (JIT) manufacturing concepts seem to alleviate production, quality, cost and yield problems faced by the semiconductor industry. "JIT is the framework for grouping a manufacturing-goal achievement system into a well defined programme," says Alex Pujari, Department of Industrial Engineering, Texas Technical University, Lubbock, Texas.

Addressing the attendees of the technical programme, Pujari said, "In the semiconductor industry the JIT trend is progressing slowly, because JIT implementation in process-oriented manufacturing is more difficult than in assembly-line production." In addition, it is recognized that the cost of implementing JIT is high and time is needed before the benefits of JIT are realized.

Other problems in the semiconductor industry include the distance between equipment suppliers and between wafer processing "frontends" and assembly "backends". JIT can also be hindered by non-JIT suppliers, non-JIT purchasing and possibly by the lack of motivation in the work force.

Pujari told Semicon/west attendees that there is no universal method of implementing JIT in semiconductor industries, but certain common principles and concepts should exist in all JIT production lines.

The main core of JIT are the "philosophies" of reducing waste, having respect for human beings, streamlining production, high quality, striving for continuous improvements and customer-driven manufacturing.

JIT production also includes quality, commitment, vision and education.

Pujari's work at Texas Technical University has included a thorough analysis of the many principles of JIT implementation, including manufacturing goals, JIT techniques, management and technology. (Pujari has developed computer-aided animation and simulation models that anticipate product flows, plant layouts and product strategies.) JIT techniques include "kanban" or pull systems, employee involvement, preventive maintenance, quick and many setups, uniform plant load, overlapping operations and JIT purchasing. "Kanban", for example, involves signalling the preceding process or source of raw material for items to be processed.

For companies that are seeking only inventory reduction, the implementation of JIT in an ideal sense is not necessary. The same effects in inventory reductions can be achieved using setup time reductions, machine breakdown reduction, higher

quality, more changeovers, line balancing, proper loading and appropriate dispatching rules. For companies that are seeking the other benefits of JIT, such as cost reduction, streamlining the manufacturing process, lowering prices, holding on to market share and increasing quality, JIT must be fully implemented. (Reprinted with permission from Semiconductor International Magazine, July 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, Il., USA)

Report on US semiconductor industry

Japanese superconductor makers are far ahead of their US rivals in the commercialization of technology, according to a draft report by the US Office of Technology Assessment. The agency recommends that the Government establish a Commercial Technology Agency with a budget of $100-500 million to pay for risky research and solve problems holding back commercialization of US technology. The final version of the report will probably be criticized for being overly optimistic about how fast semiconductor products will reach the market; for its suggesting that too much reliance on defence applications could hinder semiconductor projects; and for its call for a bigger government role. The report suggests Japanese companies are better prepared for superconductor commercialization because they have the attitude that the technology will lead to a wealth of new products in the next decade. As a result, these firms will continue to invest in product research while US companies adopt a "wait-and-see" approach. US firms are also criticized for waiting for the military to conduct R&D and then spin off commercial products. (Extracted from Wall Street Journal, 20 June 1988)

Potential market for automobile electronics

Automobile electronics have a potential market of $60 billion world-wide by 2000. Today, automobiles have an average $300-worth of computer chips/car. The chips are in such features as fuel injection systems, cruise controls, anti-lock brake systems, voltage regulators and door-locking systems. According to Motorola, the leading maker of automotive semiconductors, automotive semiconductors is already a $2 billion/year business and may reach $10 billion world-wide by 1993. Because customers have demonstrated a dislike for gimmickry and useless gadgetry, manufacturers are developing electronics that can improve, among other things, safety and reliability. According to M. Durin of Peugeot (France), "It takes five years to bring a car to market. We're making decisions today, but we will not know if they're correct until 1993".

Development is now taking place in such areas as the use of electronics to boost fuel economy, heads-up displays, traction control systems, and anti-collision systems. But customers, mindful of the expensive and unsuccessful repairs caused by some mysterious electronic problem, may lose interest in high technology cars, largely because mechanics often blame the on-board computer when the problem may only be a wire or $3.50 sensor. The problem is further compounded by computerized diagnostic systems used to service cars. "We've tried - everyone has - but there are no good diagnostic systems yet", according to S. Aono, general manager of Nissan's Electronics Research laboratory. To solve the problem, smart ships that can diagnose their own problems are being developed for "networking" - talking with the diagnostic circuits to determine if the problem is in a microprocessor, a sensor, or the wiring. (Extracted from Business Week, 13 June 1988)

Growth of computer networks

The emergence of computer networks is bringing order to corporate data management and allowing data processing managers to reassert their authority. In the early 1980s personal computers became extremely popular in the workplace. They freed office workers from their dependence on central mainframes, but data processing managers were unhappy at the scattering of data throughout the company and the proliferation of incompatible hardware. Now, with the advent of networks that tie together a number of powerful personal computers, companies are returning to centralized computing. One major question being asked now is whether a minicomputer or mainframe should be incorporated into the network, or whether it should consist solely of desktop machines.

Minicomputer makers like Digital Equipment, Wang Laboratories and Hewlett-Packard have been hurt by the rise of network computing. Sun Microsystems and AT&T recently joined forces to promote a new Unix-based software and hardware standard for network computing at the expense of minicomputers and mainframes. Digital and IBM are leading a group promoting a different standard that will favour their machines.

Of the 19 million personal computers in use today, only 10 per cent are linked together in networks. According to International Data (Framingham, MA), the figure will exceed 50 per cent in four years. M.D. Stahlman of Sanford C. Bernstein says networks and network storage systems will account for 60 per cent of the computer industry's growth over the next five years. (Extracted from New York Times, 9 September 1988)

Assessing the LAN benefits

A lot of companies are convinced they need computers before they have even bought them and find it difficult to assess the impact of computerization after installing them.

Accountancy Touche Ross decided it would carefully monitor the benefits, and drawbacks, of putting in a local area PC network in one of its smaller departments and share its findings around the company.

The result is a concise, 10-page survey that charts Touche Ross's national accounting and auditing department (NAAD) in the first year of full LAN usage from late 1986 to November 1987 available both internally and externally.

The original intention was to monitor progress so that managers elsewhere in the 3,800 strong company could use NAAD's findings as the basis for the r own purchasing decisions.

The NAAD at Touche Ross is the company's development arm, supplying its 1,000 accountants and auditors with research information on everything that is going on in the industry. The department has a team of 25 people ranging from partners to programmers to secretaries and is critical to Touche's ability to monitor its business and respond to clients' needs.

NAAD was chosen for the experiment because it was small enough to monitor closely, but big enough (and technical enough) to use PCs over a LAN as part of its day-to-day business.

In the 12 months following installation of the Torus Tapestry LAN over a variety of PC platforms - Amstrad, Compaq, IBM and Toshiba - every single

member of the department reported an increase in productivity.

Programmers, not surprisingly, reported the biggest gains, up to 25 per cent, while partners found a 5 per cent improvement. Novice PC users and experts alike said the LAN improved their productivity (8 per cent and 13 per cent respectively) and the fact that a machine was either shared or dedicated to one user did not make too much difference (7 per cent improvement for a shared PC, 12 per cent for employees with their own machine). On average, Touche says a 10 per cent gain in productivity was achieved over the year, compared to the previous 12 months.

The survey suggests that improvements in productivity do not merely reflect that employees simply do what they did before better, but that they are actually doing other tasks as well.

Secretaries, for example, had some of their copy-typing work taken away because managers, given their own networked PC, typed up a lot of their own memos and reports. This also meant that secretaries did less dictation and used their PCs for electronic mail, appointments and other PA tasks.

The department's management group more than doubled the amount of time they spent on office automation-related applications at the expense of time spent on non-office automation-related tasks.

Among novice users the increase in time spent on office automation activities showed an even more dramatic climb from just 2 per cent in late 1986 to 17 per cent a year later, again at the expense of other activities which fell from 73 per cent down to 58 per cent.

Routine and interdepartmental tasks such as arranging meetings, filing, calling colleagues within the department and photocopying showed little change over the year among either group and were likely to be affected by the introduction of a LAN anyway.

The most significant improvement was noticed in the use of internal communications, particularly electronic mail.

During the year following the LAN's introduction, the department's PC network grew from five to 20, with another five used by managers at home - 25 PCs for 25 staff, a policy now adopted as standard within the department.

As the project progressed all users in the department were asked whether they thought the cost of installing a LAN was justified; the team estimated that the cost per user was 1,500 pounds sterling over nine months, with hardware written off over two years and including software, training and implementation.

Given the limited nature of the trial, users were asked what additional IT resources would help them do their job better; 50 per cent said interdepartmental electronic mail, 38 per cent said more training, 34 per cent desktop publishing applications, 29 per cent wanted their own workstation and a similar amount wanted a PC at home as well as at work.

With that sort of enthusiasm generated for PCs, employees were asked what effect it would have if their workstation was taken away - those with a shared machine said it would be annoying but novices and expert users alike agreed that their work would suffer. (Extracted from Computer Weekly, 18 August 1988)

UPSs flourish as LAN protectors

The uninterruptible power supply, UPS, which protects computers and telecommunications equipment against blackouts, brownouts, voltage transients and related power problems, always has been a fixture in mainframe and minicomputer user sites. In the early days of the microcomputer explosion, however, the idea of incorporating a $3,000 or $4,000 backup power system into a desktop computer did not sit well with cost-conscious end users.

Along came the next information systems revolution, in the form of more sophisticated LANs, and suddenly the UPS is in fashion again. The UPS market renaissance is well exemplified by a recent $622 million contract that the US Air Force Logistics Center awarded Exide Electronics, Raleigh, N.C., for UPS systems to support its mission-critical computer and network operations.

In addition to the greater susceptibility of the LAN to data loss, the data are more important when being shared on the network by people numbering anywhere between eight and 800.

At Du Pont's Textile Fibers Department in Wilmington, Del., for example, network administration field representative W.G. Bowen says the 30-second to two-hour power outages that occur approximately twice a year are reason enough to protect his 800-person LAN with a full on-line UPS from Clary Corp., San Gabriel, California. Du Pont chose the online UPS instead of the standby power systems (SPS) or off-line units, which often are used for LAN protection.

The majority of the small, light, inexpensive SPS units, designed to support file servers or pcs, cannot be characterized theoretically as true UPSs. With these, the inverter, which is normally off, begins drawing from a battery when it detects a problem. The switchover causes an output loss, or "glitch", of perhaps four milliseconds to 10 milliseconds.

A so-called hybrid system, meanwhile, seeks to eliminate the glitch through the use of a ferro-resonant transformer, which has capacitance, or stored energy, "bled out" onto the load line during a power failure. In the full-line, or on-line UPS, the inverter powers the load continuously, which eliminates any switching and offers extended brownout protection by virtue of its not being reliant on battery power.

Venture Development Corp., the Natick, Mass.-based market research firm, sees the lion's share of the growth in the emerging LAN UPS market occurring in off-line systems. Dan Kennedy, a project director at Venture Development, pegs 1986 US sales of low-power (0KVA-1KVA) off-line systems at $76.3 million and projects dollar consumption of $139.4 million in 1988 and $253.4 million in 1991. Sales of 0KVA-1KVA on-line UPSs are seen as rising only to $62 million this year and $94 million in 1991 from $43.1 million in 1986.

Where line voltages are chronically low - in certain rural areas of the United States as well as in many of the nations in the third world - a standby system that offers only a limited operating time below 100 volts may not be enough to get the job done.

Moreover, some insist that standby and hybrid UPSs can be "fooled" by brownouts, sensing them as a total blackout and switching onto the battery. This results in premature battery drain and system shutdown.

In the event that a brownout becomes a blackcut, a full-line UPS is the only answer to saving the battery for the file server.

A number of backup power systems notify the computer once a power failure is sensed. Typically, the file server broadcasts a warning to all users on the network that a limited amount of time remains and they must get off. If they do not, the system removes them and all files are shifted to a "safe state" before the system shuts itself off.

Recently, the big gaps in price and size between standby and on-line UPS have begun to close. Topaz's Royalty says prices of full-line systems have fallen to $2 a watt - and occasionally to just over $1 a watt - from about $3 a watt. That is not much higher than the average price of between 75 cents and $1 a watt for an off-line system.

One of the reasons is increased offshore assembly of the more labour-intensive UPSs, which has made their prices more competitive with SPSs, the manufacture of which is heavily automated.

This blurring of distinctions and the generally chaotic nature of the LAN market have created a climate that often encourages hype and confuses purchasers.

Vendors themselves do not agree on the problem, let alone the solution. While some point to noise and voltage variations as a greater threat to LAN integrity than to power line service, others argue that today's micros are virtually immune to routine voltage spikes and noise.

In any event, the impressive market projections for LAN-oriented UPS suggest that the waters will get even more crowded over the next few years. In addition to the value-added retailers, dealers, and distributors that sell the bulk of UPS equipment to the LAN user community, backup power system vendors will increasingly be exploring other sales channels, such as direct sales to end users (Du Pont bought direct from Clary) and computer original equipment manufacturers.

A European IS culture for the 1990s

If Europe's information systems departments are to get the most out of technology during the 1990s, they will need to target strategic applications, create a partnership between IS professionals and the different layers of corporate management, and avoid quantum leaps into the unknown. These are the central conclusions of a survey of 300 IS executives in major European corporations across the continent that was completed earlier this year on behalf of the Amdahl Executive Institute in the UK.

The survy provides strong evidence that the business focus of IS developments in Europe is rapidly moving away from the back-room, cost-saving applications that have characterized traditional dp operations. IS is now mainly focused on adding value where the strategic competitive battle is won and lost.

One of the key obstacles to the creation of these strategic applications is that the purchasing and development responsibilities for IS systems are increasingly - and dangerously - being split three ways among the management of European corporations. Those responsibilities are now divided among the following three groups:

- Senior corporate executives who are taking charge of the strategic IS direction, but who often have an inadequate understanding of the true possibilities and limitations of information technology;
- Line managers who are being given control of user-led IS projects, without having the required technical know-how or experience to cope effectively;
- IS managers who remain responsible for providing the necessary technical infrastructure and services, yet who generally do not have the authority and expertise to participate productively in the business-planning and decision-making processes that shape the corporate IS strategy.

What is needed now is a co-ordinated set of management policies and actions designed to create a corporate IS culture that ensures everyone involved works toward common goals. Given the growing strategic value of IS, the ability to create such a culture will be a key factor in deciding which companies will be tomorrow's business winners.

The foundation for this new IS culture is a clear understanding of where the real benefits from IS will be gained in the years to come. The most important changes between the rankings in the past and in the future are found in those activities most critical to the overall corporate mission: better service to customers, improving competitive position, increasing managerial effectiveness, and enhancing product quality.

These factors are beginning to change the way companies operate in Europe entirely.

Activities with a more internal, cost-saving focus are still regarded as important, but they are becoming increasingly less urgent compared with more strategic applications. This does not mean cost-containment applications are becoming irrelevant, but it does indicate that most of the benefits have been squeezed from them and more strategic developments are taking centre stage.

The most relevant developments integrate a variety of old and new systems via telecommunications links. For example, Alan Jacobs, information processing department director of J. Sainsbury plc, London, the largest UK supermarket chain, says that the creation of an integrated environment in which different systems talk to each other has enabled his company to be managed in a new mode, with the business driven firmly from the centre.

One major new application area is the establishment of IS-based trading links between organizations, such as electronic data interchange (EDI). This is particularly important for European corporations as the European Commission strives to create a single market in Europe, with common customs, technical, and trading procedures, by 1992.

A dark cloud on the integrated systems horizon is the fact that over half of the people questioned in the study say replacing outdated systems is a key future priority. Many older systems are unsuitable for the modern distributed network. Some systems may have to be changed to be brought in line with new interfacing standards. Moreover, the rapid pace of information technology innovation means that systems can become obsolete very quickly.

Frequently, there has been a lack of foresight in management planning. One large European service company was forced to throw out all its computers in 1981 because of "neglect and mismanagment in the 1970s," according to its current MIS director. He has, however, found a silver lining: "Millions of pounds later, it is proving to be a considerable competitive advantage to have none of our systems pre-date 1982."

The problem of obsolete systems is just one aspect of the complex demands on management and IS skills created by the trend towards integrated systems. The mixing of technologies, suppliers, applications, standards, hardware, software, telecom facilities, network architectures and interorganizational and multinational systems could prove to be the recipe for disaster in many companies. It is this inherent complexity that is exacerbated by splitting IS responsibilities between corporate executives, line managers, and IS professionals.

Generally, IS executives welcome the greater emphasis on user-led projects. They feel that a commitment from the actual user and line manager in charge of the relevant business areas is essential to the success of a system.

In building effective partnerships with managers and users, there is a general acceptance that IS professionals must come to grips with business needs.

When a working partnership between the disparate management groups is achieved, the benefits become more obvious throughout the organization. This is shown by an analysis of the level of success with information technology achieved by the companies in the survey - broken down into very successful, fairly successful, and unsuccessful categories.

The study clearly showed that IS is now the very fabric of a successful business in all market sectors. Only the highest level of success with information technology will therefore be good enough for companies aming to be among tomorrow's leaders.

"Very successful" users were therefore taken as the baseline for what all companies should achieve. The fact that only 31 per cent of the companies surveyed fell into this category shows that the majority of companies in Europe still have a lot of work to do.

A clear picture emerges of the characteristics that distinguish the "very successful" user from the rest:

- A perception by top management of IS as a key to business success, with a good understanding of what it can contribute to the company's progress;
- A positive search for increasing IS applications, without resistance from management or staff;
- A willingness to be innovative and to take risks; and
- A willingness by management to devote sufficient time for projects, to provide the right resources, and to ensure that projects are implemented effectively.

Obviously, less successful companies place more emphasis on improving what has gone wrong in the past through poor systems development, which affected management confidence. The main lesson, however, is that IS success depends on a combination of business management leadership and high-quality technical skills, blended into an effective corporate partnership.

Leadership from top management is crucial in giving purpose and direction. Leadership usually begins with the vision of an individual or the board and leads to the positive role of IS in corporate strategic plans. But this will be successful only if it is followed through with well-planned policies and positive, co-ordinated actions. These must create a cultural attitude and infrastructure that encourages enterprise and commitment in exploiting information technology's benefits.

IS must become a normal ingredient in every manager's portfolio of skills, and it must be fully integrated into normal business planning processes. To achieve this, a considerable investment of time and money has to be made in developing a systematic approach to the education of all managers and staff in appropriate levels of technological and business understanding.

There must also be a willingness to spend time developing detailed IS plans. This involves not only deciding what to do, but when it is most appropriate to take particular initiatives.

All the very successful users followed a similar evolutionary pattern of development. They began by focusing on internal cost savings, which are relatively easy to cost-justify. As management confidence in IS grows and computer specialists learn how to develop a flexible IS infrastructure, the focus gradually broadens to a more strategic emphasis.

Many unsuccessful users, however, are seeking to make a "quantum leap" into sudden success. The approach is doomed to failure.

It is this emerging culture of management partnerships identifying competitive applications that will create the business leaders in Europe during the 1990s. (Reprinted with permission of DATAMATION[r] magazine[C], 1 September 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

World-wide ways to pay

Electronic payment systems are developing in different ways around the world. Some countries, like Australia and Norway, have opted for a national network, while France is leading the way in the use of smart card technology.

The UK has taken a different approach to electronic funds transfer/point of sale (eft/pos) by setting up a company, Eftpos UK, to co-ordinate a national programme and it has made the task of developing a set of standards for electronic payments a priority.

Ann Houlton, secretary of the BSI committee on eft/pos, believes the UK is leading the way in work on standards.

The committee is planning to have a standards framework ready by next spring. It will then set about defining standards to address the commercial and technical aspects of eft/pos.

Houlton adds that the committee has set up a special working group to monitor international developments. Next February it plans to host a conference on eft/pos standards for bankers, retailers and manufacturers from around the world to gain more international input.

Peter Ward, banking and retail partner with consultancy Peat Marwick McLintock, believes different national interests are driving the development of systems abroad. The Canadians, he says, have seen a rapid growth in eft/pos, largely due to a concerted effort by the VISA organization and the country's five leading banks.

Some countries like Spain, Australia and Norway, are moving rapidly from a cash-based society to a culture of electronic payment through the development of national systems.

Norway in particular has taken a very systematic approach to the development of an eft/pos network. The high street banks have formed a joint company, Fellesdata AS, which acts as a common data and clearing centre for 80 per cent of the banks.

Retailers connect to Fellesdata via the national telecommunications network using systems the company has developed for supermarket checkouts, shops, hotels and ticket dispensers.

France, fast becoming Europe's leading retail technologist, has taken a different approach, based on smart card technology. In January 1984 the French telecommunications authority and banks decided to standardize on Groupe Bull's CP8 smartcard.

They began by setting up one national payments system, Carte Bancaire, as an infrastruce for the technology.

By 1990 virtually all French consumers will have been issued with a smart card which can be used as a debit and credit card, portable medical and social security record and payment token for telephones.

Although France is the only country to build a national programme around smart cards, the technology is starting to gain ground elsewhere.

New Zealand company Asset Card has issued a combined credit, cash and bank card with Mastercard for use in 1985 regional stores. In the US, military personnel use smart cards for payment on bases, while customs authorities in Senegal use the cards for the payment of import and export taxes. (Source: Computer Weekly, 22 October 1988)

Printers survey

Page printers are becoming the peripheral of choice for many IS managers, thus helping fuel growth in the nonimpact printer market.

A survey conducted by Datek Information Services shows that 20 per cent of all printers shipped in 1987 were nonimpact printers - up from 16 per cent in 1986. The survey, published in June, also found that nonimpact printers generated 40 per cent of the whole printer market's $8.5 billion sales in 1987, compared with 31 per cent in 1986. Page printers - particularly zero- to 10-page-per-minute machines - account for much of the growth in nonimpact printers, says Naomi Luft Cameron, associate director of research for the Waltham, Mass.-based company. Datek estimates that in 1986, 290,000 page printers were shipped and generated $1.8 billion - 24 per cent of the printer market's dollar value. In 1987, 583,000 page printers were shipped, accounting for 9 per cent of the market and bringing in $2.8 billion - 33 per cent of the revenues.

At the high end of the market, page printers - such as IBM's 3800 (which prints line by line, but is considered a page printer) and Xerox's 97XX models - have been replacing line printers in many shops for applications such as on-demand forms printing.

At the low end, the clear leader in page printers is Hewlett-Packard. According to Cameron, much of the growth in the micro market has been spurred by HP's low-priced Laser Jet Series II.
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Package trends for VLSI devices

Packages must evolve constantly to keep up with the advances in ICs. As chips become more complex and operate at higher frequencies, packages must be designed to accommodate high speeds and with better power dissipation capabilities. Packages require more input/output (I/O) ports and shorter current paths to reduce inductances.

The trend is towards smaller packages with higher pin counts and finer pitches. More packages are being constructed of plastic and are being surface mounted onto printed circuit boards (PCBs). Smaller packages take up less space on a PCB and higher pin counts are required for faster, high performance chips. The plastic package is continuing its popularity due to its cost-effectiveness. The proliferation of package types continues. Package type as against pin count is shown in Table 1, and projections for package type consumption are given in Table 2.

More types of plastic packages are becoming available. Problems that must be addressed are: better ways of passivating the chip so that the passivation does not crack under the stress of being in a plastic package; eliminating soft metal movement on the chip; and a problem known as popcorn. New, tougher plastics are being developed by researchers to help deal with these issues.

Table 1. Package Type vs Pin Count

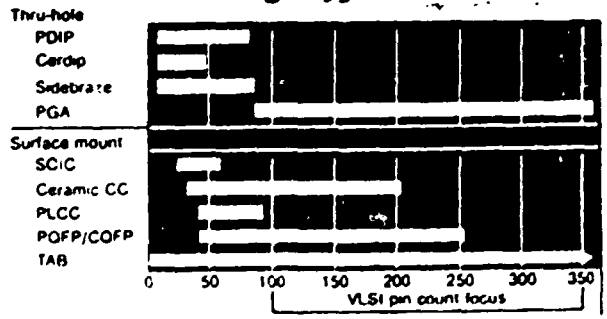


Table 2. Worldwide Merchant IC Package Consumption

Package type	(% of total IC packages) 1985	1991
PDIP and Cerdip	95.7	60.9
SOIC	2.0	27.3
PLCC/PQFP	0.3	6.7
Ceramic CC	0.7	3.2
Flatpack	0.5	0.1
PGA	0.1	0.2
TAB (bare)	<0.1	0.8
Other	0.6	0.8
Total units	17.4B	32.5B

Source: Insight Onsite, Ross Assoc., Gilligent and Walkerton

Most people agree that the plastic pin grid array (PPGA) package is becoming more widely used. Not only is package cost driving plastic technology, but a PPGA is much better than a ceramic PGA from a lead impedance standpoint. In high speed devices the PPGA gives a better electrical performance than does the ceramic PGA. This is because the PPGA has conventional copper foil traces at the interconnect between the chip and the pins, which is a better conductor than the printed titanium tungsten metalization traces that are used in co-fired ceramic packages. Another advantage claimed for the premoulded PGA is, at no extra cost, a copper heat sink can be moulded into the base of the package. This gives the PPGA better heat dissipation capabilities than the ceramic PGA.

A metal PGA has also been developed recently by Toshiba Corp. and introduced by Toshiba America, Sunnyvale, California, that deals with these problems. The metal PGA is reportedly more mechanically stable than the plastic PGA, which means that it has better thermal characteristics at low and high temperatures. It is reported to have low thermal resistance, high reliability and the mechanical strength of ceramic PGAs, but the price is competitive with PPGAs. The strength of the package enables large dies to be packaged economically without cracking problems, and it has a hermetic seal.

Many agree that the plastic quad flat pack (PQFP) will continue to be important in the industry. A new PQFP has been approved by JEDEC that some believe is better designed than the currently available Japanese PQFP that has approval of the Electronic Industry Association of Japan (EIAJ). The Japanese package will be used primarily for low-end consumer products, such as VCRs, stereo equipment, TVs, etc., and the JEDEC PQFP will be used primarily for high-end computer and industrial equipment.

The trend to manufacture packages with copper leadframes rather than Alloy 42 has been going on for nearly five years. Today it is occurring on a large scale across major semiconductor companies. But Alloy 42 leadframes are not expected to disappear completely; they will still be used for some special cases.

It is estimated that 5-10 per cent of the packages are now being surface mounted. Insight Onsight, a market research firm in San José, California, predicts that 37.2 per cent of all IC packages will be surface mounted by 1991. One reason for the growing popularity of surface mounting is that chips can be attached to both sides of the PCB directly across from one another. This enables the PCB to be smaller and less expensive. The wire routing on the board is also easier because there are no pins protruding through the board, taking up valuable space.

Another way people are improving the space used on PCBs, and also improving performance, is by placing more than one chip in a single package. The concept of multichip packaging is generating a good deal of activity in the industry today. Many companies are exploring ways to accomplish this in their own development facilities. There are two basic technologies for multichip packaging that are presently being pursued: silicon on ceramic or metal, and silicon on silicon.

Work sponsored by the Semiconductor Research Corp., and being done at the University of Arizona, Tucson, is using computer programs to design packages for chips that operate at very high clock frequencies.

Researchers at the university have developed specialized, fast-running computer programs for designing packages. There has not been a lot of interest in package electrical characteristics in the past because the majority of circuits were not so fast that they required simulation. Now, digital ICs are available with very fast pulses and nigh edge speeds that contain high frequencies very much like microwave frequencies.

A package could be designed and simulated using the computer program to determine, before the package goes into production, if there are problems such as coupled noise and ΔI noise. Then, if there are problems, changes can be made. For example, signal lines can be moved away from each other or put on different levels so that they run perpendicular to each other, or decoupling capacitors can be used to help eliminate problems.

Test structures are also being used to help in the design of pacakages, especially for new products being introduced. The test structure could be placed in the package to see experimentally how the package will respond to the chip. The thermal resistance, stress concentrations and the effect of package inductance could be tested.

Another trend in the industry is the resurgence of flip-chip bonding. This type of bonding has economic advantages over wire bonding when dealing with larger die and more I/O pads. It also has advantages when bonding multichips to a package, enabling higher density bonding. Chip speed is increased because distances are shorter between the chip and the package, reducing resistance.

Railroads market computer programs

Several railroads have found that they can profitably market computer programs and services to other railroads and other kinds of businesses. Railroads are following various methods in seeking to capitalize on openings to extend electronic data interchange and some MIS functions beyond internal uses. Some railroad holding firms have formed subsidiaries to market data services and software. The first focus of the new units is on servicing other subsidiaries of the holding firms, but moving into marketing to other businesses, governments, or financial or educational institutions are planned. Other railroads that have unveiled systems for their own internal use are marketing the systems to other railroads or railroad-related businesses, with their own employees doing the marketing and consulting. Most large railroads are expanding EDI beyond their

properties by offering their own systems to customer and vendors, generally for free. (Extracted from Modern Rail Roads, May 1988)

Merged companies reorganize forces

Systems Designers is to create two new companies from its merger with Scicon, bought from BP in March.

From 1 January 1989, their combined UK government, defence and aerospace businesses will come together under the Systems Designers banner with a UK turnover of over 40 million pounds sterling. Industrial, financial, commercial and energy operations will create the new Scicon.

These will be the principal trading subsidiaries of SD-Scicon, which had a turnover of 252 million pounds sterling in 1987.

The new firms will be able to offer a complete range of services that neither could have done alone.

Denis Harris, former managing director of Systems Designers Scientific, who will run SD, says the new grouping gives it the capital resources to compete as prime contractor and bid for the bigger projects, worth 50-100 million pounds sterling, which will be a feature of the software industry in future.

The Channel Tunnel contracts are prime targets for partnerships. (Extracted from Computer Weekly, 11 August 1988)

CSC sell-off threatens pan-European network

Computer Science Corporation has split off its Infonet world-wide data network as a separate company, and plans to sell a 45 per cent stake in it to five European telephone operators.

The five partners will get immediate access to the Infonet network, allowing them to offer customers a one-stop shopping service for international data communications.

The move looks likely to undermine plans by 18 of Europe's PTTs including British Telecom to set up a pan-European managed data network company under the auspices of their joint policy body CEPT.

British Telecom was invited by CSC to take a stake in the company but withdrew at an early stage of the negotiations. France Telecom and the German Deutsche Bundespost have each agreed to buy 15 per cent of Infonet, and the PTTs in Sweden, Belgium and Spain have options to acquire 5 per cent.

BT says it decided that the Infonet proposal "was not sufficiently attractive".

A spokesman says BT's "opportunities lie elsewhere," but would not indicate whether this meant with the 18-nation consortium due to be launched in September, or in another venture.

William Hoover, who is president of CSC, wants to expand the partnership to include other European and Asian PTTs, but CSC will retain control of Infonet.

Infonet provided CSC with more than $80 million of last year's $1.15 billion revenue, and the company will continue to use the network in the delivery of its services.

Infonet was set up in 1976. It now has direct links in 20 countries and access via the national PTT in 11 more. CSC says the deal will give its customers increased support through its "strengthened relationship" with the PTTs. (Source: Computer Weekly, 28 July 1988)

DEC's new online transaction processing initiative

One of the charges regularly levelled at Digital Equipment (DEC) and its Vax 8000 range of machines since the series' launch in 1986 has been the lack of a coherent approach towards transaction processing.

Now, says DEC, that is going to change. The company claims it is serious about online transaction processing, and has launched a series of new products.

One of these, a transaction processing monitor called Decintact, has been expected for some months. But DEC has gone further and launched what it calls the DECtp programme, offering transaction processing but within DEC's own "distributed" computing environment.

"Customers are starting to demand DEC offer more in online transaction processing," says DEC product manager Stuart Stuchbury. "Our goal is to give the user power when and where he or she wants it."

At present IBM has a massive lead over DEC in online transaction processing systems, but DEC claims it is now number two in the marketplace. It admits there is a long way to go to catch IBM, but it does have an incentive.

DEC claims the DECtp products, which include Decintact, a new upgrade of the Application Control and Management System (ACMS) transaction processing monitor, and a new version of its Rdb relational database management system can together let users achieve up to nine million transactions a day.

DEC says that the ACMS version 3 transaction processing monitor, when used with the newly-launched version of Rdb, can reach 20 transactions a second, up from its previous six.

Decintact, based on software from New Jersey-based Advanced Systems Concepts, is aimed at high-volume processing applications where transaction integrity, applications availability and transaction system recovery are critical.

DEC believes up to 90 per cent of users' applications can be achieved with transaction rates of up to 10 transactions per second, and is aiming its online transaction processing strategy at users in the financial markets.

DEC's new version 3.0 of Rdb is claimed to have a two tenfold increase in performance over its predecessor, handling up to 30 transactions per second on a Vax 8800.

Other newly launched products or upgrades which DEC sees fitting into its DECtp programme include:

- Vaxlink software to provide users with the ability to extract data from IBM IMS databases and VSAM files, providing a bridge to copy it into Vax Rdb/VMS databases;

- Vax TDMS software, allowing users of transaction processing systems to manage forms and other presentation of data by separating forms data from application code;

- Vax Data Distributor software providing means to replicate relational databases across a distributed transaction processing environment;

- An SA600 "storage array" incorporating DEC's new RA90 component disc drive.

(Extracted from Computer Weekly, 28 July 1988)

DEC investment

US computer giant DEC is entering into the systems integration business with an investment of several tens of millions of dollars.

DEC intends to get its engineers experienced in wiring up various combinations of computer hardware and software so that it can offer potential customers off-the-shelf solutions.

Senior DEC manager Doug Wood hinted that the company would eventually like to sell its systems integration expertise as a service and connect up machines from all kinds of manufacturers.

The company has also announced a close working relationship with computer-aided engineering (CAE) start-up EDA Systems which is trying to develop methods of getting different pieces of complicated CAE software to talk to each other on various kinds of computer systems. (Extracted from Electronics Weekly, 22 June 1988)

Bull and G2 chip into PS2 market

The French computer group Bull has signed a technology exchange agreement with US chip designer G2, aimed at establishing both companies as major suppliers of PS2-compatible boards and systems.

Under the agreement, G2 (an affiliate of the UK's Lattice Logic) is to sell a PS2-compatible chip set, Universal, developed by Bull in the US. The chip-set and Bios software are said to be the first to allow micro-makers to generate a complete range of PS2 computers, based on various Intel processors, from a single flexible mother board.

Bull has not required a licence from IBM to develop the Universal chip set, because IBM's technology is not protected at the semiconductor level, but any micro maker using the chip-set in a product would be expected to pay royalties to IBM, possibly via Bull. Such payments are usually tied to additional back-payments on old PC technology.

Bull itself will be G2's first large customer. It expects to launch a PS2 range based on the Universal product at the beginning of 1989 and is seeking original equipment manufacturers. Bull's computers will not be available in the UK initially, but in the long term Bull is trying to develop a common micro-product strategy with Honeywell Bull, which serves the UK market.

Other micro makers will get their hands on the chip-set later this year. G2 wants to draw major PC makers into the PS2 market by providing a simple platform for the development of an entire PS2-compatible range.

Up to now, PS2-compatible makers have had to scramble together different boards and Bios software for each PS2 model they imitate, and most have limited themselves to just one or two models from the IBM range.

G2 is providing a single board and Bios that cuts across the whole range of PS2 computers. (Source: Computer Weekly, 28 July 1988)

Unisys aims to unify factions

Unisys, the world's largest Unix vendor, is working behind the scenes to bring AT&T and the Open Software Foundation together and reunify the industry around a single Unix operating system. It is putting pressure on AT&T to give all Unix licencees equal and simultaneous access to future Unix source code "to level the playing field".

Unisys was invited to be a founder member of the foundation when it was set up on 17 May by IBM, DEC, Hewlett-Packard, Apollo and others to counter the exclusive agreement between AT&T and Sun Microsystems to put Unix on Sun's proprietary Sparc chip, and adopt Sun's Network File System.

The founder members also worried about the Japanese threat to Unix from Sun's licensing agreement with Fujitsu for the Sparc chip.

John Perry, Unisys UK chairman and managing director, says Unisys is still weighing up whether to join, but denies that the deliberation is intended to put pressure on AT&T. AT&T and Unisys have an agreement to work together to put Unisys fourth generation languages, Linc and Mapper, into Unix, and make them the industry standard Unix fourth generation languages.

Although Unisys agrees that the AT&T/Sun tie-up poses a threat to Unix's supposed hardware independence it too feels threatened by the position of IBM in the Foundation.

The Foundation will base its open software environment on AIX, IBM's version of Unix. Unisys claims IBM will "enjoy a substantial competitive advantage" in the nine months there will be between the next release of AIX and the first release of the Foundation product.

There is now a stand off between AT&T and the Foundation.

The Foundation promises that its new operating system will conform to Posix and X/Open standards. (Source: Computer Weekly, 28 July 1988)

Motorola and Intel draw battle lines in 32-bit MPU war

US chip giants Intel and Motorola are preparing for the next round in the battle for the fast-growing 32-bit microprocessor market, with plans for powerful new chips to be unveiled in 1989.

Intel plans to capitalize on the success of its 80386 microprocessor, which has been a best-seller among personal computer makers, with a completely compatible new chip aimed at minicomputer makers and called the 80486. Motorola is planning to introduce a successor to its 68030, called the 68040, which incorporates a floating point processor on-board.

The 80486 will weigh in at more than 20 million instructions per second (MIPS), three times the speed of the current top of the range 25 MHz 80386 and five times faster than the 16 MHz versions, according to Intel microprocessor expert Sharad Gandhi. "All the software that runs on the 386 will run on the new chip," he said.

Motorola's 68040 also features more than one million transistors compared to the 400,000-odd on the 68030 but many of these will be taken up by the on-board floating point unit, according to Motorola's David Letheren.

The 68040 is also expected to weigh in at around 20 MIPS, around two-and-a-half times the speed thanks to the floating point unit and also to large caches of fast memory.

But the devices are unlikely to be completely compatible although Letheren does not anticipate too many problems in running 68030 software on the new 68040.

By combining the arithmetic and floating point units onto one chip and plugging it into fast cache memory, Motorola has given its new chip a structure similar to its recently announced 88000 reduced instruction set computing processor at the expense of complete compatibility with the 68030. (Source: Electronics Weekly, 31 August 1988)

Sparcs fly in processor war

The battle to dominate the fast processor market took another twist when Cypress Semiconductor unveiled its CMOS version of the Sparc Reduced Instruction Set Computing (RISC) technology chip originally developed by computer-maker Sun Microsystems.

The 32-bit microprocessor is clocked at 33 MHz, weighs in at around 20 million instructions per second (MIPS) and is available from stock now, although users will have to wait until the end of the year for the vital cache chips.

The Cypress Sparc family consists of an integer processor, a memory management chip, two cache memory chips and floating point controller which can talk to a Texas Instruments' floating point processor. These devices are made using 0.8-micron CMOS technology.

Cypress is aiming for a slice of the fast workstation processor market and definitely sees Motorola's 88000 RISC family as the competition even though Motorola has yet to start shipping silicon. There are two competing RISC architectures which are already established as engines for fast computers: Mips Computer Systems R2000 and R3000 families and Intergraph's Clipper.

Fujitsu Microelectronics has been shipping gate array versions of the Sun Sparc chip set for several months now but it may well lose out to Cypress in a fight for raw speed. Fujitsu has its sights set on getting its RISC chips built into all sorts of electronic equipment in the form of intelligent controllers.

The controller market is potentially much bigger than the computer market for RISC processors and this many be one reason why both Intel and AMD have tailored their RISC offerings towards intelligent control applications. But it is Acorn Computers, a British company based in Cambridge, that has won more than a third of the RISC market over the last year with the ARM chip set that it originally developed for its Archimedes PC. (Source: Electronics Weekly, 6 July 1988)

Near-supercomputer use forecast

Near-supercomputers that provide part of the vector and scalar processing of supercomputers at part of the cost are finding acceptance by engineers, who find that the time-sharing arrangements brought on by supercomputers are too costly and inconvenient. Although many of the machines involve high-speed scalar and vector processing, many vendors are moving to parallel processing architectures to improve performance. Near-super use in 1991 is forecast to be made up 27 per cent by simulation/modeling, as against 32 per cent in 1986; 25 per cent by CAE/CAD, as aginst 16 per cent; 20 per cent by industry-specific uses, as against 18 per cent; 10 per cent by engineering analysis, as against 8 per cent; 9 per cent by robotics/AI, as against 6 per cent; 9 per cent by general scientific computing, as against 15 per cent; and 0 per cent graphics, as against 5 per cent, according to Electronic Trend Publications' (Saratoga, CA) The Impact of Parallel Processing on High Performance Computing. (Extracted from Machine Design, 26 May 1988)

Du Pont positions itself to market superconductors

In a move that University of Houston (UH) President Richard Van Horn calls a "key step in transferring superconducting technology to the marketplace," Du Pont has agreed to license and commercialize superconducting products and processes based on research by UH Professor Paul Chu and his research group have been central figures in developing high-temperature superconductors, including the yttrium-barium-copper oxides, also known as 1-2-3 compounds. Du Pont says its agreement with UH gives it exclusive rights to commercial applications under any patent granted for Chu's original high-temperature superconducting compositions, the 1-2-3 compounds. The company also says it has the right of first refusal to capitalize on other superconductivity inventions coming from Chu's laboratory during the next three years. Du Pont has already paid UH $1.5 million; another $1.5 million will be paid when Chu receives a patent for the 1-2-3 material, and a third payment of $1.5 million will be made two years later. In addition, UH says that Du Pont will pay royalties on net sales at a rate to be decided once the products or processes are commercialized. (Source: Chemical Week, 31 August 1988)

Network costing model

A research group in the US plans to offer a new model for calculating the cost of owning and expanding networks, and may extend it to costing general IT systems applications.

The Massachusetts-based Index Group is working with the Massachusetts Institute of Technology (MIT) on an eight-part method for working out what systems are cheapest to buy and use. Preliminary figures from 10 firms suggest DEC networks are cheaper than IBM, both to operate and expand over five years.

The early figures also show that over five years 37 per cent of the cost of running a network is in buying the kit, 26 per cent is in personnel, 22 per cent is for communications links and carriers, and 15 per cent is software and facilities.

The Index Group-MIT model isolates five components of cost - equipment, personnel, communications carriers, software and facilities (such as wiring and space). It has three life-cycle changes which incur costs - acquisition, operation, and incremental change (such as adding users or network nodes).

Possible uses would be for applications development or choosing between fourth generation languages.

The model's initial figures come from data taken in eight US and two UK firms, and contrast the cost of network ownership in the UK and US as well as the relative costs of using centralized and distributed IBM and DEC networks.

They suggest that UK users have to pay more for equipment but less for personnel. Overall, the model showed a DEC network to be cheaper per node than an IBM equivalent over a five-year period in the US. (Source: Computer Weekly, 22 September 1988)

IBM rivals challenge new bus design

A group of rival PC manufacturers has joined together in a rare spirit of collaboration to defeat IBM's plans to direct the future of personal computing.

Nine companies, led by Compaq Computers, met in New York to unveil plans for a new 32-bit bus design for PCs to challenge IBM's Micro Channel Architecture (MCA). The announcement splits the PC world into two camps and throws up new problems for add-in board manufacturers.

The move presents a threat to IBM's PS2 machines launched last April, which, with the exception of the entry level Model 30, are based on MCA. But IBM's own commitment to MCA is also being questioned because of the launch of a new Model 30 which competes with the MCA PS2 Model 50.

The consortium members AST Research, Epson, Hewlett-Packard, NEC, Olivetti, Tandy, Wyse Technology and Zenith Data Systems will adopt the Extended Industry Standard Architecture (EISA) developed by Compaq.

The EISA bus will provide capabilities similar to MCA but will retain compatibility with the first generation of add-in boards.

The need for a new 32-bit bus design to make the most of today's powerful 32-bit chips like the Intel 80386, is widely accepted. The IBM AT bus which has become a de facto industry standard is a 16-bit bus. But IBM's proposed solution, the proprietary MCA, aroused controversy. Compaq led the opposition to the design which could not take the myriad of add-in cards on the market and was only available to other manufacturers through licensing.

The proposed EISA design involves 32-bit connectors and extra electronics to manage arbitration sitting alongside the standard AT slot. Add-in cards can use the AT slot as normal but do not get any additional capabilities. A new breed of cards will have to be developed with a double strip of connectors for full 32-bit capabilities.

Opinion is divided over whether the consortium's plans will take off.

IBM's new Model 30 has an 80286 processor unlike its predecessor which had an 8086 chip, but most significantly IBM has stuck with the old PC AT bus design.

Analysts were immediately predicting the new machine would hit sales of the PS2 Model 50, an 80286 machine with MCA. (Extracted from Computer Weekly, 15 September 1988)

IBM will service rival computers

International Business Machines Corp. said it would being co-ordinating the maintenance of computers made by competing manufacturers when those machines are integrated with IBM equipment.

The new service was seen by analysts as a shift by the world's largest computer maker, based on the recognition that its customers are increasingly interested in integrating computers from different companies.

William Pohl, a spokesman for the company, which is based in Armonk, New York, stressed that the new service, called Technical Services Management, would only apply to those systems that are physically integrated with IBM computers. IBM would not service competitors' equipment, but instead would subcontract the repair work.

In 1987, the United States computer maintenance market totalled $14.8 billion, according to International Data Corp., a market research company based in Framingham, Massachusetts. The market is expected to grow to $21.1 billion a year by 1991.

Computer service is an important component of IBM's business. IBM said that pricing for the new service would initially be set on a case-by-case basis.

Separately, the Associated Press reported that IBM has committed itself to achieving market leadership in workstations, the speedier siblings of personal computers.

IBM's RT workstation was widely faulted for being underpowered and lacking in software when it was introduced in early 1986, and sales were poor. But IBM has steadily added software while doubling the performance of the RT every 12 to 18 months.

IBM had 3.9 per cent of the world-wide market for workstations used for science and engineering last year, trailing Sun Microsystems Inc.'s 29 per cent share, Apollo Computer Inc.'s 21 per cent, Digital Equipment Corp.'s 20 per cent and Hewlett-Packard Co.'s 12 per cent, according to International Data Corp.

Those numbers understate the RT's popularity because they focus only on machines used for science and engineering. About half the RTs sold are used for general corporate purposes. (Source: International Herald Tribune, 4 August 1988)

IBM and next licensing agreement

International Business Machines has entered into a $10 million user interface licensing deal over the right to use the symbols and commands developed by former Apple Computer chairman S.P. Jobs, whose new company, Next (Palo Alto, CA), will produce a new computer. IBM will adopt Next computer's user interface for use on models of the IBM PC/RT engineering workstation and other IBM computers running the Unix operating system, according to an industry executive close to Next officials and an engineer knowledgeable about the project. Industry officials are puzzled, since IBM has entered into a major commitment to another user interface technology jointly developed with Microsoft. In addition, Jobs has been opposed to IBM's role in the personal computer industry.

Next's new computer was initially designed for college students and academic researchers, but most analysts now believe that it will find a larger market. It is expected to have features not currently available on personal computers, such as a high-speed facsimile modem, powerful digital sound processing capabilities, the ability to display

television-quality video signals, and an erasable compact disk player for data storage and retrieval. It will also have 50 Mbytes of dictionaries and other reference works such as almanacs. Some analysts view the co-operation as providing an important boost for Next's computer, which is viewed as being late to reach the market and in danger of being passed by other manufacturers, such as Sun Microsystems and Apple. (Extracted from New York Times, 13 September 1988)

Xerox calls on its visionaries to change the face of computers

Human beings need use only one eye, one arm, one hand, and limited colour and sound recognition to make today's computers function effectively. Scientists at a research facility in Cambridge opened last week think this is wrong, and are working out radical ways to change computers so they can become more useful everyday tools, exploiting all the human faculties.

Rank Xerox EuroPARC is the first of a number of European research centres, the company says, which will complement the work of its famous laboratory in California, the Palo Alto Research Centre (PARC). EuroPARC, which will cost Rank Xerox around 4 million pounds sterling a year to run, exists to improve the "human-machine interface" - the way we operate and interact with computers.

Although most people associate the Rank Xerox name with photocopiers, the corporation is in fact responsible for some of the most significant developments in computing, and has been a pioneer in the field of machine interfaces for many years. It has also been extraordinarily good at letting others take the glory for its own work. Xerox was the main driving force behind the development of the popular Ethernet networking system and it carried out much of the early work on graphics-based user interfaces - software which lets users communicate with their computers through pictures or "icons". It contributed to early work on laser-based optical storage and the use of gallium arsenide in small solid-state lasers.

EuroPARC's director, Tom Moran, one of the pioneers of human-machine interface developments, wants to forge links with Cambridge University, and has already attracted visiting professors from around the world to work at the centre William Buxton who is on secondment from PARC, is developing new ways to communicate with computers which take advantage of all human senses.

In two months' time US computer companies will no longer receive government funds for electronic projects unless they meet strict criteria on access for the disabled. This, says Buxton, should encourage some companies to think about the basic barriers to disabled people using computers, such as putting the on/off switch at the back of a computer.

Another visiting professor, Tim O'Shea, who is professor of information technology and education at the Open University, is looking at how people learn high-level programming languages, and how best to design programs with which the user can interact. His research includes work on a prototype system called the Alternative Reality Kit. This, for example, allows physics students to watch billiard balls collide on screen, then remove the law of gravity or motion and see what happens. O'Shea hopes to extend it to build alternative geography and biology kits. Some of the systems under research at EuroPARC may never come out as products, but Moran says the British operating companies of Xerox are keen to incorporate their work into products. EuroPARC is also expected to develop strong links with Europe. EuroPARC has asked for funds under the second phase of ESPRIT, the European research programme for IT. It is part of a consortium which includes British Telecom, Bull, Norsk Data and Several European universities who propose to show how users can take part in systems development. (This first appeared in New Scientist, London, 23 June 1988, the weekly review of science and technology)

Intel and Siemens form computer company

Intel Corp. and the FRG's Siemens AG have formed an international computer systems company called Biin, which will be owned equally by the two firms. Based in Hillsboro, Ore., the site of Intel's systems group, the new venture will design and manufacture computer systems to be sold to original equipment manufacturers. European headquarters for Biin will be in Nuremberg, FRG. Production is slated to begin by the year's end at both locations. The computers reportedly will be designed for on-line transaction processing and computer integrated manufacturing applications. (Reprinted with permission of DATAMATION[r] magazine[c], 1 July 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Intel abandons gate arrays

Intel is abandoning the gate array business and dissolving its application-specific integrated circuit (ASIC) operation.

Behind the move are two perceptions: first, gate arrays are a bad business to be in; second, it is a lot more difficult to convert standard products into cells for standard cell arrays than it was thought to be.

Market research firm Dataquest reckons the 1991 semi-custom market will be three-quarters cell-based. Accordingly, Intel has merged its standard cell operation with its microcomputer group (which possesses the standard product cores) in the hope that this will provide a more motivated structure for accelerating the process of transferring standard product cores into a cell library.

Dataquest reckons that Intel only sold about $3 million-worth of gate arrays last year, and about $8.4 million of standard cell arrays. In addition it did $10 million in user-programmable logic chips which are more in tune with the Intel "philosophy" that standard programmable parts have always been more attuned to the economics of chip production than tailor-made or semi-tailor-made chips.

EPLD will continue to be a high-profile Intel operation in the ASIC field and as such will attract more backing from the company.

Dataquest reckons that the 1987 CMOS gate array business was a $1.4 billion market last year which will rise to $4.2 billion in 1992; that the semi-custom standard cell market was a $761 million market in 1987 which will rise to $3.2 billion in 1992; and that the EPLD market was a $500 million market which will rise to $1.2 billion in 1992. (Source: Electronics Weekly, 29 June 1988)

The computing surface of the company Meiko

Meiko of Bristol, UK, is a computer manufacturing company founded a few years ago by seven employees of INMOS Company. These employees

had been participants in the development of the INMOS transputer, which has proven to be a very successful product. As of September 1987 there were 37 announced hardware products based on the transputer in the UK, US, Japan and the FRG, as were 38 products and projects under development in the UK, US, France and the EEC.

Because of the importance of the transputer to Meiko, a brief description of the most recent version of the transputer (the T800) before discussing Meiko's computer surface products may be useful.

The T800 is a 32-bit CMOS microcomputer with a 64-bit floating point unit and graphics support. It has 4 kbytes of chip random access memory (RAM) for high-speed processing, a configurable memory interface, and four standard INMOS communication links. The instruction set achieves efficient implementation of high-level languages and provides direct support for the OCCAM language model of concurrency when using either a single transputer or a network of transputers. Procedure calls, process switching and typical interrupt latency are submicro-second. The processor speed can be pin selected in stages from 17.5 MHz up to the maximum allowed for the part. A device running at 30 MHz achieves an instruction throughput of 15 million instructions per second.

The T800 provides high-performance arithmetic and floating point operations. The 64-bit floating point unit provides single and double precision. It is able to perform floating point operations concurrently with the processor at a rate of 1.5 megaflops at a processor speed of 20 MHz and 2.25 megaflops at 30 MHz.

Graphics support is provided by microcoded block move instructions which operate at memory speed. The two-dimensional block move instruction provides for contiguous block moves as well as block copying of either nonzero bytes of data only or zero bytes only. Block move instructions can be used to provide graphics operation such as text manipulation, windowing, panning, scrolling and screen updating.

Cycle redundancy checking instructions are available for use on arbitrary length serial data streams, to provide error detection where data integrity is critical. Another feature of the T800 useful for pattern recognition, is the facility to count bits set in a word.

The T800 can directly access a linear access space of 4 gigabytes. The 32-bit-wide memory interface uses multiplexed data and address lines and provides a data rate of up to 4 bytes every 100 nanoseconds (40 million bytes/sec.) for a 30 MHz device. A configurable memory controller provides all timing, control and memory refresh signals for a wide variety of mixed memory systems.

Meiko has based its product line of what they have termed "Computing Surfaces" - which are supercomputers - on the transputer. The company began sales in 1986 and had sold 130 systems by September 1987.

The Computing Surface is a highly parallel, flexible, extensible concurrent supercomputer. Beginning in 1979 the co-founders participated in a team of developers at INMOS which concluded that the communication of sequential processes, as suggested by Professor Hoare at Oxford University, offered the best model for matching computation and communication with integrity. This work led to the T800 transputer and the OCCAM programming language. The Meiko founders were managers in the design group responsible for the transputer and its peripherals. In developing the transputer, a CAD system with over 200,000 lines of code and customized workstations was created and supported by the team. This knowledge provided a basis for developing the Computing Surface at Meiko.

Meiko did, indeed, develop a very fast supercomputer with flexible user-determined topology. It is composed of modular subsystems that permit optimization of "compute", "store", and "input/output" to particular classes of application together with straightforward software and tools essential for programming this class of machine.

Various approaches to the use of the Computing Surface are possible. Since every standard transputer is a significant computer by itself the Computing Surface can be treated as a multitask environment with a separate, independent task per computing element. An example is a numerically intensive simulation. Often, many simulations have to be performed on the same data set, but with different starting or operating conditions. The set of simulations is the overall task, but conventionally the performance of an individual simulation is measured and optimized. Performing each one of the set of simulations simultaneously with the others, with no interaction between them, leads to a linear decrease in elapsed time.

The other extreme is the truly distributed implementation, involving a fresh look at the problem, or tackling a problem which was previously looked upon as unfeasible with conventional computers.

A Computing Surface is formed by networking many computing elements in an applications-specific topology. Each computing element is a self-sufficient, independent hardware process, with processor, memory and high-speed point-to-point communications channels.

In the Computing Surface users impart their own concepts to the machine, without the constraint of arbitrary choices by the developer. Thus, configurations can be optimized for the applications.

The support infrastructure can detect hardware or run-time errors in any individual computing equipment and perform an immediate analysis. A problem is pinpointed by positioning the program source editor at the offending line of code and naming the process instance in which it has occurred. Application diagnostic messages are assured of a guaranteed route to the console or host computer using a communications structure which is independent of, and orthogonal to, the configurable network.

Software is used to specify the machine as well as the application program. OCCAM specifies connections, communications, and computations in one consistent formally based notation. The transputer was designed to implement the OCCAM model and execute OCCAM code. The Computing Surface was designed to deliver transputers and to support application development.

The Computing Surface can also be programmed in Fortran, C, Pascal, and other languages. Often, existing programs can be run on the Computing Surface without alterations. Executing such programs requires an OCCAM harness to handle communication with other processors, which may be executing copies of the same program.

Physically, a Computing Surface is contained in one or more modules. Connectivity allows the same level of interconnection between computing elements in separate modules as within the same module. The modules come in two sizes:

1. The M40 Computing Surface Module yields 1.1 billion instructions per second with 42 megabytes of concurrently accessed dynamic RAM. The effective bandwidth of the store is 24 gigabytes per second, with a peak bandwidth of 9 gigabytes per second to 300 kilobytes of closely coupled static RAM. An arbitrary number of modules can be used together.

2. A smaller desktop module, the M10, can deliver 250 million instructions per second and provides a compatible personal supercomputer for workstation or development use.

In a single pipeline of processors when the time to perform the computation on a subproblem is less than the time taken to receive the operands or transmit the results, the performance-limiting factor becomes the communications bandwidth. Adding extra processors to the pipeline will not increase throughput. The solution is to construct several pipelines in parallel, each dealing with independent segments of the problem.

The throughput of a pipeline is limited by the throughput of the slowest element; therefore, full use of all the processors can only be achieved when all are performing tasks of the same duration. Computing must be allowed to proceed at all times in order to fully use all processors in a system. In the Computing Surface, once an external communication has been initiated by the processor, it is free to continue execution of another process while the link controls carry out the message passing, only stealing single memory cycles from the processor when a complete word of the message is passed between link and store. This requires stealing one memory cycle in 160 in the Computing Surface in steady-state operation. However, startup costs and variable message size must be considered. For small message size the fixed cost of startup becomes dominant. If the message size is increased to amortize the startup costs, the time to flow a message through a processor is correspondingly increased. This requires that the processor be given a more lengthy and difficult task to ensure it is kept busy.

In the extreme it appears that one makes best use of a Computing Surface when its processors engage in no communication at all, thus allowing full use. This results in a style of use called "the processor farm". The idea is to engage each processor in an independently computed part of the entire process.

In ray tracing, each pixel in a scene is rendered by tracing rays from a point on the emulsion of a film in an imaginary camera through the lens and out into the world. More rays are traced to determine the appearance of any surfaces that the original ray may have hit. Sequential ray-tracing algorithms do not usually care about the order in which pixels are calculated, as all ray scene intersections have to be recomputed pixel by pixel. The natual implementation on a Computing Surface is to replicate both a standard sequential ray-tracing algorithm and the world model it will be tracing over all the processors of the system. Each processor can then be assigned a subset of pixels which make up a frame and can proceed with rendering them independently.

To balance the load the user should divide the scene into many more portions than there are processors and should use a load-balancing task server to distribute tasks to processors which have finished a previous task. Such a scheme has been implemented on a system with over 300 processors, and performance remained linear with the number of processors.

A Computing Surface can provide a system throughput proportional to the number of processors from which it is composed. The simplest method both of programing and of guaranteeing full use is to replicate sequential programs over all the processors, thus increasing throughput but keeping single task latency constant. However, with suitable attention to the ratio of computing to communications and the size of messages, and by programing with the intention of minimizing the extent to which algorithms are divided between processors, single task latency can also be reduced while still providing full use of all processors. (Source: European Science News, February 1988)

MACWorld '88 raises profile of Apple in engineering and scientific markets

Recent years have seen an escalation of the "MIPS Wars" between the makers of engineering workstations to provide more and more raw power expressed in "millions of instructions per second". But, side by side with this development, it is claimed that personal computers are outnumbering the more expensive workstations on the engineer's bench and scientific laboratory.

There are about 3.1 million technical professionals making up the engineering/scientific market in the United States, according to the Department of Labour statistics. Only about 10 to 20 per cent of them currently use computers at work, but growth rates greater than the general computer market are already being seen.

According to a recent report from research firm, Dataquest, engineers spend less than 30 per cent of their work day on actual design or specialized engineering; the rest of the day, more than 50 per cent, is spent writing presentations and proposals, managing projects and budgets etc. It is not uncommon for professional engineers to have two machines on their desk - a workstation for design applications and a personal computer for general productivity.

Apple, of course, promotes the single platform solution, i.e., the ability to do engineering design and productivity applications on one computer and claims that this can be served by personal computers more effectively than by high-priced workstations. Some of the same features that made the Macintosh attractive in business markets - ease of learning and use, good graphics capabilities and a variety of integrated applications - are also important to technical professionals.

Apple claims the following features that put it ahead of its traditional rivals in the personal computer field: a powerful CPU - the Macintosh II running on the Motorola 68020 operating at 16 MHz includes a built-in Motorola 68881 floating point co-processor for heavy computation; graphics - high resolution, colour graphics for design and modelling that engineers demand of workstations; networking power - communications with other Macintoshes, MS-DOS personal computers, large systems common in engineering environments like the VAX and of any other systems are supported with the Macintosh II; a sophisticated operating system - Multifinder and Hyper-Card are claimed as major pluses here and, in addition, Macintosh II can allow the user to run MS-DOS with the addition of co-processor boards;

Open Architecture - the Macintosh II features the NuBus open architecture with six slots for custom expandability.

Almost coinciding with MACWorld Apple announced the availability of AutoCAD to run on the Macintosh II. The announcement was made in Chicago on 3 May where it was demonstrated for the first time at the AEC Systems Show. (Extracted from AMT, June/July 1988)

Amstrad takes corporate aim

Amstrad has unveiled a new range of PCs aimed at corporate users but chairman Alan Sugar admits that production plans are being disrupted by the continuing shortage of memory chips.

The Series 2000 range includes Intel 80286 and 80386 based models, but they will not be available until January next year. Amstrad has always prided itself on announcing products only when they are ready for shipment, but this time around chip availability is dictating delivery dates.

The system comes with four Mbytes of memory on the motherboard and has a 64 Kbyte RAM cache.

It costs 2,649 pounds sterling for a 65 Mbyte hard disc system with a mono display and 2,999 pounds for a colour display.

The four monitors available for the PC range will also be marketed separately ranging in price from 149 to 499 pounds sterling. Also new is the Amstrad LAN made by US company Corvus Systems which costs 399 pounds for a three-station starter kit, and the SM2400 modem for 249 pounds.

The new products will spearhead efforts to woo corporate customers, who have so far resisted Amstrad's charms. (Extracted from Computer Weekly, 22 September 1988)

ES2 silicon venture hailed as model for EC companies

If any company represents the new wave in European industry, it is probably European Silicon Structures.

Many industrialists have pointed to this computer chip-maker as a model for what European companies should become as the European Community prepares to end all of its internal trade barriers in 1992.

ES2, as European Silicon Structure is called, is one of the first Pan-European companies; it has set itself up as a business without a country to help attract customers from around the continent.

It is incorporated in Luxembourg and has its headquarters in Munich. Its research facilities are in Britain and its factory is in Rousset north of Marseille. The eight members of its board come from seven countries.

ES2 was the biggest venture capital start-up in European history when it was founded in 1985.

Analysts said ES2 is one of the rare European companies to have a technological edge on its American and Japanese competitors. The company uses an electron-beam machine to etch customers' circuit designs directly onto all of a computer chip's silicon wafers, often enabling it to deliver prototype chips in less than half the time and at less than half the price of its competitors.

ES2 has chosen English as its official language. It is one of the few companies to do its accounting in the European currency unit, which is based on a basket of currencies.

ES2 had revenue of $7 million last year and projects sales of $30 million next year. It hopes to obtain 20 per cent of the European semicustom chip market, which some analysts said would reach $2 billion by 1992.

ES2 seeks to reject the cosy old way of doing business in Europe, under which intensely nationalistic companies could rely upon one another and upon friendly government officials to fill their order books.

Executives are beginning to recognize that this way of doing business is becoming obsolete as Japanese and American competition intensifies and as the 12 European Community nations implement plans to end barriers to movement of goods, services, people and capital in 1992.

Mr. Grand-Clément, the chief executive of ES2, conceived the idea of forming the company after learning that 80 per cent of semicustom chips had production runs of fewer than 10,000. He also recognized that quick delivery was often essential for the companies that ordered the chips.

Most chips are made by the photo-mask process, which involves the added step of making what is similar to a photographic negative. This is used to etch the circuitry onto a chip. Mr. Grand-Clément's idea was to use an electron-beam machine to "direct write" designs onto silicon wafers.

Photo masks cost about $2,000 each and the process often costs about $40,000 to make 1,000 chips. Making that quantity by direct-write costs about $10,000.

But Peter Mezger, vice president of the European operations of VLSI Technology Inc., the San José, California, company that is one of ES2's main competitors, said its rival's advantages would shrink. "If they have more business, their cycle time will get longer," he said.

ES2 executives have two electron-beam machines in their year-old factory in Rousset and have a third on order. The factory, filled with clean rooms and chip-testing devices, was built with seven vibration-proof bays to add more machines.

ES2 aims to keep its order books full by having marketing offices in the FRG, France, Britain, Sweden, the Netherlands and California. ES2 has just set up an American subsidiary, United Silicon Structures, or US2. (Extracted from International Herald Tribune, 5 August 1988)

Linking R&D computers to corporate IS

Historically the corporate research laboratory has always been totally segregated from other units within the corporation. Now, however, as companies find themselves required to make split-second responses to market currents, many are moving to crack open the previously isolated ivory tower's doors, tap the invaluable R&D data and pass it on to other company divisions - and even beyond.

Integrating research computing with other corporate information systems can be a tortuous process that has to overcome ingrained cultural differences. Nevertheless, progress at some leading

firms is increasingly apparent. At Marion Laboratories Inc. in Kansas City, Mo., for example, the formula for a new drug, along with engineering process control data, is passed directly from a computer in R&D to systems in manufacturing. In addition, because extensive testing is required before the product can be marketed, similar information is transferred directly to a database in sales and marketing. There, it is used to create educational materials for physicians who will be testing the drug.

At Federal-Mogul Corp., a Detroit auto parts manufacturer, R&D has developed an analysis program for main bearing performance. When one of the firm's automaker customers is designing a new engine, the quickest way to determine which bearing will work best is to transfer engine specifications, via the corporate mainframe, to Federal-Mogul's R&D laboratory, where the specifications are run through the analysis program.

Alan Porter, associate professor of industrial systems engineering at the Georgia Institute of Technology at Atlanta, is co-conductor of a 1986 survey that explored computer use in 158 US industrial R&D laboratories. The survey found that computer use has increased rapidly: in 1972, only 8 per cent of R&D professionals used computers; by 1984, the percentage had ballooned to 42 per cent; and, in 1986, it was up to 55 per cent, fuelled by the popularity of powerful pcs and workstations. Porter predicts that the next phase in R&D computer use will be "the creation of a computerized environment".

Judging from the attitudes of many R&D managers, however, any computerized R&D environment would have only limited connections to commercial IS. Seventy per cent of the R&D managers polled in the Georgia Tech. survey say R&D has control over its own computer operations. Most say they would prefer to keep it that way.

The reason R&D and commercial systems maintain their separate lives can be attributed to three basic differences: hardware, software, and cultural.

On the commercial side, the 370 architecture and its SNA architecture prevail, while on the scientific computing side, Digital Equipment Corp., Hewlett-Packard, and other vendors' minicomputers have predominated.

In the 1970s, while other user organizations tended to rely on IS for technical guidance, R&D, because it had the scientific wherewithal, tended to take responsibility for its own computer system. In the late 1970s and early 1980s, full-blown scientific computing networks grew up completely apart from corporate IS. With the dramatic increase in distributed computing resources, such as relational databases, more powerful workstations, and more easily transportable code, generic systems are now showing up in both environments.

In some respects, the sytems gap may have been little more than a manifestation of the enduring cultural difference between science and the "more corporate" side of US companies: accounting, sales, and marketing.

As with most cultural differences, this one has a rich history. For example, at Sun Refining and Marketing Co., Marcus Hook, Pa., Sheldon Thompson, director of applied R&D, recalls the days before the

Most Important Applications in Industrial R&D

Application	Percent of Mentions Each Survey Year						
	1974	1979	1982	1984	1986	Projected 1987	Projected 1991
Statistical Analysis of Data	25.5	25.6	21.1	21.1	15.7	11.7	4.2
Lab Automation/ Data Gathering/Process Control	13.3	17.2	16.3	19.7	17.8	16.3	13.5
Database Management, Storage, Retrieval	8.5	12.6	12.7	16.1	15.2	15.3	9.8
Modeling and Simulation	17.0	14.9	17.5	14.6	13.4	15.3	15.2
Scientific and Engineering Calculations	15.8	11.2	9.6	8.5	4.2	2.3	1.4
CAD/CAM/CAE	6.1	5.6	6.4	5.9	6.8	5.2	5.5
Professional Support	3.0	3.7	4.8	5.3	10.8	10.8	9.0
Graphics	2.4	1.9	4.0	4.4	6.3	5.9	3.8
Communications	0.0	0.9	0.4	2.1	3.4	7.2	6.9
Software Development/ Engineering	6.1	2.8	4.0	1.5	2.9	2.3	1.4
Artificial Intelligence/ Expert Systems	0.6	0.5	0.8	0.6	2.6	4.6	21.1
Hardware Development/ Supercomputer/Micros/Etc.	1.8	3.3	7.4	0.0	0.8	3.3	5.2
Robotics	0.0	0.0	0.0	0.0	0.3	0.0	3.5

Source: Research • Technology Management

department had its own DEC computer centre and had to rely on the corporate data centre in Dallas to run its number-crunching applications.

For the companies that have made impressive progress in closing the gap between IS and scientific research systems, the process has been slow.

E.I. du Pont de Nemours & Co. has always had three different computer sectors: an Information Systems Division (ISD); a Scientific and Technical Computing Division; and Engineering Computing, which oversees process automation and control. Since 1985, all three sectors have reported to the vice-president of technology.

Ray Cairns, head of ISD, was architect of the arrangement that merged the three computing sectors. As part of that effort, Cairns undertook to limit the diversity of computer architectures within the company, an effort that was only moderately successful in the early days.

For Marion Laboratories, the synergy that is developing between scientific and corporate systems began eight years ago with a technology transfer study with IBM that created a set of requirements for systems in the scientific computing area. As a result, Marion decided to have a separate IS organization in each of the following areas: sales and marketing, manufacturing, and R&D. Each divisional IS director reports to the head of the division, but has dotted-line reporting to corporate IS.

As part of the study, Marion identified the elements of its common corporate architecture: IBM mainframes, databases, and communications software. Each division can have indigenous software and hardware (R&D uses IBM and HP equipment) that need only be able to connect to the IBM mainframe.

Marion, like other companies trying to link R&D and corporate IS, still faces the problem of overcoming a resistance to interdivisional communication. ((Reprinted with permission of DATAMATION[r] magazine[c], 1 July 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

European electronics breaking a vicious circuit

Businessmen often assume that the old world is no good at selling new technology. This belief is particularly firmly held in electronics. Europe's sprawling companies seem unable to keep up with either the Americans or the Japanese. Pessimism seeps from results like those of Philips, Europe's largest electronics company, which followed two years of falling sales with earnings in the second quarter of this year 44 per cent lower than those in the first. In a recent report for Britain's national Economic Development Council, McKinsey, a firm of management consultants, questioned the very ability of the British electronics industry to survive. The OECD predicts that Western Europe will run a trade deficit in electronics of almost $30 billion by 1992.

In summer, three of Europe's giants, FRG's Siemens, Britain's General Electric Company (GEC) and Philips have announced big corporate reorganizations. The aim in all cases is to streamline product lines and to bring together disparate international operations. Flemings Research, a firm of British analysts, reckons that since 1987 companies with yearly sales of around $25 billion have been bought, sold or merged - over a tenth of the total annual value of the European market. One such deal is struck every two days. Such hectic activity hardly fits the picture of an industry in decline.

There are few reliable indicators with which to measure the industry's overall health. Studies which treat "electronics" as a single entity are vague. Products based on electrical circuits are sold in lots of markets, ranging from consumer electronics to defence. This complicates the assessment of Western European companies - many of which, like Siemens and GEC, have been cobbled together out of many smaller companies. They are more diverse than their American or Japanese counterparts.

Sir John Clarke, the chairman of Plessey, called McKinsey's criticisms "a monstrous travesty of the facts". Executives in other companies are talking about opportunities rather than retreat. Elsewhere, stockmarket analysts, long critical of the European electronics sector, are beginning to recommend it to investors. Such optimism is not only new, but, looking at electronics sector by sector, appears reasonably well founded.

Information technology is still dominated by American companies, particularly IBM and Digital Equipment. Datamation, a specialist magazine, analysed European sales by the top 25 electronics companies operating in Europe - including those owned in Japan and America. The European-owned members of that group are doing better. In 1985 they had only 37 per cent of European sales (measured in dollars), while last year they had 46 per cent of sales. Twelve of the top 25 companies in Western Europe were American in 1985. Last year that had dropped to nine.

Europe will benefit from the standardization of computers. Customers now demand that they can plug together computers made by different companies. New standards are being developed to permit this; as they become accepted, equipment made in one country will work in other countries too. Europe's computer market will no longer be Balkanized.

European companies' reliance on defence electronics, particularly in Britain, has rightly been blamed for much of their poor record.

Last September Ferranti, a British company, merged with International Signal & Control; that gave it markets in America and Italy. Plessey has cut its dependence on the British Government from 80 per cent of its defence revenue three years ago to 50 per cent now. Thomson-CSF, a French outfit which is the largest defence-electronics company in Europe, sold its loss-making medical-systems business to America's General Electric a year ago. It is already the world leader in air defence and air traffic-control, and wants to expand into new markets where it thinks it can excel.

Even more than defence contractors, telecoms suppliers are finding that tough times force desirable change. Once cosy suppliers to monopolies, they now have to compete for business internationally. Some medium-sized European firms have done well. According to analysts James Capel, orders for Ericsson's AXE telephone exchanges increased 54 per cent in 1987 and are already 20 per cent higher this year than in the first half of 1987. Britain's telecoms suppliers, though, show how hard life has become. GEC and Plessey have merged their telecoms businesses after years of squabbling. The new company, GPT, will probably have to find a partner if it is to stay in the market for public-telephone exchanges.

Analysts at Electronics International say that consumer electronics accounts for only 11 per cent of total European electronics sales. It is, however, the most visible sector of all, and the one where Japanese and South-East Asian companies seemed to have triumphed completely. There are three large European companies left - Philips, Thomson (the State-owned cousin of the defence company) and Finland's Nokia. Two of them are the world's top two makers of colour television sets, the single most valuable segment of the consumer-electronics market. Since Thomson bought the consumer-electronics bits of RCA from America's General Electric it has become the world's largest maker of colour television sets. It produced 7.3 million in 1987; Philips was second with 6.8 million.

While volumes may be high in this business, however, margins are low. Philips has been forced to defend its market share by cutting prices; this partly explains its disastrous recent results. The consumer electronics battle may gradually shift to a new product called high-definition television. Here the Europeans are a year or two behind Japan; the struggle ahead looks formidable.

Western Europe is weakest in the market for electronic components. According to Dataquest, a firm of analysts, the European semiconductor market is growing at about 30 per cent a year. This has not benefited West European producers. The growth has been fuelled by the demand for personal computers; these use memory chips imported from Japan and micro-processors from America.

Philips and Siemens have developed the latest generation of memory chips, but they arrived about a year too late. The experience they gained will help them in the manufacture of other chips, though their research cost enormous amounts of money. This leaves other makers like INMOS or Plessey; they have niche markets, but are badly in need of partners.

Understanding components is vital for designing the boxes into which they are slotted. Many Europeans echo American fears that, without the capacity to make semiconductors, such understanding will be lost. Britain's Amstrad, however, buys and assembles parts for its computers in East Asia; it makes no components, but that has not hurt it. Because it understands its market, its turnover is growing at about 20 per cent a year. (Source: The Economist, 6 August 1988)

IV. APPLICATIONS

New 10 W output GaAs IC for microwave communications

Toshiba Corporation has developed a new gallium-arsenide (GaAs) IC for microwave communications that features the world's largest output of 10 W, and has started distributing samples of this IC. It applies the company's 0.5-micron fine etching technology and mounts 200 elements on a single chip. The IC is available in six types working in the frequency ranges of 8.5~14.5 GHz.

Microwave communications systems and radar systems have recently come to use GaAs field effect transistors (FETs) which enable system miniaturization and performance upgrading in place of the conventional type travelling wave tubes, but the development of FETs with larger outputs is needed to enable working in higher frequency bands.

The new GaAs IC chip arranges and operates 200 FET elements consisting of source, drain and gate electrodes in parallel to obtain a high output of 5 W, and by using two of these chips in combination provides the world's highest output of 10 W. Also, by incorporating an impedance matching circuit that regulates the input signal voltage and current ratio, it eliminates the need to provide a matching circuit externally.

With this IC chip, the layer thicknesses are made uniform by applying ion-implantation, while the conditions themselves for ion-implantation are optimized, and the direct etching by electron beam is adopted to form gate electrodes on the wafer at an accuracy of 0.5 $\pm$ 0.06 micron. As a result, the chip's output characteristics are very uniform, output is obtained with minimal loss and high-frequency operation is possible. (Source: JETRO, September 1988)

A friendly supercomputer

While most manufacturers depend on advanced semiconductors to give them a millisecond advantage in the competitive supercomputer market, Edmonton-based Myrias Research Corporation has taken a different approach. Instead of relying on a new chip to divert computations into parallel streams, the Myrias supercomputer sports revolutionary software - a new memory model and language invention. The result is a machine that rivals its competitors in both price and performance.

In the Myrias system, processing power is supplied by 10 MHz Motorola 68020 processors, the same chip as in an Apple Macintosh. The processors and their communication system are attached to a Sun Microsystems computer which runs a distributed form of UNIX as its operating system.

Whereas most supercomputer users must learn a special programming language, a Myrias computer can be programmed in either Fortran or C, with one extension specific to parallel programming. The extension is called "parallel do" or "pardo". Pardo invokes independent parallel tasks and manages the memory states of those tasks.

More specifically, parallel tasks are created - one for each iteration of the pardo. These newly created tasks are called "child tasks". While the child tasks are being completed, the parent task (the task that executed the pardo) is suspended. Each child task inherits the parent's memory and cannot affect the memory of any of its siblings. When the child tasks are complete, their memory states are merged, forming the new memory of the parent task, which can then resume its computations.

The pardo extension is the last contact the programmer has with controlling the supercomputer. The execution of parallel programs is not handled by the user, but by a software construct called the control mechanism. This mechanism implements all functions required by the pardo. It manages tasks, address space and memory. Consequently, the control mechanism relieves the programmer of the task of writing explicit directions aimed at, for example, balancing the load on processors or ensuring that enough memory is always available. The control mechanism also plays a part in the scalability of the Myrias system. Myrias computers contain from 64 to 512 processors; the control mechanism manages the resources of the system so that whatever the number of processors in a particular model, programs need not be recoded or re-compiled.

The control mechanism was the brainchild of four Edmontonians who met on an informal basis. By the time Myrias was incorporated in 1983, the four had a skeleton outline of the mechanism. Serious technical problems were solved by early 1984.

Myrias president Kenneth Gordon says low hardware cost was one of the major reasons for choosing off-the-shelf components. The use of conventional semiconductors also avoided the need for refrigeration.

The Myrias system is on sale now, with the first delivery date in 1989. The company will release a detailed list of prices and delivery dates later this year.

The "first few" computers will be built by Technology Marketing, a California company. However, by 1989 Myrias plans to have its hardware built in Canada. Marketing is aimed at the traditional supercomputer application areas: structural analysis, signal processing, fluid dynamics, simulation, computational chemistry and research in mathematics and physics. (Source: Canadian Research, June 1988)

Personal neuro-computer

NEC Corporation has commercialized a personal neuro-computer that utilizes a neural network and has announced it will start marketing the computer through NEC Overseas Marketing, Ltd. from December this year. Employing this neuro-computer reportedly enables character recognition systems, self-learning expert systems, speech recognition/synthesizing systems, robot control systems and other systems to be developed in about one tenth the time normally required.

The computer industry is presently conducting intensive research to commercialize neuro-computers which are expected to supersede the existing von Neumann-type computers in the future. NEC Corporation has now come out with the very first version of this new type of computer.

The new neuro-computer uses a neuro-engine board and a personal computer and mounts back propagation learning algorithm network software. Its maximum number of neurons (actually the number of semiconductor memories) runs up to 82,000, its number of linkages between neurons to 246,000 and its maximum processing speed to 216,000 links/sec (the learning capacity per second). Meanwhile, its arithmetic processing performance is about the same as that of existing minicomputers.

Neuron processing demands the use of a neuro-engine board that superposes incoming information and performs high-speed arithmetic processing until the correct answer is obtained and a neural network software that controls the overall processing function. The neuro-engine board itself is connected to the PC9801 personal computer.

The neural network software can be constructed flexibly according to its application. At present, NEC is engaged in the development of a numerals/characters recognition system as a concrete example of a personal neuro-computer system, which features a recognition ratio of 99.95 per cent in case of 76 characters and 12 fonts. (Source: JETRO, September 1988)

High-performance single-chip microcomputer

Hitachi Ltd. has developed an original single-chip microcomputer H8/532 that features a minimal instruction time of 200 nsec and has started distributing samples of the microcomputer.

This is a high-performance single-chip microcomputer with an original architecture and was developed with the aim of coming out with a high-speed central processing unit (CPU); improving execution speeds of sophisticated languages such as C-language and materializing a zero turn-around-time (ZTAT) concept to enable user read-in of programs.

The microcomputer was commercialized through the introduction of a 1.3-micron processing technology and the sophistication of the command enforcement function. It features a faster processing speed than other company's existing 16-bit single-chip microcomputers and, as compared with the company's 8-bit microcomputers, its addition/subtraction speed is 6.5 times faster, its multiplication speed 13 times faster, and its division speed about 100 times faster.

This single-chip microcomputer is ideal for high-performance control equipment, including control of servomotors, electronic musical instruments, hard disks and automobile engines. Further details available from Hitachi Ltd., Public Relations Secretary's Office, 6 Kanda-Surugadai 4-chome, Chiyodaku, Tokyo. (Source: JETRO, September 1988)

Token-ring system interface chip in PQFP

Texas Instruments has introduced the TMS380, a token-ring system interface chip in a plastic quad flat pack (PQFP). The PQFP is a surface-mount package that was developed as an inexpensive surface-mount option to ceramic pin-grid arrays for 84 or more pins. TI intends to implement the 25 million PQFP in future token-ring products and certain ASIC and VLSI devices. Several major vendors including Intel, Motorola and AT&T Technologies endorse the device, which has been accepted by the Joint Electron Device Engineering Council and may become an industry standard. (Extracted from Electrical Engineering Technology, 29 August 1988)

Molecular graphics

The production of three-dimensional graphical representations for molecular structures by computer methods arose from the need to display visually the information obtained from crystallographic studies on chemicals and biological macromolecules. It was logical, therefore, that computer graphics packages, such as ORTEP, PLUTO and more recently, FRODO, were closely linked with the results of crystallographic analysis, and relied on atomic co-ordinates as input data. Necessity gave rise to considerable enhancements in computing power and speed such that by the end of the last decade, even complex molecular structures could be manipulated in real-time by high-resolution graphics terminals.

Since then the revolution in CAD/CAM in many industries, including the chemical industry, has given rise to the current state of affairs where there are a number of integrated molecular modelling packages available either commercially, "in-house" or in academic institutions for the combined building, minimizing, real-time manipulation and display of molecules in colour and 3-D with built-in

interfaces to MO methods of electronic structure calculations and also to an extensive range of on-line databases for information storage and retrieval. The currently available packages, such as Chem-X, Sybyl and Mendyl, Charmm, COSMIC and ASTRAL, comprise not only suites of integrated programs but they are also interactive, thus enabling the user to exercise a reasonable degree of control at stages of a particular computational process.

The appearance of molecular graphics systems has had a major impact on the pharmaceutical and other fine chemical industries. Computer modelling can assist in the design and development of new drugs, agrochemicals, flavourings and perfumes, etc., to such an extent that many of the large chemical companies world-wide have invested in fairly substantial computer graphics installations. Although there is still a certain degree of scepticism about the use of computers and an unfounded concern over possible job losses, such systems are relatively inexpensive in terms of hardware and software so that the major companies will be realising a substantial return on their capital investment in terms of world-wide sales of new chemicals which have been developed using computer modelling techniques.

However, computers are not a substitute for ideas or expertise and it is, as yet, not possible to design, for example, a new drug by computer, though one can certainly use a molecular graphics system to test out ideas on novel rational design of chemicals. For companies embarking on such ventures there has to be a certain degree of caution exercised in, first of all, choosing a particular computer graphics system, as these differ in user-friendliness, speed and in the ability to expand in order to keep up with new developments; and also, one should be aware of the strengths and limitations of the software in handling specific modelling tasks.

To a substantial degree the potential utility of such computer modelling studies is dependent upon the skill and experience of the user, as the pitfalls are numerous and erroneous results can be obtained if sufficient care is not exercised. However, in some instances, there are no pat answers to questions such as "which of the possible conformations of molecule A is the right one for the receptor interaction?". Although conformational analysis can show both local and global minima and take into account the effects of solvation and alteration in the dielectric constant, complete conformational studies would have to involve consideration of results from, for example, NMR and crystal data, in addition to any other probes of molecular structure.

Receptor docking studies would appear to be the direction that most computer modelling in the field of molecular design is heading at the moment. However, the complex and lengthy minimization that such work involves puts a considerable demand on computer time and on their ability to deal with the manipulation of large molecular assemblies. These investigations are especially time-consuming when only the primary amino acid sequence data is known, rather than those instances where the crystal structure of the appropriate biological macromolecule has been determined. Nevertheless, workstations offering the facility of local manipulations and/or knowledge-based conformation analysis considerably reduce the demand on computing time for this type of work. (Extracted from Manufacturing Chemist, August 1988)

IS: the best medicine for drug monitoring

On average, each American this year will come into contact with three prescription drugs. Add to that the countless over-the-counter substances, such as aspirin and alcohol, plus the roster of illegal drugs, and a maze of harmful - sometimes deadly - interactions can result.

"No drug is without side-effects," says Janet Arrowsmith, an epidemiologist with the Food and Drug Administration. Drugs are designed to cause reactions. It is when a reaction is unexpected that Arrowsmith and others become concerned.

Such was the response this past April when it was brought to public attention that Accutane, the acne medicine manufactured by Hoffmann-La Roche Inc., based in Nutley, N.J., was related to 62 documented cases of severe birth defects.

The task of monitoring such drugs is assuming monumental proportions. Approximately 55,000 adverse reaction reports will be filed with the FDA this year, 50 per cent more than were filed some two to three years ago.

Catching problems before a pharmaceutical is mass marketed - or even afterward - is a big task for agencies charged with protecting public health and for manufacturers who fear liability claims that conceivably could destroy their companies. To help with this task, many varieties of computer technology are increasingly being applied at hospitals, pharmacies, insurance companies, government agencies, and drug companies to facilitate access to medical databases that are vital to lives and company reputations.

The sooner problems are diagnosed, the sooner drugs can be re-labelled, withdrawn, or cleared of alleged ill effects. While a drug rarely is pulled from the market, a couple of times a month the FDA does re-label drugs to list new precautions and usage instructions.

The hope behind the use of these new systems is that public safety will be improved and that the slow and cumbersome government approval process all drugs must undergo before they can be marketed will be shortened considerably.

It is still too early to conclude that the systems now being implemented will address these safety and time issues successfully, but there is strong evidence indicating that they may. As is true of most systems development, however, a few hurdles, such as a lack of standardization, still must be cleared.

Probably the most significant system to attempt to meet those goals is an information technology exchange experiment called CANDA (computer assisted new drug applications) now under way between the FDA and major pharmaceutical makers. Another system to make side-effect information readily available is being designed in Rhode Island. There, an experiment is under way that potentially could chronicle residents' medical histories from cradle to grave - every visit to the drug store or the hospital, and every claim filed with Blue Cross/Blue Shield. The project is an attempt to see how effective prescription drugs are and how they interact when used in conjunction with each other.

That drug monitoring has become critical is partly due to more stringent FDA guidelines.

Another theory that is popular, if less provable, is that as people live longer they come into contact with more substances. Many of those substances, dubbed by some as designer drugs, are being created with the help of advanced computer-aided molecular modeling tools.

To bypass its budget crunch, the FDA is using computer equipment loaned by pharmaceutical manufacturers to permit on-line access into the companies' research databases, which include data on clinical trials or premarketing trials involving humans. A dozen companies are participating in this experiment in the hope that it will cut down the average two-year review process for new drug applications (NDAs). Without FDA approval, companies cannot legally market their products in the United States.

While the FDA is searching for ways to cope better with its increasing work load, there is another element. An FDA reviewer's worst fear is that he or she will fail to spot a problem before a drug is approved for general circulation. Being allowed to manipulate data on-line, rather than being restrained by paperwork, should help reduce that risk. (Extracted with permission of DATAMATION[r] magazine[C], 1 August 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Computer steadies the brain surgeon's knife

Brain surgeons in the US may soon have at their disposal a computerized system that allows them to see an image of a patient's brain before they operate. The system allows surgeons to "draw" their incision on an image of the patient's skull, then press a button and see the underlying folds of the brain. Another program allows them to see a cross-section of the brain at the point exposed, to check whether the tumour they want to remove is underneath.

David Levin, director of the magnetic resonance imaging centre at the University of Chicago, is developing the system with his colleagues. The team aims to provide a picture of the patient's brain on a screen which surgeons can view in the operating theatre. The video would allow a surgeon to look at the brain from any angle.

Such visual aids could make it much easier for surgeons to locate and remove a tumour while disturbing as little of the normal brain tissue as possible.

The most important feature of Levin's system is that it lets the surgeon relate the site of the tumour to the convoluted folds on the surface of the brain, known as gyri.

Levin's team generates the video images from magnetic resonance scans. Magnetic resonance imaging relies on the fact that the nuclei of some elements can be made to point in the same direction as a strong magnetic field. Hydrogen nuclei in the patient's body line up with the magnetic field produced by the scanner. If the patient is then exposed to radio waves of a given energy, these nuclei flip over so that they point in the opposite direction. When the operator turns off the magnetic field, the nuclei flip back, emitting energy in the process.

The scanner detects this energy and uses it to build up an image of the positions of protons in the brain. Different tissues in the body respond in varying ways to the radio waves.

Normally, when someone has a brain scan, doctors program the machine to take a series of "slices" through the brain. For the new imaging technique, however, the scanner excites the protons in the entire head, and gathers information about its internal structure in all three dimensions. This technique is known as "volumetric acquisition".

The scanning takes about 10 minutes. Levin and his colleagues then process the data and feed it into a computer made by Pixar, a Californian company which was founded to create special effects for the Star Wars films.

The Pixar assembles the three-dimensional image of the brain using a program that produces contours. These build up a picture of the brain, which can be made to rotate on the screen. The surgeon can then slow the picture down, or stop it and view it from different angles.

If all the information from the scan is sent to the Pixar, not just that from the brain tissue, the result is an image of the skin covering the head. The surgeon can then superimpose this image on that of the surface of the brain, "draw" the proposed hole in the skull, then view the brain beneath. By positioning a cursor on the screen, the surgeon can then ask the computer to display a scan of the brain at that particular point.

So far the team has looked at the brains of four volunteers and four patients. Before it is used in the operating theatre, the researchers want to evaluate the accuracy of the method. They intend to compare their images with the appearance of the patient's brain during the operation. Levin believes that at the university hospital, which has a very active neurosurgery unit, surgeons might use the technique about 100 times a year.

The method also has other applications. Levin and his colleagues have already produced images of tumours in people's limbs. Some parts of the body are more difficult to work with than the brain because movement of internal organs interferes with the scan.

The team is also working on producing "transparent" images. These show a pale version of the skin on the skull, wrapped around the image of the brain itself, on the computer screen. Another potential application is in medical education. (This first appeared in New Scientist, London, 21 July 1988, the weekly review of science and technology.)

Information technology and the handicapped

Information technology can allow disabled persons to contribute to companies, according to a campaign launched by the British Computer Society. A two-year project will attempt to further develop computer equipment for use by the handicapped. J. Sandhu of Newcastle Polytechnic has created a database on research in progress on the subject, software available and employment opportunities available for the handicapped. A database of technical aids for the handicapped will also be developed.

An example of the way computer systems can aid the handicapped is the Headstart System, based on an Apple Macintosh modified by Bit 32. Headstart uses a headset to allow a user to control a computer, even for making technical drawings, based on Doppler measurement of head movements. The system can be

used to control peripherals such as a telephone. (Extracted from New Scientist, London, 25 May 1988, the weekly review of science and technology)

Micro-chip medical record card

Millions of patients could be carrying their medical records around on pieces of plastic the size of credit-cards within a decade. The "smart" cards, each containing a micro-chip, could even be automatically translated into other languages if the patient were taken ill abroad. A 400,000 pound sterling study in Devon (UK) follows the apparent success of a smaller trial in Wales last year, where 2,500 patients had their basic medical history, allergies and the drugs they were taking recorded on smart cards. The European Economic Community is working towards community-wide machine-readable medical records, with the technology already in existence to allow a card written in English to come up on the machine reader in other languages. The cards will contain basic medical histories, details of prescriptions to be dispensed, recent drug records and allergies and will warn doctors if they prescribe medication which could interact with drugs the patient is taking. All diabetics in the area will also receive the card so their treatment can be recorded and other health care staff warned of their condition. However, for the cards to go into widespread use one will need easily portable terminals so GPs, health visitors, midwives and district nurses can use them in patients' homes and even perhaps so ambulance men can read them when they give emergency treatment on a call-out. (Extracted from The Independent, 28 April 1988)

Computers fa'l on deaf ears

The hearing aid, long considered a simple sound magnifier for the deaf, has been quietly revolutionized by computerization, which has made it not only smaller, but smarter. The bulky device attached to the ear and wired to a control box the size of a cigarette pack is steadily being replaced by minute, hard-to-see instruments tucked into the ear canal. They either adjust themselves to various frequencies or respond to commands from wireless transmitters as small as credit cards. One in 10 people have some form of hearing problem. These problems become more common with age, affecting one in four over 65: 500,000 devices were sold in Britain last year and 1.2 million in America, where the market is growing 6 per cent a year. As the population ages, more people will need auditory augmentation. These new sufferers are affluent and demand the latest technology to reduce the size of the hearing aids and increase their effectiveness. Nearly invisible devices not only amplify wanted sounds, but include sophisticated noise-suppression features that filter out distracting background sounds, such as traffic and crowd noises. And with a credit-card-sized remote control, one can adjust the volume, or switch off the microphone to use a special device for telephone conversations. This new technology is a far cry from the traditional view of a hearing aid as a tiny microphone connected to a simple loundspeaker stuck in the ear. Its key feature is its ability to distinguish sound frequencies so that some can be amplified and others suppressed so that users can accomplish the purpose most give for using the devices - hearing conversations. (Extracted from The Sunday Times, 13 March 1988)

BASF targets reusable disks

BASF's Computer Systems and Media division could begin commercial manufacture of reusable optical computer disks at its Ludwigshafen complex next year. The company has set up a pilot plant manufacturing 5 1/4 in. and 3 1/2 in. disks holding up to 512 Mbytes in a reusable magneto-optical format. It has also set up an experimental line for WORM (write once, read many) disks but neither will go commercial unless BASF sees signs of volume.

Dr. Karl Uhl, the division's director, claimed that the computer industry had yet to develop a way which allowed potential customers to transfer their paper and drawings into a form which a computer could recognize by content. Security was another major consideration.

The BASF reusable optical technology is based on a product which looks like a compact disc. A splutter deposition process is used to place a magnetic film of rare earth metals onto a plastic disc.

The write laser beam acting together with a magnetic field causes local heating and subsequent magnetization in the film.

The local magnetization causes a corresponding change in the local optical properties. The optical pattern of disturbance is read by a laser beam in a similar manner to a compact disc.

The WORM disks use a dye coating on a plastic platter. The write laser beam removes the coating in a sequence corresponding to the data pattern.

The read laser simply looks for patches of missing dye. The spin coating system used in BASF's WORM disk has inherently low production costs, much lower than the reusable system although the company would not speculate on the selling price of either product. (Source: Electronics Weekly, 29 June 1988)

ECL gate arrays have high toggle

The constant need for high-speed logic in high-capacity telecommunication systems and fast data capture in a new generation of instrumentation has prompted NEC to offer ECL gate arrays with a typical toggle frequency of 2.1 GHz.

Gate delays are typically 100 ps for both μPB6303 and μPB6312 which offer respective gate counts of approximately 600 and 1,200. NEC guarantees output buffer frequencies of up to 600 MHz. Power dissipation is typically 3.7 mW per internal gate/input buffer and 43 mW per output buffer for ECL-10 KH interface. All I/O buffers have ECL-100 K or ECL-10 KH signal level capability.

The ECL-4 family is supported by a library of 72 macros which includes many complex functions. Typical of these is a single cell macro that provides a ladder function that would normally require up to 20 gates.

The family is available in 72- or 132-pin ceramic pin grid array packages with integral heatsinks.

ASIC design support for the ECL-4 array family is available for Daisy, Mentor and HILO workstations. (Source: Electronics Weekly, 22 June 1988)

High-sensitivity CCD linear image sensor

Toshiba Corporation, in order to cope with the rapidly increasing demands for charge-coupled device (CCD) image sensors for use in facsimile devices or image scanners, has commercialized a new series of CCD linear image sensors which enable analog circuits (previously mounted externally) to be

mounted on a single chip. Moreover, reducing the dark current has enabled the readout sensitivity to be increased by about five times. The company has started distributing samples of these CCD linear image sensors.

Two types of sensors have been commercialized: the TCD132D series sensors for handy scanners, which mount the external circuits on a single chip and enable miniaturization of equipment, and the TCD142D and TCD143D series sensors for facsimile image scanners, which adopt the implanted photodiode.

The company applied complementary metal oxide semiconductor (CMOS) process technology which improved the basic characteristics substantially through a simplification of the peripheral circuits of the devices and a reduction of dark current.

Further details available from Toshiba Corporation, Public Communications Office, 1-1, Shibaura 1-chome, Minato-ku, Tokyo. (Source: JETRO, June 1988)

GD & T computer integration

Valisys (Santa Clara, CA) has been able to unite the geometric dimensioning and tolerance (GD & T) Y14.5 standard into CAD database software and link it to production and inspection. Its Valisys production software modules operate in conjunction with Unigraphics II, a McDonnell Douglas mechanical CAD/CAM system. The software makes sure designers rightly use GD & T symbols to show design intent. Once the design has been corroborated, the GD & T data are offered throughout the process as "Softgauges", which are graphic models showing worst-case mating parts and degrees of design-tolerancing freedom. Softgauges are used to optimize designs for assembly, to orient machining paths, to produce and execute inspection paths, for final quality experimentation and accept/reject determination, and as a basis for statistical process control on the right fit of finished parts. The result of the GD & T-based computer integrating is major improvements in productivity in design, production, inspection, and rework, and on product quality. (Extracted from Tooling Products, September 1988)

Internal programless computer

Casio Computer (Japan) will introduce a computer that runs without an internal program in October 1988. The data being input reportedly incorporates a function that makes the machine work. Conventional von Neumann computers require an operating system and an applications program. The new Casio automatic data processing system (ADPS) can file or process data on its own. (Extracted from Japan Economic Journal, 27 August 1988)

New computer network design

Fujitsu has developed a new computer network design concept that would allow computers from various makers to communicate with each other. Fujitsu's design is based on the International Standards Organization's Open Systems Interconnection (OSI) protocol. Fujitsu plans to adopt OSI for all its computers (personal computers to mainframes) with its Fujitsu Network Architecture 5 (FNA5). Fujitsu will also distribute software such as file transfer, access and management and message handling programs for use with the OSI standards. Hitachi and NEC are also developing OSI for their computers. (Extracted from Japan Chemicals, 25 August 1988)

Spatial light modulation tube for optical information processing

Hamamatsu Photonics K.K. has come out with a "microchannel spatial light modulator (MSLM)" usable for research on various kinds of optical information processing systems such as optical neuro-computers and pattern recognition systems. The company has started distributing samples of the modulation tube.

The tube is for converting images consisting of ordinary light (incoherent light) into images consisting of coherent light that has uniform phases and is capable of causing interference, which is employed primarily in research on the parallel processing of optical information.

With the conventional method of image processing, an image input with a TV camera is resolved into about 300,000 picture elements and processed sequentially with a computer. In contrast, with the newly developed modulation tube, the input image can be processed in a parallel stroke with an electronic tube or with an optical system subsequent to readout. This method enables indistinct information to be processed with ease and permits patterns to be recognized and processed by a method similar to that of a human being.

This modulation tube consists essentially of a photoelectric plane, microchannel plate (MCP = electron multiplier), mesh-type electrode and photoelectric crystal. The optical image passing through this tube (image created by light intensity differences) is irradiated with a polarized laser beam from the opposite side and converted into an image consisting of polarized light quantity differences, then further passed through a polarized light plate to obtain an image created by light intensity differences. The resolution is 200 picture elements X 200 picture elements. (Source: JETRO, June 1988)

CAD network for tailor-made cars

Nissan Motor will link its development and output bases in Japan, Europe and the US via a CAD network to develop cars tailored to customers' needs. Foreign bases will have access at once to data stored in Japan, helping them develop cars to suit their own markets, while their data will be sent directly into the main computers at the firm's technical centre in Atsugi, Japan. A usual CAD drawing that now takes one day or more to travel via air from Japan to the US and the UK will be sent in under 10 minutes via the computer network. Nissan said the on-line access to the Cray Research supercomputer at Atsugi will allow foreign engineers to implement wide-ranging analyses of such performance factors as car structures, collision phenomena, aerodynamics and combustion. (Extracted from Metalworking News, 1 August 1988)

New prototype unit

Zenith Data Systems has announced a prototype unit employing multiple 386 processors to yield mini-computer-like operation using standard personal computer know-how. Code-named Z-1000, the system incorporates dual-bus multiprocessor technology from Corollary (Irvine, CA) and an altered version of SCO Xenix, which assigns Unix tasks dynamically among two to six 386 CPUs. The floor-standing Z-1000 will support a greater number of Xenix/Unix users and LAN server capabilities than a single-processor 386 personal computer. Features include a fault-tolerant power supply system; accommodation for three full-height drives, two floppy or tape drives; and 32-bit slots for five additional cards, each of

which can hold a 386 and 387 processor operating at 3.2 MIPS. Beta testing of a commercial Zenith unit built around the multiple 386 scheme is planned for late 1988. Limited output is expected in the first quarter of 1989 and full production will begin by mid-1989. (Extracted from Information World, 22 August 1988)

New standard architecture

Compaq Computer is jointly offering a new standard for a 32-bit AT-microcomputer bus architecture that rivals IBM's Micro Channel with Tandy, AST Research, Epson America, NEC, Zenith Data Systems, Olivetti USA, Wyse Technology, and Hewlett-Packard. Other supporters of the "Extended Industry Standard Architecture" (EISA), which will officially be introduced in September 1988, include Microsoft and Intel. The Micro Channel is not compatible with AT-bus add-on boards, while the Compaq group's architecture is. In addition, the IBM competitor does not require licence fees. The success of the new standard architecture will depend on marketing, not technical issues because certain Micro Channel features have not yet been used for specific applications. (Extracted from MIS Week, 12 September 1988)

New facsimile series

Matsushita Graphic Communication Systems' (Japan) new UF82 series of facsimiles can transmit a normal sized document in just 6 seconds. They use a 14.4 kbps modem. Unlike conventional facsimiles, they can produce documents on plain as well as thermal paper. The UF82 series can receive a transmission while occupied and store it until the first job is completed. (Extracted from Asian Wall Street Journal, 29 August 1988)

Data from fax machines for computer use

British Telecom and Mercury are each attempting to adapt data from fax machines for computer use. The result would be a system enabling anyone with a fax machine to send a picture to appear on the screen of a recipient's personal computer. It is already possible to send data from a computer to a fax machine. But sending data from a fax machine to a computer is now impossible, since the two systems use incompatible digital coding techniques. It is more difficult to convert the dot matrix used by a fax machine to computer words than vice versa. (Extracted from New Scientist, London, 2 June 1988, the weekly review of science and technology)

New hard drives

Storage Dimensions (San José, CA) has introduced two new 5.25-in., plug-and-play hard drives that can store up to 651 Mbytes of information, the highest capacity to date. The new SpeedStor AT650E is targeted at complex applications such as computer-aided design and engineering (CAD/CAE) and image processing, while the new LANStor LAN 650E is designed for use on Novell NetWare servers. Both drives are built around parent Maxtor's (San José) 760-Mbyte, unformatted XT8760E drive. Other manufacturers planning to announce high-capacity hard drives include Control Data (CDC) (Minneapolis, MN), Micropolis (Chatsworth, CA), and Miniscribe (Longmont, CO). (Extracted from PC Week, 29 August 1988)

New laptop series

Compaq Computer (Houston, TX) will introduce a new series of battery-powered laptops in late 1988. The new 15-17-lb machines, which feature a clamshell design, come in two configurations: a 12-MHz Intel 80286 microprocessor-based model, and an Intel 16-bit 386SX processor-based model. Both models include 640-Kbytes of memory, a 720-Kbyte, 3.5 in. floppy disk, a hard disk with a minimum 20-Mbyte capacity, and a black-on-white LCD that provides a VGA resolution of 640 x 480 pixels. Options include larger-capacity hard disks and a separate expansion chassis. (Extracted from PC Week, 29 August 1988)

Printer for pocket-sized WP

Casio Computer's (Japan) new Casio Handwriter HW-11 pocket-sized word processor has a hand-guided printer that is about as big as a computer mouse. The printer and word processor are connected by wire. According to Casio, the Handwriter HW-11 was developed to print words in small areas. It prints in Japanese and English, and can even be used as an address book. Its RAM card (sold separately) can hold 16 K-bytes of data. The HW-11 with printer weighs nearly 15 oz. and production will begin in September 1988 at a rate of 25,000 units per month. (Extracted from Asian Wall Street Journal, 29 August 1988)

Insert moulding in 3-D circuits

A use for insert moulding is in the emerging 3-D circuit fabrication technology, according to R.W. Grandle of Tricon Industries. Moulded circuits have advantages against laminated circuit boards, which are prone to warpage and shrinkage, in processing and in the auto operating sector. Insert moulded circuits can transfer high current levels alongside signal level currents with little separation for fairly high circuit density. Insert moulding is a cost-effective alternative to assembly for making electrical connectors, switches and circuit devices. (Extracted from Design News, 6 June 1988)

Optical LAN system with 400 Mbit/sec transmission capacity

NEC Corporation has started marketing a newly commercialized optical LAN (local area network) system with a transmission capacity of 400 Mbit/sec. It is a large-scale system capable of playing the role of a backbone LAN system for interlinking independent communications networks installed on the respective floors of factories and high-rise buildings, and is being marketed for introduction into the factories of large enterprises and intelligent buildings.

The newly commercialized "C&C NETLOOP6560" LAN system essentially consists of a looped fibre optic cable system and various other systems for linking to the cable system, such as a loop master (network control system), submaster (auxiliary control system), loop slave (multiplexing) system and network management/control system.

Various kinds of small-scale LAN systems and simple radio systems can be linked together via the loop slave system to comprise a large-scale intra-corporate information communications network. The system can connect up to a maximum of 64 terminals, with a maximum terminal spacing of 10 km.

TV Conference information systems involve signal transmission of about 100 Mbit/sec and the signals are normally compounded with a code duplication system for transmission. However, since this optical LAN system has a transmission capacity of 400 Mbit/sec, one of its distinct features is that the signals can be transmitted both ways without any

special processing. Further details may be obtained from NEC Corporation, Public Relations Office, 33-1, Shiba 5-chome, Minato-ku, Tokyo. Tel: 03-454-1111. Telex: TOK J 22686. (Source: JETRO, August 1988)

New fingerprint scanner

Identix (Palo Alto, CA) has introduced a new fingerprint scanner to improve the security of data stored on personal computers. The new TouchSafe, which is comparable in size to a computer mouse, is available in both internal and stand-alone models. Targeted at accounting firms, bankers, doctors and educational institutions, the new scanner allows only authorized users to access a computer. Fingerprint scanners make up nearly 67 per cent of the "biometric-access control" market, which consists of eye scanning, signature verification, voice recognition and other biometric security technologies. (Extracted from High Technology Business, July 1988)

Electronic apple takes a ride to market

Researchers at the University of Michigan have produced the world's first computer shaped like an apple. Roland Zapp, a professor of electrical engineering, and Galen Brown, from the US Department of Agriculture, designed the apple to travel with fruit on the way to market and record any bumps and bruises as it goes.

The apple, or "impact detector device", consists of a computer powered by a battery and enclosed in a hard beeswax shell. It also contains a single piezo-electric crystal, which senses impacts along all three axes. It sends these signals to a processor chip where they are logged and timed, then sent to a memory chip inside the apple.

At the end of its journey, the data are loaded into a personal computer which produces a graph showing the time, force and direction of any impacts the apple has suffered. The apple is about 9 centimetres in diameter and its battery lasts for six hours before it needs recharging.

Zapp is working on a new model, which will be able to measure and record temperature. This new version will be just 5 centimetres in diameter, with a custom-made chip from the university. This chip will use so much less current that the battery should last for days or weeks.

The ultimate goal is to have a sphere that can be shipped internationally, but this will need at least four weeks of battery life.

All work to date has been with apples but the next target is potatoes. A smaller sphere will be buried in the field with the potatoes, harvested mechanically and shipped to the processing plant.

Processors and growers of cucumbers, citrus fruits, tomatoes and peppers have shown interest in the project. But it could also help with inedible products. Businesses that ship china, glassware and medical equipment may want to license the technology, which has been patented by the university.

Brown says that initial experiments with the apple have found that bagging is the roughest part of the journey that the fruit makes from orchard to supermarket. (This first appeared in New Scientist, London, 4 August 1988, the weekly review of science and technology)

Single-chip LSI with multiparallel processing function

Matsushita Electric Industrial Co. Ltd., and Matsushita Electronics Corporation have jointly come out with a 16-bit processor available in an "MN6740 Series" that is designed for the first time with a multiparallel processing function as a single-chip LSI.

It is designed to control the structural parts of VTRs and other electronic equipment and since it incorporates functions equivalent to four conventional types of microcomputers it reduces the number of required components and improves the operability of various kinds of electronic equipment.

Conventional von Neumann processors are designed to perform processing operations sequentially so their use for controlling several systems through high-speed, real-time processing has been difficult. By contrast, the newly developed processor contains three central processing units (CPUs) for servo-function sensing signals, servo-function output signals and mechanism control, and which together comprise the LSI's memory.

The two CPUs for servo-functions maintain a master-slave relationship, with the master CPU consigning a part of its work to the slave CPU whenever its load becomes excessive, which enables the master CPU to perform subsequent tasks without delay. Consequently, the LSI's efficiency is improved substantially.

With hardware designed for parallel processing, the LSI constitutes a multiprocessor that performs multiple controls equivalent to four microcomputers, or for single-chip system control, fine slow, tracking and motor control. In addition, this processor lends itself to performing controls provided with learning functions.

The company plans to commercialize a VTR unit incorporating this LSI processor next year. (Source: JETRO, August 1988)

Video will give users backup

Apple Macintosh and IBM PS2 users will soon be able to use standard video cassette recorders and video-tape to back up their computer data.

California-based Alpha Micro Systems is adding to its range of Videotrax products which convert computer data into video signals and back again.

The Videotrax system consists of a controller board and software for the Mac and PS2.

The system allows users to back up data via the video recorder onto standard cassette. These cassettes can subsequently be replayed on the video and converted back into digital data.

The technology is already available for Alpha Micro's own multiuser microcomputers and IBM-PCs and compatibles.

Alpha Micro claims the Videotrax storage system is cheaper and more reliable than streaming tape or floppy disc backup. (Source: Computer Weekly, 28 July 1988)

Brigades go online to share resources

The UK's 63 fire brigades are going online to an information system providing everything from fire-fighting research news to job vacancies.

The Fire Information National Data Service (Finds) will enable brigades to help each other more effectively during major incidents by showing details of equipment available around the country. It will also help cut the duplication of resources and research work among fire brigades by showing each brigade what is going on in other regions.

The service is based on a 32-bit Peanut IBM-type personal computer at Bradford University, which runs a viewdata system using the Themis data-base package from Datasolve. Each fire brigade has a terminal from UK supplier Tandata, which links to the central computer over dial-up lines.

The computer can serve eight lines but demand has already been so great that the university is installing a second machine.

Terminals are also installed at the Home Office, the Scottish Home and Health Department and the Fire Service College.

As well as providing central information services, the system can put brigades in touch with each other through electronic mail.

The system is expected to be extended to other emergency services later. (Source: Computer Weekly, 7 July 1988)

Computer-based workbench

ICI (UK) intends to develop a computer-based "workbench" for appraising the hazard and operability features of computer-based process control and safety shutdown systems. Computer-assisted CHAZOPs are expected to lower the life-cycle costs of safety-related computer control systems, enhance user confidence in the systems, and promote harmonization of standards and guidelines. ICI has submitted a EUREKA project proposal in association with TUV Norddeutschland and Adelard. (Extracted from Process Engineering, June 1988)

Lowering the cost of test and manufacturing

As a means of addressing the price/performance needs of today's test community, many test equipment manufacturers have developed more focused, less expensive versions of high performance systems. Also, test companies have engineered new systems with low cost as one of the foremost objectives.

This trend was especially evident at this year's Semicon/West, where Advantest, Megatest, Schlumberger, Trillium, Teradyne, and other test companies were touting "sub-engineered" versions of high performance systems introduced last year.

Of course, many smaller test companies, such as Axiom, EPRO and Semi-conductor Test Solutions, exhibited products targeted at production applications where cost concerns are almost equal to those of performance.

Although the industry is presently seeing an upturn, semiconductor test equipment buyers are reportedly cautious about buying performance that they do not need now but are likely to need in the near future. The ability to upgrade production systems to handle the faster more complex parts now on the drawing boards is often among their leading concerns when purchasing new systems.

The philosophy of test system development is, of course, dependent on the targeted applications, the development time and cost, and market conditions. In most cases, companies target a specific class of applications, then build into the system all the capabilities required to meet the needs of those applications. Since test systems often take years to develop, however, the system design may change to include new capabilities or incorporate new technology.

This approach has been successful because it meshes well with the way in which semiconductor devices are designed and manufactured, and the way in which test systems are designed and built. Semiconductor devices typically go through a design phase, where extensive test system capabilities are required to debug and characterize the device and develop test programs. Once these devices enter production, their test needs are well understood and much more limited test resources are required. Test systems generally go through a similar developmental process.

The current trend of initially targeting very high performance actually agrees with the instincts of many engineers.

No matter how strong the trend to low-cost systems gets, however, there will always be those who are pushing the leading edge in device development, and will require even greater performance in their test systems. For this reason, it is likely that even the highest performance systems available today will have successors with even greater performance.

It appears that the key to successful test system development is the ability to target an area somewhere between the same performance/lower price target and the higher performance/higher price target. Targeting the very high end presents more of a risk to the test equipment manufacturer, since unproved technology is often required as well as a greater amount of capital. On the other hand, once the state-of-the-art system is developed, it is easy to demonstrate the upgradability of lower end, more focused versions of that system.

The approach of targeting the high end first also allows a system architecture to be established. Test system manufacturers have found that initial system architectures are not always adequate for high end applications. New architectures are usually different enough to require new software, making old software obsolete. It is simply easier and less expensive to design out existing capabilities than it is to design in new capabilities.

The advent of advanced design tools has changed the test market significantly in the past few years. Not only is more of the test development work being done during the design phase, but a greater diversity of products are developed more quickly. This often blurs the distinction between production test needs and engineering test needs. This is especially evident in the ASIC market, as evidenced by the success of combination design verification/test systems.

Interestingly, the same philosophy of sub-engineering advanced systems seems to be spreading to other areas of equipment development in the semi-conductor industry. (Extracted with permission from Semiconductor International Magazine, July 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, Il., USA)

The changing face of supplies

Electronic designers are the darlings of the supply industry for computer-aided engineering. Relative youth and flexibility, together with faster

adoption of advanced techniques (by comparison with designers in other industrial sectors) are the qualities any purveyor of software packages dripping with features would look for in a customer.

However, the purchasers' position of strength in a market dominated by falling prices and constantly improving levels of design performance has had its effect on the shape of the supply industry. Many software suppliers have suffered low margins, or have encountered uncomfortably long periods of loss-making.

The result in the last few months has been a far-reaching shake-out of companies in the industry.

The outcome is a growing number of suppliers who can no longer be regarded as specialists in CAE or test (or, for that matter, IC design or PCB layout), but as one-stop sources of integrated systems for the range of electronic design disciplines.

This changing face of the supply industry provides a useful model of the way that users want to organise their design and test activities. The chief characteristics are integration and pragmatic use of hardware.

The elements are likely to be a network linking schematic work, simulation (perhaps PCB design and autorouting if the range of activities is wide enough), through a common database and a computing layout based on a combination of personal computers, low-end workstations and, for compute-intensive or file-serving tasks, a high-end workstation.

At the front-end of the design process, users do not seem too concerned about having single-source schematic input.

Once data is on a network, integration is de rigeur. User companies have voted with their chequebooks in choosing suppliers who can provide reliable integration of schematic and simulation systems. Similarly, suppliers who have set the pace in raising the speed of their simulators - digital and analog - have proved to be the users' choice.

Although factors of inherent speed and level of integration may dominate the users' choice of CAE systems, hardware platforms play their own significant role. Many users who have run VAX systems for libraries and processing tasks switched to greater local processing speeds, perhaps in the form of MicroVAX hardware.

Increasingly, the users' interest in still greater performance, to boost the efficiency of the applications has moved the market further still. Electronic design has in no small measure been responsible for the rise of workstation manufacturers such as Sun and Apollo.

Another instance of customer demand driving development among the software suppliers lies at the meeting point of electronic design and mechanical engineering.

But this is a fairly basic indicator of trend. Manufacturers rarely depend on 2D or 2.5D drafting to design their packaging, whether it is aircraft nose cones or mobile telephone casings.

Constructing a list of users' wishes, given the recent history of the supply industry, might equally be a matter of putting together a list of commands. There is a tight and consumer-led battle to add features to CAE software. But the central demand among users is always greater processing efficiency to cut design time, which means there is a constant search for faster analysis tools.

Equally, a drive toward integration of all design disciplines means that networked options in electronic design are becoming essential. From the users' point of view, the aim is fast transfer of files between design disciplines, with output to test and manufacturing. (Extracted from Electronics Weekly, 22 June 1988)

A testing time ahead for CAE

The rapid take-up of design automation tools has led to an acceleration of circuit complexity which, in turn, is beginning to cause major problems for the test department. A new, more sophisticated and exceedingly expensive tester is not the panacea it once was. Designing for testability is fast becoming a major issue, but for many it comes too late. However, design automation brings some benefit to the test area for those dogged enough to try to link the two.

Theoretically, as both ATE and design automation tools are computer-based, transferring data from the design environment to the test area should be easy, but life is never so simple. Certain tools and hardware platforms are becoming de facto standards in both areas, but problems arise not in physically linking the equipment but in converting data formats and sifting out the design data that will be truly useful in the test area.

While Edif is regarded as a standard by some many have "Edif-like" data formats. Marconi Instruments' testers accept information in the .pcb, .cb and .chi formats. Schlumberger Technologies has established its Caddif intermediate data format, which may yet be accepted as an international standard as it is independent of both test and design systems. In the US, Test System Strategies (TSSI) is in the business of building custom links between any CAE system and any ATE. TSSI's fast-growing list of customers gives some indication of the industry need to link the design and test areas, and of the difficulty in achieving a successful link.

In the UK, Atec Computer Services of Coleford, Gloucestershire, provides an independent third party link between CAE and board test and production equipment. The product, called Intertrack, running on an IBM PC or compatible is designed to read in CAD files from a variety of commercial systems and produce outputs in a form usable by the ATE. Netlist and schematic information is taken from the CAE and converted to the format required for test program generation.

But shifting CAE from the design schematic to the test area is not the whole story. Other information from the design department may also be needed. Design models for ASICs and logic equations for PALs. Limited device information such as electrical values and tolerances may also be of help.

Intertrack also extracts XY co-ordinate and layout data from the CAD files for use in fixture design and development. Many of the larger fixture builders are now accepting CAD tapes of board designs to make fixture manufacture a faster process.

One of the most useful tools for the circuit designer is the simulator, essential in verifying that a circuit is not only designed correctly, but that it serves its purpose. The simulator is a key link between design and test.

It has become far more rapidly accepted in the design of ICs than boards, though, in general, is equally applicable to both.

Device designers cannot afford the time or money to keep changing a circuit design. They have to get it right first time. At board level, the prototype can be hardwired or tweaked to be made to work. But with ever-increasing complexities and higher integration, board simulation is becoming more necessary.

Simulation output can be used to simplify test program generation, now considered to be the most costly and time-consuming task in the test function. However, only a small portion of the millions of vectors generated at the design stage will be useful for testing the finished product. This test vector set may also need to be supplemented with additional vectors in order to increase the fault coverage of the test program.

Fine-tuning the test vector set and converting or post-processing it into a tester-usable format can be a complicated and time-consuming task. The logic simulator in the design area is a timing or event-based tool, whereas the ATE is a cycle-based machine. (Extracted from Electronics Weekly, 22 June 1988)

The power behind processing

Putting merchant microprocessors into the heart of powerful computers is one of the major forces driving down the cost of computing. However, the nature of the microprocessors used in these machines may have to change as the world moves towards enormously powerful computers based with parallel processing architectures.

Squeezing ever more power out of computers used to mean running their processors faster by making the processor chips smaller and running them hotter. This made for expensive computers with complicated cooling systems, until someone hit upon the bright idea of harnessing lots of processors together and sharing the load without the need to run chips so fast that they get hot.

Parallel processing computers harnessing the power of lots of small microprocessors to deliver enormous amounts of computer power at a very low cost will eventually replace today's cumbersome and expensive mainframes and supercomputers. The fact that relatively cheap microprocessors are becoming increasingly powerful will accelerate this process.

Well-known computer makers, start-ups and even chip companies are all trying to get into the parallel processing market. Most of them are offering competitive systems and no clear winner has so far emerged.

There are two distinct classes of parallel processing computers emerging. Both are based on architectures which link up a number of separate processing elements.

The common memory machines that have evolved directly from conventional sequential computers are in one class; these tend to hang processors and local fast cache memories off a main bus that feeds off the main memory.

Most of the parallel processing machines coming from the conventional computer makers have adopted this approach, although some use proprietary processors and others use merchant microprocessors.

The other class of machines are built around distributed memories. These involve hooking together what are essentially separate computers with their own processors and memories. These would communicate rapidly with each other rather than with a single common memory.

So each element must combine processing, memory and communications. This is why the Transputer, which is the only device so far to sport all three on a single chip designed to be bolted together in large arrays has been seized on by parallel computer designers.

These two classes of computer could converge onto a generic parallel processing computer architecture some time in the mid-1990s, as the global memory machines run into problems that prevent them from scaling-up to even more processing elements, and as the distributed memory machines start evolving high-level systems communications.

The trouble with all this talk of parallel processors is software. Getting up to eight or even 30 parallelisms out of conventional software may not be too difficult; getting 200 or even 1,000 is tough.

Almost certainly computers of all sizes will become more heavily dependent on harnessed microprocessors. The software, compilers and operating systems needed to make them work together efficiently are still being developed. What is not so clear is whether the microprocessors will be proprietary or merchant and how the demands of parallel and multi-processing computers will affect microprocessor design. (Extracted from Electronics Weekly, 31 August 1988)

TAB for high I/O and high speed

Among the stated advantages (Table 1) of TAB (tape automated bonding) are several that make this method of bonding inner and outer leads more desirable than wire bonding in some VLSI packaging applications. TAB is becoming increasingly useful for high speed, high leadcount, very large scale integration (VLSI) ICs.

Table 1. Advantages of TAB

- Ability to pretest and preburn-in ICs prior to final assembly.
- Electrical properties superior to wire bonded leads (e.g., lower lead inductance).
- Bonding pad density greater than with wire bonding.
- Inner lead bonded components can be surface mounted.
- Higher assembly throughput than with wire bonding.
- Higher assembly reliability (e.g., higher pull test strength compared to wire bonding)
- Lower cost than wire bonding at higher lead counts.

Much of the interest in TAB for VLSI has come out of the fundamental problems that arise with packaging these circuits. In general, VLSI means high density, high speed, high leadcount circuitry (anything >40 pins, more typically >100 pins). But

pad-to-pad spacing constraints of wire bonding can limit die size reduction for VLSI. In addition, when leading edge TAB methods are compared to wire bonding, TAB shows improvements in reliability and electrical performance for VLSI.

Wire bonding imposes a greater physical limitation on bonding pad size and spacing than does TAB.

In general, for gold ball wire bonding, bonding pads can be no smaller than 3 mm x 3 mm, with 6 mm spacing between pad centerlines. Some development work, particularly for wedge bonding, has been successful with 4 mm spacing between bonding pad centrelines, but most manufacturers still consider 6 mm to be the practical lower limit. This limits the number of wire bonding pads that a VLSI circuit can accommodate on a given size chip. Or, conversely, chip size for a circuit with a high number of leads is often dictated by bond pad densities.

On the other hand, TAB is routinely capable of 2 mm x 2 mm bonding pads with 4 mm centreline spacing.

For VLSI ICs, wire bonding imposes greater limitation in electrical performance (Table 2) than does TAB.

are more accessible to probing and testing (i.e., probing a chip indirectly); this means that probing is less likely to damage ICs. An inner lead bonded TAB IC can be put through burn-in before final packaging, making it less likely to package nonfunctional chips.

The lead shape and size of TAB also improve heat dissipation over wire bonding by up to 60 per cent. The thermal resistance of wire bond leads has been reported to be 20 times greater than that of TAB under certain conditions.

In addition to the fundamental differences between wire and TAB lead (i.e., a round lead versus a beam lead), new developments in TAB materials are becoming available to further control interconnect impedance and other factors.

The ability to design TAB circuits in multilayer metal TAB tape with larger ground leads has a positive effect on reduction of mutual inductance of a circuit. Development work continues on the use of multilayer metal TAB tape for high speed circuits. With this construction, a ground plane can be located in close proximity to the die, with ground leads feeding the ground plane through copper plated vias in the dielectric. These multilayer structures may be the best solution yet for high-speed VLSI circuits.

Table 2, Comparison of Wire Bond and TAB Electrical and Thermal Properties

Parameter	Wire bonding*		Tape bonding**
	Aluminum	Gold	Copper
Lead resistance (ohms)	0.142	0.122	0.017
Lead-to-lead capacitance (pf) (6 mil spacing)	0.025	0.025	0.006
Lead inductance (nh)	2.621	2.621	2.10
Lead conduction (°C/mW)	79.6	51.6	8.3
Lead convection (free, °C/mW)	336.5	336.5	149.5

*0.001 in. diameter x 0.10 in. long wire bond
**0.001 in. x 0.004 in. x 0.100 in. long TAB lead

In general, the round shape and somewhat irregular spacing of wire bonds and leads operating at high frequencies in close proximity can have an adverse effect on signal integrity. For high-speed VLSI there are eventual limitations from lead impedance; above ~ 50 MHz, round wires used in wire bonding begin to introduce large lead inductances and lead-to-lead capacitance.

On the other hand TAB, compared to wire bonding, is characterized by shorter lead lengths, lower impedance, larger cross-sectional area, and more uniform shape and spacing, all of which result in less propagation delay and smaller signal distortion.

In general, TAB leads perform better than round wire leads at high speeds because of their rectangular cross section. Unlike round wires, the configuration of a TAB lead can be varied and specified in packaging design to control interconnection impedance.

Beyond these advantages associated with controlled impedance and high density I/O, TAB has other advantages. For example, TAB leads can be made larger in longer dimensions than wire bonds, thereby increasing current- and heat-carrying capability. Also, because the inner leads are brought out to wider pitches (test pad fanout) they

TAB material is also available for multiple chip interconnection.

TAB also has some reliability advantages when compared to wire bonding in high leadcount packaging applications.

Densely packaged wiring structures are prone to wire sag as the wire lengths increase. (As ICs shrink the distance between circuit bonding pads, the corresponding leadframe fingers increase; it is not unusual for this distance to be >120 mm).

Another advantage of TAB is in lead strength, which improves VLSI packaging reliability. TAB leads have inherently higher bond strength than wire leads. For example, tested pull strengths are commonly 10 times stronger than wire pull strengths (which are typically 10 g).

As originally conceived, TAB bonding is a gang bonding method for both inner and outer leads; a thermode is used with force and heat to bond all leads simultaneously.

In gang bonding TAB, a chip is placed beneath the window of a TAB tape, under the lead fingers. The fingers are aligned with metal "bumped" bonding pads and then the entire array of fingers, the so-called inner lead bond (ILB), is bonded by

thermal compression. Such "gang bonding" provides high-speed assembly of high density ICs.

(Although not emphasized in this article, bumping is a key part of TAB technology. Among other considerations, bumps provide a seal of aluminium bonding pads, thereby reducing a main point of corrosion.)

TAB-to-circuit bonding, so-called outer lead bond (OLB), requires the ILB bonded chip to be excised from the tape, aligned to the surface of a printed circuit board or package, and then gang bonded by thermal compression or reflow soldering.

With gang bonding, the throughput of a TAB bonder is constant regardless of leadcount; alignment time does increase with leadcount. For example, IMI cites the example of gang bonding 360 leads on a 300 mm chip in 3.5 sec (tool dwell time, not including alignment). Wire bonding throughput, on the other hand, increases linearly with leadcount.

Because wire bonding has a finite failure rate (i.e., a given number of bad bonds per million attempts), the more leads put into a package the higher the potential for rejects from wire bond failure. This reasoning leads to favouring TAB for high leadcount applications.

Problems are associated with gang bonding of high leadcounts. For example, flatness of the bonding surface is critical, making it difficult to gang bond packages and substrates with nonplanar surfaces, particularly for OLBs on ceramic packages.

These problems have led to the development of single point TAB (SPT) - separate bonding of each lead with a small wedge-like tool. Single point TAB is designed to be applicable to high density I/O packaging and can be used for both inner and outer lead bonds. Several commercial SPT bonders have been developed recently.

Although TAB is still not widely used in the semiconductor industry, the list of companies known to be using this assembly technology for small operations or for evaluation includes all top semiconductor manufacturers. Look for increased production use of TAB in the immediate future. (Extracted with permission from Semiconductor International Magazine, June 1988. Copyright 1985 by Cahners Publishing Co., Des Plaines, Il., USA)

Liquid insulating moisture-proof sealing material for printed circuits

Nitto Electric Industrial Co. Ltd. has commercialized a liquid insulating moisture-proof sealing material for printed circuits that is made of a rubber-based polymer material and features excellent performance. It has excellent pliancy and therefore copes flexibly with thermal expansion occuring in components mounted on the printed circuit board (PCB).

The new sealing material "Elep Coat" developed by the company is available in two types - the "LSS-520 Type" primarily for use on automobile electrical fittings and the "LSS-500 Type" for use on home electric appliances. Both are liquid-state materials consisting primarily of a polymer whose heat and acid resistance has been improved by denaturing a rubber-based ingredient. Since their coefficients of thermal expansion are low they are barely influenced by temperature changes, and since the material itself is pliant and undergoes flexible elongation in accordance with the expansion of the PCB itself or its mounted chips, pins and other components, there is no fear of these components being subjected to thermal impact or getting cracked under high temperature.

The material also features excellent humidity resistance and great adhesiveness. The surface coating is formed in 5 to 10 minutes after application and dries completely in 24 hours, making it quite easy to work with. (Source: JETRO, September 1988)

Single-chip floppy disc control circuit

NEC Corporation has started distributing samples of a newly developed extra densely packaged LSI that incorporates all principal functions of a floppy disc control circuit (FDC) in a single chip.

The fabrication of this single-chip version has slashed the packaging area to one fifth that of its existing FDC counterparts and has also increased the data transfer speed to the level of 600 Kbit/sec. Using this FDC enables the personal computers and word processors to be fabricated more compactly, plus the circuit's designing cost has been cut substantially.

The new single-chip FDC has been named the "μPD72068" and is 6.33 mm long and 6.18 mm wide. Complementary metal oxide semiconductor (CMOS) process technology featuring a circuit line width of 1.5 microns is used, the working power consumption has been suppressed to 50 mW and the holding power consumption to 0.5 mW.

In order to achieve data readout at a speed of 360 rpm (20 per cent faster than the usual speed of 2 Mbyte systems), the FDC's data transfer speed has to be increased to 600 bits/sec, or the existing maximum speed of 500 bits/sec increased by 20 per cent. With conventional combination systems, this is accomplished by attaching the necessary parts externally. However, user demands have increased for the reduction of assembling processes and reduction of packaging areas. Against this backdrop, NEC Corporation came out with technology for incorporating the floppy disc drive system's interface circuits onto a single chip. Through this they succeeded in attaining a remarkably fast transfer speed and a much smaller circuit packaging area.

Also incorporated on the chip are (1) a driver circuit for increasing the drive capacity of the control signals output by the FDC, (2) a receiver circuit for increasing the drive capacity of control signals output by the floppy disc drive (FDD) system and (3) a decoder circuit that converts FDC output signals for output to the FDD. (Source: JETRO, June 1988)

4 Mbyte 3.5-inch FDD compatible with 1 Mbyte systems

There has been strong demand from system manufacturers for compatibility between 4 Mbyte and 1 Mbyte systems because end users wish to fully utilize the accumulated software they possess on 1 Mbyte disks. The 3.5-inch FDDs on the market today have a memory capacity of either 1 or 2 Mbytes.

To meet this requirement, Toshiba Corporation has developed a 4 Mbyte 3.5 FDD which provides full downward compatibility with 1 Mbyte FDDs. When the new 4 Mbyte FDDs are incorporated in personal computers and other equipment, end users cannot only

retrieve the data on 1 Mbyte discs, but also erase and rewrite these data.

Toshiba achieved this full downward compatibility by developing three types of proprietary LSIs to control read/write and erase both 1 Mbyte and 4 Mbyte disks. Toshiba also secured the compatibility by incorporating an extra wide-gap erase head, which is suitable for both 1 Mbyte and 4 Mbyte disks.

The large memory capacity of 4 Mbyte was achieved by utilizing a new recording technology - "perpendicular magnetic recording" - and a new material - "barium ferrite". While in conventional FDD recording, media is magnetized in a horizontal direction, perpendicular magnetic recording magnetizes the media vertically to the media substrate, thus greatly increasing the recording density. (Source: JETRO, June 1988)

IBM's new mid-range computers

IBM will introduce a new generation of mid-range computers. Analysts believe that the new computers will be the most important models introduced during the past few years. In addition to helping IBM recapture a share of the important midrange market, the computers will be the first models based on a new set of software standards that will be used on all future IBM computers.

The new models are reportedly named the Advanced System 200 and Advanced System 400 and will replace IBM's older System 36 and System 38 computers. The System 3X family of computers is used mainly in small business applications. Larger firms use System 3X computers for software development and production operations. The performance of the new computers will be better than that of personal computers. According to R. Djurdjevic of Annex Research, IBM must be careful to distinguish its new midrange computers from the high end of its personal computer line. Industry analysts anticipate that the reaction to IBM's new computers will be generally positive. (Extracted from New York Times, 20 June 1988)

IBM's new mainframe

IBM has unveiled a new 10-model 3090 mainframe line. The new S Series will offer price/performance enhancements of 15-25 per cent. The high-end Model 600S, which will offer a 56 per cent performance increase over the existing 309G Model 600E when operating under the MVS/ESA (Enterprise System Architecture) operating system, will be positioned against Amdahl's 5990 system. The Model 600S will provide 230 MIPS of processing power, as against the 115-MIPS 5990. A tenth model, the 170S, was added to the low end of the earlier 9-model series. The new 170S offers about 15.5 MIPS. One of the main reasons for introducing the new S Series was to extend the benefits of the ESA architecture. Design improvements, which were incorporated into all 10 models, include an extra data path in multiprocessors and a larger central processor cache.

Technology improvements, which only benefit the seven high-end models starting with the 180S, include an increase in central storage to 512 Mbits and the addition of a new logic chip and new logic array chips. Although vertically upgrading from a Model E system to a larger Model S system will cost the same as purchasing the S system outright, horizontally upgrading from a Model E system to the same size Model S system will cost more. The two lowest-end S Series models - the 120S and the 150S - will be released in September 1988, while the eight remaining models will not be released until the fourth quarter of 1988. (Extracted from MIS Week, 1 August 1988)

Intel's new microprocessor

Intel (Santa Clara, CA) will unveil a new 33-MHz, 32-bit 30386 microprocessor. The new chip will initially be available in late 1988 to certain compatibles manufactures, probably the compatibles manufactures working with the company's OEM Platform Operation (Hillsboro, OR). Volume shipments will begin by mid-1989. The access time of the memory chips determines the clock speed of a microprocessor. For example, a 20-MHz clock speed is used for the 80386 as a result of its compatibility with dynamic RAM (DRAM) chips that have an access time of 100 ns. Although the processor's speed increase should be directly proportional to the computer's performance increase, the computer may be slowed down by other system components. (Extracted from PC Weekly, 7 June 1988)

Minicomputer network functions as supercomputer

Sandia National Laboratories is operating a network of 14 VAX minicomputers that functions like a single supercomputer. The computers are operated using parallel processing techniques, in which each computer performs part of the computational task. The network carried out an analysis during a rocket plume simulation twice as fast as the Cray 1 supercomputer. However, the Cray 1 is faster in other applications. Sandia's objective is to fully exploit the capacity of its VAX computers, not to design a network that is faster than a supercomputer. (Extracted from Chemical and Engineering News, 6 June 1988)

Fast supercomputer developed

Evans & Sutherland (Mountain View, CA) has developed a supercomputer that is faster than the Cray and more powerful than 60 IBM 3090s. The drawback with existing units is that the fast ones are too specialized and the general-purpose ones are too slow. E & S expects to supply the speed required for complex "real world" modelling and simulation problems, while circumventing the massive programming now necessary for supercomputing tasks. The new supercomputer's moderately parallel architecture enables each of its computational units - 32 in a minimum configuration - to handle different areas of a problem simultaneously. It is due in late 1988. (Extracted from Design News, 23 May 1988)

Application of SMT

Allen-Bradley's Industrial Computer & Communications Group (Highland Hts, OH) is using surface mount technology (SMT) at its plant in Twinsburg, OH. The firm said SMT laid the base for computer-integrated manufacturing, with the mounting of a $3.5 million CIM cell at the plant raising flexibility, cutting process time, improving quality, enhancing productivity and cutting time to market. Plant engineers found that SMT could bring better efficiency to printed circuit board (PCB) fabrication, with the plant making 10,000 PCBs per month. SMT involves automated gluing of small parts onto a PCB as an alternative to assembling PCBs via through-hole assembly whereby holes must be drilled in the boards so that the parts can be put through. The CIM cell uses data from any of four operating divisions in the company, with each

division using a different data structure and CAD/CAE system. Data for each system are transformed into at least four files, which are used for producing the needed assembly and quality testing programs for the PCB assemblies. The plant makes such products as programmable controllers, intelligent motion control products, industrial computers and communications products. (Extracted from Metalworking News, 30 May 1988)

Super high-speed 4-Kbit ECL RAM

NEC Corporation has commercialized a super high-speed 4 Kbit emitter-coupled logic (ECL) RAM with a 1 Kword x 4 bit construction and has started distributing samples of the ECL RAM.

The ECL RAM is available in the 10-K "μPB 10474A" series and 100-K "μPB 100474A" series, which feature a super high-speed access time of 5 nsec by virtue of the introduction of a high-performance shallow junction transistor and trench-element separation technology.

The ECL RAM is used, for example, as the buffer memory, control memory or picture memory element in high-performance computers, but since higher-speed access time versions have come to be demanded in the trade - in concert with increasing demands on system speed and diversification of applications - the company has been engaged in research to commercialize a 5-nsec ECL RAM in succession to its existing 8-nsec product.

This is a 1,024-Word x 4-bit construction 4-Kbit ECL RAM adopting a Schottky diode clamp type memory cell available in the series 10-K level and the 100-K level. Regarding the package, the 10-K product adopts the 24-pin ceramic DIP configuration, and the 100-K product the 24-pin ceramic DIP and 24-pin ceramic flat configuration. The current consumption is 200 mA and the chip size 3.11 mm x 3.35 mm. (Source: JETRO, June 1988)

New trench-isolation technology implanting Al ion in SiO_2 layer

Fujitsu Limited has come out with a new trench-isolation technology named "fixed negative charge (FINE)" for application between memory elements which is indispensable for developing 64-Mbit dynamic RAMs.

In order to manufacture LSIs with an integration of over 16 Mbit DRAMs, it will be necessary not only to develop related active elements but to narrow the insulation domains between elements. Accordingly, "trench" technology has been introduced to create trenches on the walls of silicon oxide insulators in order to minimize the areas of the insulation domains inside the circuit.

Conventional types of trenches are given a boron implantation at the contact point between the silicon substrate and trench in order to prevent current leakage and to maintain the transistor's inherent characteristics. However, the use of boron requires its heat treatment and it is also diffused easily, causing the boron to be diffused onto the drain electrode obstructing chip miniaturization.

With the newly developed FINE technology, boron is not used and aluminium ions are implanted on the drain sidewalls instead, which displays the same effect as boron implantation. Since no change is brought about on the properties of the electrodes or silicon substrate by aluminium ion implantation, the work of element and insulation layer miniaturization becomes easier. As a result, the company has succeeded in developing a MOS FET (metal oxide semiconductor field effect transistor) with a source-drain spacing of only 0.35 micron, without impairing the transistor's characteristics in any way. (Source: JETRO, August 1988)

Fibre distributed data interface

FDDI already has quickened the pace of high-speed networks, but a new technology, developed by a high-performance computer vendor, may leave Fibre Distributed Data Interface in the dust.

Last summer, Scientific Computer Systems Corp., San Diego, crossed the 1.4 Gbps threshold and brought out VectorNet, which, it claims, transmits data at 1.4 Gbps (or 1,400 Mbps) - 140 times faster than Ethernet. The minisupercomputer maker is offering its customers a VectorNet Interface Processor, which will enable them to connect SCS minisupers to workstations and other devices on a network. SCS plans to license a VectorNet Interface Adapter to other hardware vendors.

It remains to be seen whether or not anyone outside the high-performance world needs this kind of speed. Commercial applications such as transaction processing could benefit from the technology. Some commercial and scientific users say that Ethernet is too slow (10 Mbps) for their needs. Corporate users want high speed for their campuswide backbone LANs, and some dream of future video and voice applications, which would require considerable speed.

For users satisfied by 100 Mbps, products that incorporate FDDI have begun to hit the market. Not yet finalized by the American National Standards Institute, FDDI is a token ring passing protocol for fibre-optic LANs.

Last year, Fibronics International Inc., Hyannis, Mass., brought out the industry's first FDDI-based product. Priced at $36,800 per node, System Finex provides a campuswide backbone LAN for Ethernet networks.

In January, FiberCom Inc., Roanoke, Va., announced a "migration path" from Ethernet to FDDI. Customers that buy its WhisperNet - a fibre-optic Ethernet LAN - will get 100 per cent credit toward its future FDDI products. Other companies, such as Digital Equipment Corp., are developing their own FDDI chip sets, but had not announced specific products at press time. (Reprinted with permission of DATAMATION[r] magazine[c], 1 July 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

V. COMPUTER EDUCATION

Systems encouraged for further education colleges

Computerized management information systems are essential for the efficient running of further education colleges, says a new UK government report which sets out what the ideal system should look like.

The user requirement report from the Department of Education and Science (DES) and the Welsh Office reviews the different elements which should be handled by college management systems, such as staff and student records and timetabling.

The need for such a report was highlighted by an efficiency study of colleges published last year. This study proposed the introduction of a common set of performance indicators to measure the efficiency of England and Wales's 400 or so colleges.

The study concluded that existing computer systems were not comprehensive enough to generate all the information needed for the performance indicators, which would measure staff/student ratios, room use and so on.

The user requirement has been put together by a team from the DES, a local education authority and a further education college. The team surveyed the type and scope of systems in use and made suggestions about what will be needed for the performance indicators.

There are two established further education college management systems in common use. The FE Management Information System (FEMIS) was developed by a unit of the Further Education Staff College in Bristol and the College Management System (CMS) comes from Sheffield-based Fretwell Downing Computer Group. (Source: Computer Weekly, 18 August 1988)

Power to all

Every student who wants to follow a course of higher education in the UK, and every staff member, should be obliged to buy a micro. In fact, Tom Stonier, Professor of the School of Graduate Studies in Science and Society at the University of Bradford, wants nothing less than the total computerization of British universities. Without it, he argues, "they are simply not doing their job in an information technology age". Though this sounds a revolutionary idea in British educational circles it is already becoming well established in the USA. In the UK, many universities have taken steps down the same road. Queen's University in Belfast, Aston University and the Open University will have thousands of students using Amstrad and Akhter PCs this year. Many universities and colleges are starting to link up the computers in their various departments. The Joint Academic Network, JANET, which links different higher education and research establishments, is already in place. British universities will eventually become computerized anyway. But Stonier sees the limitations of doing this in an ad hoc way, with little agreement on standards and minimal support from the Government. Making a national commitment would have three advantages. First, there would be immediate benefits in efficiency in administration, research and teaching, just as in any business. Second, students would be better qualified to take their place in an information-oriented society. And third, it would enhance national prestige. (Source: Computer Guardian, 5 May 1988)

Program to assist EBL

A program to help streamline computerized explanation-based learning has been developed by researchers at Carnegie-Mellon University (Pittsburgh). EBL can improve a computer's problem solving capabilities, but not always, if the program gets bogged down in lengthy and unnecessary explanations. PRODIGY/EBL simplifies and consolidates information, evaluating what has been learned and deciding which information is most useful. PRODIGY/EBL will be especially useful in scheduling problems. (Extracted from Science News, 3 September 1988)

Jobs scheme helps mental patients

The UK's first computer training scheme for psychiatric patients was launched last July following a successful two-year pilot project.

The Speedwell Information Technology Project, based at the Speedwell Day Hospital in Deptford, London, was jointly developed by Birkbeck College and Guy's Hospital.

The year-long scheme involves an initial three-month introduction at the hospital, covering keyboard skills, basic PC operation, word processing, databases and spreadsheets, followed by a further nine months at Outset Itec, where students have the chance to specialise.

The hospital also offers support and back-up to the students when they get a job, and provides help and reassurance for employers if they encounter any problems.

The project organizer, Dr. Angela Summerfield, a lecturer in psychology at Birkbeck, feels the benefits to the patients go beyond gaining operations expertise. "Learning to use a computer - when so many people admit to computer illiteracy - helps psychiatric patients to improve their self-esteem, making them feel valued as well as giving them marketable skills."

The cost for each student for the year is estimated to be around 2,000 pounds sterling, but the organizers argue that this is far less than the Government has to pay out to hospitals, and in unemployment and sickness benefit.

Recently the British Computer Society launched its IT Support for the Disabled project, which aims to show employers how information technology can help disabled people at work and how disabled people can be a valuable source of skills which are in short supply. (Source: Computer Weekly, 7 July 1988)

World Conference on Computers in Education

Australia will be host to the Fifth World Conference on Computers in Education (WCCE) in July 1990 in Sydney. Held every five years, the WCCE is a major IFIP event. The other WCCEs have been held in the Netherlands (1970), France (1975), Switzerland (1981), and USA (1985). The WCCE/90 will be organized by IFIP's Technical Committee on Education (TC3).

Announcing the venue for the Conference, International Program Committee Chairman Ms. Sandra Wills said that World Conferences on Computers in Education address all aspects of computer education, ranging from primary grade to university level and including industrial and community education. They cover both learning ABOUT computers and learning WITH computers. They sponsor debate on social and ethical issues arising from technological change in education. They provide an opportunity for cross-fertilization of ideas and experiences between the diverse sectors of this developing field and between countries of the world.

This is the first time a major world computer education conference has been held in the southern hemisphere. One reason for the decision to hold WCCE/90 in Sydney is that Australia is in a key position to co-operate with developing nations. It provides an opportunity to bring to the people of this region the cream of educational research and

development from overseas. At the same time, it enables the rest of the world to view at first hand the strategies employed to tackle the problems of computer education faced by countries over here.

Negotiations are under way with the United Nations Educational, Scientific and Cultural Organization (UNESCO) to help ensure that the Conference meets the needs of the developing nations of the region. To further Asian-Pacific co-operation, there will be a pre-conference workshop in New Zealand and a post-conference event in Japan.

Mr. John Hughes, Dean of Computing Science at the University of Technology, Sydney, has recently been appointed Chairman of the WCCE/90 Organizing Committee. He stresses that the Conference aims to achieve the widest possible participation plus maximum value for money.

Plans are under way for two innovative schemes which will be of interest to delegates, particularly to teachers on tight budgets - "Australian Home Hospitality" and "Australian School Visits". The former will provide overseas teachers with free accommodation in Australian homes. Both host and guest gain companionship at the Conference and an opportunity to compare different education systems. The Australian School Visits Scheme will enable overseas teachers to visit Australian schools and colleges near Sydney or even farther afield in another state of Australia, if they wish to explore the country before or after the Conference. In Australia the main school holidays are in summer - January rather than July. Schools, therefore, will be open during the Conference.

These two schemes, combined with the pre-conference and post-conference offerings, add up to the educational opportunity of a lifetime: a major conference plus workshops plus a study tour in countries you have always dreamed of visiting.

For further information contact:

WCCE/90
Australian Computer Society
PO Box 319
Darlinghurst
NSW 2010, Australia
tel.: (+612) 211-5855
fax.: (+612) 281-1208

(IFIP Newsletter, Vol. 5, No. 3, September 1988)

IBM line workers offered chance of MSc

Unqualified IBM factory workers are being given the opportunity to study for MSc degrees at the company's expense and partly in company time.

The courses, on computer integrated manufacture (CIM), are being run by Strathclyde University at IBM's Greenock factory.

The university has been running MSc courses for IBM staff for four years but these courses were open only to graduates such as engineers and programmers and were held only at the university, over 20 miles away.

Applicants now need just two O-levels plus strong commitment to their jobs and to improving their performance. They will be interviewed and tested on their commitment by IBM and then again by the university.

IBM expects between 12 and 24 staff will start the next course. The course is flexible, in that people can start by working towards a lower level diploma and switch to the MSc programme if they are doing well.

Apart from the one afternoon a week the staff have to work in their own time, IBM says it could take two or three years to complete the course.

The staff do not have to stay at IBM when they have got their qualifications.

Strathclyde already keeps 2 per cent of its places back for people without the necessary entry qualifications, although these are normally school leavers. (Source: Computer Weekly, 11 August 1988)

Society backs report urging upgrading computer science schooling

The USA's Computer Society Board of Governors has unanimously endorsed a report recommending "excellence in undergraduate computer science education ... be made a matter of high priority for our nation".

The report evolved from a March 1988 workshop at George Washington University sponsored by the National Science Foundation.

According to Gerald L. Engel, education vice-president of the society, the workshop participants issued an "executive summary" of the report. The summary states:

"Computer science is a relatively new and dynamic field. In just over 40 years, it has become a central technological influence in our society and a key element in our continuing economic development, international competitiveness and national security.

"To use computers effectively, the nation must have a continuing supply of well-educated computer professionals. Further, an understanding of the central ideas concerning computers is essential to all college graduates, who will increasingly use computers. Therefore, excellence in undergraduate computer science education must be a matter of high priority for our nation.

"Computer science and the computer industry have experienced explosive growth. There have been staggering advances in the depth and breadth of our knowledge of computer science and nearly exponential growth in the number of computer science degree programmes. Computers have improved in capacity and performance and fallen in price at an extraordinary pace.

"New computer science knowledge has necessarily led both to a need for continuing revision of curricula and instructional materials, and to a need for retaining and revitalizing many current faculties. An expanding number of undergraduate degree programmes and insufficient rewards for undergraduate educational activities have caused serious shortages of qualified faculty, especially in non-PhD-granting departments.

"Although computer science PhD production has recently improved, it still falls far short of satisfying the nation's demands. For example, there are over 1,000 computer science degree programmes in the nation's colleges and universities. Most of these programmes are in four-year institutions, do

not offer the PhD, and have no or only a few faculty who themselves hold a computer science PhD.

"Yet, in 1986-87, only 41 of the 466 new computer science PhDs took teaching positions in the non-PhD granting computer science degree programmes. This contrasts, for example, with the 202 of 845 new mathematics PhDs who took teaching positions in the non-PhD granting mathematics degree programmes.

"Computer science is a laboratory science, yet many undergraduate computer science departments have not yet been able to establish instructional labs. Even where labs are in place, the advent of powerful workstation computers means that many existing labs need to be modernized. Instructional materials need to be created to take advantage of new opportunities for better instruction. Opportunities for using new media or improved instructional strategies to improve instructional delivery in a wider educational context should be exploited."

"To identify solutions to these concerns, the NSF-sponsored workshop brought together 32 computer scientists who organized their efforts by focusing attention on problems in four separate areas of concern: curricula, faculty, laboratory infrastructure, and instructional delivery. Solutions which were both highly ranked and for which there was a broadly based consensus are listed below; order does not imply priority.

"In the area of curricular development, we recommend that the NSF establish two national centers to serve as focal points for computer science curricular development, training, and dissemination. These centers will focus the energy and attention required to create and maintain the curricula, instructional materials, and training opportunities needed to bring undergraduate computer science instruction up to date and to maintain it in the face of continuing rapid change.

"To focus more national and faculty attention on teaching, we recommend that the NSF implement presidential young teacher awards, which will provide incentives and rewards for creative and successful teaching of undergraduates, indicate to administrators, faculty, and students that both teaching and research are significant, and bring national attention to the importance of educational excellence.

"To provide adequate laboratory infrastructure, the NSF should significantly expand the Instrumentation and Laboratory Improvement Program to create and update effective laboratory infrastructures in a substantial fraction of the nation's undergraduate computer science degree programmes.

"To improve instructional delivery, the NSF should support research into new instructional technologies to realize the opportunities that computer science has to lead the academic community in general enhancement of instruction through computer technology.

"The workshop participants are pleased that NSF has recently begun to respond to the need for increased emphasis on undergraduate education. Some of our proposals call for expanding existing programmes; others, for fundamentally new programmes.

"The importance of computer science undergraduate education to the nation dictates that additional funding be found to support the initiatives proposed in this report. Our recommendations address the creation and updating of curricula, the enhancement of faculty knowledge, development and improvement of laboratory infrastructure, creation of instructional materials, and use of new computing equipment to improve instructional delivery."

Full copies of the report may be obtained by contacting James Foley, Department of Electrical Engineering and Computer Science, George Washington University, Washington, DC 20052. (Source: Computer, September 1988)

AAAS and Apple initiate project

Young people who might otherwise never touch a computer will be given the chance to explore the technology when a creative joint undertaking between the American Association for the Advancement of Science and the Apple Computer Company gets under way later this summer.

The AAAS Office of Opportunities in Science and Apple have announced that 232 computers will be placed in 38 community-based organizations in 22 United States states and the District of Columbia. These organizations will set up community computer-learning centres for minority, female, and disabled youth and their families.

The computer-learning centres will serve pre-school to elderly and include activities targeted at juvenile offenders, migrant families, mobility impaired, and AFDC (Aid to Families with Dependent Children) participants. Centres will be located in schools, colleges and universities, churches, housing projects, community centres, Indian reservations, and a shopping centre.

All sites will be connected electronically to each other and to AAAS through AppleLink. Science and mathematics activities aimed at out-of-school audiences will be made available to the sites from AAAS.

The AAAS/Apple Computer Program is a part of the AAAS Linkages Project, which works to connect community-based and science-based organizations to improve the science, mathematics, and technology education of minority, female, and disabled youth and promote increased science literacy by these groups. The project is supported by Carnegie Corporation of New York, The Ford Foundation, and Pew Charitable Trusts.

Apple Computer became a Linkages partner in 1987 to promote access to computing technology to community-based groups in nontraditional settings, a complement to their school-based programmes.

The Linkages Project, which began in 1986, works with a broad number of community-based organizations such as the National Urban League, Girls Clubs of America, and A.G. Bell Association for the Deaf. The Project also networks with black churches throughout the country in an effort to bring organizations already involved with the community into an active partnership with parents, teachers, and the scientific community. Another activity of the Linkages Project works with Recordings for the Blind to get scientists to record technical material for distribution to visually impaired science and engineering students.

As the AAAS/Apple Computer Program suggests, the focus of the entire Linkages Project is in finding creative ways to bring together science-based

organizations and groups of people who traditionally have not had easy access to science and technology. For more information on the Linkages Project, contact the Office of Opportunities in Science at the AAAS address, 1333 H Street, NW, Washington, DC 20005, USA. (Extracted from Science, Vol. 241, 1 July 1988)

VI. SOFTWARE

Software for 3-D modelling produced

Bechtel Power has unveiled software for 3-D computer modelling/design and real-time animation, with each system capable of various power plant uses. Bechtel has used the systems for various engineering and construction projects from conceptual design to construction and ongoing plant operation. Bechtel has unveiled Walkthru, a real-time, 3-D animation system to permit users to interact with present 3-D computer models similarly to the real world. The user sitting at a colour graphics workstation can move through the 3-D computer model via a control panel to control body and head motion to see the physical objects as they would be in the real world. The system was designed and unveiled in response to the need for enhanced visibility and interaction with the 3-D computer models used on other projects. (Extracted from Power Engineering, June 1988)

Measuring software quality

Measuring software quality and productivity is becoming increasingly important to in-house development shops. A survey published by the Quality Assurance Institute (QAI) finds that 94 per cent of the 69 organizations it polled expect to focus more on software measurement this year and in 1989. Bill Perry, director of QAI, attributes the growing interest to "increased competition, budget-cutting, and the new need for productivity". As banks, manufacturers, and government organizations tighten their belts, software development gets closer scrutiny, he says.

For Perry, the old way of measuring productivity - by lines of code per programmer per day - does not add up anymore. "When you measure lines of code, people produce more code. A lot of bad systems have been made with lots of lines of code," he says. As an alternative QAI recommends counting defects. At the moment, counting defects in source code has to be done by hand. Products on the market - such as PATHVU from the Chicago-based catalyst division of Peat, Marwick, Mitchell, and Inspector from Salem, Mass.-based Language Technology Inc. - analyse source code, measure complexity, and provide statistical data, but they cannot count certain kinds of defects, such as defects in logic.

Measuring the defect rate has not yet become standard practice in most IS shops. The survey shows that only 7 per cent of participants knew their defect rate per 1,000 lines of source code. But counting defects was one of the four most frequently mentioned measures that respondents plan to introduce in the next year. Other popular barometers are customer satisfaction surveys, defects occurring in system/program development, and function point analysis. (Reprinted with permission of DATAMATION[r] magazine[c], 1 September 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company - all rights reserved.)

Clever databases

Computers are learning to think laterally. To do so they use software called hypertext which organizes information more flexibly than a conventional database. Enthusiasts say it will revolutionize the way people work with computers and, eventually, the way they think. Critics say that hypertext is just a buzz-word to be pronounced with an accent on the hype. Products now entering the market will allow computer-users to decide for themselves.

Hypertext is one of the oldest ideas in computer science. Its essence is simple. At the heart of hypertext is a sort of automated cross-referencing system. Instead of storing data in fixed categories, like a conventional database, it allows one to link just about anything with just about anything else.

Such cross-references could help a reader work his way through a complex technical manual, or they could help a researcher see links between disparate bits of data, or they could take straightforward ideas and make a complete hash of them, something not unknown in the research laboratories where hypertext was developed.

There have been some successes. Researchers at Carnegie-Mellon University put their hypertext technology to work helping sailors to navigate the voluminous and complex technical manuals of the nuclear-powered aircraft carrier USS Carl Vinson. Xerox's NoteCard system has helped some writers to research and write documents - though others said they preferred an old-fashioned word-processor.

The creators of these large systems are now debating several possible revisions. Many are minor, but some involve changing the core of the system: the way in which the data are linked together. Today's hypertexts allow any piece of data to be linked to any other piece for any reason. Too often, this creates a sort of logical spaghetti, hard for the user to untangle.

Instead, researchers want links which clearly and consistently define a relationship between the data they join. A lot of that depends on the user; people have to be taught to write "good" hypertext, just as they need to be taught to write good prose. But there are several ways in which hypertext could be made more idiot-proof.

Instead of defining a subjective set of logical links between data, some computer buffs propose a set of standard links: one type of link would move from the general to the specific, another would bring up the computer equivalent of footnotes, etc. Another idea for making the links understandable is to have a diagram of them on the screen. Still another is to add some artificial intelligence to hypertext so that the system knows how to answer questions with relevant information.

Only experience can separate good hypertext ideas from bad. Experimental systems have shown that hypertext can be made to work, but they have not shown how people will want to work with it - if, indeed, they want to work with it at all. For that information, researchers and software companies alike are watching the fortunes of various hypertext programs for microcomputers which are coming onto the market.

Despite the high hopes of the companies involved, the public may be slow, or even positively unwilling, to accept such an unfamiliar technology. Back in the laboratory, researchers are already working on a successor to hypertext. Called hypermedia, the next generation of hyperstuff promises to link video and music as well as text and computer graphics. (Source: The Economist, 30 July 1988)

Expert system software developed

IBM and IntelliCorp have jointly developed the IBM KEE expert system software, which helps EDP professionals that have been trained in artificial intelligence to deal with complex problems. IBM has also introduced a new release of Expert System Environment (Version 1/Release 2), which permits customers to bring expert system uses into the mainstream of corporate remedies. IBM also offers a new KnowledgeTool version (Version 2/Release 1), which adds a test facility with windowing capacities for EDP professionals who are inserting expert functions to present uses. (Extracted from Metalworking News, 5 September 1988)

Prototype high-speed data communication system

IBM will jointly install a prototype high-speed data communications system with Carnegie-Mellon University. The new Andrew File System will simplify data sharing between several users operating computer workstations from various suppliers. Although the existing system uses Transmission Control Protocol/Internet Protocol (TCP/IP) standards, a future version may use the Open Systems Interconnection protocol suite, according to A. Spector, director of Carnegie-Mellon University's Information Technology Centre. In early 1989, the universal distributed database system will start beta testing with researchers in both business and educational organizations, including the Massachusetts Institute of Technology and the University of Michigan. The bulk of the beta tests will be run on computers running the Unix operating system. Depending on the success of the tests, the Andrew File System may be released in the 1990s. (Extracted from Communications Weekly, 29 August 1988)

Help for engineers

Clever software aimed at helping engineers to design very-high-speed digital signal processing (DSP) chips of the kind used in military and aerospace applications has been developed by scientists working for General Electric of the US.

The program, known as a silicon compiler, can help chip engineers to design algorithm specific integrated circuits that operate much faster than devices designed using conventional silicon compiler techniques, according to GE.

GE's compiler, called PARSIFAL, can design extremely fast DSP chips which handle large lumps of data up to some 16-bits wide rather than the small 1-bit wide lumps of data that conventional DSP chips can cope with. DSP chips operating at speeds of up to 500 million operations a second can be designed using the compiler.

GE claims that several chips have already been designed using the new software. One of them converts right-angled X-Y-Z co-ordinates into polar co-ordinates for a medical body scanner at the rate of more than 10 million operations a second, even though the chip is clocked at less than 10MHz.

The chip took a total of two weeks to design. Designers work by entering a computer program-type description of the desired chip's logical functions and the compiler turns this into a chip layout.

PARSIFAL runs on Sun workstations and GE intends to make the software available to the semi-custom chip customers of its GE Solid State subsidiary. (Source: Electronics Weekly, 22 June 1988)

Programs that make sense to deaf children

Computer software designed to help deaf children has been developed at the University of Cambridge: good for the personal development of deaf children, as well as helping them learn mathematics, a subject in which they tend to fall behind. Many of the emotional and behavioural problems associated with hearing-impaired children may result from their inability to stop, think and reason. The difficulty is one of vocabulary. A hearing child learns about six words a day between the time he begins speaking and starting school. It is unnecessary to teach him the meaning of concepts such as "why ... because" and "if ... then" because they are learnt by listening. Because they fail to understand why things are happening, the world appears bewildering and hostile. Deaf children are seldom asked what they want and often do not know how to choose. One child, on his first day at school, burst into tears when offered a choice between orange and lemon squash. It was the first time he had been asked. So the software is designed to help them make choices. One program shows a series of pictures - a woman with an umbrella, a boy splashing in a puddle, a man wearing a scarf and gloves. The word "why" appears on the screen. Underneath is written "because" with pictures of a sun, a cloud raining and a snowman, one of which the child must choose. The computers respond immediately to the child. The feed-back in the form of a smiling face and the words "well done", encourages him in a way that traditional methods, such as work-books, cannot. (Source: Financial Times, 20 May 1988, p. 12)

Developers ponder choices among graphic environments

It is almost enough to make a programmer yearn for the simpler days. With nearly a dozen graphical user interfaces and operating environments soon to be available and contending for attention, the obtuse C> and $ prompts may quickly prove to be relics. Colour bands, scroll bars, menus and buttons are taking their place.

Another change may be equally obvious. Those confused and puzzled looks that used to identify a new system user may turn up instead on the faces of veteran programmers.

Behind the merely cosmetic differences lie significant development issues. They can be as basic as a choice of windowing systems, or as substantial as the computing philosophy.

Many emerging graphical environments impose a client-server approach that invokes a minicomputer or other server to execute parts of an application. Others allow the application to reside wholly on the workstation. The degree of differences within environments can be as varied as the applications themselves.

For instance, Hewlett-Packard's NewWave initially employs Microsoft Windows as its windowing system. Future versions will be available for IBM's Presentation Manager and the X11 window system.

To developers, the environments bear on issues as diverse as the computer type and the way an application is approached. Richard Treadway, Digital Equipment Corp.'s manager of DECwindows programs, says the client-server approach of X11 enables the lowliest of workstations to display the results of an application running elsewhere on a network. However, X11's demands on computer performance rule out enabling the DEC windows graphical environment to run directly on the most widely used workstations.

Such differences should not obscure the common features of various graphic environments. Both client-server and networked pc approaches position intelligent workstations as the focal point for rendering an application. Similarly, each graphical environment positions C as the common language for developers. With the exception of Apple Computer Inc., all profess a readiness to license their environments to hardware and software developers.

Some developers anticipate a gradual reduction of differences to alleviate the dilemma for programmers. Others already working within a graphical environment say they expect third-party software developers to have the greatest say on which environments and features will remain.

Regardless of some of the difficulties that graphical environments present, most companies are more concerned with the greater problem of getting end users to learn new applications readily - and users tend to like graphic environments.

Even if developers are forced to deploy various toolkits for competing graphical environments, the end user should see more similarities than differences. (Reprinted with permission of DATAMATION[r] magazine[c], 15 August 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Software maintenance

A theological college in Durham was the venue for the biggest software maintenance meeting to be held in Europe.

The apparent unattractiveness of maintenance is one of the chief things the conference organizer, Durham University's Centre for Software Maintenance, is fighting to redress.

The bad image of maintenance was a nearly obsessive theme running through the conference. It emerged as a seriously damaging factor to this area of computing - and not just a petty deflator of egos.

"Maintenance" is associated with boring repair work - and in truth does not represent much of what takes place, such as writing large chunks of code afresh. The motivation issue surrounding maintenance is a constant problem. Dissatisfaction and the reluctance of staff to stay around in maintenance means new people are constantly having to learn from scratch how programs they have to work on operate.

One of the world's leading maintenance authorities, Mel Colter, said at the conference that he finds over half of all maintenance effort is spent understanding how a system works before being able to design code changes. That is a lot of resources considering many organizations estimate that maintenance absorbs 80 per cent of their data processing budget. The implication is that nearly half the data processing budget goes on understanding what is already in place - not improving it.

A curious element in motivating maintenance people, though, has been uncovered by business research firm Butler Cox. In a survey carried out among large UK public and private sector organizations, it found that motivation was highest among people spending nearly all their time on maintenance, but low among those having to do it as a large part of their job. As a full-time occupation it can inspire, so it seems.

Maintenance is usually thought to apply to managing unwieldly systems in big organizations, and rarely to package software houses.

To stimulate discussion on maintenance, the Durham centre (set up in Easter last year) is to produce a journal on the subject starting with two issues a year, then four. (Extracted from Computer Weekly, 22 September 1988)

University develops transputer OS

Programmers at Cornell University have developed an operating system for the Inmos transputer that allows users to organize the solution of problems on parallel computers consisting of arrays of transputers, according to the university.

The Trillium system manages processing and communications on the transputer array and on attached front-end computers and workstations. It also allows users to program transputers in Fortran and C. Trillium commands are compatible with Unix.

The operating system was developed in the Advance Computing Facility of the Cornell Theory Center by programmers Gregory Burns, Andrew Pfiffer and David Fielding under the direction of the Center's associate director, Alison Brown.

The first implementation of Trillium is for the T-Series from Floating Point Systems. The Center has a 16-node T-Series computer.

For more information, contact Cornell University, News Service, Village Green, 840 Hanshaw Road, Ithaca, NY 14850-1548, telephone (607) 255-4206. (Source: Computer, June 1988)

New CASE product

Sage Software has unveiled a new personal computer-based computer-aided software engineering (CASE) product that is currently the only such product to offer full-function application generation and design and analysis facilities. Built around PS/2 technology and the Micro Focus Cobol/2 Workbench, the new APS/PC Workstation produces applications to be run in either the personal computer or MVS mainframe environment. Available for immediate shipment, the newest member of the APS Development Center series of CASE products represents two current trends: the downward migration of application development platforms to the personal computer and workstation level, and the move toward 32-bit computing environments, according to E. Acly of International Data (IDC) (Framingham, MA). Recommended for the APS/PC Workstation is an IBM PS/2 Model 70 or 80 equipped with 3 Mbytes of extended memory, 640 Kbytes of RAM, the Micro Focus COBOL/2 compiler, PC DOS 3.3, and a 5-Mbyte hard disk. (Extracted from MIS Week, 1 August 1988)

New computer language introduced

A new computer language that makes programming easier for first-time developers has been introduced by Carnegie Mellon University. The new cT language lets developers direct particular points on the screen directly with a mouse, write multifont text directly into the source code, and move the source code across hardware platforms without rewriting the compiled program. An Apple Computer Macintosh version of the language is available now. The university will release a version for IBM PCs, PS/2s, and compatibles running Microsoft Windows in late 1988. A version of cT for Unix workstations running X Windows will be available by the end of 1988. (Extracted from PC Week, 18 July 1988)

New fourth generation language

Relational Technology (RTI) will introduce a new fourth generation language (4GL) to ease ad hoc queries on workstation database management systems (DBMS) in late 1989. The new Windows 4GL will feature a SunSimplify-based database windowing interface, which is being jointly developed by RTI and Sun Microsystems (Mountain View, CA). RTI will be able to link the interface to window managers on DBMSs from workstation vendors such as Apollo Computer, Digital Equipment and Hewlett-Packard. Also, H-P's New Wave and other window managers can be interfaced to RTI's Ingres and Sun's SunUnify DBMSs. An internal production release of Windows 4GL may not be available for nine months. General availability is expected in 18 months. (Extracted from MIS Week, 1 August 1988)

Copyright it right

The computer on which you write software can now help copyright it too, says the company selling a program that completes the necessary forms online. The $25 program, Copyright-It, includes help screens, explanations of the information required, examples, and warnings.

The program also prints the information on a replica of the TK copyright form. It runs on an IBM or compatible PC. Contact: Synthetic Intelligence Inc., 286 Fifth Ave., New York, N.Y. 10001; 212-967-2399. (Source: IEEE Spectrum, September 1988)

Software aids response to chemical accidents

The US National Safety Council (NSC) plans to offer in a few weeks a computer program to help emergency planners and responding personnel deal more effectively with chemical accidents. The program, called CAMEO II, contains response information for more than 2,600 commonly transported chemicals, a detailed mapping system for locating chemical storage depots, an air-dispersion model to evaluate release scenarios and evacuation options, and a group of easily adaptable databases that can be used to organize response information. The program is an improved, more powerful version of CAMEO (for Computer-Aided Management of Emergency Operations), which was developed by the National Oceanic and Atmospheric Administration, with support from the Environmental Protection Agency. Responsibility for disseminating the program is now shifting from NOAA to NSC, which will sponsor a five day training course for CAMEO II users. The program, priced at about $325, requires a Macintosh Plus or SE computer with hard disk, 11 megabytes of memory, and Apple Computer's Hypercard. (Source: Chemical & Engineering News, 25 July 1988)

Asian-language desktop-publishing software

Aldus has delivered the first Asian-language version of the PageMaker desktop-publishing software, according to P. Brainerd, president. The new Kanji PageMaker 2.0, an implementation of the US version of PageMaker 2.0, combines both Japanese and English text and graphics. It requires an Apple Computer Macintosh II, Macintosh SE, or Macintosh Plus equipped with 2 Mbytes of RAM, a hard-disk drive, a LaserWriter or ImageWriter printer, and Apple's KanjiTalk 2.0 operating system. The software is marketed in Japan by Canon Sales. (Source: Technology Update, 5 September 1988)

Database from Hewlett-Packard

Hewlett-Packard is developing a fully distributed database for its Spectrum HP 3000 Series 900 RISC systems. The company has not decided if the new product, which will be built around its HP SQL offering, will be bundled with Spectrum's previously released Allbase database. Available at the end of 1988, the initial release will offer distributed access to read and update across HP SQL. Heterogeneous read and access of non-HP SQL databases will be offered in 1989, with a completely distributed database divided across systems planned for later. (Extracted with permission of DATAMATION[r] magazine[c], 15 July 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Keeping out the Kaos Club

A computer network is like a box with a padlock on the outside. It is no place to keep valuable secrets. If the padlock (which is often only a simple password) is picked, its contents are laid bare. Such vulnerability is spurring the computer industry to strengthen simple lockboxes with a maze of locked doors and sentry posts. Passwords are no longer enough.

Few people in the computer business publicly admit how bad security has become. But witness the recurring tales of fraudsters, hackers and viruses. A recent attempt to steal SFr 82 million ($54 million) from the Union Bank of Switzerland was not a real computer fraud - though it has been described as one. Computer crime involves intruders manipulating a computer themselves, rather than tricking others into doing so. One good example of the real thing is a gang of Federal Republic of Germany hackers - probably the Kaos Club, whose members are computer buffs from Hamburg - which has repeatedly broken into NASA's Space Physics Agency Network.

According to APSAIRD, an association of French insurers, companies in France suffered at least 15,000 breaches of computer security in 1986. About 70 per cent of them are thought to have been committeed by the companies' own employees. A report earlier this year by Coopers & Lybrand, a firm of accountants, found that only one out of a sample of 20 large European companies was "adequately secure".

The danger is increasing. As networks grow from hundreds of machines to thousands, the job of ensuring that all of them are secure grows even faster, since a hacker needs to break only the network's weakest link. Also, greater standardization in computing means that tricks used to break one system are likely to work for others too.

As dependence on computers and telecommunications grows, so do the consequences of security breaches. Fortunately, top-level defence networks are relatively safe. They do not use the public telephone lines which give the hackers their entrance. Defence employees are also more carefully screened to weed out potential data thieves. Everything else is at risk.

The first step towards security is good management. System managers often fail to insist that passwords are not too obvious and thus guessable (the user's name spelt backwards, or the letter "Z", for instance), or to ensure that passwords are changed frequently. Careful vetting of staff and established routines can help too. But even the best-managed system is still vulnerable.

This is where the computer companies have stepped in. All computers use an operating system to manage the flow of data inside them - allowing a program to collect data from memory, or send them to another computer. The American Government grades such operating systems for security from A to D (D is the worst). Few commercial systems score better than a poor C; and the problem with Cs is that, once a user has given his password, they do not distinguish between different types of information he might be using. Computer makers aim to rewrite parts of such operating systems to win them a B.

Besides identifying the user, a B operating system will actively police the information in its care. Suppose you want to send a file to another computer. A C-class operating system lets the user decide whether such a transfer is allowed. This can lead to trouble. The Kaos Club is believed to have sent in a file that sits quietly in the NASA network recording everybody's passwords. The passwords can then be used to gain access to other parts of the network.

A B operating system is not so easygoing. Each file is tagged - "confidential", "secret" and so on. Even after the user has given his password, the file must identify itself to the officious operating system, which checks that it is going where it should. The computer can be programmed so that files are used only during office hours; that they cannot move from one department to another, and so on. Also, as each file identifies itself, the system can take note so that system managers know who is doing what, and when.

One trick used by expert intruders is to spot trapdoors or mistakes in the operating systems. Programmers try to shut all possible trapdoors, but there are probably always errors in the six million or so lines of code that make up an operating system. Such mistakes are a hacker's rusty lock. To win a B, an operating system must be tested to check all its locks are shiny. After exhaustive testing, an operating system may edge towards an A.

At the moment few B systems are being sold. The federal divisions of IBM and AT&T sell them to the American Government. Gould, based in Illinois, sells companies a "secure" version of the Unix operating system which is graded with high C. An even more secure Unix, called Multix, comes from Honeywell. Honeywell also sells the only class A operating system, called SKOMP. Unfortunately, SKOMP is more preoccupied with security than productivity. It has won an unfriendly reputation. Most computer companies are working on B systems; many should appear in the next few years.

Meanwhile, they are making some easier improvements. For instance, most operating systems do not delete the information stored on disks when a user asks them to. Instead, they delete the file's name so that the information cannot be summoned. (The file will be wiped from the computer's memory only if it is overwritten by a new, named file when space runs out.) An intruder can retrieve "deleted" files with the help of a program that searches disks. When it finds a file with no name, it gives it one. He can then summon it and read any information it might contain. Secure operating systems laboriously erase not only the file's name, but the data it contains too.

The more secure a system is, the more tags, passwords and checks will accompany its data on their journeys around a system. Some estimates suggest that just 70 per cent of the traffic in a secure system is genuine data; the rest is the paraphernalia of security and protocol. Besides slowing down the computer, this security traffic is itself vulnerable. If an intruder learns the appropriate labels, he can exploit the operating system's security by forging them. In the case of a password, this will give him access to a set of personal files. In the case of a file classification, attaching the forged label to a file of his own lets him send it wherever he likes. To avoid such breaches, some people think a system must be encrypted.

Heavy-handed government agencies can make the problem of security even more labyrinthine. It took the Computer Security Act of 1987 to stop America's eager National Security Agency (NSA) from imposing its standards for secure systems on all American companies. According to an American journal, Government Computer News, many people feared that NSA-approved systems, whose workings were to be kept secret, would have backdoors built into them, allowing government to snoop.

Such political scraps spread across national boundaries. The American, British and Federal Republic of Germany Governments refuse to recognize each other's work and are using separate tests to grade their operating systems. The computer companies fear this will mean that they have to make different systems for each country, which would be hugely expensive. It would also make it harder for international networks to work. It would be a pity if secure networks excluded not only hackers but foreigners too. (Source: The Economist, 9 July 1989)

Fourth generation languages

The ever-increasing demand for applications software has led the software industry to devise novel methods of "programming". One of the most recent, in a long line of high-level languages, report program generators and application generators, is the fourth generation language.

But while the improvements in productivity offered by these and other techniques are to be welcomed, the fourth generation language is creating a new breed of specialist which threatens to aggravate a skills shortage in application development.

In the early 1980s, the fourth generation language sought originally to bring the power of programming to end-users. When it was discovered that this created more problems than earlier methods, fourth generation language suppliers aimed their products at professional programmers.

Fourth generation languages have now existed long enough for their impact to be assessed, but reports on their usage are conflicting.

A report published a year ago by the Central Computer and Telecommunications Agency (CCTA) and consultant Spicer Pegler discovered that savings in staff and maintenance were offset by increased hardware costs. Fourth generation languages are notorious resource-consumers and need more powerful machines than those required by earlier programming technologies, such as Cobol and Fortran.

By contrast, a report published in the US by Focus Research earlier this year shows that fourth generation languages are helping to reduce the application backlog.

In the UK, fourth generation languages still have a long way to go before they replace Cobol, still the main language used by mainframe data processing installations. And Cobol continues to live on through the medium of the fourth generation language - many of them use Cobol-type structures and produce Cobol code. This leads to a highly confused reading of the real impact of fourth generation languages.

The background to fourth generation languages is also confused.

There is no clean definition of what a fourth generation language is. The name implies something which lies between a third generation procedural language and a fifth generation, artificial intelligence-based artefact.

Many of the products which claim to be fourth generation languages existed long before the term came into common use.

A survey of fourth generation languages, sponsored by the Institute of Data Processing Managers and published in 1986, notes that there are "many different definitions of fourth generation languages. Some provided lists of their facilities. Some described the new technique in general terms. Some defined fourth generation language by stating what they achieve. Some offered a formal definition."

The survey suggests that the formal definition, which says fourth generation languages are non-procedural languages, means those which specify what needs to be done, rather than how it should be achieved.

Despite the advances made by fourth generation package suppliers, this definition would appear to be well ahead of the capabilities of many current products and probably explains why many are moving to the attractions of computer-aided software engineering (CASE).

CASE is the natural successor to the fourth generation language. It attempts to implement the idea of a specification language within the concept of the software-like cycle, something which does not sit easily with fourth generation techniques.

There are other developments in the pipeline. The most important is the coming together of initial experiments in expert systems and artificial intelligence.

At the same time many of the original expert systems shells have matured into more general development aids. It seems likely that these tools will develop alongside the new breed of CASE tools.

The positive side of these developments from current fourth generation language technologies is that they provide unprecedented choice for users. Never before have there been so many different ways to build applications.

The negative side is that the proliferation of different programming technologies creates the equivalent of the Tower of Babel, with no single technology (or language) dominant. This dilutes the skill pool. The effects have already been felt acutely in the UK and there is no evidence that it will get better. (Source: Computer Weekly, 21 July 1988)

Rain-spotting by personal computer revolutionizes locust control

Researchers at Bradford University have developed computer software that they say will drastically reduce the cost of monitoring the locust plagues currently threatening North Africa. The software will enable a personal computer to convert data from the European satellite, Meteosat, into rainfall maps.

Locust control centres currently use mainframe computers, costing up to 80,000 pounds sterling, to process satellite data. The new system cuts the cost by one third. Control units would also monitor rainfall more efficiently because Meteosat provides new data for the whole of Africa every half hour.

The UK intends to equip a regional locust control centre in Algeria and national centres in Morocco, Tunisia and Algeria, with the new system. The British contribution is part of a regional project of the UN World Meteorological Organization.

The current locust plague - the worst in 30 years - began after heavy rains last autumn. Swarms spread from the Sahel - the drought-prone lands on the southern edge of the Sahara - to northwest Africa.

Meteosat transmits infrared images of North and West Africa every half hour. Clouds show up easily on the images because the Sahelian belt is mostly hot and arid and the clouds appear cooler. Researchers at the University of Reading have identified 10 climatic zones across the Sahel. For each zone they have studied the relationship between the temperature of clouds and the rain they produce. The colder the cloud, the greater the chance of rain. From the position, temperature and persistence of cloud cover, locust control units will be able to justify the most likely areas throughout the Sahel, where rain might have fallen.

Maps of rainfall provide an early warning of where locusts may next breed because females must lay their eggs on wet ground. They time laying so that the eggs hatch when there is sufficient fresh vegetation for the young to feed on.

Rain storms in the Sahel are short-lived and impossible to monitor efficiently using rain gauges. However, such short, heavy rainstorms may provide enough water for locusts to lay eggs. Meteosat records even these shortlived rainstorms all over Africa. (This first appeared in New Scientist, London, 21 July 1988, the weekly review of science and technology)

VII. COUNTRY REPORT

Brazil

Research at Sao Paulo University

Brazil now has the technology to produce the most modern products for integrated circuit interconnection: titanium silicides. The research to develop that material has been conducted since 1985 by the Materials and Processes Division of Sao Paulo University's Integrated Systems Laboratory (LSI). That process is currently at the disposal of the computer firms interested in investing in titanium silicides, which are now being used in integrated circuits with 1 and 4 Mbits of memory, produced in the United States, Japan and Europe.

Prof. Dr. Jacobus W. Swart, co-ordinator of the Materials and Processes Division, explains: "Because they have an electrical resistance 10 to 20 times less than that of traditional interconnection materials, such as polycrystaline silicon, the silicides reduce the signal propagation time and make the circuit more rapid." He claims that the use of this material also makes it possible to reduce the total area occupied by the interconnection lines, decreasing the size of the chips. This is possible because silicide is refractory and can be oxidized, allowing for the use of interconnection on various levels. In other words, they can be placed on top of one another, and separated by an insulating layer. (Source: O Estado de Sao Paulo, 5 January 1988)

Workshops on microelectronic processing

Recently the Department of Semiconductors and Photonics at the University of Campinas, Brazil, together with the Brazilian Vacuum Society and the Brazilian Microelectronics Society held a two-day workshop on "microelectronics processing". Nine professors from different Brazilian universities and institutions were invited to present 10 tutorials covering the fundamental subjects of integrated circuit technology. These tutorials have subsequently been printed in book form, the first on this subject in the Portuguese language. Attendance at the course was over 150, drawn from all over the country and due to the success of the workshop, it is intended to hold a further one in February 1989. Participants are asked to pay a small fee to cover printing costs only since all the tutors are volunteering their services in an effort to strengthen this area of research in Brazil. Courses could be held in future in other Latin American countries since most of the tutors are fluent in Spanish and English. Further information may be obtained from Prof. Baranauskas, Head, Department for Semiconductors and Photonics/FEE/UNICAMP, P.O. Box 6101, 13081 Campinas, SP, Brazil.

Canada

Descriptions of integrated circuit designs received by the Canadian Microelectronics Corporation and reprinted with permission from the supplement to VLSI in Canada, March/1988, Vol. 6 No. 1

Design descriptions were requested from universities for each integrated circuit design submitted to the Canadian Microelectronics Corporation. These descriptions (of maximum length 10 lines) are intended to provide information regarding the IC design activities within the university community. Further information about specific designs or the integrated circuit technology interests of the universities sponsoring the design activities can be obtained by contacting the universities concerned.

Member Organization	Representative	Tel. No.
University of Alberta	Dr. C.R. James	(403)432-3333
University of British Columbia	Dr. D.L. Pulfrey	(604)228-3876
University of Calgary	Dr. J. Haslett	(403)220-5808
Carleton University	Prof. C.H. Chan	(613)564-7415
Concordia University	Dr. A. Al-Khalili	(514)848-3119
Ecole Polytechnique de Montréal	Dr. J.-L. Houle	(514)340-4753
Lakehead University	Dr. D. Leffen	(807)343-8583
Université Laval	Dr. U. Ganguly	(418)656-7943
University of Manitoba	Dr. R.D. McLeod	(204)474-8886
McGill University	Dr. N. Rumin	(514)398-7120
Memorial University of Newfoundland	Dr. P. Gillard	(709)737-8632
Université de Montréal	Dr. E. Cerny	(514)343-7472
University of New Brunswick	Prof. D. Luke	(506)453-4561
Technical University of Nova Scotia	Dr. D. Pincock	(902)421-1250
University of Ottawa	Dr. D. Gibbons	(613)564-3446
Queen's University	Dr. A.R. Eastham	(613)545-6320
University of Regina	Dr. W.J. Misskey	(306)584-4161
University of Saskatchewan	Dr. R. Muir	(306)966-8576
Université de Sherbrooke	Dr. S. Richard	(819)821-7[illegible]
Simon Fraser University	Dr. R. Hobson	(604)291-3128
University of Toronto	Dr. A. Salama	(416)978-8458
University of Victoria	Dr. E.G. Manning	(604)721-8612
University of Waterloo	Dr. J.A. Barby	(519)885-1211 ex. 3995
University of Western Ontario	Dr. Z. Kucerovsky	(519)679-2111 ex. 8309
University of Windsor	Dr. G. Jullien	(519)253-5751 ex. 2574

University of Alberta

Polysilicon Cantilever Based Vibration Sensor, M. Parameswaran

This is a CMOS compatible, polysilicon bridge based vibration sensor. The post processing technique described for IC3AARBG will be used here to obtain a polysilicon cantilever structure. This polysilicon cantilever and the p-well below it will act as the two plates of a capacitor whose capacitance will be modulated by the vibration that is sensed by the die (chip). The circuit on the chip is a capacitance controlled multivibrator, whose frequency output will have modulation (freq-modulation) from the vibrating capacitor. It is also felt that this structure can be used for accelerometer.

CMOS Process Compatible Vapour Sensor, M. Parameswaran

This design is a CMOS process compatible vapour sensor. The vapour sensing is achieved by measuring the mechanical resonance shift occuring in a vibrating microbridge in the presence of vapour

molecules. The microbridge is designed by the polysilicon interleaved structure on this chip. A two step post processing has to be performed on this chip (die) to remove the field oxide below the polysilicon to obtain the bridge structure. The p-well below the polysilicon acts as an electrode below the bridge structure for electrical excitation as well as detection.

Test devices, Aruna Ajjikuttira

Substrate transistors can be used in band-gap reference circuits and as output devices in Op-amps. Since not much information is available on substrate bipolar transistors in NT CMOS3 process, I am sending in two transistors Q1 and Q2, so that I can measure their characteristics after fabrication. Also included are four p-well resistors R1, R2, R3 and R4. The main interest here is matching. By design R2 = 8(R1), and R4 = 8(R3). I would like to see how well they match up. The same design was submitted in October 1987, but was not properly fabricated.

CMOS humidity sensor, M. Parameswaran

This is a CMOS humidity sensor. The interdigitated structure at the centre of the design forms a humidity sensitive capacitor and the circuitry around it forms a current-controlled multivibrator whose output frequency is timed by the humidity sensor. This design uses a fairly large area in order to isolate the sensor from the circuit, as well as to allow some space to pour an epoxy to cover the bonding wires.

University of Calgary

Switched Capacitor, cyclic algorithmic converter, Brian Leckie

This submission combines the circuitry of the previous two submissions (IC3CYCMP and IC3CYMUL) to produce a fully integrated switched capacitor cyclic algorithmic converter. This single chip converter will be compared to a multichip version with respect to noise performance. The circuit is capable of A/D and D/A conversions using ratio independent and reference refreshing algorithms. The design contains a pair of fully differential, switched capacitor integrators and a pair of fully differential, low offset comparators. The submission also contains four large W/L ratio transistor test cells to assist in reconciling simulations and actual performance. Operation of the integrators and comparators have been simulated using HSPICE and SPICE2G.6. The transistor models for these simulations were extracted from large W/L test devices submitted in April 1987 and from the test strip of that submission.

Pattern checker, Angelos Vrionis, Angelo Cuffaro and John Vamvakas

Basically the chip was designed using static logic. Twenty-three D type flip-flops, 8 2-input MULTIPLEXERS, 8 EXCLUSIVE-OR gates, 8 drivers, 18 input pads, and 2 output pad drivers were used in the pattern detector. The pattern checker can detect an 8-bit pattern from a stream of serial data. The output pin can drive one TTL load and is a logic high when a pattern is detected. A 15-bit shift register is used to clock in the serial data at a maximum rate of 16.67 MHz. Then the 8-bit pattern is clocked in through an 8-bit parallel load register (the second clock can operate at a maximum rate of 50 MHz.). In addition the user can cascade both registers together to create a 23-bit shift register for testing purposes.

A systolic VLSI matrix for fundamental searching problems, Warren Berman and Marco Zelada

This chip has been designed to solve basic searching problems; in particular, it is capable of reporting intersecting pairs in large sets of rectangles, a crucial step in checking the design rules for VLSI circuitry. It can also be used to perform general range queries. Approximately 13,000 transistors were used in this chip which is quite dense. It is estimated that the IC will work at around 5 MHz (+/- 10 per cent). Two input clocks are required, clock 1 and clock 2. Clock 2 must be 180 degrees behind clock 1. The chip matrix is composed of 20 rows. Each row contains 4 identical cells composing the columns. Attached to each row there is a multiplexer which will receive the anded row result and shift it down between the word begin (WB) and word end (WE) signals. Each cell itself contains two 8 bit shift registers (SR) and one boolean operator which performs the operation. Computations are carried out in parallel and outputs are generated in a bit serial manner.

Université Laval

Generateur d'histogramme, Yves Trottier and Bonanventure Karuta

Le design consiste en un bloc mémoire de 16 x 7 bits contrôle par 4 bits d'entrée (décodeur 4 à 16) et trois signaux d'entrée: H1, H2 et CLR. Les sept signaux de sortie est re-injectée à l'entrée des registres. La valeur du dit registre est alors incrementé lors du premier coup d'horloge et sauvegarder lors du second. Un registre de depassement permet finalement de verifier si une erreur de depassement s'est glissée lors du traitement. L'operation du circuit se resume donc ainsi: (1) mise a zero de tous les registres; (2) envoie sequentiel de tous les pixels de l'image (la valeur du pixel doit rester stable pendant les deux coups d'horloge); et (3) lecture sequentielle de chacun des 16 registres constituant l'histogramme.

McGill University

McRmppl - Processing element for a reconfigurable massively parallel processor, H. Cox, K. Fadlallah, S. Gaiotti, A. Jain, M. Malowany, R. Ito and B. Mandava

The McRmppl is a bit-serial processing element (PE), which is functionally equivalent to the Goodyear MPP PE, augmented with reconfiguration switches. It contains a one-bit full adder, five one-bit registers, a general logic function unit, a variable-length shift register, and a distributed control unit. The PE is implemented in static CMOS, using a robust single-phase clocking scheme. A nanocode assembler and a functional simulator, coded in C, were used to generate test vectors. This object of this second submission is to verify the functionality of the entire processing element. It includes a few modifications to the control logic and the D flip-flops of the July 1987 submission.

An array multiplier cell incorporating a self-configuring network, Stephen Pateras

This chip contains one cell or an array multiplier which incorporates a self-reconfiguring interconnection network. The multiplier is being used as a testbed for the self-reconfiguring network

which is the main focus of this design. The self-reconfiguring network permits a two-dimensional array of cells to automatically reconfigure itself to bypass faulty cells thereby maintaining a working two-dimensional array.

Ecole Polytechnique de Montréal

IMAGE 2 - A VLSI multiprocessor chip for image processing, Daniel Audet, Claude Cyr and Gilles Chouinard

This high performance multiprocessor chip is intended to perform image processing algorithms. Its main application is oriented toward local operations on fixed point image data. High processing speed is achieved using a SIMD architecture, and bit-serial calculations and communications. Indeed, the chip contains eight usable bit-serial processing elements which can communicate with their immediate neighbours. Two other processing elements were added to enhance yield as part of fault tolerance research.

Royal Military College

Boolean processor, Doug Moore

This design is one part of a larger design for doing rapid boolean pattern matching. When coupled with its GOAL PROCESSOR mate the pair will form the basis of a logical inference engine in a rule based expert system. The inference engine would be composed of one goal processor; the number of boolean processors would be determined by the maximum number of antecedents to be processed at any one time.

Université de Sherbrooke

An implantable neural prosthesis, Mohamad Sawan

This device is the second version of an implantable neural prosthesis. It is composed of various channels designed to control the stimulation of up to eight electrodes. The device operation is controlled by an elaborate PLA. A decoder manchester received the information as a stream of binary signals. The information can then be addressed to various registers integrated in the chip, or to external EPROMS or EEPROMS. The conversion to analog signals is completed by means of four separate 5-bit D/A converters.

A 16-channels cochlear implant, Marc-Andre Talbot

This neural stimulator recovers serially transmitted manchester coded data via an inductive link through the skin. The numerical data are translated into analog signals by means of an array of 16 totally independent 7-bit D/A convertors. Transconductance output amplifiers assure perfectly controlled current densities into the nerves. The configuration also permits monopolar and bipolar stimulation. The system's operation is regulated via an elaborate 100 per cent testable PLA.

EEC

EC allocates 2 million ECUs for Delta-4 architecture

The EC Commission, after successfully completing the initial phase of the ESPRIT DELTA-4 and CONCORDIA projects, has approved a large-scale project that combines the two.

This project will continue to be carried out under the name "DELTA-4" ("Definition and Design of an Open Dependable Distributed Computer System Architecture"). The new phase, which started on 1 March 1987, will last two years with a budget of 10 million ECUs. The project consortium includes partners in the previous DELTA-4 and CONCORDIA projects and two new partners, BASF and LGI.

The industrial partners are currently Bull (France) as prime contractor, BASF (FRG), Ferranti (Britain), Jeumont Schneider (France), and Telettra (Italy).

The primary objective of the project is to support progressive levels of reliability and performance in an open and distributed environment. Consequently, the project is developing an open architecture able to coexist and interact with the ISO (International Standards Organization) standards in accordance with the OSI (Open System Architecture) model. Both the existing ISO standards and those yet to be defined are of interest and within the framework of new developments the project intends to make a substantial contribution to the new area of ISO activity concerning distributed processing (ODP - Open Distributed Processing).

As can be seen from the name, the project tends to specify general architectural characteristics and to develop a prototype of the resulting architecture. As an example of this prototype work, in Phase 1 a system of communication based on atomic multicast protocols was presented. To provide these characteristics, this initial implementation extends the IEEE 802.5 standard token ring. In the new phase, this process will be effected on other communication standards such as the IEEE 802.4 token bus and the ANSIX3T9.5 FDI optical fibre token ring, and will be integrated with the defined computational model through a new application support environment.

In addition, some complementary extensions to the relevant Network Management System will be developed.

A vast area of applications that include Computer Integrated Manufacture (particularly in relation to MAP) and Office Automation is expected, emphasizing aspects of real-time information processing which have been neglected until now.

The importance of testing the entire architecture in an industrial environment is recognized, and plans have been made for further development of the project under ESPRIT 2, with installation of large prototype in the BASF plants at Ludwigshafen. (Source: Technologie Electtriche, January 1 88)

ESPRIT 2 gets formal go-ahead

ESPRIT 2, the second stage of the European Community's R&D programme on information technology (RACE), was endorsed by the European Community's Research Ministers in Luxembourg on 11 April.

ESPRIT 2 commits 1.6 billion ECU (around $2 billion) to be spent by the Community on collaborative information technology research over the period until 1992. An equivalent amount will be spent by participants, giving a total programme expenditure of 3.2 billion ECU ($3.9 billion). This will be for collaborative, precompetitive research involving industry, higher education institutions and research bodies. (Source: European Science News, April 1988)

Europe's researchers deluge ESPRIT

The European Commission has been so overwhelmed with requests for funding from its programme for research in information technology, ESPRIT, that it may use money set aside for other research over the next five years.

For instance, a 7 million pounds sterling project called Advanced Network Systems Architecture, which aims to lead the development of international standards for distributed computer processing, is attempting to satisfy demands from the Commission to include more non-British collaborators.

The huge demands being placed on ESPRIT's finances derive in part from the inclusion of a number of large collaborative projects known as "technology integration projects" (TIPS). Ten TIPS are under consideration on, for instance, computer-assisted design and parallel computer architecture. Sources in Brussels expect "a fair number of these TIPS will be funded". This will cost well over the 600 European Currency Units budgeted for this year. (This first appeared in New Scientist, London, 21 July 1988, the weekly review of science and technology)

Parallel processing computer proposal for ESPRIT

ICL, Siemens and Bull have proposed jointly developing a parallel processing computer under the ESPRIT programme. The computer would be called the European Declarative System. The project has been approved by ESPRIT technical staff, and now needs management committee approval. The project originally was estimated at 50 million pounds sterling, and it will involve researchers from 16 organizations. It will draw heavily on research done under the Flagship project of the UK's Alvey programme. A rival parallel processing computer project run by Philips and Olivetti may also be included in ESPRIT. (Extracted from New Scientist, London, 14 July 1988, the weekly review of science and technology)

Informed decisions on information technology and voice projects

European researchers in information technology have been put out of their misery now the European Commission has decided which projects it will fund under ESPRIT II, the second phase of its programme of research in IT.

The Commission has named the 158 projects which have won money. The ESPRIT management committee has decided to spend around 780 million ECUs this year, 180 million ECUs more than planned. The main reason, say sources in the Commission, was to reduce the rate at which good projects would otherwise have been rejected.

Successful projects include work on a European supercomputer, and new software which is cheap to develop and reliable. In the microelectronics area, projects include research into integrated circuits, with the aim that Europe could produce one new design every day.

Projects in this area will also examine high performance chips that can work at frequencies as high as 1 gigahertz, and memory circuits that retain their information even after disconnection of the power source on which they rely.

There will be three projects on speech recognition, despite the deluge of requests for ESPRIT funding in more established fields.

The exact amount of funding will not be announced until final contracts are hammered out with companies. The projects include Sundial, with participation from the British software company Logica, FRG's AEG, the University of Erlangen and a number of Italian companies. Sunstar, which will emphasize the design of computer interfaces, includes AEG and Siemens, as well as Danish, Dutch, Italian and Portuguese companies. Polyglot will aim at the conversion of speech into text in several languages. It involves Olivetti, the University of Edinburgh, the French science agency CNRS, and German, Dutch and Spanish companies. The third project involves the recognition of speech in noisy environments, like cars, and will include universities at Edinburgh, Madrid, Kiel and Turin, as well as Logica.

The Sundial project aims to build a system which will recognize continuous speech. It will have a vocabulary of 2000 words, and will conduct "intelligent" conversations over the telephone.

British Telecom and Logica have already produced a railway timetable which gives travellers information over the telephone. The system, called Vodis, asks callers to repeat themselves if it cannot understand what has been said.

Despite success through work under ESPRIT, researchers in this field are still struggling to make up ground lost last year when Plessey pulled out of a 14 million pounds sterling project to build a machine, nicknamed the Speakwriter, capable of producing text from dictation. Marconi Secure Radio is to take over the project after a year of talks with Plessey and its partner, the Centre for Speech Technology Research at Edinburgh University. Marconi, which has had to haggle with Plessey over intellectual property rights, has no plans to develop the Speakwriter itself. This work, which involved 30 people at Edinburgh, was sponsored by the Alvey advanced computer research programme. It was to be run on a parallel computer built by the computer company ICL, Imperial College, London, and Manchester University.

Plessey planned to build a word processor that could run the Speakwriter software, but pulled out because it could not raise the cash or find a computer powerful enough to perform the speech recognition.

Marconi wants to use Edinburgh's work on phonetics and semantics to improve the powers of its own voice recognition systems. (This first appeared in New Scientist, London, 4 August 1988, the weekly review of science and technology and Computer Weekly, 11 August 1988)

Funds shortage screens research

In 1989, EEC ministers will begin an 18-month review of Europe's 5.4 billion ECU Framework high technology research programme of which ESPRIT is part. This could provide some scope for a second look at ESPRIT's share of research cash.

The only advantage of a small purse means that only the very best projects will get funded.

ESPRIT 2 is putting particular emphasis on strengthening European capabilities in areas such as ASICs (application specific integrated circuits), very high speed (bipolar) integrated circuits, non-volatile computer memories, high performance parallel processors and new office workstations which will handle voice, data, graphics and handwritten input.

A major new initiative is to establish Europe wide software certification procedures so that users can be confident products conform to their specifications.

The project, which is called Scope, involves the UK Atomic Energy Authority, the universities of Strathclyde and Glasgow, the City University and teams from Denmark, Italy, Spain and the Federal Republic of Germany.

Alongside it, the Commission is also launching projects to encourage faster take-up of formal design methods, the use of knowledge engineering techniques in system development and maintenance and a more rigorous approach to capturing user requirements.

The programme will also build on the successes of ESPRIT 1, such as Supernode (based on Inmos' transputer technology) and CNMA (community network manufacturing applications). (Source: Computer Weekly, 11 August 1988)

Europe prompted into neural action

Europe is to have a neural computing research programme under ESPRIT. The European Commission will fund two projects (chosen from four proposals submitted this year) to the tune of 5 million ECU (3.5 million pounds sterling) for an initial definition phase.

Neural computing did not originally feature in the ESPRIT workplan, but the Commision's head of information processing, John Elmore, has found industry keen to apply the technology. The US and Japan are already investing heavily, but Europe has done little, even though the idea of computers emulating brain function have been around for at least a decade.

The two projects are Pigmalion, led by Thomson CSF of France, and Annie, led by the UK Atomic Energy Authority, which has already set up its own neural network applications laboratory.

Pigmalion is an ambitious project which will study architectures and algorithms for neural processors in an attempt to find the best structure for a general purpose neural computer. The 17 European partners include Siemens, Philips and University College, London.

Annie's participants include British Aerospace, Artificial Intelligence and French, Greek and German research organizations. UKAEA and British Aerospace see potential for neural networks in automating non-destructive testing of pressure vessels and planes.

One main task for both teams before ESPRIT will put up further funds is to define the industrial applications. Potential applications could be in condition monitoring for early fault diagnosis and in robotics for handling radioactive materials and decommissioning nuclear power stations. There could also be widespread commercial potential from combining neural networks with expert systems technology.

Annie will also compare hardware and software simulations of neural nets, to compare their problem-solving capabilities with conventional techniques.

A key component of both projects is technology transfer - both want to get the research as widely known as possible. (Source: Computer Weekly, 11 August 1988)

Ministers encouraged by EUREKA success

If European industry is to present a united front in the international high-technology market, it must make unification of standards a priority from the outset of research and development. This was one of the main resolutions of the fifth ministerial meeting of the Commission of the European Communities' EUREKA high technology research and development programme, held in Copenhagen on 15-16 June.

EUREKA was started in 1985 as a non-military alternative to participation in the US Strategic Defense Initiative programme. The approval of 54 new projects reflects the consistent annual increase in proposals from industry and brings the total number of active projects to 213, worth 4,756.2 million ECU (1 ECU = 0.69 pounds sterling).

Ministers were able to see three projects near completion - the high-definition television (HDTV), a modular assembly-line applicable to different industries (FAMOS) and EUROTRAC, a project to monitor and deal with atmospheric and marine pollution. EUROTRAC is one of the few examples of a non-commercial application of EUREKA funds and, to be effective, has meant that Eastern bloc countries have been asked to take part.

French research minister Hubert Curien said that agreement on standards is essential if European industry is to compete with US and Japanese manufacturers. The incompatibility of electricity mains frequencies between Europe, the United States and Japan is greatly complicating development of products, he said.

Having initiated EUREKA, France remains its most active supporter, with involvement in 102 projects, an investment of 1,374.8 million ECU. (Source: Nature, Vol. 333, 30 June 1988)

New EUREKA project to develop automated chip inspection

The IMAGIA project (Inspection Machine for an Automated and Genuine Intelligent Analysis of Semiconductors) was given the EUREKA label by the Council of European Research Ministers which met in Madrid.

The project is the outcome of French-Swiss co-operation; its partners are two French companies, Bertin and Serge Dassault Electronics, plus the Swiss Electronics and Microtechnology Centre (CSEM) and the Wild Leitz group.

With a total budget estimated at Fr 100 million, IMAGIA is expected to market, by 1992, a system that would provide automatic quality control of integrated circuits, using in particular artificial intelligence techniques; today, IC control is mostly a purely visual inspection.

In order to identify the features of a size much smaller than one micron that will characterize the circuits of the 1990s, the system will use the most advanced image acquisition devices. The images observed must then be processed electronically and then interpreted by an expert system which will sort out what is acceptable and what is not, based on experimental criteria.

Thus to separate "the wheat from the chaff", the expert system will use not only the know-how of experts in semiconductor manufacturing, but also the very same computerized data that will be used to produce the circuits.

The system will therefore be particularly well suited to the inspection of ASICs (a market that is booming) which are usually produced in relatively small series and pose very specific control and testing problems.

The consortium was formed specifically to regroup the diversified and complementary expertise required for such a project. The prime contractor is the Swiss company CSEM, a designer and producer of ASICs. Two companies will be in charge of the optical part: the Wild Leitz group, a world leader in industrial optics, and Bertin, which will contribute its expertise in image processing; Serge Dassault Electronics will be in charge of the artificial intelligence part and will contribute its 15 years of expertise in the field of ASICs.

As it prevents any scattering of efforts, to which none of the partners would probably have agreed, the gathering of these capabilities reflects, according to the four partners, the very purpose of the EUREKA program, "and there is no doubt that, despite the technical risks involved in this ambitious project, such a synergism should enable the European industry of 1992 to take over an additional position in the large economic battle that is already being fought worldwide in the field of advanced technologies," they added. (Source: Electronique Actualités, 22 January 1988)

EC warns of communications trade war

The European Commission last week has warned of a potential telecommunications trade war if the liberalized European market becomes dominated by non-European companies.

Michel Carpentier, director of the European Commission telecommunications directorate has said there are serious imbalances in the conditions of access to international markets for telecommunications equipment.

This applies particularly to Japan whose exports to the EEC have been rising rapidly, especially into the UK and FRG markets. In 1987 Japanese imports into the EEC were worth almost one billion ECUs (about 700 million pounds sterling), while European exports to Japan were worth only 40 million ECUs (about 28 million pounds). The deficit with the US is nearly 500 million ECUs (350 million pounds).

Carpentier warned that freer access to the EC market will have to be closely linked to multilateral or, if necessary, bilateral concessions in this or other sectors. The Community cannot afford to make major unilateral trade concessions as a result of domestic integration.

Japanese suppliers are expected to respond quickly to the liberalization of European markets but trade in the opposite direction will be of little significance, because of both Japanese reluctance to buy overseas and European manufacturers' lack of confidence to produce substantially for the Japanese market.

US companies are already entering the European market, both as equipment suppliers (AT&T has a joint venture with Philips) and service suppliers (IBM, EDS and Geisco all offer managed data network services across European national boundaries). But the US market is also difficult for European suppliers to enter, partly because of the diversity of networks.

Despite the fears the European Commission is pushing ahead with further proposals for breaking down the national barriers that limit the growth of the telecommunications industry. The recent directive laying down a timetable for the opening of the terminal equipment market will be followed at the end of the year by one to insist on common technical specifications and mutual acceptance of conformance testing.

Next year will see measures designed to open the market for telecommunications switches, force the separation of regulatory and operating functions, and move towards harmonization of tariffs.

Liberalization seems inevitable, but its consequences cannot be predicted with any certainty. (Source: Computer Weekly, 7 July 1988)

Super opportunity for Europe

The European parallel processing community has been given a clear direction by John Elmore, head of information processing for ESPRIT. Speaking at Conpar 88, the third international conference on parallel processing, hosted by the British Computer Society at Umist, Elmore called for a European supercomputer initiative to take advantage of the "major opportunity now opening up in high performance, low cost supercomputing".

Supercomputing is dominated by US companies such as Cray and Control Data and by a host of minisupercomputer companies such as Alliant and Convex which are aggressively looking for sales in Europe and Japan.

The ESPRIT information processing division is currently canvassing supercomputer users such as British Aerospace, Rolls-Royce, the CEGB and their European counterparts, to identify their requirements.

The supercomputing initiative would give an extra focus for the various high performance parallel processing projects in Europe inherited from national research programmes, such as the Alvey-funded Flagship and the German Supernum, as well as ESPRIT I projects. (Source: Computer Weekly, 22 September 1988)

Federal Republic of Germany

FRG launches long-term subsidy programme for neural networks

In January 1988, the Federal Ministry for Research and Technology (BMFT) initiated a five-year subsidy programme to further research and development in the area of neural networks. A second project phase is expected to follow, with the aim of implementing the systems to be developed nationwide during the first five-year phase. The close attention paid to the area of neural networks (or more generally, connectionalist computer systems) by the federal Government is further emphasized by the fact that 50 per cent of the funding of this programme has been "scavenged" from other, already running programmes.

The programme, at this time, focuses on algorithms for data representation and system organization. Emphasis will be placed on methods of expressing external sensory and motor situations, and on methods suitable for perceiving, evaluating and generalizing knowledge in a neural network. It is expected that the proposed projects will pay special attention to the development of flexible systems that can function in a variety of changing and unpredictable conditions.

Industry, research institutes and universities are all invited to participate in the BMFT's programme, which is co-ordinated by scientists in

the Information Sciences Division of the J. Gutenberg University in Mainz. (Source: European Science News, April 1988)

Breakthrough in conductive polymers

Even though electrically conductive polymers have been known for over a decade, their lack of stability and low conductivity made practical applications seem remote. However, in late 1987, the Max Planck Institute for Polymer-Research in Mainz and the University of Bayreuth reported that they had developed a stable polyacetylene compound which has conductivity as high as metals.

The research was done within the heavily sponsored materials-science programme of the Federal Ministry for Research and Technology (BMFT); industrial scientists were also involved.

Interested colleagues may contact the Director, Max Planck Institut, Saarstrasse 23, Postfach 3060, D-65 Mainz, Federal Republic of Germany directly. (Source: European Science News, April 1988)

FRG is a leading player in the European Integrated Services Digital Network Buildup

The Federal Post Office has initiated two pilot projects (in Mannheim and in Stuttgart) in order to test the Integrated Services Digital Network (ISDN), which is to provide an integrated network for all forms of telecommunications. These two projects, each handling some 400 users from the administration and business sectors, represent the start of a European system capable of simultaneously transmitting voice, text, video-picture, data, and on-line drawn diagrams. By late 1988, ISDN will be commercially available throughout the FRG, and it is hoped that by 1993 most of the nation-wide demand for ISDN ports and networks will be met. By then, integration with other countries will have also proceeded substantially.

The system allows for very sophisticated communications. For example, while conducting a telephone conversation or even a videophone interaction, a user will be able on the same line to telefax a text to his partner, or use a "telewriter" for simultaneously transmitting explanatory diagrams.

Most of the sophisticated digital switching equipment (and much of the peripherals) will be supplied by Siemens A.G. The compact, high-performance CP 113 switching processor recently developed and demonstrated by Siemens is claimed to be the most powerful in the world. It controls the setting-up of calls between subscribers, and it also records and administers traffic and change data. Its final version will serve up to 250,000 lines, and will be able to carry out 1.2 million "busy hour call attempts". (Source: European Science News, April 1988)

Report on research and technology policy

The Federal Minister for Research and Technology has released the 1988 federal report on research and technology policy. The promotion of basic research has gained considerable weight in the BMFT budget. A second priority has been the promotion of health, ecological environment technology and climate research. Funding in these areas is up by 72 per cent since 1982. The BMFT has focused on promoting industry-oriented technologies such as information technology, materials research, biotechnology and Airbus development as well as selected physical technologies. Research promotion for medium-sized industries in 1987 reached DM 780 million (about $460 million). The FRG intensified its international co-operation efforts, particularly in Europe: the EUREKA program grew to a total volume of DM 9 billion, and a new framework for research and development was established in the EC setting. The FRG has initiated efforts towards technology standardization in Europe, committed to participation in the new high energy accelerator (LEPO at CERN) and an expanded European space programme. (Source: European Science News, May 1988)

Protecting the environment with IS

Against a background of numerous environmental disasters in central Europe, the Government is gearing up an environmental research programme to develop environmental control systems based on information technologies. Research centres are springing up across the country. Developing environmental protection control systems is becoming a key area of opportunity for the IS business in the FRG. Environmental protection is already a fast-growing industry - $12 billion last year in the FRG alone - and will be second only to electronics as the industry of the future, say business analysts. (Reprinted with permission of DATAMATION[r] magazine[c], 1 September 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Highly automated manufacturing system outlined

While other manufacturers have the data concerning the future model written down on papers that accompany the developing automobile through all production stages, this task is performed by an ordinary chip at Audi. The casing box in which it is placed is as big as two cigarette packets and is attached to the floor panel of the automobile's unfinished body by a robot.

What makes the idea technically interesting is that before being fixed, the chip is "loaded" with a microwave device. A so-called communicator instantaneously feeds all necessary information into the chip; during the production process other microwave devices gradually read this. This ensures that the future Audi 80 or 100 is painted in the right colour, that it is equipped with the right engine and that its optional equipment meets customer's requirements.

The chip is a sort of identity card for the developing model; in addition to order-related data, it contains the chassis number, production stage-related data (model, body, varnish, assembly), data concerning the destination ("originating place, final destination") and quality characteristics (inspection reports, outcome of finishing operations, missing parts, etc.).

Once loaded, the automobile goes through individual production stages as if magically guided, only stopping for a short while at about 70 reading stations where microwaves scan the data carrier and then tell the production computer what has to be done next. At this point, the computer decides which department the automobile must be sent to, it lays down the production operations that have to be performed there and determines the next stop.

The whole reading and re-writing processes are accomplished in just a few milliseconds. Microwaves are used for this purpose for good reasons. They ensure accurate scanning up to a distance of 1.5 metres, while other systems function only at a distance of up to 10 centimetres, due to the beam

focusing required. In this case, scanning becomes difficult when the data carrier is wobbly or hanging wrong, not to mention steel surface reflection, which only minimally affects microwaves, but makes laser beam reading and writing virtually impossible.

Audi's production is to date controlled by chips until the final assembly stage. However, there is a slight flaw. In fact, the identity plate must be exchanged before the automobile is painted and subjected to the heat treatment, because its batteries, which are expected to last eight to 10 years, would not survive the temperatures of up to 250°C.

This is why, before painting, a robot exchanges the data carriers, mounting special steel pots with Teflon lids which protect the identity plate, enabling it to survive the extreme stress with no damage. One such pot can undergo about 20 painting cycles, before the layers of paint settled on it have to be removed or the crumbling color crusts will dirty the dipping tanks.

By 1990, the system is expected to be installed in the entire production process from body assembly to delivery. By then Audi will have invested about DM 30 million in automated production control. This is no wonder, because mobile data carriers alone absorb considerable sums. They cost about DM 500 a piece, mounting device included, whereas heat-proof structures cost about DM 700 each. (Extracted from Hightech, No. 1/88, January 1988)

France

STRIDE: Advanced microelectronics research in France

The Laboratory for Solid State Physics and Solar Energy (Laboratoire de Physique du Solide et Energie Solaire [LPSES]) at Sophia Antipolis near Nice is devoted exclusively to research on advanced, high-performance, photo voltaics for space applications and studies of the electronic properties of semiconductors. The focus of attention is GaAs (III-V) and its derivatives. The laboratory excels at molecular beam epitaxy and metalo-organic vapour phase epitaxy. It is the only laboratory in Europe which can produce GaAs thin films on silicon substrates by both methods and make quantitative and qualitative comparisons between the two techniques. LPSES is the head of a European consortium, including EIM, EC (Belgium), Marconi (UK), Fraunhofer (FRG), and an Italian company charged with working on GaAs and related materials for space applications. In the area of GaAs thin films deposited on silicon substrates, LPSES may be the best laboratory in the world.

LPSES consists of 25 full-time Ph.D. scientists and 13 support staff of engineers, technicians and administrators. Excluding major expenditures such as large equipment purchases but including salaries, the LPSES budget is about F 10 million (about $1.8 million) per year.

LPSES possesses state-of-the-art equipment in both molecular beam epitaxy and metalo-organic vapour phase epitaxy. C. Verie, the Director, argues convincingly that it is easily the best laboratory in Europe in this regard. It is the only laboratory in Europe that has the capability to compare thin films produced by the two techniques. Using these techniques, attention is focused on GaAs (and related materials) thin films on silicon substrates, taking advantage of the properties of both media. The aim is to produce reasonably sized photovoltaic systems for space applications that can produce tens of kilowatts as compared to the hundreds of watts currently available. (The Soviet MIR Space Station uses 13 kW supplied by 100 square metres of GaAs solar cells, but these are not thin films. The Japanese satellite GS-III uses 1 kW derived from 10 square metres of GaAs thin films on a silicon substrate.) In this area LPSES has collaborative efforts under way with the universities of Delaware and North Carolina and with Stanford University and the Jet Propulsion Laboratory at the California Institute of Technology. It also works with Varian Corporation and the Hughes Company. In the area of III-V systems (including GaAs and GaInAs), LPSES heads a European consortium consisting of 25 LPSES researchers and 35 researchers from the industrial firms EMIEC (Belgium), Marconi (UK), Fraunhofer (Federal Republic of Germany), and an Italian company which was not identified.

LPSES is also the only French laboratory which conducts research on ultrahigh-purity germanium vapour. The work, funded by the French space agency CNES, includes epitaxy studies. Ultrahigh-purity germanium thin films with impurities on the order of 2×10^{-12} have been achieved. The laboratory also studies impurities in semiconductor single crystals under high pressures (40 kilobar) using photoluminescence. Work is in the planning stage on high-temperature superconductivity in organometallic materials. (Source: European Science News, May 1988)

Superconductivity research in France

Research on high-temperature superconductors carried out at the Centre de Recherches sur Les Très Basses Températures (CRTBT - Centre for Research at very low temperatures) and the Laboratoire de Cristallographie (Crystallography Laboratory), both in Grenoble, is world class. An extended but loosely aggregated scientific group effort (Groupement Scientifique), which includes industrial as well as academic researchers, has been organized under the leadership of R. Tournier of CRTBT. This collaboration includes scientists from these two laboratories, the group of J. Etourneau at the Laboratoire de Chimie du Solide in Bordeaux, the group of B. Raveau in Caen (who prepared the first ceramics which led to the discovery of high temperature superconductivity) and groups from the industrial firms Rhône-Poulenc, CGE, and Thomson. The Centre Nationale de la Recherche Scientifique (CNRS) has committed, exclusive of salaries and overhead, F 1 million per year for four years to this group effort which has been matched by the industrial participants. In US budgeting terms, the resources available amount to about $1 million per year. The number of researchers involved is about 40. Major recent developments have been the achievement at CRTBT of current densities of 4,000 amps/cm^2 in silver-doped YBaCuO, the discovery at Caen simultaneously with IBM of the $TlBa_2Ca_2Cu_3O_9$ HT_c superconductor and the measurement on a powder sample of this material (with large grains) of 70 per cent diamagnetism at about 100 K. (This extrapolates to 100 per cent diamagnetism in a solid.) In the facilities available in the scientific park at Grenoble, including the international Institut Laue-Langevin (ILL) with the highest neutron fluxes in the world and the International (French/German) High Field Magnet Laboratory, the "groupement" can do most things of interest in HTC superconductivity research except, perhaps, thin films and optical measurements, although capabilities in these areas are actively being developed. (Source: European Science News, May 1988)

France's LCC to double ceramic chip production with new factory

The new LCC ceramic condenser chip plant is now in operation in Dijon. The plant, on which work began in April 1986, received help from the Passive Components Programme, among others, and required investments in the region of Fr 30 billion. Once the modernization is completed, production capacity will exceed 1.3 billion condensers.

The plant, producing ceramic chips, occupies a surface area of 7,000 square metres, of which 5,300 square metres are devoted to workshop. Seven workshops, all located on the same level, are involved in the various production phases, each equipped with its own integrated control systems.

The technology used to produce ceramic layers is compatible with new technologies (nickel barrier) and allows considerable savings in the use of precious metals.

In addition to its condenser production units, the plant also supplies other LCC factories located abroad - primarily in Spain and Brazil - with raw materials.

LCC's goals in the field of multilayer ceramic condensers are ambitious, though more in terms of growth than of market share because the firm at present produces only 1.5 per cent of world production expressed in sales. With these investments the company expects to double this share over the medium term. The effort will also spill over into related sectors, and in this way LCC intends to increase its market share for products for professional use, such as telecommunications and computers, through the cost reductions created by both the critical-size effect and the development of new technologies. (Source: ETI Electronique, 15 January 1988)

Alcatel-CIT, CNET sign agreement on dry etching technology for substrates

The CNET (National Centre for Telecommunications Studies) and Alcatel-CIT have just signed a licensing contract for the transfer of the dry-etching method for III-V semiconductors developed by CNET. Among other things, this technology makes submicronic and anisotropic etching of substrates possible.

The reactive ionic etching method involved in this technology transfer was developed from a mixture of non-toxic, non-corrosive gas (methane, argon, and hydrogen) that reacts with III-V semiconductors producing volatile organometallic composites. First used with InP materials (InP, GaInAs, and GaInAsP), it was subsequently expanded to include other III-V compounds such as GaAs, GaAlAs, and GaSb.

In conjunction with several research laboratories, this procedure has been used to produce various components such as optical guides, Gunn diodes, field effect transistors, and DFB (distributed feedback) laser networks. (Source: ETI Electronique, 15 January 1988)

Trends in optical computer research in France

Possible now is the increase of the computing power of computers and parallel processors by means of optic networks interconnecting processors whose function is the processing of data. These networks make use of the nonlinear interactions of light with matter.

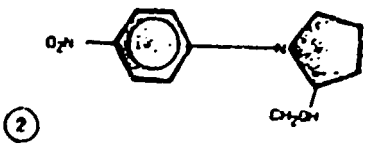
The advent of optical computers is expected to unbolt several technological "lockups". Instead of exploiting electrons in the customary manner, they will be used to modulate light. Instead of striving as at present against the barrier of the nanosecond, optics will jump directly to the level of the picosecond, indeed to the environs of the femtosecond.

"The principal approaches at present involve semiconductors; that is, those of the III-V family, integrated or of the multiple-quantum-wells type, or those of the II-VI family, or even silicon ...," says P. Chavel, of the Institut d'Optique at Orsay, "but mention should also be made of photorefractive materials which include - besides certain semiconductors that have already been mentioned - lithium niobate crystals in particular, and oxides of bismuth-silicon and of bismuth-germanium; in addition, some hopes are being placed in organic materials of the delocalized π electron type."

Delocalized π electrons are the topic of studies by P.A. Chollet, F. Kajzar, J. Messier, J.M. Nunzi, and D. Grec, at the IRDI (Saclay Centre for Nuclear Studies). These electrons are localized in semiconducting organic polymers (polydiacetylenes and polyacetylenes, polythiophenes), which are well known for their nonlinear, fast response times (less than a nanosecond). This property is owing specifically to π electrons, which are far more polarizable than classic, valence-bond electrons. "Although optical bistability at high energy levels is thought to be achievable, no specific experimental work has been done in this domain," say the IRDI researchers. "Infrared-induced variations of absorption could lead to fast optical valves."

At the CNET (National Centre for Telecommunications Studies) at Bagneux, the research being done by Joseph Zyss and Isabelle Ledoux is centred on molecular organic layers and is oriented towards electro-optical modulators and components and parametric amplifiers. It is in this regard that the behaviour of a new organic crystal, the NPP, has been analysed at 1.44 gmm. A material such as this could be used for infrared signal processing devices; the potentials in this regard are still largely unexplored (Figure 1).

Figure 1



(2)

Molecular structure of N-(4-nitrophenyl)-(L)-prolinol, alias NPP. It is an organic crystal used at the CNET-Bagneux to obtain peak high power optical impulses of less than 1 picosecond duration from a continuum of white light.

It is noted that an ESPRIT project on organic materials characterized by a high degree of nonlinearity currently links several European laboratories (including that of the CNET, but also the Thomson Central Research Laboratory) doing research in this field.

At the same CNET laboratory, J.L. Oudar is doing research on semiconductive structures of the III-V family, with a view to developing bi-dimensional networks of the planar-structure type, capable of building integrated optic gates into matrices with pinpoint accuracy. These structures are obtained by photolithography of epitaxial layers of AsGa and AlGaAs some 100 or so Angstroms - that is, several tens to several hundreds of atomic planes - thick, known as quantum wells (or quantum multi-wells, or even as super-networks) of the exciton type. Such a structure comprises a periodic arrangement of ultra-thin layers alternated with two different alloys or semiconductors. This alternance of layers is overlain by the appearance of potential wells that affect the properties of the particles (positive holes and electrons) in the vicinity of these networks. The CNET's research programme, which got under way a year ago, is centred first on analysing their nonlinear optical properties in the presence of high intensities generated by semiconductor lasers at a wavelength of 0.85 gmm. The instrumentation proves easier to set up and operate at this wavelength than at 1.3 or 1.55 gmm. Later, however, plans call for changing to longer wavelengths with a view to building fibre-optic switching matrices.

Exciton states are also being studied by the team of J.P. Pocholle and C. Puech at the Thomson Central Research Laboratory. "The optical properties of quantum-well structures have been actively explored with the aim of realizing optical-logic functions (bistability), spatial modulation (free propagation), and fast guided-propagation modulation."

The team spirit that reigns at the [joint] Applied Optics Laboratory of ENSTA (Higher National School of Advanced Techniques) and the Ecole Polytechnique, headed by Alain Orszag and Andre Antonetti, is motivated by the fact that this laboratory is participating in the race to attain the femtosecond. The producing of laser pulses of 10^{-15} second duration is in fact one of the major objectives of some 20 American laboratories. The work of this Palaiseau team is a benchmark in this speed race.

Pursuing its research, the Palaiseau team has recently discovered the optic Stark effect: "The electromagnetic field of the incident light wave can itself produce optical modifications without requiring that the light actually be absorbed by the medium it traverses." The perturbation persists as long as the light wave is present in the medium and disappears with the end of that presence. This mechanism has been applied to the realization of an optic gate which switches then returns to equilibrium in several hundred femtoseconds.

For their part, Gerald Roosen, Gilles Le Saux and their Ecole Superieure d'Optique colleagues are devoting their attention to the photorefractive effect in bismuth-silicon-oxide (BSO: $Bi_{12}SiO_{20}$) and bismuth-germanium-oxide (BGO $Bi_{12}GeO_{20}$) crystals. The photorefractive effects found, with even greater sensitivity, in semiconductors (GaAs: Cr, InP : Fe, undoped GaAs), than in BSO, lend themselves to contemplating the possibility of optic data-processing in the near infrared.

"Although nonlinear optics and the filtering of spatial frequencies have few if any common points of departure, they converge today in a common aim to introduce optics into the computer," says P. Chavel.

Hence, the advent of the first spatial light modulators, still being defined as: Optic valves, components compatible with present technologies, capable of modulating the transmission or reflection of an image in response to an optical or electrical command.

In the classifying of modulators, a distinction is made between unidimensional modulators (acousto-optic volume modulators, electro-optic modulators, or acousto-optic modulators of the integrated optics type) for tridimensional or guided-wave optic systems and optically- or electronically-addressed bi-dimensional modulators (coherent imagers). A distinction is also made among analog, binary and nonlinear modes of operation ... "The principal development is the growing use of microelectronics," notes G. Lebreton, commenting on the convergence towards technologies compatible not only among themselves, but also with analog and digital electronics.

An example is provided by ONERA at Toulouse, where a multidiscipline team from the data processing and optics departments has set out to introduce optical techniques into parallel-computer architectures. "Data processing machines of the centralized-structure type have inherent traffic-jam problems on data transmission lines," explains D. Comte, and "the distribution of tasks among several independent modules palliates that situation." A good palliative, to be sure, but only if each of the modules is a powerful electronic processor equipped with local memory. ONERA is studying the linking of processor networks, and in this instance INMOS Transputers, to one another by a configuration of programmable communications nodes. There remains nevertheless the telecommunications problem, which electronics is at a loss to resolve.

"Our objective is to proceed directly to communications within this massively paralleled architecture," D. Comte told us. Optics enables communication at high speeds (several gigabits) over a large number of channels (1,000 channels, for example) that can be configured according to requirements (assuming a reconfigurable system). The idea is to be able to select the transmitter that, linked to the proper receiver, will best fulfill a given range of required functions. D. Comte adds, "The sole network offering the full range of connection possibilities between any two subscribers, without conflicts, is the crossbar type." The optical crossbar switch used by ONERA is a liquid-crystal valve manufactured by Hughes. It consists of a succession of thin layers. A dielectric mirror and a blocking layer provide optic isolation of the read and write beams.

A "breadboard" model is being assembled, with an architecture based on eight T414 Transputers (hence eight systems, each providing four output channels, each channel equipped with an electroluminescent diode), and an optical crossbar network providing 35 channels for connecting 35 transmitters to 35 receivers (photodiode arrays in this instance) in any way whatever by means of single-mode optic fibres.

According to G. Roosen (Institute of Theoretical and Applied Optics) and P. Gravey (CNET-Lannion), the holographic approach to reconfigurable optical interconnections is also characterized by a large number (1,000) of inputs

and outputs and a speed of reconfiguration that permits the modifying of some 10 connections per second. Deflection of the beams propagates freely between an input matrix and an output matrix, is provided by a matrix of erasable holographic recording cells. Photothermoplastics are being studied in this regard at the CNET, and photorefractive crystals at the Thomson Central Research Laboratory and the Institut d'Optique. In the first case, the recorded diffraction networks are thin; in the second, they are thick. (Source: Electronique Industrielle, 1 February 1988)

India

Indian news review

All of a sudden a nation of 800 million people are discovering computers or, to be precise, Sinclair Spectrums. Despite the efforts of other expatriate micros, including the BBC (government- sponsored in India, apparently, but not much in evidence) and the Commodore 64, the Spectrum now reigns supreme on the fast-developing Indian home computer scene. The secret of its success? The Sinclair machine, unlike its competitors, can easily be fitted into a briefcase. Of the estimated 10,000 Spectrums now in the country, at least half passed through the door labelled "Nothing to Declare". This black market trade continues almost unabated, despite the fact that Spectrums have been manufactured under licence in Poona and available over the counter in most major cities for nearly two years now. Decibell Electronics, who manufacture the machine and Computer Point, who sell it alongside Indian-sourced PC clones, are facing a big struggle in their efforts to manufacture and sell their wares. Despite the apparent size of the market, statistics and social behaviour are laying havoc with technological development. The parents of the children learning Spectrum Basic belong to the exclusive one per cent of India's population earning over 160 pounds sterling a month. They're the lucky ones. Forty per cent of the population subsist on or below the poverty line, where poverty means existing on a wage (if you have one) that can drop as low as 100 rupees (about 4 pounds sterling)) a month. A Spectrum costs 6,000 rupees (240 pounds sterling), but money is only part of the problem. Many of the basic requirements for the introduction of computer technology simply do not exist in India, and creating such an environment is easier said than done in a country where the electricity supply is eccentric. A home computer needs a television costing between 9,000 and 12,000 rupees, and it helps to be able to read the manual and the messages on the screen - which only 27 per cent of the population would be able to do. You then face a government import duty of up to 350 per cent on imported components, and a buying public which is highly trained in the art of getting things cheaper - either through illegal imports or software piracy. The Indian market for software is very dirty and very low priced, and the hardware market is taxed almost into oblivion. Most peripherals are either unaffordable luxuries or simply irrelevant. Despite these odds, the Indian fascination with gadgets is winning through, and nowhere is this more obvious than with computer games. Full Throttle, a motorcycle racing game is far and away the biggest seller. Psion's Flight Simulator is much in evidence, and the salesmen are very much in awe of it. Although the games look impressively authentic in their gleaming plastic cases, closer scrutiny reveals some curious omissions. Psion's Flight Simulator is simply Flight Simulator, and along with all the other products has a striking absence of copyright marks. A local dealer explained the situation. "My managing director visited Englar and made representations to the English software houses. Their only interest was in how many units we would sell. We told them the truth - maybe 250, maybe 500 of each title - and they simply lost interest. What else were we to do?" But in the business micro market, things are quite different. There are an estimated 60,000 machines already installed, with a projected base of 200,000 units by 1990. Figures like that breed a sense of unease but one has yet to see a legal copy of Wordstar. Selling games at budget prices is hard work, but shifting premium-priced business packages seems almost impossible. In spite of the difficulties, computers are gaining profile in India at an astonishing rate. In a country where bureaucracy rules the lure of computerization is obvious. Add to that a fervent desire to improve social standing by ownership and understanding of Western technology and you have a market whose eagerness to buy is matched both by its inability to pay and a genius for extemporization. (Extracted from Computer Guardian, 9 June 1988, p. 29)

The Computer Society of India by Maj. Gen. A. Balasubrahmanian

The Computer Society of India formally came into being on 6 March 1965, upon the renaming of the All-India Computer User's Group, which had been constituted in June 1964 by 16 pioneers in the field of computers in India. Since then, the Society has grown to the current membership of over 10,000 individuals and 800 institutions.

The Society conducts its operations through various geographical (4 regions) and technical (8 divisions) groups. The divisions are: hardware, software, scientific applications, business applications, data communications, education, data security, and microcomputers. The CSI's principal activity centres are the 35 chapters, located in townships all over the country. There are also 13 branches for student members.

CSI started conducting the National Standard Test for Programming Competence in 1975. A Directorate of Education was set up in 1985, and a number of modules, such as systems analysis and design, data communication, OS, and DBMS, are being brought under the National Standard Test scheme, which aims at ensuring a minimum level of professional competence, especially amongst those without university backgrounds.

Student activities have been encouraged through the student branches as well as Student Paper Contests at the Annual Conventions. National Student Conventions have been annual events since 1985. (Extracted from IFIP Newsletter)

Israel

Computer science records at the Hebrew University

The main areas of research in the Department of Computer Science are concerned with complexity of computations, design and analysis of algorithms, natural language processing, operating systems, computation with distributed systems, computer architecture and computer vision. The Institute has a Vax 11/780 and a Vax 750. Of the two laboratories in the department one is concerned with distributed computations and the other with computer vision and image processing.

Prof. A. Barak directs the distributed computations laboratory. His research is directed at the experimental and theoretical aspects of

distributed processing systems. He has developed a general-purpose multicomputer distributed operating system for a cluster of loosely coupled independent computers. The present system with seven nodes, based on the NS32000 family of computers, is used to demonstrate algorithms in networking, scheduling and load balancing developed by Barak. What is interesting about the laboratory is the ability to experimentally test theoretically developed parallel and distributed algorithms. The distributed operating system is a UNIX system.

Prof. M. Bercovier's primary research is in numerical analysis. He has been applying the finite element method to nonlinear elasticity problems, which in this case means rubberlike materials - with particular reference to tyres. In a contract with Israel's Urdan company, Bercovier has simulated the metal-casting cooling process. He is also active in software engineering for large industrial processes using computer-aided design. At present he is investigating partial differential equations of advection-diffusion problems where the advection dominates the diffusion. In his approach, finite differencing of the total derivative yields schemes which do not require upwinding. Bercovier has applied his method with some success to problems involving the Navier-Stokes equation, the Euler equation, and to the advection-diffusion linear problem.

Dr. S. Peleg is concerned with digital image processing and pattern recognition. His work has been supported by a joint French and Israeli project and by the Israel Aircraft Industries. In a recent article he used a vector space representation to invert image blur, enabling nonlinear restoration with relatively small computations. The second area is in artificial intelligence, in which Dr. D. Lehmann is seeking the development of a programme capable of negotiating with other programmes or human beings. He is also conducting work directed at a connectionist approach which aims at the development of intelligent highly parallel machines built out of a large number of simple components. Also in expert systems, Dr. C. Beeri has developed an advisory system for birth control which can be used by people prior to discussion with a human consultant.

Some further topics include cryptographic protocols in distributed systems, data-based management systems, and parallel processing. In this last area is a paper with the intriguing title, "Competitive Snoopy Catching". The department publishes a yearly summary of all research activities; it is available from Bercovier, who is at present the department Chairman. (Source: European Science News, April 1988)

Italy

New superconducting material tested in Milan

Researchers in CNR's Institute for the Technology of Nontraditional Metallic Material in Cinisello, Balsamo (near Milan) have developed a bismuth-strontium-copper-oxygen compound which becomes superconducting at -165°C. This temperature is 15°C higher than that reached by YBCO (yttrium, barium, copper and oxygen). Bismuth is also more easily available than yttrium. (Source: European Science News, April 1988)

Broader offerings

European users should watch for a series of new products from Honeywell Bull over the next few months following an agreement between Groupe Bull and the Honeywell Bull subsidiaries in Italy and the UK to form the European Solution Centre in Brussels. This is part of a corporate effort to broaden the group's European market product offerings. The companies will be exchanging selected products with the aim of targeting national offerings to international markets. Michele Cimino, general manager of Honeywell Bull Italia's marketing division, will have responsibility for the new centre. (Reprinted with permission of DATAMATION[r] magazine[c], July 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Ansaldo motor uses superconductors

The first Italian superconducting electric engine is being developed in Genoa. The prototype, which will be produced jointly by the Ansaldo firm and the physics, chemistry, and electronics departments of the University of Genoa, is scheduled to be ready for experimental trials.

The Ansaldo prototype is based on the same principle as the prototype presented at the Argonne (United States) research laboratories. The rotating part of the American version is in the form of a 3-layer disc. The intermediate layer is made of aluminium and the external layers are made of superconducting ceramic material. The disc rotates because of the magnetic field created by a certain number of poles and continues to turn as long as it is kept at the temperature of liquid nitrogen (-180° Celsius). If the temperature rises, the disc stops.

The special advantages of a superconducting electric engine are: performance superior to that of conventional engines; very quiet operation; and a more compact size that makes this engine useful wherever there are space problems. (Source: Il Sole 24 Ore, 19 January 1988)

Japan

Superconductor strides

Until about 1980, Japan made little effort to produce new technology; most of its successes - cars, VCRs, laser printers, and robotics - are basically refinements of Western technology. But in the late 1970s, Japan began to focus on developing new technology. Industry and government tried to demystify the research-and-development process. They also kept track of world-wide developments, a strategy that has paid off. The discoverers of high-temperature superconductors, employed at an IBM laboratory in Switzerland, had arranged to publish their results in a relatively obscure German journal. Japanese monitoring systems picked up the publication immediately, and the work was replicated in Japan even before it was known throughout IBM.

Hitachi Limited has announced several superconductor devices, including an optical switch that adjusts electric current depending on the amount of light in the vicinity. The company claims the switch handles five times more current than do conventional devices. Hitachi has also announced an extremely sensitive magnetic-field detector called a "squid" (superconducting quantum interference device) that doctors can use to detect tumours and other abnormalities in the body.

Japanese computer manufacturers have revitalized research into Josephson junctions - superconductor-based computer-memory devices. According to Japanese press reports, Nippon Electric plans to build a supercomputer using

Josephson-junction technology that would reduce size and power consumption by 90 per cent.

Sanyo Electric and Sumitomo Electric, two diversified manufacturers, and Fujikura Electric, a major electric-cable producer, have all announced commercial sale of superconducting wire.

Raw materials for superconducting applications are selling well in Japan. For example, as early as last December, Hayashi Chemical Industries Co. was selling a metric ton per month of a bismuth-based material used to manufacture high-temperature superconductors.

Other major Japanese companies that have announced superconductivity products include Fujitsu, Kyocera, Matsushita Electric Industrial, Mitsui Mining and Smelting, Nippon Chemical Industries, Sharp, and Toshiba Electric.

One reason the Japanese have become so heavily involved is that they anticipate a far larger market. The Nihon Keizai Shimbun, Japan's equivalent of the Wall Street Journal, reports that Japanese estimates of the potential world market for superconductors in the year 2000 run about $20 billion to $40 billion.

Whether or not Japan succeeds in systematizing innovation, one thing is certain: the rest of the world will soon be reading more about Japanese superconductor innovations. (Extracted from High Technology Business, July 1988)

Superconductors surge to the fore in Japan

New evidence of Japan's determination to stake out a lead in the development of high-temperature superconductors is emerging from the patent office in Tokyo. The Japanese policy of publishing patent applications 18 months after filing has revealed a rush of claims on formulations and manufacturing processes for materials which lose all electrical resistance at the temperature of liquid nitrogen or above.

However, the likely winner in the patent race, Professor Shoji Tanaka, the head of Japan's research consortium on superconductors, urged the scientific community to continue to exchange information freely on the new technologies.

Professor Tanaka headed the group at Tokyo University that in January 1987 beat IBM by three days to file the first Japanese patent on the new superconductors. Researchers at IBM's laboratory in Zurich had announced the Nobel-prize winning discovery in September 1986, but the computer company did not apply for patents until early 1987.

The delay may have cost IBM its patents in Europe as well as in Japan. Unlike the US both Japan and Europe grant protection to the first applicant for a patent, not the first to invent. Applications just published by the Japanese Patent Office show that Hitachi, which has announced several breakthroughs in the manufacture of superconductors, was only 10 days behind IBM, filing on 30 January.

However, experts in Tokyo are more intrigued by the clutch of patents that Sumitomo Electric, Japan's largest maker of electric wires and cables, filed at the beginning of February 1987. The first three to be published cover a way of making superconducting thin films, essential for constructing electronic devices from the new materials, a superconducting wire, and a vapour process for making superconductors. The company has filed more than 600 patents on superconductors. (Extracted from New Scientist, London, 1 September 1988, the weekly review of science and technology)

Superconductor research institute to be set up

The Ministry for International Trade and Industry will establish a superconductor research institute in October 1988 under the auspices of the International Superconductivity Technology Centre. Some ¥680 million have been earmarked for the institute in the current fiscal year, but next year the figure will be doubled. MITI hopes 100 engineers and scientists from around the world will come and take part. The International Superconductivity Technology Centre includes 97 Japanese firms, one UK firm and two US firms. (Extracted from The Asian Wall Street Journal, 29 August 1988)

Word processor market

The word processor market will grow to ¥230 billion in 1988, as against ¥35 billion in 1982, according to the Japan Business Machine Makers Association. Volume sales have risen even more sharply since 1984, as advancing technology has created word processors that can handle the huge range of characters in the Japanese alphabet. The new systems use keyboards with the 102 phonetic characters that make up the Katakana and Hiragana components of the language, and from this input calculate the thousands of characters in the Kanji component. Screens require 16 x 16 dot matrices for each character, as against 5 x 7 dots for Roman characters, while printers require at least 24 x 24 dots, against 8 x 9 dots. Now that the problems of the Japanese language have been solved, Japanese offices are keen to use the new equipment and Japanese word processor firms have new models far superior to previous models sold around the world. (Extracted from The Financial Times, 26 May 1988)

Fifth generation computer in three years

The Ministry of International Trade and Industry and eight Japanese computer makers expect to complete a fifth generation computer prototype in three years. The machine, which will feature parallel processing by 1,000 processors, will have 500 times the processing capability of existing mainframes. It will have the ability to process 100-1,000 MIPs and understand human voice commands. It will also incorporate inference functions. The Government, which will own all copyrights and patents relating to the development, will invest ¥30 billion in the project over three years starting int 1979. (Extracted from Japan Economic Journal, 21 May 1988)

New consortia possible next year

Japan may launch consortia next year to conduct basic research in neural and optical computing. The Ministry of International Trade and Industry (MITI) thinks neural computers would be more adept than conventional computers at pattern and voice recognition and robotic control. The optical project MITI is considering would develop materials that could be used in optical computers, which use light rather than electricity. MITI has until September to make its requests to the Finance Ministry in time for legislative bodies to consider funding for next April. The Key Technology Centre, a government foundation, already has decided to form

a consortium with industry and academia to study fuzzy computing over a six- to eight-year period beginning next March. Fuzzy computing, based on multivariate rather than binary logic, could be applied to machine translation, expert systems and defence. (Reprinted with permission of DATAMATION[r] magazine[c], 15 August 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Date is set for cloning rules

Rules allowing Japanese cloning of IBM mainframe system software will be announced in September, but IBM believes arbitrators setting the rules have given away too much.

Since 1982 IBM has been battling against the Japanese electronics group Fujitsu, alleging copyright infringement of the MVS mainframe operating system.

Last September, IBM half-capitulated and offered to reveal its source code to Fujitsu in return for an estimated $1 billion.

Two independent arbitrators were appointed to settle the terms of the deal whose rules will determine how much access Fujitsu gets to IBM source code, and how much the Japanese company will have to pay for the privilege.

Previous attempts by the two companies to reach an agreement themselves have failed.

In addition, Fujitsu's payment to IBM over copyright claims will be decided by the arbitrators, who have made complaints of the two organizations' intransigence during discussions.

The indications are that Fujitsu will emerge with more access than IBM had originally intended, and that IBM executives are concerned that the constraints on Fujitsu's rights to source code will be too loose.

The US computing services association ADAPSO believes that following the uproar at the Fujitsu deal IBM has begun to relax its hold on source code.

ADAPSO lobbied the US Congress and the European Community, saying it was "unthinkable that Japanese software developers be given access to source code ... while American companies that add value to IBM's products are excluded". Attempts by ADAPSO members to get access to IBM's source code for the OS2 Extended Operating System have so far been rebuffed. (Source: Computer Weekly, 14 July 1988)

Japan boosts semiconductors

Japanese semiconductor companies are boosting investment in new production capabilities by about 47 per cent over last year.

A survey of 16 major Japanese semiconductor companies by Japanese newspaper Nihon Keizai Shimbun shows that combined investment in 1988 will be about $3.4 billion. This investment will lead to a boost in the production of Japanese semiconductors by 15.7 per cent to $23.9 billion.

The survey also indicates that shortages of key components such as memory chips will continue until at least December when the new investments will begin to have an impact on production. Shortages of 1 Mbit dynamic RAM chips will continue into next year and prices will remain high. (Source: Electronics Weekly, 13 July 1988)

DRAM demand hits SRAM production

The introduction of 1 Mbit static RAMs being developed by Japanese manufacturers may be delayed because fabrication capacity is being used to meet the world-wide demand for high-density dynamic RAMs.

Both Fujitsu and Toshiba admit that current emphasis on DRAM fabrication could affect the volume production of the new SRAMs. Toshiba does not expect to have a capacity problem in the short term. Its 1 Mbit SRAM will not be ready for production before 1989, which is also when Fujitsu expects to sample its 1 Mbit device.

Hitachi is currently sampling selected customers with a 1 Mbit SRAM with a 70 ns access time, but production is not tabled before the fourth quarter.

The problem of capacity becomes more acute because both Hitachi and Toshiba are also developing high-speed 256 Kbit SRAMs with 25 ns access times. These devices, destined for fast cache memories, are expected to be available, like the 1 Mbit parts, before the year-end. (Source: Electronics Weekly, 29 June 1988)

Association seeks improved market access

To improve market access for foreign-affiliated semiconductor manufacturers, Japanese semiconductor trading firms specializing in imports plan to establish a distributors' association. Present members include Hakuto Co. Ltd., Tokyo Electron Ltd., Ryoyo Electronics Corp., Internix Inc., Marubun Corp., Evic Corp., and Teksel Co. Ltd.

According to industry sources, representatives of the soon-to-be-formed association have appealed to their firms to take an active role in the development of the association. (Source: Semiconductor International, July 1988)

Artificial intelligence in financing operations

Companies in the financial services industry are using artificial intelligence technology to upgrade their operations. In June 1987, Nomura Securities began using expert systems to help put together portfolios for its clients. "Personal AI" terminals were installed at its 41 branch offices, and M. Nakamura of the company's marketing planning and sales promotion department says they have had a "strong psychological impact" on customers. Industry sources claim there are few differences, performance-wise, between an investment programme put together by an experienced human financial planner and one put together by an AI programme. The programme, after all, is based on the same information and expertise that a human would apply.

But investors are apparently attracted by the idea of being guided by a computer's "superior intelligence". A manager at a bank that uses AI systems says investors who are usually not enthusiastic about human planners will "jump" at investment advice prepared by an AI system. A number of firms including Dai-Ichi Kangyo Bank, Sanwa Bank, Daiwa Securities, Yamaichi Securities and Meiji Mutual Life Insurance claim to have set up AI portfolio investment programmes. Nikko Securities will join their ranks in September 1988. Sumitomo Bank began using an AI system to help generate credit ratings in June 1987. Nippon Life Insurance is using AI as part of its loan department's decision-support system. Industry observers believe some Japanese security houses and

banks are developing stock options trading systems based on AI. Nikko Securities recently bought a majority stake in Intelligent Technology (Japan), which has links to Carnegie-Mellon University, a leading AI research centre. (Extracted from Japan Economic Journal, 30 July 1988)

Car makers ease chip tension

Japan's two largest car makers have bowed to American pressure to import electronic components. Deals between Nissan and Intel and Toyota and Motorola will ease tension in the main outstanding issue in the "chip wars" between Japan and the US.

Nissan Motor will import 16-bit microprocessors from Intel. A representative said the Japanese company would buy "several hundred a month for the time being". The deal is a blow to Hitachi, which supplies Nissan with microprocessors for a device to monitor combustion in car engines.

Toyota, the largest domestic car maker, announced plans to develop application-specific chips with Motorola. The company would give no further details.

American government and industry officials have focused on the motor industry in their demands for Japan to open its chip market in the wake of the two countries' semiconductor agreement in 1986. Japan's car firms import around two per cent of their semiconductors. The Americans want 15 per cent. The Electronics Industry Association of Japan says that fixing an import share "would destroy free competition and be incompatible with anti-trust laws".

Meanwhile, Japan's leading memory chip makers, now working flat out to meet the world shortage of dynamic RAMs announced new investment plans. NEC said it would build a ¥35 billion plant to produce 4 Mbit DRAMs. The new plant, in Hiroshima, southern Japan, will open in 1990. It will produce 30,000 6 inch wafers and up to five million 4 Mbit DRAMs a month. (Source: Electronics Weekly, 17 August 1988)

Japan shapes a superconducting future

Two years after the discovery of new materials which lose all resistance to electricity at convenient temperatures, Japanese thoughts are turning to ways of using the new superconductors. Japan has the world's largest commercially funded research programme in high-temperature superconductivity, but an international conference in Nagoya, south of Tokyo, heard that the technology is unlikely to reach the market this century.

The race began in late 1986, when a team at IBM's laboratory in Zurich announced the discovery of a class of materials that lost all electrical resistance at the temperature of liquid nitrogen. Transforming the new materials into useful shapes is the difficult part.

Undaunted, the companies backing Japan's research programme hope that the new superconductors will revolutionize three fields: electronics, generating and transmitting electrical power, and transport.

Computer scientists are striving to produce computers which mimic the human brain. These computers would be capable of a form of cognitive thought. They would be linked to sophisticated "information bases" over a vast broadband communications network.

Such machines would need around 10 trillion logic gates, says Yasutsugu Takeda, director of Hitachi's Central Research Laboratory. Creating such a circuit with conventional electronics would require "a very large power station," Takeda said.

Superconducting circuits are theoretically faster and consume much less power. Superconducting microprocessors, however, are still a dream. The first superconducting electronic devices will be based on Josephson junctions, in which an external magnetic field controls pairs of electrons "tunnelling" through a superconducting sandwich. Such circuits are extremely sensitive and consume virtually no power, but are "still in the fundamental research stage," said Takeda.

Engineers have long considered harnessing conventional low-temperature superconductors in improving the efficiency of power generation.

The most obvious advantage is that superconducting transmission cables would not lose the 5 per cent of electricity lost through resistance by today's cables. This will not be possible, however, until superconducting cables capable of being cooled by liquid nitrogen, rather than liquid helium, become available.

Equipment to cool the cables to the temperature of liquid nitrogen is smaller than that required to reach the temperatures of liquid helium. "The cables will be small enough to go through existing ducts," says Tsuneo Mitsui, of the Tokyo Electric Power Company.

Mitsui also showed a concept of an electrical generator in which superconducting wires replace the copper coils. It would be half the size of a conventional generator. He would not put a date on when any superconducting part of the power system would become reality.

The closest Japan has come to bringing superconductors into everyday life is its attempt to develop a train which can be levitated by electromagnets. Here, too, work has concentrated on conventional superconductors. Researchers say that only superconducting electromagnets can create enough power to suspend "maglev" trains high enough above the track to cope with Japanese earthquakes and soil subsidence. To do this the train would need to hover some 10 centimetres in the air.

Japan's Railway Technical Research Institute is now running an experimental maglev car in the south of the country, which can carry 44 passengers at up to 375 kilometres per hour along a 7-kilometre test track. Superconducting magnets in the car interact with coils on the track to magnetically suspend the car and keep it aligned with the track, as well as to propel it forward. The existing superconductors are cooled with liquid helium. Higher-temperature superconductors would greatly simplify the cooling, but many technical issues remain to be solved.

Tanaka believes that commercial maglev transport which can travel long distances will not be a reality for another 15 years. (This first appeared in New Scientist, London, 8 September 1988, the weekly review of science and technology.)

Republic of Korea

Samsung presents latest PC models

Last autumn, the Korean giant Samsung introduced a line of extra-flat monitors foreshadowing the microcomputers that will be

introduced at the next SICOB (International Data-Processing, Communications and Office Organization Show).

Exporting to over 120 countries, Samsung achieves 50 per cent of its sales abroad, amounting to over $8 billion in 1986. The new line of PC-compatibles and microcomputers introduced by the French subsidiary is part of a global strategy of confrontation with leading micro manufacturers. The new PC will enable the company to make itself known pending the arrival of its high-end models, next summer.

To the SPC-3000 and MFC-6000 models, the company is now adding the SPC-6500, actually a variant of the MFC-6000; it still uses an 80286 processor timed at 6 or 10 MHz, 1 M 8-bit bytes of RAM and one 5.25-inch disk drive with 1.2-M 8-bit bytes; but it has five 16-bit slots instead of 6 on the MFC-6000. The SPC-6500 will cost a little less than the MFC-6000, which has a hard disk with 20- or 40-M 8-bit byte.

Equipped with an autoswitch EGA video board in the monochrome MDA (monochrome display adapter)/Hercules or colour CGA (colour graphics adapter)/EGA mode, the Samsung AT-compatibles have controllers which can support two disk drives and two hard disks. The hard disks are manufactured by Seagate and equipped with Western Digital controllers.

In the 8088 world, the SPC-3000 is already known. With its 640 K 8-bit bytes of RAM, its two 360 K disk drives and its 20-M hard-disk version, it is leading to a new model with a 720-K 8-bit byte 3.5-inch disk drive and, as always, the monochrome (MDA/Hercules) and colour (CGA) multimode card.

To complete the line, a compatible built around an 80386 microprocessor, running at 20 MHz and with a VGA (videographics adapter) card as a standard feature, is expected for June. It may be introduced at the SICOB.

There is also something new in monitors, on which Samsung has focused special efforts. Two new models will be added to the monochrome (MD-1252Y) and CGA/EGA 14-inch (CD-1464 W and CD-1453 M1) models; these new models are the MP-5671, a full-page display with a definition of 1,006 x 1,048 pixels which, in the text mode, can display 82 lines of 66 characters; and the SM-430, a 14-inch MDA- and HGC-compatible display, in green or amber.

At the SICOB, Samsung will also show colour monitors, such as the CS-4551, with a definition of up to 720 x 480 pixels; the VGA version will be named CQ-4551. Samsung is now developing boards for its high-definition monochrome displays, the ML-4571 and ML-2611, which are equipped with 12-inch and 14-inch flat-panels and will operate in three modes: 738 x 362, 730 x 414 and 656 x 496. 'Source: Zero un Informatique, 11 April 1988)

Singapore

PC-based CIM system

A small Singapore company is developing a working model of CIM based only on pcs. Roger Au, general manager of C.M Systems Singapore, believes this is one of the world's first such models. His company's R&D team has already hooked up 65 IBM-compatible pcs, ranging from ATs to 386s, through Ethernet, to manage office, management, engineering and process automation at the facilities of the North American Philips subsidiary, SMT Circuit Assembly Pte Limited, in Singapore. Au hopes to complete the whole system by mid-1989. Once it has proved its mettle, he wants to market CIM Systems' expertise in the US. (Reprinted with permission of DATAMATION[r] magazine[c], 1 September 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Hitachi checks out Singapore

Japanese IS giant Hitachi is determined to get its fair share of software development expertise from one of the fastest growing software centres in Asia - the city-State of Singapore. By early next year, it plans to establish a regional Software Development Centre here. NEC, HP, Cullinet, Sony and Nixdorf already have similar software centres in place. Sources say the Singapore centre will likely focus on three key areas: English versions of Hitachi's Japanese-developed AI and expert systems products; new manufacturing applications software; and a special project to create protocols and communications software for linking Hitachi systems with other vendors' machines, particularly those from IBM and DEC. (Reprinted with permission of DATAMATION[r] magazine[c], 15 August 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Spain

Spanish participation in EEC technology development programmes

Spain's involvement in the EEC technology effort began in earnest in September 1987, when Spanish Minister of Industry Luis Croissier chaired the annual meeting of participants in the EUREKA programme where Spanish participation has been greatest. For example, Spain is participating in 17 of the 58 projects approved at the September 1987 EUREKA ministerial meeting. Those 17 account for 17.2 per cent of EUREKA's overall budget. At present, Spanish companies are involved in 40 EUREKA projects worth $270.7 million (7 per cent of the total programme budget).

These are in the following fields:

- Biotechnology, medicine and agriculture (10)
- Communications (2)
- Energy (1)
- Information technologies (7)
- Laser (2)
- Advanced new materials (6)
- Robotics and industrial automation (12).

In terms of other EEC programmes such as the European Nuclear Research Organization (CERN) and the European Space Agency (ESA), ESPRIT and RACE, Spain is in the unfortunate dilemma of paying more into these programmes than they have been able to get out. For example, in the case of CERN, from 1983 through 1987 Spain contributed $83 million while receiving only $75.7 million in contracts. Spanish policy-makers are quite determined to reverse this situation.

Perhaps the most important impact of these programmes to date has been on Spain's priorities and projects in the industrial/technological development area. CDTI, the principal Spanish agency in the industrial technological development area, was reorganized in 1986 and early 1987 principally to better take advantage of EEC programmes. Senior staff at CDTI directly reported that 100 per cent of CDTI's efforts were now focused on EEC programmes.

Similar phenomena have occurred at the regional autonomous government where the CDTI-equivalent agency, CIDEM, has been required to devote 100 per cent of staff time and promotion resources to EEC programmes.

In summary, Spanish public and private sector attention is devoted almost exclusively to work on EEC technology development programmes. (Source: European Science News, May 1988)

United Kingdom

Moves to strengthen information technology research

In May, new plans were announced for closer working ties between the UK's Science and Engineering Research Council (SERC) and the Department of Trade and Industry (DTI) in Information Technology (IT) R&D and training. The arrangements cover proposed expenditure of 90 million pounds sterling (about $163 million) in 1988/1989.

The objective is to establish a unified framework for the support by the SERC and DTI across the whole spectrum of IT research, ranging from fundamental work in higher education institutes through collaborative LINK programmes to industry-led activities, often in collaboration with the academic sector.

A new advisory structure will be set up, drawn from the academic sector and industry in roughly equal numbers and headed by a single advisory body, advising both SERC and DTI on research programmes and resource allocation, and on individual applications for support. Both SERC and DTI will use their normal procedures for the award of grants.

The new advisory arrangements will be supported by a new management structure which will provide greater co-ordination between the various components of the overall programmes, and between national and European Community activities. There will be new arrangements for financial management, although both SERC and DTI will retain responsibility for their own funds. (Source: European Science News, May 1988)

SERC sets up research centres

National research centres specializing in parallel computing, process control systems and optical and laser technologies are to be set up by the Science and Engineering Research Council.

The plan is part of the council's move to form so-called interdisciplinary research centres at nominated universities and polytechnics. Early this year Cambridge University was named as the centre for superconductors. And next month London University's Imperial College will become the centre for work on new materials for microelectronic components.

No extra funds are available. Universities are expected to provide staff and accommodation and to seek support from industry.

The network, to be run by Racal, will be shared by four government departments. (Extracted from Computer Weekly, 30 June 1988)

New R&D programme for information technology

In late March, the UK's Department of Trade and Industry (DTI) issued draft plans for the new national collaborative research and development programme in information technology. The newly formed Information Engineering Directorate, which includes the former Alvey Directorate and parts of the former Electronics Application Division, will be responsible for most of the DTI's support of collaborative research and development information technology.

The draft plans, which have not yet been formally endorsed by Government, represent a first approach to the programme and were issued for consultation. Comments were invited from the research community and others with an interest.

The three research areas will each be monitored by a director, seconded to the Directorate from outside the DTI (including industry). They cover:

- Very large scale integrated (VLSI) advanced microchips and computer-aided design (CAD);
- Systems architecture, including parallel processing, speech, vision, and distributed systems;
- System engineering, including intelligent knowledge-based systems, software engineering, and human/computer interface.

The proposals also cover work that may be done under other related programmes such as ESPRIT. (Source: European Science News, April 1988)

Government drawing up AI methodology

UK users may have to continue wondering about the best way to come to grips with expert systems for another two years until a new initiative by the British Government's technology agency, the CCTA, produces results. The agency, which recommends purchasing criteria and standards within UK government departments, is drawing on the experience of the country's expert systems experts to formulate a national methodology for applying the technology. Called Project Gemini, it involves UK computer services companies SD-Scicon and Logica, management consultants Ernst and Whinney, ICL and UK expert systems house KBSC Ltd. The result will be a methodology, with support tools, by the end of 1990. (Reprinted with permission of DATAMATION[C] magazine[C], July 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Computer academics told to chase European money

Academics heard at the launch of Britain's latest programme for R&D in information technology that they must learn how to win money from EEC research budgets.

The IT88 conference, in Swansea, marked the end of the Alvey programme, Britain's first initiative in information technology, and the inauguration of the new information engineering directorate.

Academics heard from several speakers that they should look for industrial partners to shoulder the administrative burden for involvement in European research projects such as ESPRIT, the EEC research programme for information technology.

John Butcher, the Minister for Industry and Consumer Affairs, opened the conference with a call for proposals for funds from the new national IT research programme. This has a budget of 84 million pounds sterling. Of this,

29 million pounds comes from the Government over three years, and 55 million pounds from the Science and Engineering Research Council over five years.

The new national programme will be directed jointly by the Department of Trade and Industry and the council. Academics who are nervous of the new régime will face a very different process of funding review when they apply for money for IT research in Britain. Their proposals will be subject not only to peer review, but also to examination by a committee with representatives from industry, charged with choosing projects that fit into a national strategy for research in IT. This committee will be chaired by Nigel Horne, the director of technical and corporate development of STC.

The Information Engineering Directorate has now laid down the basic structure through which it will co-ordinate Britain's R&D in information technology. The IED is responsible not just for the new national research programme, but for the 25 million pounds initiative to encourage British companies to exploit gallium arsenide chips, as well as work on high-temperature superconductivity and the LINK programmes of collaborative research between industry and academics.

The strategic committee mentioned above will allocate the budget. It will consist of roughly equal numbers of academics and industrialists. It is not yet clear if the committee will have the authority to dictate how the Department of Trade and Industry and the Science and Engineering Research Council allocate their individual budgets, or if it could veto decisions by either to spend money on particular projects.

This strategic committee will draw together different technologies and keep the national strategy for information technology balanced. It will oversee both research and training and IT awareness programmes for industry and the public.

Tim Walker, who heads the IED, says the strategic committee will monitor the relationship between the national and European programmes, for example, and will also try to involve users in all its schemes.

Four subcommittees will answer to this strategic committee, and each will be responsible for a particular area. These committees are:

- Devices, including computer-aided design and optoelectronics;
- Systems architecture, which covers parallel-processing, communication, speech and vision; and
- Systems engineering, including software engineering, human-computer interfaces and computer science. The fourth committee will monitor work by both the DTI and SERC on control and instrumentation. The directorate also hopes to build up links with the Ministry of Defence.

Assistant directors within IED will be responsible for a particular technology across the whole programme. Walker hopes many of these assistant directors will be academics. The new committees will identify areas of research that have a high priority and that might become the subject of new interdisciplinary research centres. (This first appeared in New Scientist, London, 7 and 14 July 1988, the weekly review of science and technology.)

Optoelectronics: Britain sees the light

Britain should set up a major initiative to promote R&D in optoelectronics, according to the Government's Advisory Committee on Science and Technology. In a report published recently, ACOST made it clear to the Government that optoelectronics is "vital to our future as an industrial nation".

Optoelectronic technology enhances the performance of electronic devices by using light to carry out what were once electronic functions. Because light travels faster than electrons and is easier to manipulate, optoelectronic devices function much faster and are smaller than their electronic equivalents. Advocates of optoelectronics say that optics is to the integrated circuit what the transistor was to the valve.

ACOST said that the Government should bring British optoelectronics companies together "to develop strategic plans and exploit [their] undoubted strengths". Its recommendations are that the Government should set up large-scale demonstration projects to show the benefits of optoelectronics and to heighten the awareness of the potential of the technology.

Any national programme should include research into new materials, optical switching systems, optical information processing and storage. The report also recommends that the Government should improve education and training in optoelectronics. Optics should be part of the core curriculum in secondary schools.

ACOST suggests that an optical industry association should be formed to gather data on markets, develop strategic plans and act as a focus for the initiation of research.

The report says that Britain is not spending as much on optoelectronics as its international competitors.

To prosper, UK companies will need to establish alliances with overseas companies and European Community programmes for collaborative research and development. (This first appeared in New Scientist, London, 7 July 1988, the weekly review of science and technology.)

Alvey wins praise for UK's intelligent revival

The Alvey intelligent knowledge-based systems programme has revived the fortunes of artificial intelligence in the UK, developing a research community and expanding industrial capability. But the programme strategy lacked industrial focus and clear technological goals, which have made it difficult to manage and evaluate.

These are the major conclusions of a review of the programme published by the Science Policy Research Unit at Sussex University, one of two groups evaluating Alvey.

The report's author, Erik Arnold, says the achievements in intelligent knowledge-based systems are significant but fragile. He adds that resources are urgently needed, especially in academia, to protect what has been achieved so far in the UK.

The programme sought to establish a research base after a decade of funding famine after the publication of the damning Lighthill report in 1973.

When it began in 1983, there was virtually no one in industry who could lead significant artificial intelligence projects.

What is more, artificial intelligence among large IT users was very limited.

Arnold believes the programme has funded world class research.

ICI got the lion's share of the intelligent knowledge-based systems funds, primarily for systems architecture work.

Arnold suggests this changed its existing pattern of R&D to gain the important technological breadth crucial to making the right choices for product development.

Industry found the program helped in other areas such as command and control systems, and in IPSE (integrated project support environment) development. This was because of artificial intelligence research work on debugging software.

The most significant commercial contribution so far has been made by the intelligent knowledge-based systems community clubs. These were added almost as an after-thought to the research programme proper.

The nine clubs showed industry and commerce the potential of artificial intelligence - especially expert systems - to their business and gave users cheap hands-on experience of system specification and use.

This was the only area of the program that was to address the intelligent knowledge-based systems needs of users in data processing.

Arnold believes however that the strategy suffered from key weaknesses in formulation and implementation, which kept it from reaching the goals it had set itself.

He says the program was technologically isolated; it made little attempt to exploit the major base of LISP tools and products emerging from the US.

Computing equipment (from GEC and ICL) initially chosen for UK academics was inadequate, administration was too complex.

This caused delay and damage to some projects, and a failure to review progress meant the program was inflexible.

The information engineering directorate has already incorporated some of Arnold's criticisms into recommendations for Alvey's successor, due to get off the ground later this year. (Source: Computer Weekly, 15 September 1988)

Europe pushes out its flagship

British, French and FRG scientists are confident that this week they will get the go-ahead for an ambitious project to build a computer which uses parallel processing.

A proposal from computer companies ICL, Siemens and Bull to build what they call the European Declarative System has been approved by technical assessors and is awaiting financial clearance from ESPRIT's management committee.

The project involves researchers from 16 organizations and is one of the biggest collaborative schemes in the ESPRIT programme of research into information technology. It draws on existing work by the British partners on an Alvey program called Flagship.

The research team, which also includes groups from Imperial College, London and Manchester University, may have to accept restrictions on the length of time for which ESPRIT will fund the venture, and will have to satisfy ESPRIT administrators that everybody involved will collaborate closely. ICL, Siemens and Bull already run a joint research laboratory in Munich.

The European Commission is keen to include in ESPRIT a rival group working on parallel processing, led by Philips and Olivetti, although the research programme is already heavily oversubscribed.

The aim of the Flagship team is to produce a machine which runs "declarative languages", such as Prolog and LISP, which are designed for artificial intelligence applications. These languages describe to a computer a result but not how to get to it. Because of this feature, declarative languages are ideal for producing programs in which operations are performed randomly and in parallel. The collaborative project will concentrate on producing a computer that can search the databases in which airlines and banks store their information.

The computer, based on a machine called Alice constructed by Imperial College, uses chips from Motorola and circuit boards used in Sun computers to perform its parallel processing. The machine incorporates a number of software innovations which mean that programmers can store information in a way that reflects the way it was created. This software also lets programmers change their programs without having to touch the original code. (This first appeared in New Scientist, London, 14 July 1988, the weekly review of science and technology.)

Reliability experts get ready

British software reliability specialists are to play a key role in a 10 million ESPRIT project to goad the European software industry into giving products formal certification.

Current certification methods are costly and demand "a heavy workload of audits and reviews" that cannot be automated, according to the project leader Frederic Copigneaux, who described the ESPRIT Scope venture at a software certification conference in Gatwick.

Copigneaux explains the extreme costliness of the certification project by saying "we have the job of motivating a large number of organizations and companies throughout Europe".

The move comes at a time when customers are still groping for criteria they can measure software products against. There are only isolated initiatives, like X/Open's scheme to "brand" software conforming to open systems standard, to clutch at.

Among the main aims of the Scope project are "to define the procedures enabling a seal of approval to be given to software complying with a set of attributes" and "to promote the use of software engineering techniques for development of programs to ease certification," Copigneaux says.

The benefits will be twofold, he believes. The customer will be helped in choosing the right software according to its intended use, and the

supplier will get legal protection with less likelihood of customers claiming they have been misled.

The four UK contributors are the Atomic Energy Authority's National Centre of Systems Reliability, the Centre for Software Reliability (which organized last week's certification conference) and the universities of Glasgow and Strathclyde. (Source: Computer Weekly, 22 September 1988)

A British first

Here is what is claimed to be the first "universal" data communications computer, capable of linking together non-compatible computers and their protocols. Produced by the data networking division of Southampton-based HTEC, the Darwin System 5000 is based around a processor running Unix, with multiple input/output processors dealing with the applications-specific requirements through Softlink, a proprietary operating system. More than 600 lines can be dealt with by a single System 5000 machine, which will link, say, word processors to mainframes. HTEC sees organizations which rely on a variety of different machines, such as finance houses and central and local government, as major customers of the system. (Source: The Times, 22 March 1988, p. 37)

Computer museum

Plans for a 20 million pounds sterling national computing museum have moved forward with offers of support from nine leading international computing companies and the appointment of a full-time project director.

The project was launched a year ago with support from ICL, DEC and Harris, which were appointed trustees, including Unisys, Hewlett-Packard, Sun, Norsk, Nixdorf and Xerox. They are represented at meetings by top executives, normally managing directors.

A final commitment decision on the first round of funding will be made at a trustees' meeting in October.

That meeting will decide on the 4 million pounds sterling needed for a total revamp of the London Science Museum's computing gallery. If the trustees agree on that funding, the next target will be a new national museum in Reading. This is supported by Berkshire County Council and property developer Speyhawk, which is offering a site. (Extracted from Computer Weekly, 18 August 1988)

New advanced robotics research centre

A five-year, 15.8 million pounds sterling Advanced Robotics Research Centre will be set up at Salford University. The centre, spearheaded by Salford University Business Services, is already operating with an acting director and its own staff. The Department of Trade and Industry will contribute 5 million pounds to the project, which is intended to be self-financing by 1993. Advanced Robotics Research will conduct generic research at the centre and pass on the intellectual property rights to Advanced Robotics Research Technology for commercial exploitation. Other organizations collaborating in the project are British Nuclear Fuels, GEC Marconi's Command & Control Systems Unit, Royal Signals & Radar, Subsea Off-shore, SD Scicon, Taylor Hitch, Vickers Shipbuilders & Engineering and Apollo Computers UK. Areas the centre will stress for developing advanced robots are: Sensors, effectors, controls, systems engineering, artificial intelligence, man/machine interfaces, navigation and task planning, and mobility and locomotion. (Extracted from Metalworking News, 25 July 1988)

Crime report expected in September

The English Law Commission expects to publish its long-awaited report on computer crime in September - but it could be another six months or more before it makes recommendations. The September report will only be a consultative document which presents the issues and asks for comments from computing and legal people. The consultation will last three to six months and the commission will then produce a final report, probably including a draft Bill for Parliament. The Scottish Law Commission published its final report a year ago; the English commission suspended its work pending the result of British Telecom's case against two hackers who broke into the Prestel viewdata service. (Source: Computer Weekly, 14 July 1988)

Code to help UK

The British Microcomputer Federation (BMF) is hoping that its Seal of Confidence code of practice, endorsed by the Department of Trade and Industry (DTI), will help UK suppliers to compete in Europe post-1992. The campaign, backed by Computer Associates, Microsoft, Ashton Tate and Pegasus, is intended to steer users clear of software pirates by giving them a professional body that regulates the microcomputer industry in the UK. (Source: Computer Weekly, 22 September 1988)

BCS opens dialogue with European groups

The British Computer Society is spearheading a campaign to establish closer ties between European computer societies to prepare for 1992 and the single European market and has invited all European societies to a meeting in November. The meeting will concentrate on such issues as harmonization of qualifications and standards, representation to governments and the European Commission and the organization of joint events. More information can be obtained through the BCS's chief executive office. (Source: Computer Weekly, 11 August 1988)

United States of America

Centres of excellence for semiconductor research

Five university "centres of excellence" will get $0.5-1.5 million in funding for research concerned with semiconductor output from the Semiconductor Manufacturing & Technology Institute. The centres are the University of Arizona for contamination/defect control, University of California at Berkeley for optical lithography, a New Jersey University consortium for plasma etching, the University of New Mexico for metrology, and the Massachusetts Microelectronics Center for single wafer processing. Universities that will create future centres of excellence are the University of Southern Florida for in-process testing, Rennselaer Polytechnic Institute for multi-level metallization, North Carolina State University for advanced processing, and the University of Wisconsin for X-ray lithography. (Extracted from Metalworking News, 13 June 1988)

Commercializing superconductivity

The failure, real or perceived, of American industry to engage fully their Japanese counterparts in the battle to develop commercial uses of the new high-temperature superconductors has contributed to a general perception of the inadequacy of the US

research and development enterprise. The Congressional Office of Technology Assessment (OTA) has added its voice to the debate with a mostly pessimistic report on the relative standing of the United States and Japan.

Although the US Government intends to spend $95 million on superconductivity research during this fiscal year, most of this amount has been diverted from other programmes. Because superconductor development is necessarily multidisciplinary, involving chemistry, materials science and electronic engineering among others, redirecting funds from these areas may dilute the research effort.

Furthermore, the report notes, half of the superconductor money is going to the Department of Defense, whose track-record in commercially advantageous research is undistinguished, and another quarter is for the Department of Energy, whose forte is large projects with specific goals rather than small-scale, flexible research. OTA argues that better use would be made of federal funds if a greater proportion went to the National Science Foundation (NSF), which at present has been allocated only $14.5 million for fiscal 1988.

The OTA report also repeats the familiar complaint that US industry is too short-sighted in its pursuit of technological development. A few large companies - AT&T, Du Pont and IBM - are spending large amounts on superconductor research, but there are no US equivalents to the numerous and diverse Japanese manufacturers whose leaders evidently see long-term profits in superconductors.

OTA presents three strategies the US might follow when pursuing superconductivity. The first would be continuing present policies, which probably will not provide enough support for commercialization of the technology, OTA says. The second strategy outlines a series of steps the federal Government might take, such as sharing costs of joint industrial R&D to increase competitiveness of US companies. And the third strategy would be to consider reorienting federal policies through creation of something like a civilian technology agency to support industrial technology development.

The report concludes that adherence to the traditional laissez-faire approach to technology transfer will concede the advantage to the Japanese, and argues that the US Government must actively push the research priorities it deems essential. This might be done, it says, through the creation of a new federal agency devoted to civilian technology, to support research which is too speculative for industry but too "unglamorous" for the existing agencies. (Source: Nature, Vol. 333, 30 July 1988 and Chemical and Engineering News, 11 July 1988)

MIMIC programme to aid GaAs IC growth

In January 1987, the Pentagon selected 16 teams made up of 48 US defence contracts for Phase 0 of the microwave/millimetre-wave monolithic integrated circuit (MIMIC) programme. That list will be narrowed during subsequent contract phases, beginning with the award of Phase 1 contracts in April 1988. The selected competitors will share $536 million in research funds during the four-phase, seven-year programme, but the real potential lies in large production contracts for new weapons and the MIMIC circuit that will make them possible.

According to a recent report from Electronic Trend Publications, Saratoga, Calif., the MIMIC programme is intended to spur the development of technologies that civilian firms regard as too risky or expensive for normal investment. Specifically, the goal of the MIMIC programme is to develop reliable, high-performance monolithic analog circuits operating in the 1-100 GHz frequency range that can be mass-produced at relatively low cost.

MIMIC circuits will be based primarily on GaAs technology and could be used in a wide range of military systems such as phased-array radars.

MIMIC technology has potential commercial applications as well, particularly in the field of satellite communications. But the primary short-term commercial benefit of MIMIC may result from the technology-base improvements it must produce in order to succeed. Among these are enhanced gallium arsenide yields, computer-aided design techniques for non-linear circuits, improved device processing and fabrication techniques and more effective test methods.

The Information Network, San Francisco, Calif., agrees that military applications will account for the bulk of the US GaAs market while the development of a commercial industry is left to the private companies motivated by the expectation of substantial profits once the technology has become established. (Extracted with permission from Semiconductor International Magazine, June 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, Il. USA)

New programme for neural network computers

A $400 million programme to take neural network computers out of the laboratory and into wide-scale, practical use is under consideration by the US Department of Defense. The programme is mapped out in a 586-page report commissioned by the Defense Advanced Research Projects Agency (DARPA) and previewed at the Second IEEE International Conference on Neural Networks held in San Diego at the end of last month.

The seven-year programme would establish a neural network office, managed by DARPA, that would fund research within the universities, national laboratories and industry. Equivalent amounts spent by other agencies would be likely to push government expenditure on neural network research to over $1,000 million over seven years; up from the current total of $40 million a year.

The actual performance of neural network computers is described as "far from awesome". But the belief remains that they will provide the next major advance in computing technology. What are now needed are machines powerful enough to test whether building computers inspired by biological nervous systems can provide human-like abilities that have proved so hard to model in conventional computers.

A neural network computer consists of many simple processors, densely or sparsely connected, whose function is determined by the strength and pattern of their connections. Each simple processor is, in essence, a neuron, and each of its inputs a single synapse, whose weighted input can change with experience. Unlike a conventional computer, with one central processor carrying out operations in sequence, neural network computers carry out operation in parallel and are generally designed to be trained - rather than programmed - until a particular input produces a desired output.

But an enormous disparity in computing power divides even the most sophisticated neural network

computers from real nervous systems. Computers cannot match a fly's brain, let alone a human's.

The DARPA report estimates that the human brain contains 100,000 million neurons (10^{11}), each having roughly 1,000 dendrites that form 100 million million (10^{14}) synapses. In neural network terminology that gives the brain a storage potential of 10^{14} "interconnects", a measure of the number of weighted inputs in the system. And given the rate at which nerves fire (100 Hertz), a human brain has the potential to make 10,000 million million (10^{16}) interconnects per second. A fly's brain can manage 10^{7} interconnects, and 10^{9} interconnects per second which is still way ahead of the most advanced supercomputer - a Cray XMP 1-2, for example runs at 2×10^{6} interconnects, and 50×10^{6} interconnects per second. Of course, a Cray supercomputer has not been designed with neural network programming in mind. Special purpose computers now under development should achieve interconnect values 20 times higher in the near future.

But the DARPA report calls for speeds in the 10^{9}-10^{11} interconnects per second range within three to five years, and of 10^{12} interconnects per second in six years. To do so requires ambitious technology development; in the shorter range gallium arsenide, charge-coupled device and analog-digital hybrid chips, and in the longer run, optical technology, which will allow a much higher density of interconnects.

Specific applications considered by DARPA are necessarily military, although the report stresses that they would have to be built on generic applications in vision, speech and robotics. Non-military applications are potentially enormous, and if the US Government and industry is not prepared to back development, there may be others who will. (Source: Nature, Vol. 334, 11 August 1988)

New programme to produce superconducting magnets

The US Department of Energy will launch a programme in autumn 1988 targeted at developing the industrial capability needed to produce superconducting magnets for the supercollider. Thousands of powerful superconducting magnets are needed to keep the kamikaze protons on course. The supercollider send atomic particles rushing toward each other from opposite sides of a 53-mi tunnel at speeds nearing the speed of light. The resulting subatomic collision may develop new particles and reproduce situations at the time of the Big Bang. About 25 per cent of the estimated $4.4 billion cost of the project will go towards the magnets. About 8,000 dipole and 1,600 quadrupole magnets will be needed for the project. Dipole magnets lead the protons, while the quadrupole magnets concentrate the speeding protons into a needle-thin beam. The DOE launched the Magnet Industrial Program aimed at getting industrial firms to participate in the project. The article details Phase I, or Technology Orientation, of the project. Two subsequent phases are planned including tooling and magnet preproduction, and magnet production. (Extracted from American Metal Market, 27 July 1988)

Major new network possible

A major US national research network may be established to provide computer network infrastructure to support the scientific research community. The National Research Council has endorsed the concept, proposed by the Office of Science & Technology Policy. Phase 1 would involve interconnecting existing networks that are fragmentary, overloaded and poorly functioning; Phase 2 would upgrade and expand existing US networks supporting research to achieve data communications at 1.5 million bps for 200-300 US research institutions, with a 45 million bps backbone network; Phase 3 would aim to deploy within 15 years communication and switching capabilities that support backbone transmission of 3 billion bps, and connect over 1,000 sites.

The Department of Defense's Defense Advanced Research Projects Agency (DARPA) plans to develop a new national network for research to replace ARPANET. The new network, the Defense Research Internet (DRI), folds into the overall national research network concept. DRI would also replace ARPANET as a test-bed for advanced networking concepts. DARPA is working with other federal agencies to acquire a shared Research Internet Backbone rated at 45 million bps, and a Research Internet Gateway to provide high-speed packet switching and connect DRI to other networks. (Extracted from Chemical and Engineering News, 29 August 1988)

Du Pont gambles on superconductor patents

Betting that the University of Houston will be granted patents covering high-temperature superconductors, Du Pont has bought the rights to commercialize the compounds.

The agreement gives Du Pont exclusive rights to commercialize superconducting materials included in any patents granted for work done by Houston physics professor Paul C.-W. Chu. The university has filed broad patent applications covering many compounds, including the so-called "1-2-3" superconductors composed of yttrium-barium-copper-oxide (Y-Ba-Cu-O). Those materials, announced in early 1987, were the first to be made that become superconducting above 77 K, allowing cheap liquid nitrogen to be used to cool them rather than expensive liquid helium.

One competing application has been filed by the University of Alabama, Huntsville, where the Y-Ba-Cu-O superconductor was first made in the laboratory of physics professor Maw-Kuen Wu, a collaborator and former student of Chu's. Wu and Chu are two of the nine co-authors of the paper in the 2 March 1987 issue of Physical Review Letters where the work was first published.

The Y-Ba-Cu-O materials may also be covered in patent applications filed by others. Both AT&T and IBM are aggressively pursuing patent claims for high-temperature superconductors, for example, although neither firm will reveal for exactly which compounds. (Extracted from Chemical and Engineering News, 29 August 1988)

Union of Soviet Socialist Republics

New joint venture formed

Elorgsoft International (USSR) will be formed to make personal computers as a joint venture of V/O Electronorgtechnica (USSR), an electronics trading firm with $3 billion/year in sales, and Advanced Transducer Devices (US). The new firm will operate as a government-sanctioned firm modelled on IBM's present AT PC; however, to comply with technology limits on computer trade with the Eastern Bloc, the PCs will be a generation or more behind those offered in the US. Analysts warned that US backers must find a way to get paid for sales, preferably in US dollars. (Extracted from Metalworking News, 30 May 1988)

USSR, Italy, France establish first joint venture for data processing

A joint venture of Eastern and Western partners for software development and the provision of services in the EDP sector has been established in the Soviet capital with the name "Interquadro".

The Ministry of Higher and Secondary Specialized Education as well as the State Agro-industrial Committee are participating in the joint venture on the Soviet side, while the French PC and "school computer" manufacturer Aniral Utec and the Italian trading and consulting firm Delta Trading are its foreign partners. Nothing has as yet been disclosed about the Western partners' capital shares. Aniral Utec and the Ministry of Higher and Secondary Specialized Education had already been working together on joint scientific and technical projects since 1984.

The Soviet managing director of Interquadro, L. Wainberg, stated that the new enterprise is intended to contribute to bridging the chronic [USSR] deficit in services and software for imported computer technology, particularly in personal computers from the West, noting that "orientation assistance" for Soviet enterprises, especially in the agricultural sector, should also be offered to aid in choosing and procuring modern EDP technology and in tracking EDP technicians.

The interim goal is to export user programs and other EDP software to Western markets. Wainberg implied that the joint venture has to tackle considerable personnel problems. It is not easy to find computer and software experts with international experience and extensive qualifications in the Soviet labour market.

Interquadro has already received its first contracts. The agricultural-industrial complex Kuban (North Caucasus), the agro-industrial firm Adashi (Lettland), the Moscow central health service administration, the Ministry for the Merchant Marine and the Soviet State Circus are among the clients. In addition, a number of foreign firms have expressed interest in establishing business relations. (Source: Markt und Technik, No. 2, 15 January 1988)

Under-water robot

A remote-control robot for exploration work on sea shelves down to 400 metres deep has been introduced by Bauman Higher Technical School (Moscow). The robot, appearing like a moon research vehicle and crab, is guided by cable from a control desk that can be up to 1 kilometre away. The robot has a stereoscopic TV set and manipulator arm mounted on a forward chassis. An operator and navigator can follow its underwater operation via a number of monitors while staying ashore or on board a ship. The robot travels along the sea bed to take samples of soil, examine and lift objects, and implement easy repairs to machines. (Source: Machine Design, 21 July 1988)

VIII. FACTORY AUTOMATION

Robots and information management systems take hold in the laboratory

Although machines do not replace researchers, they are carving out a useful niche in laboratory work. For example, laboratory automation can increase sample throughput, cut down on worker exposure to hazardous substances and free scientists to do more demanding, less routine tasks. It also improves accuracy and recordkeeping and can give sales, manufacturing or shipping departments computer access to laboratory results and reports.

Three principal activities occur in an analytical laboratory: preparation of a sample for testing, analysis of the sample and processing of the data generated by the analysis. All three steps can be automated and linked by computer, using robots to prepare the sample; "intelligent", programmable analytical instruments to inspect it; and laboratory information management systems (LIMS), to work with the analytical results and to produce reports.

A LIMS has three basic functions: replacing a paper-based laboratory record system with a computerized one; replacing manual data entry of test results with on-line data collection; and replacing physical distribution of laboratory test results with electronic distribution.

The main features of laboratory information management systems are essentially the same. For example, a sample can be logged into the system manually or automatically and its progress can be tracked on a computer as it passes through the laboratory. The LIMS generates a worksheet for assigning tests on the sample to a laboratory section or to a particular instrument. Test data can be entered into the computer manually or fed in directly from analytical instrument interfaces. Results are calculated automatically and the system can flag out-of-range data. When it is time to review the test results, both access and editing can be limited to specified people. Finally, the system can print or display standard or customized reports. The data and the methods used are archived and may be copied to protect against loss.

Whether a company buys or writes its LIMS, the laboratory manager must expect to spend months choosing it and getting it up and running. Planning for the arrival of a LIMS can take six months to two years. System installation can take one to three months and training and establishment of system-support capabilities a further three to four months.

Factors to consider in selecting a LIMS include the number of samples the system has to keep track of, the complexity of tests to be performed on those samples, how well the LIMS interfaces with user-written code and with a mix of instruments, the number of simultaneous users and how easy it is to use. Other factors to be considered include backup and archiving capabilities, how much customization of the LIMS is necessary and whether the system can accommodate laboratory growth and changing hardware.

One topic that comes up in any discussion of information management systems is integration - between a LIMS and other departments in a company or between a LIMS and laboratory instruments or data acquisition systems (a computer linked to a number of instruments). Another key feature in choosing a LIMS involves the relationship of customer and vendor, which may last 10-15 years.

If the LIMS customer cannot find a system to suit its purposes, the customer may decide to write its own software or get a consultant to write it. Cost, the deadline for having the system in place and the adequacy of continuing support are parts of that decision. Some companies, after writing their own LIMS, find that updates, revisions and tinkering absorb so much effort that they eventually drop their version and buy from a vendor after all.

Others say that customizing a vendor's LIMS would take so much time that they might as well write their own program from scratch.

The 1987 world-wide market for LIMS was $30-40 million and is growing at about 10 per cent per year.

While LIMS clearly seems to have a place in medium to large-size laboratories, there is more controversy about the role of robots. The two companies involved in producing robots - Perkin-Elmer and Zymark (Hopkinton, Mass.) - project vastly different outlooks for market growth.

In 1989, says James N. Little, senior vice-president at Zymark, 400 robots will be installed in laboratories world-wide, accounting for $30 million worth of business, a 30 per cent jump from the year-earlier period. In 10 or 15 years, he adds, 50,000-90,000 robots could be in place in laboratories. David P. Binkley, PE Nelson's marketing director, does not expect such growth in robotics: he believes the market is flat.

Perkin-Elmer's MasterLab System blends robotics and software to automate such projects as tablet-dissolution and polymer-viscosity testing. The system is controlled by an IBM personal computer (or an IBM-compatible microcomputer).

The robot moves along a straight track to reach different workstations, including a bar code reader (to log a sample in), a pipette apparatus, a balance, a mixer, a centrifuge and a gas chromatograph. While one sample is analysed at one of those workstations, the robot can ready the next sample. The robotic arm can switch fingers during a procedure so that it can pick up objects as different as microtiter plates and flasks. And if the robot is linked to a LIMS, the robot carries out the tasks listed in the LIMS worksheet.

The robots are used primarily with infrared spectrometers and gas chromatographs (GC) and less often with liquid chromatographs (LC) and atomic absorption spectrometers. More than 100 robots have been sold at prices ranging from $25,000 for a robot and controller to $100,000 for a complete system, including some instruments and service.

Since Zymark rolled out its first model in 1982, the company has supplied 1,100 Zymate Laboratory Automation Systems. They are used in research laboratories and for quality control at plant sites, primarily in the pharmaceutical, chemical, food processing and energy industries. Prices for Zymark's automation system run from $30,000 to $80,000. At the low end, a typical system might include modules for a balance (price not included), a solvent dispenser, a mixer, filter and LC injector. The most expensive systems might also include extraction, centrifuge and evaporation modules. Individual modules can be added as needed.

Zymark's software keeps a record of every step in the automated procedure. For more sophisticated data handling, the system can be linked to personal computers, minicomputers or mainframes. It can control up to 25 stations, the company says, and can be used to automate recombinant-DNA purification, tests of pharmaceutical tablet content or pesticide residue analysis, among other functions.

One third of the Zymark robots installed are used for sample preparation for high-pressure liquid chromatography and an additional one third are devoted to sample preparation for GC, titrations and spectroscopy. Typical users process about 50 samples/day with a robot, though some robots run 24 hours/day with as many as 150 samples, but that volume can be handled only if the assay is simple; for example, weighing a sample, adding a solvent, mixing the solution and putting it into a gas chromatograph.

Unlike Perkin-Elmer's system, which moves along a straight track, Zymark's robot arm swings in a circle, with a radius of 26-36 inches (depending on the hand) and a height of 22 inches. Also, the Zymate has a stiff arm, whereas the Perkin-Elmer arm has an elbow. Little says the stiff arm allows the Zymate to move straight up and straight in, which is useful for picking up a test tube from a rack or putting a sample in an instrument. Such movements, he says, are "hard with an elbow". The Zymate system can prepare one sample while another is being analysed, and it can automatically change hands. It can use one type of hand to grasp a test tube, then park that hand in a stand and attach a syringe hand for the next step. (Extracted from Chemical Week, 20 July 1988)

Computer-controlled manufacturing

Manufacturing applications under computer control cover the entire range of factory operations. Computerized numerical control (CNC) systems for machine tools make part programming easier and enable the units to communicate with other computers. Process planning is integrated with other functions such as CAD and factory management.

On the factory floor, the accuracy and flexibility of robots increases with computer control. Vision systems help guide robots as well as act in a stand-alone operation for quality control and sorting. In addition, computerized statistical quality-control methods improve factory output.

For overall factory control, computer networks could soon replace paperwork and allow for fast exchange of information, either between lower-level processors or host computers. Factory-management software for resource planning controls operations. It links management functions to further increase productivity and shorten product lead times.

Many manufacturers create flexible manufacturing systems (FMS) by linking machine tools and material-handling equipment and centralized computers. An FMS increases throughput and cuts lead times for product changeover by one half or more.

On a larger scale, linking all data-processing functions within a company creates computer-integrated manufacturing (CIM). Here, management, finance, engineering and manufacturing all share information to increase quality and productivity as well as shorten lead times.

One of the first steps in turning a design into a finished product is to create a part programme to run a numerical control (NC) machine. This set of instructions details how the part is machined and lists instructions for the operator. Depending on the size of the firm and the complexity of the part, this programming can be performed with CAD/CAM systems, programming workstations, or at the machine tool itself.

At any of these locations, NC programming is simplified by interactive graphics and prompting features that guide the user through the process. For simple parts, even operators with a knowledge of machining but with no programming experience can

create a program to machine a part efficiently. On the other hand, experts in part programming can increase their output and reduce errors. Because programs can be created quickly, users can try different approaches to further increase productivity on the shop floor.

Programming with interactive graphics typically begins with defining part geometry. This computer representation of the part geometry (called a geometric model) can be transferred electronically from the CAD database, or it can be built by the user from scratch at the NC workstation. After the part program has been created from this geometric model, tool paths can be displayed over the part to check for errors. Some systems even present an animation of tool motion to further check tool paths. Such simulation virtually eliminates machining problems on the shop floor.

Interactive graphics for NC programming were first introduced on CAD/CAM systems. Most commonly, the geometric model is called up from a central database so programming can begin. If the information is accessed by a database-management system, it is relatively easy to return the part design back to engineering should it be impossible or impractical to machine.

In addition to quickly sharing information in CAD and CAM, complex parts can also be programmed on CAD/CAM systems. Curve-fitting routines and other aids automate some of the programming. Moreover, wire-frame and even shaded models help the programmer visualize the part and tool path, essential in 4- and 5-axis work. The program can usually be modified graphically to further ease the process.

Data from solid models can be used for NC programming. In theory, these geometric models contain complete, unambiguous part information, but in reality the data contained in the solid may be too imprecise to apply to machining. Also, because solid models require a great deal of processing power to create, manipulate, and display, they are generally too slow for production use at this time.

Dedicated workstations for NC programming is also widely used. These units are based on micros or mini-computers and are generally aimed at manufacturing firms that do not require CAD systems. But the increasing capabilities of these workstations, such as 3D graphics and colour terminals, are making them resemble CAD systems. In fact, many programming workstations have extensive drafting capabilities for defining part geometry so they can also be used as a CAD system to create drawings for the shop floor.

Many programming workstations can also accept CAD data through custom links or neutral files such as the Initial Graphics Exchange Specification (IGES). These workstations are then used to produce APT or cutter location (CL) files. The program is then post-processed into a format acceptable by the machine tool, and sent to the machine tool by NC tape or through a direct link.

A new standard format for binary cutter-location data, known as BCL, is gaining popularity with manufacturers and machine-tool control suppliers. With this approach, the NC data is post-processed into the BCL standard format, which is then put into any machine control that can read BCL. This avoids the need for multiple post-processors in a shop with multiple machines, and allows a job to be scheduled flexibly on any suitable machine without machine-dependent post-processing.

At the machine tool, computerized numerical control (CNC) systems house microprocessors for programming parts with prompting features, and sometimes, interactive graphics. Many CNC systems also store material, tool and machining parameters to guide users through the programming process.

Microprocessors in CNC systems also add other capabilities to machine tools. In addition to part programming, CRTs at the machine tool can display set-up instructions and other information. Full alphanumeric keyboards permit operators to communicate with the machine tool or other factory computers; and some CNC systems incorporate in-process gauges or tool-breakage detectors into the machine-tool system.

The use of LSI and VLSI chips has also made CNC systems more reliable and durable than in the past. Moreover, extensive use of ICs has added capabilities on the high end and reduced cost and size on the low end. Memory at the machine tool has also increased through the use of large RAM chips; and battery backup is keeping data in memories even when power fails. Some CNC systems incorporate more costly bubble memory which does not require battery backup to retain data.

A few CNC systems now have extensive communication capabilities, often housing several ports for linking up to factory computers, robots, programmable controllers and gauging systems. Through distributed numerical control, for example, part programmes and other data can be directly down or uploaded in CNC systems. Such systems can alsobe used with robots and other computer controls to create manufacturing cells which form the basis for an FMS. (Source: Machine Design, 16 June 1988)

How to create a CAM drawing

Sometimes, a drawing that looks fine on the screen or when plotted is a garbled mess when transferred to an NC program. Though some NC program vendors include "translation" routines that automatically format design drawings, some do not, and others require the NC programmer to fuss with the geometry to prepare it for programming. The Point Control Co. has developed a checklist of hints that designers should keep in mind when entering CAD data that will be used for numerical control programming.

- Numerical data must be accurate - Co-ordinate data must be accurate before the drawing is sent to the NC program.
- Part data should be scaled properly - If parts are drawn using nominal dimensions, they must be edited to actual size before data are sent for NC programming.
- Separate notes and dimensions from drawing data - If such information is on the same layer with part geometry, the CAM system might reject the data file.
- Establish standards for layer assignment - Assigning specific layers for data-like dimensions, notes, borders, and materials lists makes it easier for different programmers and designers to work on the same files.

- Avoid overlapping drawing entities - If an arc or line is copied over an existing one, the resulting toolpath will be unusable.

- Profile entities must connect - A typical CNC machine tool will cut continuously only within 0.001 inch, so it is imperative that CAD data meet or excede machine tool accuracy.

- Drawing tolerances should match manufacturing practices - Certain dimensions and tolerances are easier to programme than others because of the limits of NC programmes and machine tools. For instance, a dimension of 1.002±0.001 may be easier to programme than 1.001+0.002/-0.000. Preferred dimensioning tolerance notation usually specifies the mean dimension plus or minus a specific amount.

- Application requirements must be specified - If a design calls for milling operations that require Z-axis work, the CAD package chosen should have some 3D capability. However, a 2D package would be sufficient for certain applications, such as routing.

(Source: Machine Design, 16 June 1988)

Linking PCs and machine tools

Distributed Numerical Control (DNC) was once practical only for large organizations that could afford the expensive minicomputers needed to control large numbers of machine tools. However, relatively inexpensive PC AT-class machines can now provide DNC to smaller organizations.

There are several ways of connecting a PC to machine tools for DNC. The PC equipment required mainly consists of the computer itself and a serial link board. The PC talks to the tools over its serial ports. However, most PCs are equipped with only one or two serial ports. This limits the number of NC machines that the PC can handle, but multiple machines can be linked to one PC through the addition of multiplexers, electrical or mechanical switchboxes available from communications vendors. Multiplexers can be daisy chained to link from 8 to 64 machine tools to one PC. A less expensive method of linking fewer than four tools is through a mechanical switchbox.

Machine tools must be equipped with serial ports to allow network connections. Serial links are not standard equipment on most computer-controlled machine tools and can cost as much as $2,500. In some cases, software can be found to emulate the serial link. Software of this type usually runs about $800.

Serial links to machine tools that do not contain resident computer control can be obtained through use of behind-the-tape-readers (BTRs). A BTR is an electronic box that simulates a paper-tape reader. The input to the BTR is a serial link. The output is parallel data, which makes the BTR look like a tape reader to the NC.

BTRs provide standard NC machines with computer control and resident memory so that programs can be edited and stored at the machine tool. However, in some cases the BTR is less expensive than a serial link, even on machines containing a computer control.

A PC can play several role in a DNC system. Sometime the PC both programs the machine tool and stores the finished program. In other cases, the PC primarily stores programs and collects data about machines on the DNC network. (Source: Machine Design, 16 June 1988)

Workcell simulation

Simulation systems now available remove much of the uncertainty from new automation projects. They allow planners to select, place and realistically operate hardware. Errors can be detected on the screen, not through costly foul-ups on the factory floor.

Part-flow and process simulation have been available since the early days of software. They are most valuable in helping evaluate entire systems, establishing the type and quantity of equipment, and estimating optimum cycle times. There are several levels of simulation to consider.

For example, programming part flow serves as a check to establish the need for various system elements. Questions can be answered such as: would two small milling machines or one machining centre do the job most efficiently?

Many existing software packages are capable of this type of work, or can be modified to present such data.

As the demand for more detailed manufacturing data increases, more specialized programs are being developed. One of the high-growth areas of simulation stresses graphic presentation of automation islands, or workcells. This level of simulation allows the engineer a detailed evaluation of system performance. Quality graphics are stressed so that the equipment can be analysed in detail and viewed from any angle.

A good simulation package can allow verification of concept, analysis of cycle time, collision avoidance, tooling feasibility check and off-line programming, as well as being an aid in equipment evaluation. Normally the programs specialize in detailing a segment of a complete system. Detail and simulated processing speed tend to fall off with the larger, more complex installations.

After the simulation is completed, some systems allow data to be given directly to automation equipment. Thus, programs developed on simulation systems can be modified in real time.

Where a simulation program is appropriate, there are several factors to consider. Among these is whether the type of simulation needed can be carried out on an available software package or requires a specialty program.

The level of operating detail that is presented is also a key factor in selecting simulation packages, as is the accuracy of the program as to critical data, such as envelope dimensions or cycle time. Most systems specialize in envelope problems, such as whether operating units will collide or smack into surrounding walls. But other interactive variables, such as the influence of speed changes or part modifications, can be important.

Usually, the main component of a workcell is a robot, which must be programed. Nonservo robots are programmed by physically placing stops, setting limit switches, connecting wires or fitting air tubes. Servo robots, however, can be programmed in

several ways, including manual teaching or off-line programming.

In manual teaching, a programmer leads the robot arm through an operating sequence either by physically moving the arm or by driving it from a hand-held device called a teach pendant or computer console. Commands are inserted when the arm is in an appropriate point. The completed program is then stored in the robot's controller memory.

In point-to-point programming, only end points are memorized so the path followed by the arm in operation may differ from the one followed during programming. For continuous path robots, however, a programmer must guide it through the precise sequence.

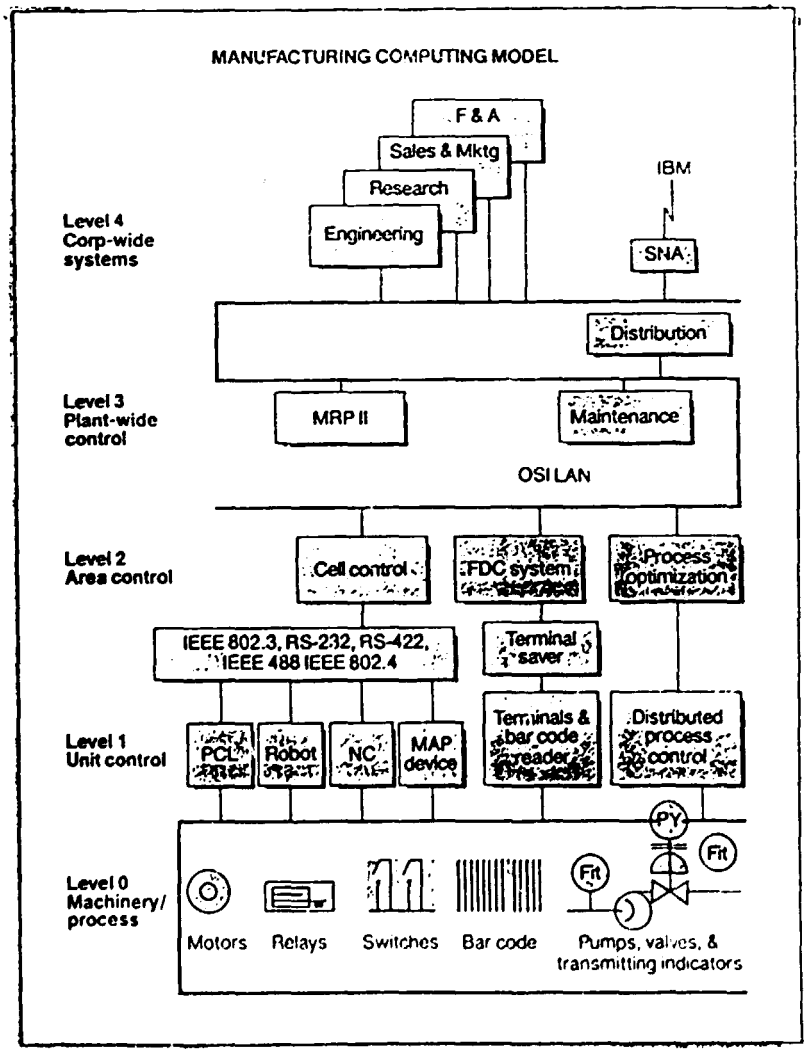
Manual teaching is sufficient for many applications, but becomes tedious if many points must be outlined - and the robot is not doing useful work when it is being taught, so many users keep another arm off-line to develop programs without taking working robots out of the assembly line.

In off-line programming, detailed routines for robot motion are created at a separate computer and then sent to the robot controller for execution. The robot and related production activities do not have to be shut down for reprogramming, and the process creates a listing that can be easily stored, edited, documented and transferred from one robot to another. Off-line programming can also easily handle input from devices such as force or vision sensors to modify robot motion in real time.

Process plans outline the sequence of production steps needed to make a part, describing step-by-step routing through the shop. This task has traditionally been performed manually, but a shortage of trained process planners and the need for consistent routings has brought computers to bear on the task. This concept, called computer-aided process planning (CAPP), attempts to fully automate the function based only on information from CAD and the machining database.

There are basically two approaches to CAPP - variant (or retrieval) and generative. The earlier method, the variant approach, works by retrieving a process plan for a similar part from the computer database and modifying it to fit the new part.

Group technology, a method used to classify and code parts with similar attributes into families, also plays an important role in variant process planning. A standard process plan can be created for each family and entered into a computerized database. Plans for new parts are then made by



searching the computer files for a suitable procedure and modifying it.

In the so-called generative approach, software contains decision-making logic to route the part through the shop. The decisions are based on part geometry as well as machine tool and process data to create an efficient route. Databases for this software can be supplied as a set of standard information which can then be modified by the user. Such databases contain machining times, estimates, standard allowances, and operational instructions.

Both CAPP approaches have their own set of benefits. Variant process planning is more efficient than manual methods and the plans produced are more consistent, reducing set-up times, queuing and material costs. Moreover, shops that make parts easily separated into families can greatly benefit from this method. But process plans produced with the variant method are typically difficult to modify to account for new equipment, methods, or part types and the technique may ignore subtle differences in part geometry, leaving some routings incomplete or inefficient.

The generative approach, on the other hand, bases the process plan on part geometry, so even small differences in parts produce changes in the process plan. Moreover, process plans created with the generative approach can be used to produce to the same depth as the actual routings, minimizing differences between bids and actual costs. Generative CAPP is typically geared toward one type of process, such as only rotational parts. And users must also be prepared to do some programming to customize this software. (Source: Machine Design, 16 June 1988)

MRP in the factory

Software for factory management generally involves control of both inventory and production. These programs assist in planning for all resources of a manufacturing company, with separate modules covering scheduling, capacity planning, shop-floor control, and purchasing. Other sections cover engineering change orders, cost control, and even sales and marketing.

The first of these programs to achieve widespread use was packages for materials resource planning, called MRP. With this approach, software determines when to order parts based on inventories and sales orders. From this beginning, packages grew more comprehensive and became manufacturing resource planning (MRP-II), which starts with business and sales planning and includes master production scheduling, capacity-requirements planning, and sometimes process planning.

MRP-II touches on almost every function in a factory, acting as a central planning and control system. For example, CAD/CAM and MRP-II can share a substantial amount of data such as part specifications, bills of materials, process plans, and group technology coding. Since MRP-II typically runs on a separate computer, linking it to other systems has proved difficult and, so far, is limited in application. Such links are vital, however, to create a "closed-loop" system in which production results can be fed back almost instantly to planning functions. (Source: Machine Design, 16 June 1988)

A magic factory

A new process that allows three-dimensional computer drawings to be automatically turned into physical objects has been developed. It is seen as the first step towards the sort of computer manufacturing envisaged by science fiction writers where consumers will be able to request a product from their computer and have it instantly manufactured. So far the process produces plastic models but the system is likely to have almost immediate commercial applications in designing intricate three-dimensional prototypes within minutes of a design being finished on a computer. When the process becomes more sophisticated it holds out the promise of considerably reducing the cost of making prototypes for industrial parts or scale models for architectural projects. The process, called "selective laser sintering", uses granulated plastic, or similar substances poured into a tank about the same size as a computer terminal. Thin layers of the plastic powder are steadily built up with a computer-controlled laser beam heating certain areas of each layer until it melts into a solid shape. A roller mechanism moves over the layers keeping the plastic smooth. Unwanted parts of each layer stay in powder form and can be simply removed. Dubbed "desktop manufacturing", designs can be fed in from conventional computer-aided- design software and the models can include complex internal shapes. (Extracted from The Times, 29 March 1988, p.33)

Salford robots

Sixteen UK organizations led by Salford University Business Services are to jointly develop technologies needed for a new generation of robots, after responding to a Department of Trade and Industry (DTI) initiative. The Advanced Robotics Research Centre will have a budget of 15.8 million pounds sterling over its first five years. (Source: Computer Weekly, 30 June 1988)

Advances in computer-controlled automation

Computers are now expected to operate trouble-free in limited-space offices and severe factory environments. Such recent technologies as very large integrations and complementary metal-oxide semiconductors have put thousands of circuits on one chip and enabled manufacturers to cut cabinet sizes and broaden operating conditions. To gain acceptability for office use, computer makers had to cut the size of their machines and minimize their noise levels. Complex maintenance also had to be cut to nearly non-technical levels. (Extracted from Machine Design, 26 May 1988)

Computer-integrated demonstration plant

InfoMart's Ideacenter (Dallas, TX) has started up a computer-integrated demonstration plant for manufacturing automation technologies including artificial intelligence, integrated material handling, robotics, CAD/CAM interfaces, automatic identification, data entry and Manufacturing Automation Protocol. The plant that unites hardware and software from 18 vendors has five cells; order entry and product forms; product design; output management; shop floor automation; and warehousing and distribution. (Extracted from Metalworking News, 30 May 1988)

Mathematics frees robots for finer tasks

An engineer in the US has solved a complex mathematical prob. which should mean that robots will be able to perform difficult manoeuvres much more smoothly and accurately. The solution, which has baffled researchers for years, could lead to more mobile "humanoid" robots says Eduardo Bayo,

from the University of California in Santa Barbara, who has solved the "inverse dynamics problem", which calculates how each of the numerous electric motors that control a robot arm must move to produce a particular action. Humans can perform very complicated and precise movements, such as controlling the tip of a fishing rod well enough to cast the bait accurately. Before the arm moves, the brain calculates the necessary movement of each muscle involved and tells the muscles what to do as the arm swings.

In the case of a robot arm, the "muscles" are electric motors which must turn by a given amount at a given moment. Each motor must be supplied with just the right amount of electrical current, at just the right time.

Researchers can predict the motion of a robot arm if they know how the motors will move. This is known as the forward dynamics problem. They have not been able to work backwards to calculate the movements of the motors required to generate a particular complicated motion.

Bayo's approach to solving the robot arm equation differed from previous attempts which treated sections of the arm as rigid structures. He originally studied as a structural engineer, and applied standard methods from this field to the problem. These techniques break down movements of the arm to consider the many frequencies each is built from. Such techniques are usually applied to flexible structures, in predicting the response of buildings to earthquakes or high winds, for example.

In a series of tests Bayo has shown that sophisticated arms, with two or more joints, can be programmed to move very smoothly - to 2 per cent accuracy on a desired path.

At present it takes about three minutes to solve the problem on an IBM PC AT desktop computer, but Bayo hopes to develop the work using "more sophisticated" computers which could run the program in a fraction of a second.

Eventually, the robot arms may be used on robots which could tackle dangerous jobs, such as clearing rubbish from nucelar reactor sites, remotely. (This first appeared in New Scientist, London, 25 August 1988, the weekly review of science and technology)

Factory automation identification system

Sharp Corporation and Mazda Motor Corporation have jointly ventured into the development of an identification (ID) plate system for factory automation and have installed it in the latter's head office factory production line.

A memory function on the workpiece (pallet) enables the establishment of a flexible manufacturing system (FMS) for the mass production of diverse products while maintaining communications with a host computer and programmable controller (PC). With an automobile assembly factory, for example, the system enables custom-built passenger cars to be assembled with greater ease than before, so it is expected to gain popular acceptance as a next generation production system.

The set-up consists of an interface unit linked to the PC and an antenna and an ID plate (memory) for fitting onto the pallet. Whenever manufacturing information such as the car model, body colour, displacement, machine working conditions and inspection results are transmitted from the host computer, they are temporarily written into the ID plate via the PC. Necessary bits of information are read out from the ID plate in each assembling process, so that the workpieces are discriminated and the automatic machines controlled appropriately at the same time. Information generated in the manufacturing processes are also written into the PC and, in the final process, stored in the host computer.

Since information is stored on the workpiece side, complicated programming will become necessary when networks are established, so the load on the host computer is alleviated through distributed control. Since all communications procedures are performed with the PC's programs, a large-scale FMS can be designed with great ease. Information exchange is accomplished by the method of electro-magnetic induction between ID plate and antenna, so non-contact data exchange is possible up to a distance of 25 mm, which has the effect of inhibiting system interruption caused by imperfect contact or contamination.

The system is compact with a size of 80 x 40 x 17 mm, but has a capacity of 2 Kbyte which enables the storage of a huge quantity of information. Further details available from Sharp Corporation, Public Relations Sect., 22-22, Nagaike, Abeno-ku, Osaka, Tel.: 06-621-1221, Telex: J63428 (Source: JETRO, June 1988)

Systems for automatic fitting/insertion of semiconductors onto PC boards

Sony Corporation has started marketing two new factory automation (FA) systems for fitting and inserting semiconductors and electronic components onto and inside PC boards automatically by drawing on unique, precision automation technology.

One is the "SIM - S-A Series" system for high-density surface mounting of film form and thin semiconductors or components onto PC boards, and the other the "SS-7" system for inserting electronic components into PC boards, both of which are to be delivered under order starting in November 1988.

The former system consists of a standard chip mounting machine and a non-standard chip mounting machine. Standard components of up to 80 different kinds and non-standard, special-shaped components of up to 32 different kinds can be fitted automatically. It enables up to 3 million chips/month to be processed, and is suitable for medium-scale mass production of diversified products. The system is also designed for picture processing with a CCD camera and also for confirming proper component mounting and automatic remounting.

The "SS-7" electronic component insertion system for inserting connectors and other components into PC boards is designed for grasping inserted components and reinserting them, and therefore preventing component loss. Further details available from Sony Corporation, Public Relations Sect., 7-35, Kitashinagawa 6-chome, Shinagawa-ku, Tokyo, Tel.: 03-448-2111, Telex: SONYCORP J22262. (Source: JETRO, August 1988)

Sensor centre to be established

An application and development centre for factory-floor sensing and manufacturing technology is being formed by the Industrial Technology Institute (Ann Arbor, MI). The Sensor Center for Improved Quality, being partly funded by a five-year, $800,000 grant from the Michigan Strategic Fund, is planned to offer manufacturers

practical uses of measurement and sensing tools to improve quality of goods and cut cost of plant operations. More funding will be supplied by the centre's member firms. The centre will in its first year gather such data on sensing and measurement technologies as machine vision, co-ordinate measuring machines and sensors for machine tools and form a data clearinghouse. A project to be developed in the first year is an Implementation Needs Project where durable-goods producers will be surveyed to find certain sensor needs and study practical implementations of sensor technology. Another first-year project concerns Lighting Science, which will be concerned with the lighting needs of machine-vision users. Future work will involve input from member firms. (Extracted from American Machinery and Management, May 1988)

Automated manufacturing program developed

An automated manufacturing program is being developed by the National Bureau of Standards (Gaithersburg, MD) under a legislative mandate. The Automated Manufacturing Research Facility in Gaithersburg is a prototype computer-integrated manufacturing system tailor-made to support research on standards for the factory of the future. Research subjects are software and hardware interfaces; data representation, management and communication; process control and measurement; and plant reference models. Detail is given to NBS's efforts in robotics and vision systems, wear analysis and process control, CAD, structural analysis, a flexible workstation, and rapid access to parts. (Extracted from Mechanical Engineering, September 1988)

Robots in future kitchens

The fast food industry will install increasing numbers of robots and other labour-saving devices in kitchens in the future, due to the shortage of workers in the industry, according to experts. At Premise Institute (Burbank, CA), a market research firm estimates that the fast food industry is 250,000 workers shy of the 6 million workers needed to keep it running smoothly. J. Durocher of the University of New Hampshire's Whittemore School of Business and Economics notes that with unemployment as low as 3.1 per cent in some areas of north-eastern USA, fewer workers are willing to prepare fast food for the minimum wage of $3.35 per hour when they can earn $8-10 per hour in manufacturing.

Pepsico, Taco Bell and Pizza Hut have developed a prototype automated beverage dispenser that takes 15 seconds to deliver a 16-oz beverage. A computer sends orders from the cash register to the dispenser, which drops a cup, fills it with ice and the selected soda, and places a lid on top. A conveyor moves the filled cup to the customer. Pepsico will test market the unit in late 1988. The critical link in future automation will be the computer linking the cash register to the food preparation machines. (Extracted from New York Times News, 24 August 1988)

High-functional manipulator for nuclear power reactors

Fuji Electric Co., Ltd. has come out with a large-sized multi-articulated manipulator for inspecting the structural members of nuclear power reactors and has delivered the first manipulator to the Japan Atomic Power Company, Ltd.'s Tokai Power Station No. 1.

Designed to approach target structural members by avoiding obstacles even in narrow places congested with pipes, it permits the inspection range in power vessels to be greatly expanded.

This manipulator consists essentially of an arm to do the actual work, a 14 m cylinder (guide tube) for supporting the arm, a control system and a supervisory monitoring system.

The arm consists of a jointed structure connecting six links each with a length of 1.2 m and diameter of 20 cm. It has 10 degrees of freedom which provide the arm with great working flexibility, by virtue of which the manipulator is capable of inspecting complicated structural members existing inside the pressure vessel.

Each of the arm's joints can be controlled simultaneously, and its tip's positioning accuracy is within a few millimetres. Final positioning is accomplished with the aid of a camera and a laser measurement unit fitted at the arm's tip. Also, a newly developed control system is introduced that shifts the arm's respective joints along the same paths treaded by the arm's tip, with the result that the arm is capable of moving about without coming into contact with surrounding equipment even when working in narrow places. Any deviation from this path is sensed immediately.

Operational control is performed with the operator giving instructions based on the nuclear reactor displayed on the CRT in the control room and the manipulator's positioning information. Manipulator operation based on the teaching playback system is also possible.

Normally, the manipulator's main parts are stored in a fixed place, assembled whenever a need arises, and the manipulator is then sent inside the pressure vessel through fuel exchanghe pipes.

The manipulator is used primarily for precision inspections checking for injury, deformation or other abnormalities in the reactor by using a TV camera, and for making repairs by fitting the arm's tip with equipment such as drills and welding heads. Further details available from Fuji Electric Co. Ltd., Public Information, 12-1, Yuraku-cho 1-chome, Chiyoda-ku, Tokyo. (Source: JETRO, June 1988)

Load-shifting robot arm

Inter Plan (Japan) is offering a pneumatic robot arm that can move 220 lb loads. It measures the weight of whatever is being lifted and automatically makes the appropriate changes in the amount of force it exerts. The arm can move a load in any direction. It resists smoke, dirt and heat and can lift molten metal and other hot substances. Attachments such as large vice grips and drills will be available. The robot arm will be produced at a rate of 300 units per year. (Extracted from Asian Wall Street Journal, 8 August 1988)

"Smart" sensors

Ford Motor is developing "smart" sensors whereby the circuits for signal processing could ultimately be integrated on the same silicon chip that includes the sensing unit. The concept involves the micro-machining silicon etching method and thin-film fabrication. The research currently is at the experimental prototype stage, using a method that can be upscaled for high-volume output. The facilities include a clean-room where employees wear customary protective suits that expose only the face. (Extracted from Auto Engineering, May 1988)

Computer-controlled aircraft washing system

Kawasaki Heavy Industries has jointly developed an automatic aircraft-washing system with Japan Air Lines. The giant-size structure, which is equipped with computer-controlled rotary brushes, has been installed at the Tokyo International Airport in Narita. The automatic aircraft-washing system, which can wash and clean a commercial jetliner in about one hour, will be put into full service in late 1988. The system, which has 16 washing robots, can handle the Boeing 747-400 and 747SP and Lockheed's L-1011. The $8 million, 90 x 100 metre system uses specially developed rotary brushes that are pressed against the aircraft under a constant tension to prevent damage to the aircraft body. (Extracted from Metalworking News, 16 May 1988)

Fishing robot

Japan Radio has jointly developed Shing Robo-JAM-80, a fishing robot, with the Federation of Japan Tuna Fisheries Co-operative Association. Production is seen at 200 units per month, according to Japan Radio. The robot employs five poles and five fishing devices and one control unit. A sensor is used to differentiate between genuine strikes and false alarms caused by vessel movement. Shing robo-JAM-80 can cast, reel fish in, remove fish from the line and weigh the catch. The robot's targets are fish like bonito and tuna which are used for sashimi. (Extracted from Asian Wall Street Journal, 16 May 1988)

IX. STANDARDIZATION AND LEGISLATION

OSI: Putting world standards into practice

For the last 10 years, groups of technicians, negotiators, and standards officials around the world have been toiling away to produce a set of basic standards to support the Open Systems Interconnection (OSI) seven-layer model of communications standards. By the end of this year, the International Standards Organization (ISO) in Geneva finally will have ratified many of the main foundation standards for OSI.

For users to benefit, these standards will have to be applied in real products and users must be confident that the products they buy are genuinely compliant. The challenge for the next decade is to put OSI into practice.

There is only one way that this can be achieved successfully, and that is through internationally aligned and widely accepted conformance testing and certification procedures. The result will be a kind of global information systems industry seal of approval for OSI-compliant products.

However, the communications standards involved are imprecise and they are peppered with a variety of sometimes conflicting options, while existing conformance procedures have some severe limitations. But more threatening to the future of OSI in the global information systems industry is the danger that three different sets of tests and procedures will emerge in the US, Europe and Japan - at least in the short term.

Major users must be aware of these factors if they are to put their faith in the conformance tests and certificates that vendors will cite when they propose their equipment. If these factors are ignored, users will be disappointed. It is a case of understanding how closely the reality of Open Systems Interconnection can match up to the ideal.

The first problem is that communications standards, in general, are not precise specifications. Sometimes, this imprecision is accidental since it is very difficult to write exact specifications for complex communications sequences. Or, the imprecision may be deliberate; only by the inclusion of a variety of options can standards groups reach a consensus. Whatever the cause, the result is the same: two independent implementers are unlikely to come up with identical interpretations or options, so interworking will not happen, or at least it will be very difficult.

This situation is not unique to computing and communications standards. Other, longer established industries have learned that standards must be precise and testable. Indeed, many standards outside computing specify exactly which tests must be applied and how they should be carried out to ensure accurate implementation. For example, ISO standards dealing with food, chemical and metal industries are virtually all related to methods of testing.

The testing of communications equipment is an integral part of its production; no supplier offers communications equipment without subjecting it to rigorous tests. But these tests and the specifications are usually under the supplier's own control. For OSI to work in a situation where the base standards are imprecise, the necessary precision must be provided by unambiguous tests. Moreover, the tests themselves must be available to every implementer or potential implementer.

Internationally agreed upon conformance tests for products provide a perfect answer, in theory, but perhaps not surprisingly, practice falls short of perfection. The shortfall is an interesting mixture of a lack of experience, legal complexity and other real-world constraints. An understanding of this mixture is necessary for an understanding of what must happen for OSI to succeed.

Conformance testing is not a new topic for computing. It is routinely practised for language compilers and, in fact, the US federal Government requires COBOL and FORTRAN compiler certification from its suppliers.

This process has established four important precedents within computing, although again they are relearned from older industries. One is that a conformance test only tests that a product conforms to what is written in the standard. Although this sounds simplistic, its implications are devastating. For instance, in the case of COBOL, the accuracy of arithmetic calculation cannot be tested, since it is not defined by the standard.

The second lesson is that products may accurately implement a standard, but actually rely on additional, or superset, features for some aspects of performance. There is nothing a pure conformance test can do about this. Although these features may be of vital interest to a user, a conformance test cannot even comment on them.

The third lesson is that there is a vast gap between conformance and usefulness. For example, the ISO Transport Standards for communications

allows for a product to generate a reject at any time. Thus, a system that produces no response other than rejects may be claimed to conform, but could by no means be described as useful.

The last precedent is not a technical one. COBOL and FORTRAN validation, despite their limitations, are now widely accepted as reasonable and helpful to the industry at large. They reached this state through the backing of a powerful procurement agency - the US federal Government - and, indeed, without it they may not have succeeded. The moral is that standards need to be "pulled through".

These limitations of conformance testing should not obscure the fact that for OSI to work there must be both precise specifications and common tests. If tests are sufficiently comprehensive, they become the specification, in de facto terms. This requirement for testing is well recognized and has led to the emergence both of highly visible demonstrations - such as the multivendor electronic mail and data exchange demonstrations at the Enterprise Networking Event, Autofact, and the Hanover Fair - and of organizations producing and offering testing technology for widespread common use.

This leads at once to two interlinked problems that must be solved. One is that the tests actually used must be of a sufficiently high technical quality to allow meaningful communication between implementations that pass them. The second is that there must be universal agreement on the tests that will be used.

In effect, this means that the specifiers of the tests must achieve a degree of precision that has eluded the producers of OSI standards over the years.

Finding the necessary test suites will be gradual rather than instantaneous. Initial test suites may not guarantee interworking, but as each problem is identified, the suite can be enhanced. Only usage over a period of time will provide the necessary knowledge to allow deficiencies to be identified. Like standards, tests to be used must be in the public domain and under public control. This work on public standardization of OSI test suites is under way at the ISO and will take time to complete.

The complexities of conformance testing are not all technical, however. The problem of finding widespread agreement on what tests to use could take longer to solve because of commercial and/or political pressures. That arises for two reasons. In some circumstances, testing to local standards has been used by governments to favour their own industry and this is anathema to industries that are trying to achieve open markets.

The second reason is that tests used in procurement may differ in different parts of the world or in different industries. This makes it impossible for suppliers to produce consistent product lines and for interworking to take place.

These numerous issues affecting the successful testing of OSI leave the global IS industry with four main problems:

- Organizations offering tests must be prepared to stick with them until they are of sufficient quality to give a guarantee of interworking;
- Tests must have the backing of reputable organizations;
- All laboratories must apply tests in the same way, so that there is no suspicion of cheating; an inspection mechanism will therefore be necessary and there must be sanctions for misuse;
- Tests must be openly available and not locked in to any vendor or testing institution.

Moves are now under way in Europe, North America and Japan aimed at providing solutions to these problems. The European Commission has taken two major initiatives, each offering a partial solution. The first is the setting up of a formal Certification Scheme that will ensure equivalence between testing laboratories across the continent. The second initiative is the launching of the Conformance Testing Services (CTS) programme aimed at ensuring that test services of adequate quality exist.

In North America, the Corporation for Open Systems (COS) has been established to produce and make available tests and test systems necessary to make OSI a reality. In Japan, a major project is under way to offer testing services associated with Japanese functional profiles of the OSI standards.

In Europe, the problem of aligned tests must be solved for many industries if the European Commission's goal of an open market in Europe in 1992 is to be achieved. An outline scheme has been proposed by a committee operating under the aegis of CEN/CENELEC (two of Europe's standardization bodies, based in Brussels) and will be overseen by CENCER, the certification arm of CEN. Any organization is free to propose a set of tests and procedures for use within the scheme. CENCER will accept these tests and procedures as long as they are being used within the scheme and will also make them available, under licence, to any laboratory wishing to operate within the scheme.

These designated laboratories will test equipment under the rules of the scheme and prepare formal test reports for their clients - the suppliers or purchasers of the equipment. If they wish, clients may then offer these test reports to national certification authorities, which will in turn issue a certificate if the test report is satisfactory. The certificate will be valid in all countries operating under the scheme and will remove the need for any retesting.

At first sight, the scheme looks complex, but it is born out of much experience in other industries and has some powerful advantages. It allows testing laboratories to be operated by a supplier (first-party testing) or by major users (second-party testing) or by independent organizations (third-party testing). It does this by rigid definition of the standards of operation that must be met and by insisting on detailed record-keeping. It also provides for proper periodic inspection of laboratories to ensure that they are operating within the scheme. This is a necessity if certificates are to be widely recognized; there must be absolute assurance that laboratories are operating consistently and neither deviating from the rules accidentally nor as a favour to local industry.

The aims of the European CTS programme, meanwhile, are to encourage organizations to bring

forward test services that can be offered for use within the CENCER scheme. This involves the specification of tests and procedures, as well as the establishment of laboratories prepared to offer these services for public use. The use of such testing services is seen as an essential part of European public procurement.

The programme consists of a series of contracts, each involving participants from more than one country. The largest programme deals with tests for wide area networking and will bring forward test services for lower levels of OSI, Transport and Session, FTAM, and MHS. The co-operating partners in this programme represent Denmark, France, Federal Republic of Germany, Italy, Spain and the UK.

In North America, COS is attempting to achieve the same effect by publishing tests and procedures and by licensing the use of a registered mark. This may be associated with products that meet those criteria specified by COS. As with the CENCER scheme in Europe, testing in the US can be carried out by suppliers or by other laboratories set up by or approved by COS. Effectively, what is happening is that the corporation is prepared to give the market an implicit guarantee that products bearing its mark will achieve interoperability.

One major issue in the US that requires clarification is whether COS testing will be recognized by the US Government as an adequate proof of conformance for procurement purposes. The role of specifying such tests for government procurement lies with the National Bureau of Standards. If NBS decides to use tests that are different from COS tests, a very confused situation would exist.

The situation in Japan is even more complex. There, the Interoperability Technology Association for Information Processing (INTAP) was established in late 1985 as a joint public/private sector initiative. It has several aims, the principal ones being to oversee a large demonstration project on interoperable databases. This project will be developed around OSI standards, and it is a fundamental part of the project that INTAP develops and makes available OSI testing services. INTAP is supported by all major Japanese IS producers. Although there is as yet no formally stated intention to defer certification based on tests developed by INTAP, precedent suggests that certification to Japanese standards will happen in Japan and there is no other project in existence that could be used as a base.

Meanwhile, the World Federation of MAP/TOP User Groups is considering the introduction of MAP/TOP certification marks based on approved tests. Unlike the other certification efforts, this would represent a genuine example of user "pull". Two points arise from this: financial resources must be available to do the job properly, and the tests should be aligned with the other certification schemes in operation.

That there could be three different sets of tests and procedures operating in Europe, the US and Japan, at least in the short term, represents an improvement over a situation where there is no testing at all, but it also means that different variants of OSI may find use in different parts of the world. Given the long-term goal, it means this can only be a temporary solution; the problems of finding a longer-term solution are that the individual services are dissimilar in some respects and that no formal harmonization work has yet begun.

The most sensible approach is for each standard to have associated with it an internationally agreed upon set of tests and procedures. The alignment of regional standards is the first step and here progress has been made. The recent bilateral arrangements between the Standards Promotion and Application Group (SPAG) in Europe, COS in the US and the Promoting Conference for OSI (POSI) in Japan have led to wider alignment involving the European Workshop for Open Systems, and the NBS in the US. Given such moves, it will not be difficult to produce common test suites and procedures, but it will take both time and resources.

There is one further factor. If there is to be alignment of testing between the US and Europe, then access to those tests would allow Japanese industry access to US and European markets. In theory, access to Japanese tests should allow US and European industry access to the Japanese market, but, historically, this has proved to be only theoretical. This topic has much more to do with government procurement conditions than technical alignment of tests, but it should be regarded as one of the major inhibitors of OSI in the real world.

The principal problem is that alignments are usually slow to happen, and the slower they are, the more likely retroactive alignment of operational testing services will occur. We could yet have a situation where parochial obstinacy gets in the way of progress. For instance, at the current time, European tests will be used for public procurement and those of COS primarily for marketing purposes, but possibly also for public procurement.

Historically, too many attempts at alignment have meant "We are happy to align, if they will do it our way". If these arguments are extended into government procurement issues in terms of "If we change, their industry will have an advantage", progress will inevitably be slow in coming.

The fact that it will take a long time to implement OSI does not mean that it will fail, however. In the real world, it is not possible to switch immediately from non-OSI to OSI solutions. Both suppliers and users have too much invested to allow this.

The principal problem OSI must face is that suppliers will for some time be able to claim that since OSI does not guarantee interoperability, they really cannot recommend it in preference to their own solutions. This response can be dealt with only on a case-by-case basis, e.g. where an application has requirements for interworking with unspecified machines outside a user's control, then an OSI gateway is a necessity and can, in fact, be provided in addition to proprietary protocols.

OSI, and the production of the enormous family of related standards, represents a tremendous feat of engineering for the world's IS community. This is all the more remarkable because it has involved - and will continue to involve - finding agreements among many different interests throughout the world. The next step is to make sure those agreements extend to conformance and certification for the benefit of suppliers and users alike.

It should not be surprising if OSI, which has been so long in coming, should take time to reach its full potential. And when it does, its greatest achievement will be that it can, at last, be forgotten about.

US Government moves toward implementing OSI standards

After a ten-year effort supporting open systems interconnection (OSI) standards, the US Government is moving ahead to implement the concept.

The vehicle for the Government's action is the Government Open Systems Interconnection Profile (GOSIP), a specification that is compatible with industry specifications for OSI. This move is expected to push the demand for OSI standards-conforming products.

The Government expects to complete its Federal Information Processing Standard (FIPS) for GOSIP before the end of July. Based on national and international standards for OSI, GOSIP will enable US governmental agencies to start planning for and acquiring the technology that will make it possible to communicate information between computers manufactured by different vendors.

GOSIP and its underlying technical agreements are the result of activities the National Bureau of Standards initiated in the late 1970s, when the NBS Institute for Computer Sciences and Technology (ICST), the agency responsible for developing computer and related telecommunications standards for the federal Government, began a long-term effort to foster development of the standards needed for government networking activities for the remainder of this century.

The efforts are now coming to fruition and, when they do, GOSIP is expected to be an important tool for the Government's use of networks to improve information exchange and productivity.

With the increased use of computers for a variety of information-processing tasks, government users cannot satisfy all their computing requirements with a single vendor's products. They need to integrate and transfer information between the systems of different manufacturers in a multivendor environment and must be able to add to existing systems in a modular fashion. Standards are important technical and management tools for achieving these objectives in a cost-effective way.

This approach encouraged standards that would meet the needs of both industry and Government.

GOSIP is based on the agreements developed at workshops. Industry groups developing similar profiles, such as the Manufacturing Automation Protocol (MAP) and the Technical and Office Protocol (TOP), also use the workshop agreements as the basis for their specifications. Similarly, the conformance tests being developed by the Corporation for Open Systems (COS) are based on workshop agreements.

Agreements developed by the NBS Workshop for Implementors of OSI were used for the 1984-1987 demonstrations of OSI protocols. The first full set of planned GOSIP-conforming products will be demonstrated at the 1988 International Enterprise Networking Event in Baltimore, Maryland.

GOSIP implementation. GOSIP was announced as a proposed FIPS in October 1987 and is now undergoing final review. The document includes the technical details necessary to specify exactly what a vendor must provide for an agency network acquisition.

The FIPS may be used immediately by agencies ready to proceed with acquisition of OSI networks, but it establishes a two-year transition period before federal Government use of the FIPS becomes mandatory. This transition period enables vendors to develop products that meet the specifications and enables users to plan for the implementation of OSI.

Initially, GOSIP defines a set of protocols to support file transfer, access, management, and electronic mail applications over existing standard networking technologies. The relevant existing standards are IEEE local area network standards 802.3, 802.4 and 802.5, plus the International Consultative Committee for Telegraphy and Telephony (CCITT) recommendation X.25 for the public data network interface.

Additional protocols, networking technologies and functionality will be added as the international standards and the implementing workshop agreements are developed.

At most, revisions to GOSIP will be made once a year. The initial version defines a minimally useful set of applications and other services. Additions will be made to increase the functionality.

Future near-term additions are expected to include protocols for remote terminal access, office document interchange and directory services. Other applications that may be added later are electronic exchange of business forms and graphics data.

New network services will be added, including connection-oriented network service for operation over single networks. Expected additions for transaction processing, Integrated Services Digital Network (ISDN) and the fibre distributed data interface (FDDI) lie further in the future.

Upward compatibility will be maintained when new functions are added to GOSIP. As each new function is added, a transition period will be provided for implementers and users to plan for future products.

Other planned additions to GOSIP are also being considered. Three important areas under development include dynamic routing, network management and network security.

The first version of GOSIP only includes provisions for static routing. While this is acceptable for many applications, static routing does not meet the needs of advanced users such as the US Department of Defense.

In the next version of GOSIP, provision will be made for host and network routers to work together. Later, dynamic routing will be possible among network routers administered by a single organization. Later still, dynamic routing will be possible between separately administered routing domains.

The requirement for network management will be critical. Although voluntary industry standards are unlikely until the early 1990s for network management and even later for products, some interim solutions may be available within the next year or two. For example, the MAP 3.0 specification contains some network management capabilities that might be considered for use in the period before standards are final and standards-conforming products are available.

Perhaps even more critical is the requirement for network security. Here, requirements must be met for protecting both classified and unclassified information. Work is under way within several federal Government organizations to create a suitable architecture and specific protocols that will allow for appropriate OSI security.

In its current form, GOSIP will enable users to achieve interoperability of standard applications operating over standard network technologies.

Added advantages. While the benefits of interoperability are significant for users, GOSIP will also provide other benefits. The standard internetwork and transport protocols specified in GOSIP will allow users to interconnect non-standard network technologies and will provide end-to-end service reliability.

The Department of Defense is taking the lead in requiring GOSIP in future network acquisitions.

After two years, OSI protocols will be used in acquisitions. The transition will be eased by using gateways between the two protocol suites.

This DoD policy recognizes that there are significant advantages in using commercial vendor products if they meet the Department's operational needs. These advantages are:

- Lower costs because of a broader market for vendor products and improved competition;
- More effective products integrating protocol functions across product lines; and
- Better use of scarce management and technical resources by the organization.

Using a complex specification such as GOSIP raises issues of conformance and interoperability testing. Several testing organizations are developing conformance tests and test systems. ICST will specify which tests, test systems and testing organizations are certified for GOSIP protocols.

Interoperability testing may also be desirable considering the complexity of GOSIP implementations. ICST may also recommend tests suitable for interoperability testing.

The development of GOSIP points up the need for overall organizational planning to overcome incompatible networks that may have developed over the years. OSI standards can be implemented in compatible, interoperable products. The planning for them should be done in a systematic way across operating units within an organization.

Incompatible computers and networks present a growing problem within many government organizations. GOSIP provides an opportunity for organizations to establish control over their network resources.

The work of the federal Government and the private sector to advance the implementation of OSI standards in products can help to overcome the problems of non-communicating applications. By planning now for OSI use, users can take steps to improve information exchange in the future. (Source: Computer, June 1988)

Industry and NBS complete conformance test for POSIX

Representatives of US industry and the National Bureau of Standards Institute for Computer Sciences and Technology have developed a test suite to evaluate conformance of operating systems to the proposed federal standard entitled Portable Operating System Interface for Computer Environments. Known as POSIX, the standard was developed by the Computer Society's Technical Committee on Operating Systems.

POSIX defines the interface - or link - between applications and AT&T's Unix technology. This technology is rapidly gaining acceptance as the cornerstone for an open-systems architecture to facilitate moving software from one computer environment to another.

AT&T, Digital Equipment, Hewlett-Packard, IBM, Perennial and a consortium of 13 vendors called X/Open contributed to development of the test package.

POSIX is expected to be approved soon as an interim Federal Information Processing Standards (FIPS) developed by the NBS for use by the federal Government.

For ordering information on the conformance test package, contact the NBS Systems and Software Technology Division, Rm. B266, Technology Bldg., NBS, Gaithersburg, MD 20899, phone (301) 975-3295. (Source: Computer, June 1988)

US, UK and Canada working on office exchange test

Researchers at the NBS in the US, the National Computing Centre in the United Kingdom and the Department of Communications in Canada are collaborating on a testing method and tools for a newly adopted international standard related to formatting office documents.

The standard will make it possible to revise, process and exchange office documents across different manufacturers' systems without reformatting. A test method is needed to determine whether the standard is implemented properly in a particular product.

The NBS was involved in developing the international standard, called the Office Document Architecture and Interchange Standard (International Organization for Standardization 8613), and plans to propose it as a FIPS.

For further information, contact the Systems and Software Technology Division, NBS, Rm. B266, Technology Bldg., Gaithersburg, MD 20697, phone (301) 975-3344. (Source: Computer, June 1988)

Brussels witnesses OSI leap

European and US suppliers will announce major progress in the move to link their systems through OSI standards at a meeting in Brussels.

Members of SPAG (Standards Promotion and Applications Group) and COS (Corporation for Open Systems) will announce substantial progress and plans towards common standards and tests for system interoperability.

In November, the two groups which represent all the leading US suppliers including IBM, DEC and Unisys and European suppliers including ICL, Nixdorf, Siemens and Honeywell Bull, will meet their Japanese counterparts INTAP and POSI to discuss commitment to a common toolset for OSI conformance testing.

The Japanese bodies are already working on a superset of Western standards to ensure systems talk to one another but few results have reached the West.

"Even if you have identical standards there are nearly always implementation problems," says Rod Matthews, ICL's director of systems engineering,

who has played a unique role in getting COS and SPAG to work together.

"The conformance test tool itself lays down the standard to be confident of interoperability," says Matthews. The two groups have been developing their own test suites.

COS and SPAG signed an agreement to co-operate at the end of last year. Now they will announce a programme to integrate their tool sets.

They expect to come up with the specifications for a common tool set by January which should be developed by April 1989. Between now and April the COS and SPAG suites need some work to create a common user interface and outputs.

The bulk of OSI conformance testing will be done at major vendors' sites but the National Computing Centre (NCC) and the The Networking Centre (TNC) will set up a joint test centre.

This will serve users and small system suppliers as well as distributing the toolset. Last year COS awarded the NCC three contracts to develop software for testing OSI components and conformance to the OSI message handling system standard.

Acerli, a French organization similar to the NCC, may also carry out some conformance testing.

The toolset agreed covers the complete set of international standards for the seven-layer OSI model. They include the COS FTAM (file transfer, access and management) test system, the COS message handling system, and SPAG tools for network management, directory services, manufacturing messaging services, access control and routing. (Source: Computer Weekly, 15 September 1988)

Foundation to advance standards and develop open software environment

Seven leading computer companies have established an international foundation to provide a completely open software environment designed to facilitate customer use of computers and software from many vendors.

The Open Software Foundation will develop a software environment, including application interfaces, advanced system extensions, and a new operating system using the specifications for X/Open and Portable Operating System Interface for Computer Environments (POSIX) as the starting point. The POSIX standard, developed by the Computer Society's Technical Committee on Operating Systems and closely related to the Unix system, specifies how software should be written to run on computers from different vendors.

Initial OSF funding is being provided by Apollo Computer, Groupe Bull, DEC, Hewlett-Packard, IBM, Nixdorf Computer AG and Siemens Aktiengesellschaft. Membership is available around the world to computer hardware and software suppliers, educational institutions, governmental agencies and other organizations.

The foundation is launching operations with over $90 million in funding. Initial development will be based on technologies offered by the members and its own world wide research.

"Creation of a standard software environment is one of the most important issues facing the computer industry today," said John Doyle, foundation board chairman. "This foundation fulfills the critical need for an open, rational and equitable process to help establish the standards our customers demand and to protect their long-term software investments."

OSF is incorporated as a non-profit research and development organization. It will define specifications, develop a leadership operating system, and promote an open, portable application environment. To support the latter, the foundation will provide software that makes it easier for users to mix and match computers and applications from different suppliers by addressing the following needs:

- Portability - the capacity to use application software on computers from multiple vendors;
- Interoperability - the capacity to have computers from different vendors work together; and
- Scalability - the capacity to use the same software environment on many classes of computers, from personal to super.

To achieve maximum acceptance for the new software environment, the foundation will provide all members with early and equal access to the development process.

The OSF will follow a direction consistent with the international X/Open Common Application Environment, the National Bureau of Standards Application Portability Profile, and equivalent European and international standards. The foundation will work with standards groups to help define standards where they do not exist.

OSF members will be encouraged to contribute ideas on technical as well as policy matters, will be informed of foundation activities on a regular basis, and will be periodically polled on specific issues.

An institute is being created to fund and conduct research to enhance application portability, interoperability standards, and other advanced technologies for future foundation use. An academic advisory panel will provide guidance and input to the institute.

The initial set of interfaces will support POSIX and X/Open specifications and will be extended to include areas such as distributed computing, graphics and user interfaces.

To provide a clear and easy migration path for application developers and end users, the foundation's system will include features to support current System V- and Berkeley-based Unix applications. The operating system will use core technology from a future version of IBM's AIX operating system as a development base.

Additional information may be obtained by contacting Open Software Foundation, PO Box 545, Billerica, MA 01821, phone (617) 250-0035; or by calling Deborah Siegel, Cohn & Wolfe, (212) 951-8300. (Source: Computer, July 1988)

Suppliers resist contract standard

Attempts to come up with a standard contract for software purchase are meeting fierce opposition from suppliers.

At the behest of the European Commission, the Confederation of European Computer User

Associations (CECUA) is drawing up standard contracts for custom and packaged software, which it expects to publish in February 1989.

The group has already drawn up contracts for hardware purchase and maintenance, but the European Computing Services Association (ECSA) is resisting its plans for software. The Commission tends to think of the "nasty supplier versus the poor consumer - it is often the opposite way round in the software industry," says UK CSA director general Doug Eyelons.

The CSA is refusing to talk to the Commission about the contracts, because it does not want a standard contract under any circumstances, but it has issued a response to an eight point user charter prepared by the National Computer Users Forum (NCUF) for CECUA earlier this year.

The CSA says the charter, which sets out the terms suppliers should observe, is "very one-sided". Some demands may be negotiable but users will have to pay a higher price if suppliers are to "relax normal restrictions" on copying and liability. (Source: Computer Weekly, 25 August 1988)

Reporting outgoing quality levels

The Electronic Industries Association has announced the availability of JEDEC Standard No. 16, "Assessment of Microcircuit Outgoing Quality Levels in Parts Per Million (PPM)". The new JEDEC standard was developed for the purpose of providing a uniform method of determining defect density in finished components, and to provide a standard definition of the quality index referred to as PPM.

JESD16 provides semiconductor manufacturers with a common methodology for assessing and reporting PPM. Its use is expected to reduce the differences in quality levels reported by suppliers and users because of the different methods previously used throughout the industry.

The standard consists of 14 different definitions, ranging from acceptance inspection to statistical control. A minimum sample, for example, is defined as the minimum number of devices to be used to assure (with a 90 per cent confidence) the PPM being reported is within an accuracy of $\pm$ 30 per cent, shall be derived from the equation: $S = 2.71p(1 - p)/(0.3)^2 = 30(1 - p)/p$, where S is the total samples tested and p is the average proportional defectives.

The standard provides a list of assumptions and the procedure for accumulating and calculating data. (Reprinted with permission from Semiconductor International Magazine, June 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, Il., USA)

Standard raised for CAD forum

Standards are now in vogue and everybody seems to be setting up standards bodies. Hot on the heels of the Open Software Foundation (OSF) comes the CAD Framework Initiative (CFI) which was launched earlier this year at the design Automation Conference in Anaheim, California.

The CFI aims to find ways of getting complicated computer-aided design programmes to talk to each other. This is vital now that the computer industry is standardizing on hardware and operating systems; after all, what is the point of being able to run all of your software on the same computer if none of the programmes can exchange information?

Just like the OSF, the CFI is backed by industry. Nine members of the computer-aided design community representing both hardware and software vendors have got together to form the CFI. At the moment, they have set up a steering committee to get the ball moving during the next six months while the CFI is formally established.

The founding companies include DEC, Hewlett-Packard, Honeywell, Motorola, Mentor Graphics, Valid Logic Systems, Cadence Design Systems, Microelectronic and Computer Technology, Cadence Design Systems and EDA Systems.

CFI representatives stress that the body will be pushing for open standards rather than endorsing particular products. The CFI aims to create a forum of users and suppliers which will tackle issues such as user interface and data modelling, as well as data and process management technologies. The initiative is open to all interested parties. More details can be had from Andy Graham in the US on 0101 602 821 4180. (Source: Electronics Weekly, 29 June 1988)

TAB standards continue to evolve

US users of TAB (tape automated bonding) are dedicated to establishing standards. TAB, which has been used in the Japanese electronics industry for 10 years, is rapidly emerging in the US as the package of choice for high leadcount ICs.

Scott Voss of Mesa Technology, and a spokesman for ASTM TAB standardization efforts, notes: "US electronics manufacturers have done a lot of hard work to establish TAB standards. Most necessary standards exist and the missing pieces are rapidly falling into place".

"Users who had already invested in their own internally designed TAB programs are switching to the new standards. And companies just getting started are nearly all using the standards."

In addition, TAB equipment and materials suppliers are rapidly embracing the new standards, often before they are finalized.

The first set of TAB tape standards (adopted in February 1988) defined outer lead pitch and windows, tape widths, sprocket holes, test pad locations and alignment holes.

Then (in March 1988) JEDEC standards for "one time use" tape carriers were adopted; these have the same notches and slots as PGA and flatpack standards. "It is generally agreed that high (>100) leadcount TAB will be handled in carriers rather than reel-to-reel, especially when ICs require burn-in. Vendors are already providing standard carriers and burn-in sockets."

"The combination of a standard tape design loaded in a standard carrier naturally led to a standard land pattern (PCB footprint) for TAB." Such a proposal has been submitted to the Institute for Interconnection and Packaging Electronic Circuits (IPC). Approval is expected late in 1988.

Dieter Bergman, technical director of the IPC and a member of the Surface Mount Council, has thrown the support of this organization behind the TAB standards effort.

Further guidelines are also expected from three ASTM sub-committees working on standards for suppliers and users of chips on tape. The issues

being addressed by these sub-committees include shipping and handling; chips on tape, chip protection and identification, and lead finish requirements. (Reprinted with permission from Semiconductor International Magazine, July 1988. Copyright 1988 by Cahners Publishing Co., Des Plaines, IL, USA)

MAP/TOP centres to be managed by ITI

A programme to identify global Manufacturing Automation Protocol Technical and Office Protocol (MAP/TOP) equipment and software conformance test centres will be managed by the Industrial Technology Institute (Ann Arbor, MI), under an order from the World Federation of MAP/TOP Users. The federation will soon unveil the 3.0 level of technology standards for MAP/TOP and Open System Interconnection systems for interoperable, multivendor computer and communications networks for plant floor and office environments. The federation said test centres will be qualified so test results for MAP/TOP products will be consistent between world regions. The test centres will confirm that MAP/TOP equipment conforms to 3.0-level technology specifications. The goal is to have MAP/TOP products tested by qualified centres with consistent results, enabling users to buy equipment off the shelf and know that it will plug right into their systems. (Extracted from Metalworking News, 6 June 1988)

Error-control standard

The V.42 Modem Error-Control standard promises users several benefits. Recently finalized by CCITT, V.42 is expected to improve the integrity of data transmitted with modems, make error control a standard feature in modems, open the door to data compression and, most important, provide compatibility.

In the micro-modem world, the V.42 standard should help improve data integrity by bringing error correction to the modem, according to Rick Villars, a senior market analyst for International Data Corp., Framingham, Mass. This means users do not have to rely on devices such as PCs to handle it. As users move from leased lines to dial-up lines, error-free data transmission is crucial.

Another benefit V.42 may offer is the inclusion of error control as a standard feature. Villars predicts that error correction will be like PC AT command sets.

There are undefined parts of the standard the vendors are particularly fond of. As Villars explains, "There is room left for proprietary value-added features". For Dennis Hayes, president of Hayes Microcomputer Products Inc., Norcross, Ga., this means "the vendor can make enhancements without interfering with the progress of the standard". (Extracted with permission of DATAMATION[r] magazine[C], 1 August 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company - all rights reserved)

New forum opens up

Eight major IT companies have created a forum for implementing open systems network management standards in advance of full international agreement. The decision is both a blow at the standards-making bodies and a boost to open systems' chances of success.

The eight, British Telecom, STC, AT&T, Unisys, Hewlett-Packard, Northern Telecom, Telecom Canada and Amdahl, want to speed up the process of producing products and service to manage multivendor networks.

The formation of the OSI/NM Forum (Open Systems Interconnection/Network Management) was supported by users such as British Rail and Prudential Canada. British Rail is a classic case of a user with several data networks linking computers from different suppliers and needs a network management system that is independent of any one supplier.

The initiative is already gaining momentum with 20 other companies interested in joining the organization, including Nixdorf and GEC Plessey Telecomms (GPT).

Users are also eligible to join the forum and an STC spokesman says several large users "are queuing up to become members".

Work on creating international standards in Open Systems Interconnection (OSI) began a decade ago and it is only in the last few years that enough standards, and products, have become available for OSI to start acquiring a market share.

OSI, which is based on a seven-layer model, enables users to buy equipment from different manufacturers to build multivendor networks. However, one vital component that is still missing is an agreed network management standard.

IBM's network management product, Netview, is seen as one of its strengths but, being proprietary, in the long run ties users into IBM's products. If OSI is to seriously challenge IBM's dominance in networking it needs similar products quickly.

But the task is a substantial one given the complexity of network management functions and the long consultative processes that OSI standards have to go through.

David Flint, a principal consultant at Butler Cox, says that defining the network management standard is "comparable to the whole OSI process to date", which means perhaps another five to 10 years.

It is this process that the eight want to leapfrog. Although they insist that they do not want to "create standards but to implement them" they are effectively trying to create a de facto industry standard by their plan.

The OSI/NM Forum will be based in New Jersey. Launching the Forum, Brian Hewat, director of Telecom Canada, said that it is "committed to ensuring that network management products and services can work together - and to do so as quickly as possible".

The Forum members promise to implement existing standards and to build on the official work but, as Hewat comments, "Some aspects of OSI still need to be fully worked out but we need to find a means to address customers' network management needs now".

An International Standards Organization (ISO) committee is working on defining a network management architecture. So far it has issued a draft standard, Common Management Information Services and Protocol (CMIS/P), that specifies the format of network management messages.

The Forum will adopt this draft but in doing so will effectively make it an agreed standard as the

process of implementation, production and purchase will make it difficult to change. The forum aims to demonstrate an interoperable network management system within 18 months.

Its first tasks will be to select "profiles" (vertical sets of standards) of the OSI layers. For example, for wide area networks, it will adopt the X.25 packet switching standard. For local area networks it will initially choose the IEEE 802.3 (Ethernet) as standard.

At the same time it will start work on defining network management message content, establishing the messages and services required for management purposes, such as status changes, additions or deletions of managed objects, collection of alarms, etc. This is the effective creation of standards and not just their implementation.

Network management is a vital part of networking. As networks become more important to businesses - such that the network often has a much greater value to the business than its capital and operating costs - the need for network management increases as well.

Network management handles error conditions (it "traces, isolates and corrects errors" in OSI parlance); controls nodes in the network such as switching in and out of processors, gateways, etc.; monitors and analyses performance to help improve network usage; handles accounting; and, vitally, oversees network security - all irreplaceable functions.

IBM and DEC, both with their own network management products, were approached to be founder members but declined.

The STC spokesman says that they share the Forum's view and both were "extremely positive".

By bypassing the full consultative process the Forum is snatching back for the suppliers the role of creating standards which users have been increasingly seeing as their task.

But by telescoping the process for creating acceptable standards for the vital network management functions from five to 10 years or just 18 months, OSI will have more chance of becoming a serious force in networking in the 1990s.

And, of course, the Forum members will hope to gain a larger market share than otherwise would have been the case. After all the Forum is a "commercial enterprise", says the STC spokesman. (Reprinted from Computer Weekly, 11 August 1988)

Copyright battle reopens

A judge in California is being asked to decide whether the codes that run microprocessors can be copyrighted and, if so, whether a Japanese company had infringed an American copyright. Intel of California claims that NEC of Japan copied onto its V20 and V30 chips the microcode from Intel's 8086-8088 series of microprocessors.

Microcodes are fixed permanently into the microprocessor and translate commands into a language understood by the machine. The 8068-8088 chips are used to run IBM computers and others with which they are compatible.

In September 1986, US District Judge William Ingram ruled that the microcodes could be copyrighted. But, last December, lawyers for NEC pointed out that he held $80 worth of Intel stock through a private investment club so his ruling was nullified and he stepped down from the case. Last week, William Gray, a judge from Los Angeles, began re-hearing the case from scratch. (This first appeared in New Scientist, London, 23 June 1988, the weekly review of science and technology.)

Copyright ruling

The US Copyright Office has ruled that when a software company copyrights a program, it automatically copyrights the graphic and textual displays produced by the program. Furthermore, software publishers do not need to register any display or textual screen separately.

The copyrighting of the "look and feel" of software programs has been an ambiguous and controversial issue. The most notable legal case of late is Apple Computer Inc.'s suit, filed this spring, charging both Microsoft and Hewlett-Packard with copyright infringement. Apple charged that Microsoft's Windows 2.03 and HP's New Wave interface programs violate visual displays and graphics images generated by its Macintosh personal computer. (Reprinted with permission of DATAMATION® magazine©, 1 July 1988, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, all rights reserved)

Threat to software companies

The British computer industry could be radically changed by the new Copyright, Design and Patents Bill: software companies stand to lose millions in British revenues as the new legislation would give users the right to rent microcomputer software starting one year from the date of release of that software. This could make it as easy to rent (and duplicate an unprotected copy of) Lotus 1-2-3 as to rent a video for the night. The industry stands to lose up to 50 million pounds sterling a year to software pirates if the bill goes through. FAST claimed the legislation will make the UK a "pirate's paradise" in which the copying of expensive business software would become "almost impossible to police". It also says: the Government is wrong to consider software rental as computer programs are predominantly licensed, not sold, to users; that there is no demand by users for rentals; and that the benefit of a computer program is derived from using it continually, no from a single performance or playing (as with a video). (Source: Computer Guardian, 28 April 1988, p. 27)

Italian law backs IBM on copyright

IBM has won a court action to prevent Italian PC clone maker Bit Computers selling computers using a disputed basic input/output system and a basic interpreter software. The court ruled that Bit Computers "illegally used" these IBM copyrighted software programs. Director of workstations at IBM Europe Brian Utley welcomed the Rome court's decision to accept and enforce software-related copyright law. "Infringements of intellectual property rights undermine fair competition, and the incentive for innovation," he said. (Source: Computer Weekly, 4 August 1988)

X. GOVERNMENT POLICIES

US modified code for Japanese chips

Start-up costs associated with the production of advanced semiconductors will now be taken into account in determining the minimum prices Japanese companies can charge for their chips.

The US Department of Commerce agreed to modify this rule, which is part of the US/Japan Trade Pact, after pressure from the American Electronics Association (AEA) and the Semiconductor Industry Association. They argued that if the formula for setting the minimum price or fair market value (FMV) was not changed it could penalize US companies trying to add extra memory chip production capacity. (Source: Electronics Weekly, 17 August 1988)

XI. RECENT PUBLICATIONS

The impact of microelectronics: diffusion, benefits and problems in British industry
by Jim Northcott with Annette Walling

These are some of the findings of a survey of 1,400 factories, representative of the whole of the manufacturing industry in Britain - the fourth in a series undertaken by the Policy Studies Institute (PSI), the independent policy research institute. The full results of the survey are now published in a 320-page report.

In 1978 only one British factory in 14 was using microelectronics in its products or production processes. Now two thirds of them are and they account for five sixths of total employment in manufacturing. Within a decade microelectronics has grown from being a "new" technology to becoming a "mature" one.

It has also become one of the most all-pervasive ones. Sixty-three per cent of all factories employing 20 or more people are using microelectronics, compared with 11 per cent which are using new materials, 6 per cent fibre optics and 3 per cent biotechnology.

Only 13 per cent of factories have applications in their products - most of the rest say they make products which offer no scope for applications. More than four times as many (59 per cent) have applications in their production processes.

On average, existing users are already using microelectronics in about one third of their products and of their processes - but they estimate there is scope for use in nearly two thirds.

Altogether, it can be estimated that about 8 per cent of the total value of manufacturing output consists of products in which microchips are incorporated and that about 25 per cent of manufacturing processes are now controlled by microelectronics.

Use of microelectronics is spreading from the larger plants to the smaller ones. In 1981 three quarters of the large plants employing more than 1,000 people were users, but only about one in 12 of the small ones employing 20-49 people; now virtually all the larger plants are users and more than half of the small ones.

Use is also spreading to industries previously considered "low-tech" in this respect. Forty-four per cent of factories in the clothing industry and 57 per cent in textiles are now using microelectronics - in both cases nearly twice as many as two years before.

More of the overseas-owned plants than of the British-owned ones are using microelectronics (78 per cent against 61 per cent), but the gap has been narrowing compared with two years before.

The majority of applications are still simple stand-alone ones. Only 19 per cent of factories are using microelectronics for centrally integrated control of groups of machines or processes (normally more difficult, but also more valuable) - but this is more than double the number four years before.

Fourteen per cent of factories are using it for automated handling (about double the number four years before), and 17 per cent for design and 26 per cent for quality control and testing (about three times the number four years before).

About 18 per cent of factories are using CNC machine tools (about twice as many as four years before), but the proportion using robots is still only between 2 and 3 per cent.

The survey was based on a sample of 1,200 factories representative of the whole of manufacturing industry, as far as possible the same plants as used in the previous surveys in 1981, 1983 and 1985, plus a supplementary sample of 200 very small plants employing 1-19 people. Fieldwork was in the second quarter of 1987.

The project was funded by the Department of Trade and Industry and the Department of Employment.

The report is available from all good bookshops and from the Policy Studies Institute (100 Park Village East, London NW1 3SR), price 19.95 pounds sterling.

Personal computers close in on workstations

Wider software availability is helping personal computers push their way farther into the scientific and engineering market that was once dominated by special-purpose workstations.

A newly released report by Frost & Sullivan titled Scientific and Engineering Personal Computers and Related Software Market in the US shows that 1,204,600 US-made scientific/engineering personal computers were in use worldwide at the end of 1987.

Unit sales in that area are expected to rise at a compound annual rate of 21 per cent, making the current $1.3 billion market a $3.2 billion market in 1992, in spite of falling hardware prices.

The report found that the market for add-ons, which are vital for using PCs as scientific/engineering tools, is expanding at an annual rate of 32.7 per cent in dollars.

The report stated, however, that software is the driving force behind the growth of PCs in this market. With more than 100 vendors targeting the scientific/engineering market, unit sales are expected to expand at an annual rate of 39 per cent over the next five years, creating a $1.2 billion market by 1992.

Frost & Sullivan noted that some drawbacks have held back the scientific/engineering PC market, such as the delayed release of Microsoft's OS/2 and the resulting lack of application software to take advantage of 32-bit processors.

For more information on the $2,000 report, contact Customer Service, Frost & Sullivan, Inc., 106 Fulton Street, New York 10038. (Source: Computer, August 1988)

The volatile solid state

The major actors in the contest for semiconductor supremacy are the United States, Europe, Japan, and other nations on the Pacific rim.

Spurring the dynamics of the contest is the transfer of technology that began with Japan's early interest in the US semiconductor industry, dating back to the early 1950s. Inertia and protectionism - forces that deter technology transfer - have since lost out to the forces that accelerate such transfer. Some of them were identified in a report of the Council of Academies of Engineering and Technological Sciences just published, "Globalization of Technology: International Perspectives", National Academy Press, Washington D.C., 1988. They include the increasing size of the settled world, the accelerating rates of technology change and technology growth, and the greater mobility of information, capital, and people.

Jan Kolm, a contributor to the report, points to a 1980 declaration by the Japanese Ministry of Trade and Industry as a watershed event. It marked the lessening dependence of Japan on its "fast follower" policy, in which government-supported programmes introduced applications of US technology, and the nations's subsequent embarkation on programmes to develop its own semiconductor technology.

Meanwhile, US semiconductor manufacturers have asserted that deliberate low pricing of Japanese semiconductors in the United States has driven the companies out of important markets, such as dynamic random-access memories (DRAMs).

The US Government, reacting to calls from semiconductor makers to stem the flow of low-cost semiconductors into the United States, worked out a trade accord with the Japanese that required them to stop selling chips to the United States at less than cost.

Ironically, but perhaps not surprisingly, one result of the Japanese manufacturers' adherence to the accord has been a shortage of chips needed by US computer makers and a corresponding rise in chip prices. A less expected result has been a failure of US semiconductor firms to pick up the slack by getting back into the memory chip business, principally because of the high risk and huge start-up costs.

Meanwhile, US chip makers have helped establish a burgeoning semiconductor industry in South Korea, with at least one of the four major Korean manufacturers already opening a fabrication plant in the United States. (Source: IEEE Spectrum, September 1988)

TC3 anthology published

IFIP's Technical Committee on Education (TC3) announces the publication of Information and Education, an anthology of papers selected from TC3 publications since the establishment of TC3 in 1963. The book, edited by Dr. E. Duncan Tagg (GB) and Professor Robert Lewis (GB), was published by Elsevier in July. The book is about 750 pages long and contains approximately 100 papers and extracts from reports. The majority are drawn from the proceedings of world and regional conferences and working conferences.

The anthology is made up of 10 sections, the first being an outline history of TC3. Then follow sections on nine themes that span the main concerns of TC3.

- The Impact on Society
- Developing Countries
- Information Technology Literacy
- Computers in Support of Learning
- The Impact of Computers on the Curriculum
- The Role of Programming
- Teacher Education
- The Provision of Hardware Resources
- Computer Science Curriculum

Each section contains papers selected to illustrate the changing perspective of contributors over the period since the first World Conference on Computers in Education in 1970. There are large (full papers) and small (panel contributions) papers from 150 authors, and all TC3 publications are represented.

The anthology contains a foreward by the president of IFIP and a preface from the chairman of TC3. The history of TC3 has been prepared from contributions of past chairmen. (Source: IFIP Newsletter, September 1988)

Technology Trends Series No. 8: Integrated manufacturing

UNIDO has just issued another study in the Technology Trends Series, prepared by John Bessant and Howard Rush of the Centre for Business Research, Brighton Business School, UK.

The study is part of UNIDO's continuing review of technological advances and their potential and implications for the industrial development and policy approaches of developing countries.

Recent advances in manufacturing technology such as Flexible Manufacturing Systems, Computer Integrated Manufacturing and Robotics are in essence complex and interactive systems. Developing countries may be faced with having to import turnkey and inappropriate systems unless they have the capacity to disaggregate and build their own systems, enabling them to import or produce relevant equipment with the required degree of systems integration.

Against this background, the study examines the use of Advanced Manufacturing Technologies (AMT) and new approaches to the organization and management of manufacturing operations in the quest for flexibility. The focus is primarily in the advanced industrial nations but with a view to presenting options to developing countries.

The study begins with a look at the organizational and technological context in which changes are taking place and considers the limitations likely to confront developing countries in their access to technologies and their capacity to assimilate them. The technological options now available in the key activities in manufacturing design and pre-production, production itself and the

overall co-ordination and management of the process - are presented and the ways in which integrated technology can change the nature of linkages between firms on both the supply and distribution side are discussed.

The fact that these technologies exist does not mean, however, that they are easy to install or manage. Thus, the experience so far with these technologies is reviewed, covering the diffusion across different economies and the costs and benefits that have emerged so far. The sources of supply for such automation technologies and the type and limitations of assistance they can provide to potential users are also outlined.

Since successful implementation of integrated automation often seems to require alternative organizational approaches - in structures, patterns of work organization, skill levels and distribution - the theme of organizational innovation is taken up, exploring the experience so far with new approaches to production organization and managment such as "Just-in-Time" and "Total Quality Management". Evidence suggests that many of the problems of demand for greater flexibility and efficiency can be dealt with using approaches that emphasize investment (via training) in human capital rather than advanced technology. This is not to argue that these approaches should be seen as alternatives but as complementary to options in technological innovation. Possible programmes combining organizational and technological change are looked into.

The discussion moves on to a general strategy for exploring the opportunities offered by new automated technologies and organizational techniques, stressing the need to take a long-term view and building up capacity and experience in increments rather than taking a "Big Bang" approach and trying to effect radical change too quickly. The requirements for developing countries interested in evolving a strategy for Computer-Integrated Manufacturing - in terms of awareness raising, skills and resource development and building up local technological capacity - are analysed.

The study does not mean to suggest that all developing countries will wish to adopt these technologies, or that they necessarily should. It would, however, be to their advantage to monitor developments, increase awareness and develop some experience in the techniques available in order to make more appropriate choices.

Finally, the report takes up some of the key policy issues in implementing integrated manufacturing technology, particularly at the firm and national levels. The report concludes with recommendations for UNIDO activities, including demonstration projects to illustrate the potential of the new technologies for improvements across the range of manufacturing activity.

Software production: organization and modalities

UNIDO issued a study last summer which was prepared by Professor H.J. Schneider of the Technical University of Berlin, Federal Republic of Germany.

Software production is emerging as one of the most important services in this age of information-driven technology. This makes it crucial to examine the organization and modalities of software production, especially as it applies to developing countries. Importing software that is unstructured and polluted from industrialized countries has to be handled with the utmost care and consideration.

The study describes the great potential of software development in developing countries through North-South co-operation, based on the encouraging success of Singapore. It discusses new techniques of software production in so-called software production environments, along the lines of Japan's fifth-generation computer project. Drawing on his experiences as the co-founder of a German software house; the author presents suggestions on installing a software house in developing countries and considers the economic issues.

The major contribution of the report is a series of recommendations for promotional action on software development. The idea for a technology transfer centre and an international centre for Microelectronic Applications and Software (MAS) is explored, including a range of activities that can be undertaken.

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