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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

MICROELECTRONICS MONITOR

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Dear Reader,

The regional meeting for the initiation of a regional network for microelectronics in the ECLAC region (REMLAC) took place in Caracas, Venezuela from 3 to 7 June 1985 and the network was established on a pilot, inter-institutional basis from 7 June for a period of six years. Representatives from eight countries in the region participated in the meeting and on behalf of their governments nominated national institutions in their countries to serve as national nodes. The recommendations and conclusions reached at the meeting are reproduced in these pages (see section News and Events). The results of the meeting are gratifying and show a serious concern of participating countries for cooperation in both R+D and manufacture in the area of microelect·onics. The countries represented at the meeting will be the initial members; however particiation in the network is open to all countries in the Latin American and Caribbean region and the meeting called upon these countries to join the network.

Cooperation with the Economic Commission for West Asia (ECWA) following the joint meeting on development of microelectronics in the ECWA region held in March 1984 is continuing. UNIDO financed the mission of two experts to assess the feasibility of setting up a design centre for the ECWA region. A conference on computer technology and applications is planned for March 1986.

As already indicated in the previous issue of the Microelectronics Monitor, UNIDO is on the threshold of becoming a specialized agency. The first part of the First General Conference of UNIDO will take place on 12 August 1985 . We will report on this in the next issue of the Monitor.

G.S. Gouri
Director
Division for Industrial Studies

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NEWS AND EVENTS

UNIDO:

REMLAC established

The Regional Meeting for the Initiation of a Regional Network for Microelectronics in the ECLAC Region (REMLAC), organized by UNIDO in co-operation with the Sistema Economico Latinoamericano (SELA) and the Economic Commission for Latin America and the Caribbean (ECLAC) was held at Caracas on 3 - 7 June 1985. Representatives from eight countries in the region, viz, Argentina, Brazil, Cuba, Guatemala, Jamaica, Mexico, Peru as well as the host country Venezuela participated. Representatives from the Junta del Acuerdo de Cartagena (Junac), the Latin American Technological Information Network (RITLA), the Caribbean Industrial Research Institute (CARIRI), the International Development Research Centre (IDRC) and the Intergovernmental Bureau of Informatics (IBI) attended as observers.

The meeting unanimously agreed on the structure as well as work programme of REMLAC and the network was established on a pilot basis as from 7 June 1985 for a period of six years.

The detailed conclusions and recommendations adopted by the meeting are as follows:

Structure of REMLAC

The country representatives agreed that the institutions indicated by their governments in sub-paragraph (e) below shall perform functions as the Regional Network for Microelectronics for Latin America and the Caribbean (REMLAC) on the following basis:

(a) The network is established on a pilot, inter-institutional basis from 7 June 1985 for a period of six years or until it acquires an intergovernmental personality, whichever is earlier;

(b) The overall objective of the network is to carry out joint activities with the aim of strengthening technological capabilities in microelectronics in the participating countries individually and collectively, in order to apply the technology for meeting their specific needs;

(c) Participation in the network is open to all countries in the Latin American and Caribbean region. The following countries represented in the meeting will be the initial members, i.e. Argentina, Brazil, Cuba, Guatemala, Jamaica, Mexico, Peru and Venezuela. The meeting called upon other countries in the region to join the network;

(d) The network will comprise of, and operate through, national nodes, (i.e. national centres or groups) in the member countries. There will be only one node per country acting as the focal point and other local entities should link up to the network through the national node. National nodes may have different functional characteristics, but typically would include R+D and applications capabilities;

(e) Representatives from some of the participating countries have indicated their national nodes as follows:

Argentina:	National Electronics Programme, Subsecretariat of Informatics and Development
Brazil:	Instituto de Microelectronica do Centro Technologico para Informatica
Cuba:	Centro Científico Técnico
Guatemala:	Bank of Guatemala (in the first instance)
Jamaica:	National Computer Centre
Mexico:	Instituto de Investigaciones Eléctricas (in the first instance)
Peru:	Instituto Nacional de Investigación Technológica Industrial y Normas Técnicas (ITINTEC)
Venezuela:	Fundación Instituto de Ingeniería

In the course of its operation, the network will recognize as regional nodes national institutions in participating countries which can function as regional centres of excellence.

The functions of the network will be:

(i) Periodical meetings with substantial technical scope (approximately once in eighteen months) for review and evaluation of the network activities and for agreeing upon new programmes. The meetings will also include discussion and exchange of experience on specific subjects of common interest. The country in which the meeting is held will bear the local cost, while the travel cost of representatives of other participating countries will be borne by the respective countries. UNIDO, SELA and ECLAC are requested to support such meetings; and

(ii) Joint activities of (i) a general character such as exchange of information and studies and (ii) a specific character, such as R+D, training and industrial co-operation which may be undertaken by two or more members of the network.

Indicative programme areas of network activities are contained in Section B below. Activities will be carried out only to the extent that funds are available. The UNDP is requested to finance the specific technical assistance needs of the countries and network activities including preparatory assistance in 1986. Until such time as the network attains a juridical personality the programme of activities will be implemented through one or more projects executed by UNIDO. To carry out the above-mentioned projects UNIDO will take into account the programme of work in microelectronics of ECLAC and the relevant decisions of the Consejo Latino Americano of SELA, and could also request the co-operation of SELA.

The activities of the network would be funded through different sources, such as:

(i) Voluntary contributions in national currency by Member States are expected for activities of relevance to the network, and in addition funding of national activities of relevance to the network by external funding sources;

(ii) Financing by funding agencies of the activities through one or more projects;

(iii) Funding of activities by international organizations.

Funding agencies, in particular the Inter-American Development Bank (IDB) and the World Bank are invited to fund specific projects proposed by the network. UNIDO and other international organizations are requested to support the implementation of joint activities of the network on request, in accordance with the established procedures.

The projects formulated to carry out the activities of the network will have a detailed chapter explaining their financing.

UNIDO as the promoter of the network is called upon to support it through technical assistance, advisory services and promotional activities in the participating countries.

The nodal point of the country which hosts a meeting of the network will perform the secretariat functions of the network until they are taken over by the nodal point of the country which hosts the next meeting. The Fundación Instituto de Ingeniería, being the node of Venezuela, will perform secretariat functions until the next meeting of the network. The secretariat will:

(i) receive notifications of participation in the network by other countries in the region;

(ii) circulate information pertinent to network activities; and

(iii) participate, when required, in preparatory activities for the formulation of the programme of work of the network.

UNIDO, in co-operation with SELA and ECLAC, is requested to assist the network secretariat as appropriate. The network will develop and use links with existing regional and subregional organizations within the region and also with the appropriate organizations outside the region.

<u>Indicative Programme Areas for Network Activities under REMLAC</u>

Indicative programme areas for network activities are presented in broad outlines in five modules. Specific network activities will be elaborated subsequently in the form of one or more projects. In such elaboration the following consideration should be kept in mind:

The need for selectivity and substantial impact;

The modules would not necessarily require equal resources;

It is not necessary for each participating country to participate in all activity modules. Where it does participate, the complementary actions necessary at the national level should be carried out;

The activities of the network are envisaged in two phases, i.e. (1985-1986 and 1987-1991). The activities of the modules span both phases, it being understood that all necessary preparatory work should be completed in the first phase and, where possible, substantive activities also carried out in the first phase itself;

Projects will essentially finance network activities and the additionality required for extending a network activity into an inter-country one.

Information exchange

Activities of information exchange in which all member countries will participate. The national focal points will make efforts to collect such information from within their countries and supply it to other members:

(i) Circulation of reports of national activities by focal points;

(ii) Collection and dissemination and information relating to production and supply of raw materials, components and equipment from within the participating countries;

(iii) Inventory of training and educational courses in microelectronics in participating countries;

(iv) Inventory of experts in all aspects of microelectronics technology and industry in participating countries; and

(v) Inventory of expatriate Latin American experts in all aspects of microelectronics technology and industry.

Generation and use of information relevant to other programme area modules. The countries participating in each programme area module will make efforts to collect the information for the formulation and conduct of specific network activities;

Collection and analysis of information pertinent to future network activities, e.g. pooling and analysis of information relating to technology development and production of rural telephone exchange systems in participating countries. The participating countries are requested to supply the information to other members of the network;

Participating countries which have established groups or mechanisms to monitor technology and market trends will each monitor selected aspects of those trends and exchange the information. External consultants and sources of information will be utilized as necessary. The information collected should be suitable for answering real and practical questions of actual concern to the participating countries.

Improvement of the capability for design of custom and semi-custom hybrid and monolithic ICs and other semiconductor devices and printed circuits

Activities will be carried out within a total context which will cover (a) establishing or strengthening national centres for design; (b) regional co-operation in design; (c) access to silicon foundries outside the region; and (d) establishment of and access to silicon foundry facilities within the region. The aim is to increase the number of designers in each participating country at least fivefold in three years.

An important activity of the network, which is emphasized as a priority, is a project for the manufacture of a multi-project chip at a silicon foundry to be selected. Such a chip would consist of a series of circuits of interest to each country, designed by their respective design groups. This requires that each of the participating countries possesses or develops, through regional co-operation, a capacity for the design of highly complex integrated circuits and also agrees on design tools and rules, time schedules, testing procedures etc. Each of the participating countries would finance its own infrastructure but activities such as training and meetings necessary for the design activities, and fabrication, testing ad dissemination will be carried out as a network project.

In addition to the multi-project chip a programme of co-operation among design centres will be developed and promoted with a view to increasing interaction among designers and carrying out common design projects.

Establishment and strengthening of the semiconductor manufacturing capacity of the region

The network activities will aim to improve personnel training in the already existing R+D laboratories and university entities.

The network activities will also aim at the establishment and strengthening of facilities which are capable of acting as foundries for the region so as to create a regional capability in this respect.

Application of microelectronics

Surveys of national and regional application possibilities will be carried out in one or more of the following sectors, such as capital goods, petroleum refining, telecommunication, electricity, transport, agro-industries, ready-made garments, leather, agriculture and education. Surveys will be carried out by the personnel of each participating country on a format to be agreed upon by all participating countries and with the assistance of external experts as necessary. Training for carrying out such surveys will be an integral part of the programme.

Feasibility studies will be conducted by inter-country consultancy groups for manufacturing units in selected sectors and for software and system houses.

Co-operative activities will be carried out in setting up or strengthening microprocessor application centres, their application interests identified and co-operative activities undertaken including the development of software, the testing of prototypes and commercialization of products developed. The respective countries will be responsible for the establishment and operation of the microprocessor application centres. Co-operative activities may be funded through network projects. Training should be an integral part of these activities.

Acquisition and use of hardware and software

A specific aim of the network activities will be to strengthen negotiating capabilities in the acquisition of hardware and software in particular through co-operation in conducting training workshops; the collection and consolidation of training material; identification of institutional facilities for training in participating countries; and training of trainers.

Advisory services will be provided among member countries on maintenance and optimization of use of existing computer facilities.

* * * *

UNIDO organizes meeting on CMMS

An expert group meeting on Computerized Management Systems (CMMS) in Metallurgy was organized by UNIDO in co-operation with INORGA Prague Institute, at Prague, Czechoslovakia from 28 January to 1 February 1985. The objectives of the meeting were: to examine the current situation and trends in CMMS in the iron and steel industry in developing countries; to identify the most effective way to develop and implement CMMS in this sector; to develop the practical recommendations and guidelines for implementation of CMMS in developing countries; to discuss and determine the experiences in the development of human resources to support the application of CMMS; to propose follow-up activities for completed pilot projects and effective forms of dissemination of know-how in the field. Further details as well as the report of the meeting containing the recommendations and conclusions reached can be obtained from the Metallurgical Section, Division of Industrial Operations, UNIDO.

Third World lacks adequate information technology

A study submitted to the UN advisory committee on science and technology revealed that there was an urgent need to enhance the accessibility of third world countries to science and technology information. The study maintained that a revolution in information processing would gradually dominate policy-making and no country would be able to escape its after-effects. It also argued that though traditional means of disseminating science and technology would continue to play an important role in third world countries, global trends would inevitably make advanced technologies like computers the universal language of science and technology information. The approximate mix of traditional and advanced information technologies would therefore have to be decided at the national level in accordance with national requirements. The UN advisory committee on science and technology recommended the setting up of a global information network on science and technology. (Inter Press Service, Third World News Agency, 12 and 16 February 1985)

New computerized inquiry service for third world nations

The UN's global information referral systems (INRES), which was inaugurated in January 1985, has built up a comprehensive data bank on the technical expertise and skills available in institutions in third world nations. The INRES data bank lists education and training courses, research and technological development services, consultancy and expert services, scientific and technical information services as well as previous TCDC projects experience in the listed institutions. A booklet on the operation and use of the inquiry service has already been circulated to national TCDC focal points and UNDP Resident Representatives. Queries should be addressed to: INRES computerized Inquiry Service, Special Unit for TCDC, UNDP, 304 East 45 Street, New York, NY 10017; telex 125980; telephone 212-906-5140. (IPS, 7 February 1985)

Conference on South-South and South-North Co-operation in Science

The Conference on South-South and South-North Co-operation in Science took place in Trieste on 5-10 July 1985 at the premises of the International Centre for Theoretical Physics in Trieste. The Conference was organized by the Third World Academy of Sciences. The Conference, for the first time ever, assembled representatives of science academies and research councils of the Third World along with representatives of science academies in industrialized countries, to discuss the problems of development of sciences in the Third World and to examine various modalities of South-South and South-North collaboration in this regard.

The specific objectives of the Conference were as follows:

- To identify science projects in which South-South and South-North co-operation is most profitable, and to examine possibilities of finding financial support for such projects;

- To strengthen co-operation among Science Academies and Research Councils of the South and to promote their role in the development of science in the Third World;

- To strengthen co-operation between Academies of the South and Academies of the North;

- To develop and set indicators to study the status of science teaching and science research in the Third World and to examine possibilities of South-South and South-North co-operation in the advancement of science; and

- To identify high-level scientific research performed by Third World scientists as a modality of South-North co-operation in the advancement of science.

Five working groups on agricultural sciences, biological sciences, medical sciences, physical and mathematical sciences, chemical sciences were organized with the view to formulate proposals for South-South and South-North co-operation in sciences.

The discussions of the working group on physical and mathematical sciences included a proposal to set up an International Centre for Computers and Informatics in view of the rapid developments in microelectronics, computers and informatics and their increasingly significant impact on both developing and developed countries. Such a centre might focus on both conventional and innovative applications of computers and informatics in the Third World (especially the rural sector), software development, hardware and microelectronics technology aspects, computer architecture, policy development and analysis, education and training, networking and telecommunications etc. One suggestion put forward in this connection was that prior to establishing such a new centre, scientific networks should be started in the Third World as a first step to facilitate and enhance the effectiveness of such a centre.

(UNIDO's recent achievement to establish a regional network for microelectronics in the Latin American region, REMLAC, - see page 1 - is a step in that direction and might serve as an example).

COGIT NEWS

International Journal on Information Technology for Development*

The new journal launched by the UK Council for Computing Development, UKCCD, as reported earlier in the Monitor, is taking shape. The first quarterly issue is planned for early 1986 and will be published by Oxford University Press, UK. Editor is Mr. Julian Bogod of the UKCCD; managing editor is K.B.S. Willder C.B.E., UK and consulting editors are Isaac L. Auerbach, USA and A.S. Douglas of the London School of Economics. A first call for papers has just been issued soliciting contributions to the journal which describe the practical application of Information Technology in developing country environments. Additionally, papers which deal with the social, political or industrial implications of IT development, or which are concerned with training issues, are welcome. A leaflet providing more details on the scope of the journal is available from the editor of the Monitor. Manuscripts should be written in English and submitted to Mr. J.L. Bogod, The U.K. Council for Computing Development, Charles Clore House, 17 Russell Square, London WC1B 5DR, England.

UKCCD conference on IT in developing countries

The UK Council for Computing Development organized a conference on "Information technology in developing countries" at the University of Kent, Canterbury, UK on 17-19 April 1985. The theme of the conference was practical aspects of information technology in commercial and administrative environments and was intended to provide senior students from developing countries with a broader insight into the practical aspects of information technology than is available to them in the academic environment in which they work. Topics discussed at the conference included networking, office automation, controlling software development, the provision of suitable training and applications of information systems.

Training courses in the UK

The National Centre for Information Technology (NCC)** in the UK has issued a new catalogue of NCC public training courses covering the second half of 1985. The courses are grouped under six general headings: IT appreciation and selection and selection of IT systems; using microcomputers; computer audit; skills training for DP professionals; specialist training for DP professionals; and training in IBM operations. For details write to NCC, Oxford Road, Manchester M1 7ED, UK.

* * * *

Conference on application of microcomputers in information

A first call for papers was issued by the Deutsche Gesellschaft für Dokumentation, Westendstrasse 19, D-6000 Frankfurt/Main (FRG), for the second international conference it will organize March 1986 at Baden-Baden, FRG on the application of micro-computers in information, documentation and libraries. The conference will serve as a platform for the international exchange of experience in this area. Emphasis will also be laid on the discussion of tendencies of development and on the impact of microcomputer application in an information environment in global, regional and local networks or as stand-alone systems. The main topics will be description of existing systems; software requirements; application in libraries; application in information centres; special problems for applications in developing countries; application of micro-computers in electronic publishing; and education and training for librarians, information professionals and users.

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* This was one of the recommendations made at the Discussion Meeting on Information Technology for Development, March 1984.

** NCC is the UK centre for information technology and is backed by government, the IT industry and IT users.

The IBINET project

The Intergovernmental Bureau for Informatics (IBI), over the last few years, has been following the convergence in the telecommunications and informatics field. In line with its objectives to promote informatics as a development tool for the emerging countries, IBI launched a project, the IBINET project, to promote the creation of data transmission networks especially adapted to the conditions and needs of its member countries. A first feasibility study was prepared by experts which came up with the recommendations that networks should be based on satellite links using high transmission technologies which keep equipment and operating costs comparatively low. It also recommended that local telecommunications authorities should be closely involved in the project. In 1983 IBI carried out an in-depth technical analysis and obtained INTELSAT's and Telespazio's support to carry out a technical evaluation of the system at pilot level. Networks have been installed in the African region and two networks are being installed this year in Latin America.

General Assembly of AEU

The Asia Electronics Union will hold its General Assembly on 4 September 1985 in Tokyo. The agenda will include presentation of country reports on policies, activities and trends in the field of electronics of their respective countries. The General Assembly meeting will be preceded by a symposium which will feature telecommunications and computers technologies for the development of the developing countries with special discussion on their role, impact and implications on social, economic, security, industrial and educational aspects.

Software Conference

The 8th International Conference on Software Engineering will be held in London on 27-30 August 1985. Details can be obtained from IEE Conference Services, Savoy Place, London WC2R 0BL, UK.

NEW DEVELOPMENTS

Tungsten coats protect chips

Fewer circuit faults on the surface of chips may result from the successful deposition of tungsten films on to their surfaces and it is now possible to produce these films with the necessary accuracy. Tungsten coatings could be used to replace the conventional polysilicon and aluminium lines that carry the signals between transistors on a chip, according to researchers at the Sandia National Laboratory at Albuquerque in New Mexico. Tungsten could also be used to selectively fill holes that interconnect the different levels of advanced ICs. The resulting flatter surfaces make it easier to fashion chips with two or more layers of interconnections stacked on top of each other. This increases the operating speed of the devices by reducing the distance that signals need to travel. It is only recently during work at Sandia, that tungsten films could be deposited onto a surface with the necessary precision, although industry has known for some time that tungsten can protect the chip surface from over-etching, shorts and open circuits. Open circuits are caused by electromigration, which is the electron induced drifting of metal atoms in a conductor that is carrying a high density current.

Sandia's workers claim that they can now deposit films of tungsten in an area selective manner, to thicknesses up to one micron, greater than has been possible in the past. It has not previously been possible to control deposition on pre-patterned areas without getting spurious deposits on adjacent oxide locations, when attempts have been made to deposit films much thicker than 0.3 micron. It has been difficult to keep the films thin enough to limit corrosive silicon substrate consumption during tungsten deposition and to prevent intrusion into the active region of the underlying semiconductor device. The Sandia group of the Radiation-Hardened Microelectronics Centre now seem to have solved this problem too. ...(Electronics Weekly, 3 April 1985)

Superconducting silicon

Three physicists from the University of California at Berkeley, Michel M. Dacorogna, Kee J. Chang and Marvin L. Cohen, calculated what would happen to silicon under pressure. At normal pressure silicon has the same crystal structure as diamond and is, electrically, a semiconductor. Under more and more pressure, silicon should go through a series of metal-like crystalline states - first the configuration known as beta-tin, then simple hexagonal and finally hexagonal close-packed. In these configurations and at sufficiently low temperatures silicon should become a superconductor.

Biocomputers beckon

Fifth Generation computing is on the way, if a little later than predicted. If teams of American and Japanese scientists fulfil expectations, the era of Artificial Intelligence, parallel processing, logical interfaces per second and high level languages such as LISP and PROLOG should be with us before the end of the decade. But with the Fifth Generation still on the drawing board, research has already started into the likely shape of the Sixth Generation. And the shape may well be helexical as yet another science fiction stalwart, the biocomputer, looks like becoming fact.

One of the difficulties with present computers - one which will probably dog the fifth generation also - is the inability to handle what is known as fuzzy logic. This is an area where nothing can be measured in terms of black and white but, rather, in many shades of grey. The first biological computational components will probably be used as add-ons for conventional digital computers, dealing with such hard tasks as vision and natural language translation - anything that involves the handling of sensory data or parallel processing. Biological systems do both a great deal better than anything made out of silicon. Also, the physical limits of miniaturisation will mean that even advanced materials, such as gallium arsenide, can only be made to a certain density before the problems of heat dissipation become too great.

Using biological structures built from protein molecules, geneticists should be able to fit billions more 'transistors' per inch in an effort to create a computer 'brain' with all the benefits of the human brain - and a great deal more accessability, control and memory retention/retrieval capability.

Already, scientists at Bell Laboratories in the US are reported to be investigating the brains of such creatures as slugs and squids in an effort to define the workings of the neural networks so that they can build an analogue model. While analogue computing may not be as accurate as digital technology, it does have many considerable advantages. Such computers could, perhaps, not only react like humans, but offer intuitive, creative and, indeed, commonsense responses to problems - even if the data input was incomplete. (Technology Ireland, June 1985)

Into the 1Mbit era

The high-density dynamic RAM (DRAM) is now about to enter the 256Kbit era, and at Toshiba, development of a 1Mbit DRAM for the next operation has already begun. In conjunction with conventional NMOS technology that has been employed for high-speed DRAMs, CMOS DRAM technology, which will lead to lower power consumption, and is a promising fabrication process for larger-capacity DRAMs is already in an advanced stage of development.

In addition to the usual access mode using both RAS and CAS simultaneously, four access modes that utilize only CAS have been proposed for DRAM operation. These are the conventional page mode, which is already familiar to most people; the nibble mode, that enables high-speed serial access to four bits at a time; the fast page mode, that is a higher-speed version of the page mode; and the static column mode, in which column access is initiated only by column address setting, as with the SRAM. Of the four access modes, page- and nibble-mode products, up to 256Kbit DRAMs will be developed using NMOS technology. Both the fast-page- and static-column-mode products are to be implemented in CMOS which holds the key to the success of these new operational modes. The 1Mbit DRAM, a current experimental research target, will be organized as 1M words x 1-bit and packaged in a standard 18-pin DIP. For this, state-of-the-art 1.2 μm rule technology is being developed to realize the minimum possible chip size. ...

Until now, it was believed that CMOS techniques were inappropriate for DRAM fabrication because of cost, latch-up problems, and other similar disadvantages. Toshiba has successfully resolved these problems and developed 1.2 μm rule CMOS DRAM techniques that enable high-speed operaton with low power consumption as well as a wide circuit operational margin. The achievement has been made possible thanks to several factors including sharply reducing the conventional 2 μm rule to 1.2 μm, establishment of new techniques for high-voltage-withstanding P-channel and N-channel MOS transistor fabrication and the establishment of high-voltage-withstanding micro-element isolation techniques.

The optimum circuit configuraton by combining N-channel memory cells, that enables high-speed operations, with CMOS sense amplifiers has also been achieved. The cross-section view of the device in Figure 2 shows a bit line made of polycide, a dual-layer structure of Poly-Si and metallic silicide, and a word line made of a double-level structure comprising Poly-Si in the gate areas and aluminum for the wiring. This structure assures high-speed accessing. Throughout the sensing system and peripheral circuits, several new attempts have been made to incorporate CMOS. In particular, the peripheral circuits have been completely changed to a CMOS circuit configuration. They have also been optimised for new operational modes such as fast page mode and static column mode. ... (Electronics Weekly, 22 May 1985)

Twin-technology

Add National Semiconductor Corp. to the growing number of chip makers that intend to have the best of both the high-speed bipolar and low-power CMOS worlds by combining the two technologies on a single chip. National is putting the finishing touches on a process it calls Bipolar-CMOS and expects its first chip will be ready for production in about two months, reports Bruce Gray, product-line manager for bipolar logic development at National here. The first part is a revamped bipolar bus transceiver, originally the NSC DP7304 chip; while on its way to becoming the dual-technology DP73BC04, it received three extra mask steps in order to add 3-μm CMOS to the existing bipolar circuitry.

The process allows optimal performance of the chip's CMOS portions because it uses polysilicon instead of metal gates. Interdigitation, or interlocking, of circuits through the extra metal layers on the chip connects the vertical bipolar processes with the horizontal CMOS, thus conserving die area. Tietz claims that the process can work with all varieties of high-performance bipolar technologies, including emitter-coupled logic and all advanced Schottky TTL circuits. The result is a bipolar chip with much lower collector current....(Reprinted from Electronics Week, 22 April 1985,

IBM's new million-bit-chip

IBM has announced recently that it has fabricated a new, extremely small, one million bit computer memory chip. The chip is designed to operate at a speed of 80 nanoseconds - initial samples have operated as fast as 60 nanoseconds. Measuring 5.5 millimetres by 10 millimetres it is among the fastest and densest chips reported anywhere. The chip is fabricated using conventional optical photolithography techniques, and features extra "redundancy" cells should any defective cells be found during manufacture. (Electronics Report, March 1985)

Four new centers for supercomputing

The University of Illinois at Urbana-Champaign, where Smarr directs the new $75 million Center for Supercomputing Applications, will soon get its own supercomputer. This week, the National Science Foundation (NSF) announced that Illinois is one of four institutions that will share about $200 million over the next five years to establish "national advanced scientific computing" centers. The other centers will be at Cornell University in Ithaca, N.Y., at the University of California at San Diego where 18 universities and research institutes will contribute to the center, and at a facility, run by a consortium of 12 universities, near Princeton, N.J. NSF selected these four winners from about two dozen proposals submitted as part of a nationwide competition. To match NSF funding, the new centers are expected to raise a total of $200 million from state governments and industry. Cornell's center, for example, will receive more than $30 million in equipment and services from IBM Corp.

Supercomputer primer

Although the concept of supercomputing has been traced back to Charles Babbage in the 1830s, and even to the Greeks of Salamis in 100 B.C., the terminology of today is calculated to confuse, especially since it is badly tangled with vocabulary of fifth generation computers.

SUPERCOMPUTERS - Currently computers which process data at 20 megaflops or higher speed, but the fastest supercomputers today operate at sustained speeds of 400 megaflops and peak speeds of 1 gigaflop or higher. Speeds on supercomputers vary depending on how much of the data flows through parallel scalar or through vector processors. In the future, supercomputers may operate simultaneously in multidimensional arrays with many parallel operations being performed in a pipelined way. Over the last 30 years the raw speed of the fastest computers has approximately doubled each year.

SCALAR PROCESSOR - Operates on individual data elements with instructions that yield one result for each instruction. To perform a single operation on all elements of an array (such as calculating a 5 per cent turnover tax), the scalar processor must loop through the table of numbers constituting the array, repeating the same instruction on each element to achieve the desired results. Scalar processing therefore requires fast circuitry for high performance.

VECTOR PROCESSOR - Uses only one instruction to perform a single calculation on an array of data and achieve an array of results, all in one operation. In supercomputers, the more data vectorized, the faster the operation. Vector processing is usually not available on general purpose mainframe or minicomputers. However, vector processing is a feasible alternative to scalar processing only when repetitive operations must be performed.

ARRAY PROCESSORS - Do not include scalar processing. Array processors are usually configured as peripheral devices on which both mainframe and minicomputer users can run vectorizable portions of programs. Synonymous with vector processors, but operating as independent units, array processors can, in some applications, serve as an inexpensive alternative to supercomputers. Unlike the more elaborate parallel processing supercomputers, array processors are produced and sold in volumes akin to minicomputers.

PARALLEL PROCESSING - Concurrent application of two or more processors to perform simultaneous operations in a single task. Superspeed computers must use high speed vector processors in tandem with scalar processors, dividing each task for optimal use of the multiple processors under a central operating system control. The processors may or may not be pipelined.

PIPELINING - Speeding computer operations by breaking down instructions into discrete steps for processing in an assembly-line system, with different steps in the preparation and execution of an instruction performed simultaneously. In a strictly sequential processor, in contrast, all operations on one instruction are completed before processing of the next begins. An essential adjunct to pipelining is the use of vector registers - high speed memories to store temporarily and then feed instructions to the pipeline at a speed that is greater than is possible when instructions must be called up from the computer's main memory.

FLOATING POINT OPERATIONS - refers to the binary version of representing numbers called scientific notations. In ordinary scientific notation a number is represented as a product in which one factor (the mantissa) has a magnitude between 0.1 and 1, and the other factor (the characteristic) is an exact power of ten. Thus 7,700 is represented as $.77 \times 10^4$ and 77 is represented at $.77 \times 10^2$. The computer relies on a binary version of floating-point notation, making possible a standard representation of a very wide range of magnitudes. A single floating point operation is the addition, subtraction, multiplication or division of two floating point operands to get a floating point result. Computing speeds are, therefore, expressed in terms of floating-point operations per second (flops).

MEGAFLOP - One million floating-point operations per second.

GIGAFLOP - One billion floating-point operations per second.

OPERAND - A quantity that is to be the subject of a mathematical calculation.

FIFTH GENERATION COMPUTERS - The proposed next generation of computers, to be produced in the 1990s, which will have radically new inferential architectures to exploit the potential of developments of artificial intelligence.

GaAs IC market to exceed $13 billion by 1994

A recent report by Strategic, Inc., Cupertino, Calif., estimates that the worldwide gallium arsenide (GaAs) IC market will exceed $13 billion by 1994. According to Yves G. Blanchard, vice-president and manager of the firm's Semiconductor Group, "What we are talking about is a technology whose time has come and won't go away. There is an essential synergy between GaAs technology and the performance requirements placed upon active components by state-of-the-art systems."

A case in point is optical fiber communications, to which the U.S., Japan and Europe are now clearly committed. "GaAs integrated optoelectronic devices are a natural for this kind of application," says Blanchard, who believes that their wide bandwidth, optoelectronic properties and electrical ruggedness are a perfect complement to the advantages of fiber-based communication links. However, the major growth area for GaAs integrated devices will be in digital applications. Declares Blanchard, "We feel that GaAs technology will take less than 10 years to match current silicon IC complexity levels."

Accordingly, the market research firm sees the development of a host of new GaAs digital ICs, starting with simple logic circuits and developing into memories and processors. In the near term, GaAs ICs will be used in unique applications that take advantage of the inherent superior performance characteristics of the GaAs IC technology.

In the 1984 to 1987 timeframe, applications of GaAs digital ICs will displace their silicon IC equivalents such as ECL circuits. Ultimately, the fabrication of GaAs microprocessors and memories will be a major factor in fueling rapid growth in the GaAs IC merchant market in coming years. "But," cautions Blanchard, "for this scenario to unfold, two major stumbling blocks must be addressed: development of automatic test equipment compatible with GaAs speed and the development of adequate and economical packages."

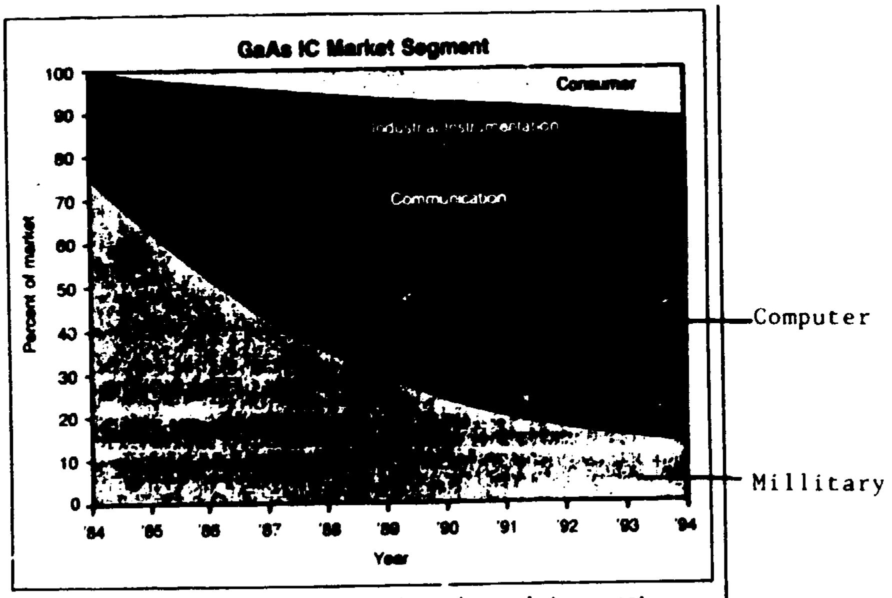
So far, the total testing volume requirements of the GaAs IC industry (both captive and merchant) have not been sufficiently high to gain the attention of traditional ATE suppliers. As a result, there are no test equipment suppliers that currently supply automatic test equipment to satisfy the needs of the GaAs IC industry. The lack of automatic test equipment could prove to be a major obstacle for the entire GaAs IC industry to overcome.

New package types suitable for the high operating frequencies and clock rates of GaAs ICs are not only non-existent, but such items as test fixtures and sockets must await the development of new package types. Package standardization is slated to become a key factor in gaining user acceptance of the GaAs IC technology.

Assuming early solutions for those problems, Strategic predicts that a healthy industry will develop mostly based on aggressive startups in the U.S., with the silicon establishment joining in later.

In terms of product categories, the market research firm foresees Japanese producers becoming the leading suppliers of random access memories (RAMs) (as they have done in the silicon RAM markets) and sees U.S. suppliers becoming the leading producers of complex logic function ICs such as processor, memory controllers and peripheral circuits. (Reprinted with permission from Semiconductor International Magazine, January 1985, (c) 1985 by Cahners Publishing Co., Des Plaines, Il. USA)

Figure 1



Forecast of worldwide GaAs IC markets by major market segment market share (source: Strategic, Inc.)

GaAs technology remarkable, many challenges remain

The future impact of GaAs IC technology on the semiconductor industry depends on how the challenges of GaAs technology are solved, according to Charles Liechti of Rockwell International, Thousand Oaks, Calif. Liechti recently addressed attendees of the 1984 International Electron Devices Meeting.

"In the last five years, extraordinary R&D progress (Fig. 1) has been made in advancing GaAs IC technology," says Liechti. He explains, for example, that high-speed digital circuits have been demonstrated with up to 100,000 components/chip. And microwave monolithic ICs have been successfully operated at frequencies as high as 60 GHz. The scope of GaAs R&D has also increased. "In the western world, about 4,500 people are now working on GaAs related development programs. Companies in Japan, Europe and the U.S. are starting to build manufacturing facilities to serve the GaAs IC market, which is expected to expand from $130 million to $1.3 billion by the end of this decade (Fig. 2)," says Liechti. Until now GaAs IC development has been dominated by large individual companies with captive markets. Now, a merchant industry is developing slowly. "Maturing GaAs IC technology, combined with a growing market for the highest speed ICs, will provide many business opportunities for merchant suppliers," says Liechti.

He sees GaAs ICs as "critical components that will provide significant performance leverage in important high-speed systems. Major beneficiaries of this technology will be systems manufacturers. They will be using the leverage of GaAs to enhance performance capabilities, and provide a competitive edge and profit margin to their products." However, as Liechti notes, many technical challenges still remain. These include the transition of GaAs fabrication technology from research to production, the exploitation of higher-speed GaAs ICs in systems and the resolution of radiation hardness issues.

Specifically, Liechti challenged conference attendees to seek:

- Meaningful reliability data for potential GaAs users.
- Pilot line quantities of GaAs MSI and LSI ICs, demonstrating reproducibility and device parameter control.
- Accurate process, device and material models for sensitivity analysis.
- Conclusive demonstration of the advantages of GaAs over silicon ICs for large, interconnection limited integration levels.
- Architecture and optimum partitioning of large systems using GaAs chips.
- The necessary high-speed packages and interconnect boards.
- Very high-speed wafer probe cards, test fixtures and test equipment.
- Standardization of supply voltages, logic swings, interfaces, wafer sizes and packages.
- Resolution of soft error upset in GaAs RAMs.

"These, and related issues, are currently our technical roadblocks in GaAs technology," says Liechti. "They must be addressed by GaAs IC suppliers, users and equipment manufacturers to enable the GaAs technology to mature and provide the foundation for a growing market."

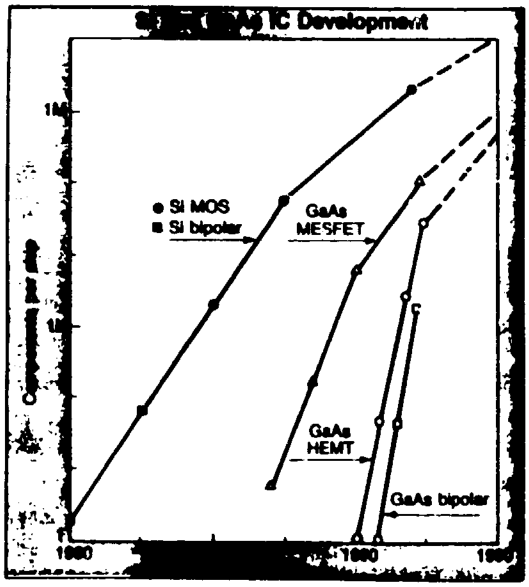
The best defined markets for GaAs IC applications are in microwave systems for the military, telecommunications and test instrumentation. Outstanding opportunities are also believed to exist in system applications of the highest-speed GaAs A/D and D/A converters. "Ultimately, the greatest payoff may come from a new generation of mainframe computers incorporating GaAs parts," says Liechti. "However, this area for GaAs application bears greatest business risk, considering the continued speed advances of silicon based circuits with submicron device geometries."

Liechti also pointed out, to conference attendees, that numerous business opportunities will occur in GaAs support activities. For example, capital equipment suppliers will find a growing market in III-V materials reactors, specialized wafer fabrication equipment, design tools, high-speed test systems and safety related equipment. In engineering services, opportunities will grow for custom GaAs IC design and layout, and for chip mounting, interconnection and testing to customer specifications. Reviewing expected market trends, Liechti believes that GaAs technology will have a minimal impact on silicon markets. "GaAs circuits do not compete in applications that can be satisfied with silicon circuits. Instead, GaAs is seen as a complementary technology." (Reprinted with permission from Semiconductor International Magazine, March 1985 (c) 1985 by Cahners Publishing Co., Des Plaines, Il. USA)

Integrated circuits made of gallium arsenide are faster than any type made of silicon. And since gallium arsenide uses relatively little power and produces little heat, chips can be packed closely. (Source: IEEE Spectrum)

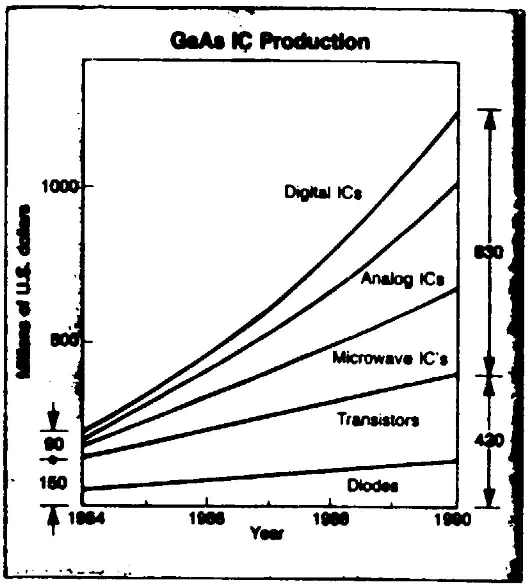
One problem is that gallium arsenide is extremely difficult to manufacture without defects. Some entrepreneurs hope to grow purer gallium-arsenide crystals in orbit, where gravity is negligible.

Figure 2



1. Comparisons of silicon and gallium arsenide digital integrated circuit developments via first disclosure in R&D reports. (Source: Charles A. Liechti and IEEE IEDM 1984)

Figure 3



2. Projected North American production of selected GaAs devices through 1990. (Source: K. Taylor, SRI International and IEEE IEDM 1984)

Source: Semiconductor International, March 1985)

STC opens Europe GaAs IC assault

The first European semiconductor maker to offer digital integrated circuits made from gallium arsenide is STC Components' electron devices division at Paignton. STC says it can provide samples now of a programmable divider and a 4-bit counter, both operating to 900 MHz. The divider is intended for frequency generation in radio synthesisers, particularly cellular radio. The counter is intended for signal processing in any processing system operating to 900 Mbits/s. The function of both ICs is similar to established silicon digital devices but to maximum frequencies several times higher coupled with low power consumption. Both will be standard products. Device types to follow are said to include latched adders, shift registers, multipliers, multiplexers and demultiplexers, further counters and dividers, and high-speed memories. A 128-bit static RAM with 3 ns access time will soon be available as a sample, but volume production will wait upon incorporation of the technology in larger devices.

Robin Baker, GaAs sales and marketing manager, believes a steady market will emerge for GaAs gigabit logic as soon as reliable devices are available. STC has developed low power device technology to appeal particularly to military system and civil communication system designers preoccupied with low power consumption and heat generation. Standard and custom devices will be available, and a foundry service for manufacture of customers' own designs.

Some lower frequency analogue devices such as amplifiers and filters, and some combined analogue-digital devices such as A-to-D and D-to-A converters also will be made, but STC will not compete with Plessey Three-Five Ltd. and Marconi Electronic Devices Ltd. in supplying microwave analogue ICs for specialised applications.

Baker believes that in course GaAs IC sales will grow to about seven or eight per cent of the world IC market, perhaps through 10 years. He thinks GaAs digital logic may grow to be about half of the total market for GaAs devices. (Electronics Weekly, 6 February 1985)

British GaAs chips go to market

As is the case with most of their U.S. counterparts, the British trio - General Electric Co. plc, the Plessey Co. plc, and Standard Telephones and Cables plc - have acquired their GaAs expertise through military development contracts. In fact, Britain's Ministry of Defence has slated GaAs technology for use in monolithic microwave ICs (MMICs) as well as for high-speed digital signal processing. But the competition is going to be fierce. Government funding has been the prime mover for most GaAs development and European governments have not been lavish. In 1984, according to the market research firm Strategic Inc., U.S., European, and Japanese governments laid out more than $513 million for GaAs research and development. Fully 65% of that was spent in the U.S.; Japan came in second with 24%, and Europe was last with 10%.

Nonetheless, the UK crew figures it can find worthwhile market niches. Plessey, for example, pioneered III-V semi-conductor development in partnership with Britain's Royal Signals and Radar Establishment. Now, Plessey is looking for the payoff. It has started sampling a six-chip set that implements the complete transmit/receive function for a phased-array radar ...

By 1986, Plessey expects to have a super-analog process up and running. This planar process utilizes self-aligned gates and selective ion implantation. It makes possible both depletion and enhancement devices on the same chip, a combination that consumes little power.

GEC has two GaAs groups at work in its Hirst Research Centre. One is developing a basic depletion-mode process for immediate production. The other is starting with a clean slate of technology.

The flagship product for the first group is an amplifier chip whose bandwidth stretches from 10 MHz up to 12 GHz. The chip - a natural for electronic-surveillance applications - is now being sampled. Thanks to its distributed-amplifier structure, four such chips can be hung together to provide 24 dB of nominal gain.

Meanwhile, the other team has tackled two major problems for operators of GaAs works: the high costs and long delays involved in the production of custom chips. Typically, an MMIC chip can cost up to $150,000 and take up to 12 months to develop because of the complex simulations involved.

Unlike Plessey and GEC, Standard Telephone is using GaAs to make super-fast logic for advanced military and communications equipment. Later, STC expects to move on to the higher densities needed for computer chips. The firm then will face stiff competition from Japanese chip makers. But it has one potential solid customer: Standard Telephone recently bought Britain's largest computer maker, International Computers Limited plc. (Electronics Weekly)

USA: Ford to make microchips of GaAs

Ford Motor Co. says it will make and sell semi-conductors made of gallium arsenide, a promising material that is expected to replace silicon in many types of integrated circuits. Ford, which now designs and oversees the manufacture of silicon-based chips for use in its own cars and aerospace products, will be the first high-volume producer of the new chips for sale on the open market. A gallium-arsenide wafer now costs $200, or 15 times as much as a silicon one, Ford says.

Ultra-fast computers now on the drawing boards "are requiring performance levels that are out of the reach of silicon," said Anthony Livingston, sales and marketing vice-president at Gigabit Logic Inc. of Newbury Park, California, the first company to specialize in production of gallium-arsenide chips for outside use. Ford has become a major designer and producer of microchips for under-the-hood computers that control emissions, engine timing and other functions in cars. As the auto companies have gained expertise in electronics and industrial automation, they have been diversifying into high-technology areas. (International Herald Tribune, 16-17 March 1985)

Honeywell plans GaAs IC start-up

Honeywell Inc. says it will start production of gallium arsenide integrated circuits in July 1985, in the facility specially built at Honeywell's optoelectronics production centre at Richardson, near Dallas, Texas. The first devices are for aerospace and defence uses. Devices for commercial markets are not due for production till 1987. The aerospace and defence ICs are part of the project sponsored by the US Defense Advanced Research Projects Agency in which Honeywell is a subcontractor to Rockwell in a $24.5m programme to develop GaAs IC manufacturing technology.

First chips off the line will be gate array logic devices which Honeywell says have a typical drain of 400 μW per reset flip-flop at 50 MHz. Honeywell does not give the application but the slow speed (for GaAs) suggests the main point of the devices is radiation hardness, in which respect GaAs is many times better than silicon. The process used is Honeywell's first generation in which all transistors work in depletion mode. (Electronics Weekly, 15 May 1985)

Rockwell to Market GaAs ICs

Rockwell International Corp. Semiconductor Products Div. is moving toward expansion of its commercial marketing programs into the rapidly emerging gallium arsenide (GaAs) technology, according to Dr. Gilbert Amelio, division president. GaAs devices represent a market estimated by industry sources to reach $1 billion in 1992, a dramatic increase over the $48 million market in 1983, Amelio noted. "Current plans call for initial applications in the digital communications area where GaAs chips are especially important." He added that the only barrier to wider acceptance of GaAs devices is their price, which today is typically three to four times greater than comparable silicon-based circuits. Amelio said that Rockwell's planning effort is based in large part on advances made at the firm's Microelectronics Research and Development Center (MRDC) in Thousand Oaks, Calif. ...

Amelio stated that plans could lead toward 1985 availability of some telecommunications devices beyond those destined for DoD use. Several logic circuits, including a latch, data selector/multiplexer, shift register and a 4 bit ALU, are also being developed. (Reprinted with permission from Semiconductor International Magazine, January 1985, (c) 1985 by Cahners Publishing Co., Des Plaines, Il., USA)

(Computer Weekly, 21 July 1984)

MARKET TRENDS AND COMPANY NEWS

In developing countries multinationals go high tech

Contrary to conventional wisdom, when multinationals open up subsidiaries in developing countries, the lower labor costs found there are not the primary reason. If so, their operations would necessarily be more labor-intensive. But quite the opposite appears to be happening, according to a study by the UN's International Labor Organization. The subsidiary realizes that it must use the technology that is most economically competitive and able to respond to fast changing local and international market demands. More often than not, this technology is state-of-the-art and capital-intensive. Hence, although multinationals have generated some 4 million jobs in developing countries, the total employment impact have not been considerably higher as desired, says the UN study. Among its recommendations: encourage technological "trickle down" from foreign to local firms. If local suppliers can use new processes learned from the multinationals to make products for other customers as well, job markets will increase. (Industrial World, May 1985)

Semiconductor industry business climate stabilizes

U.S. market bookings by U.S., Europe and Japan based semiconductor manufacturers remained nearly flat in January, while shipments declined, resulting in a book-to-bill ratio of 0.66 for the month. Average monthly bookings for the three month period ending in January were $596 million, up a modest 5.6% from December levels. This increase, however, has been attributed to a year-end adjustment in the calculation, rather than an actual improvement in orders. January billings, at $728.1 million, were 31.1% below the December level, reflecting the traditional pattern of light shipping activity during the month of January. For the three month period ending in January, bookings and billings were both more than 24% below the three month period ending in October. Based on January performance, first quarter 1985 shipments to the U.S. are estimated to reach $2.4 billion, down 20% from the fourth quarter of 1984. Book-to-bill ratios for shipments to the U.S. market by U.S., European and Japan based semiconductor manufacturers were 0.76 in October, 0.67 in November, 0.58 in December and 0.66 in January. (Reprinted with permission from Semiconductor International Magazine) April 1985.

TI lowers its estimate of 1985 world semiconductor market

Don't look for the semiconductor industry to enjoy an immediate recovery from the business doldrums that set in suddenly last summer. That's the message from top officials at Texas Instruments Inc., who released their annual world semiconductor market forecast during last week's stockholders meeting in Dallas. J. Fred Bucy, president of the world's largest merchant chip vendor, said that industrywide semiconductor sales in 1985 would register a disappointing 15% drop to $22 billion from last year's record $26 billion. "This is a lower forecast than others that have been publicized," Bucy explained, "but we believe the impact that the weakness in the computer market will have on future semiconductor demand has not been fully realized." Reflecting the poor outlook, TI announced it would lay off another 1,000 workers during the second quarter, which would bring its total work-force reduction since December to 3,000. The major bright spot of the meeting: an announcement that TI has working silicon on a 1-Mb CMOS dynamic random-access memory. (Reprinted from Electronics Week, 22 April 1985

The bloodbath in chips: there's no relief in sight

Extraordinary deflation is nothing new in the semiconductor business. The price of computer memory chips drops, on average, by 35% every year. But even veterans of the chip wars are aghast at what's happening now.

The industry's workhorse computer memory, the 64K RAM, is now selling on the spot market for 75 cents or less, down from $3.50 a year ago, reports Integrated Circuit Engineering Corp. That price, says ICE analyst Dean A. Winkelmann, barely covers the manufacturing cost for the most efficient producers. And this one chip accounted for about 10% of total integrated circuit sales last year.

No wonder analysts are chopping earnings estimates for the big semiconductor houses, most of which racked up record years in 1984. At San Francisco's Montgomery Securities, Daniel L. Klesken forecasts that the operating margin at Texas Instruments Inc., the world's No.1 chip producer, will shrink from 20% to 5% this year as semiconductor sales drop by 13%. Memory chip specialists, such as Micron Technology Inc., can't help but drift into the red, adds Klesken. In fact, Micron Technology expects to lose $6 million in the current quarter. And Mostek Corp., also big in memories, laid off 2,000 of its 5,230 workers and shut a plant in Colorado. Even Japanese chipmakers are feeling the pinch. Sources in Tokyo say that NMB Semiconductors Ltd., a new spinoff of bearing maker Minebea Co. Ltd., is in serious trouble. It was counting on selling its 256K RAMs for $8 or more. But the current price is around $5.50 - with no bottom in sight. "It will be another year before this horrible pricing stops," warns Charles M. Clough, president of the semiconductor distribution group of Wyle Laboratories.

The price cutting is so severe for several reasons. First, the makers of electronic equipment are in a slump of their own. They are still working off an inventory glut accumulated last year because of overambitious sales projections. In addition, huge outlays for new chipmaking plants in Japan, Korea, and the U.S. have brought additional capacity on stream at the worst possible time. The imbalance between demand and supply, says George J. Popovich, marketing manager for memory products at Intel Corp., "is greater than I've seen it in 10 years." Some Americans blame Japan for continuing to crank out chips despite the oversupply. "One would think," says William N. Sick Jr., executive vice-president of TI, "that the Japanese would assess the capacity of the market and adjust their production accordingly." But other observers demur. A couple of Japanese companies may be especially aggressive, says Frederick L. Zieber, director of semiconductor research at Dataquest Inc. But he adds: "I'm not sure there are any white hats."

Ironically, the price collapse in RAMs, where the Japanese are dominant, has effectively trimmed Japan's share of the U.S. market from 18% of sales late last year to around 16% in the first quarter, according to a preliminary estimate by the Semiconductor Industry Assn. (SIA). But that hasn't tempered protectionist sentiments. W. J. Sanders III, chairman of Advanced Micro Devices Inc., recently lined up with Hewlett-Packard Co. Chairman David

Packard in calling for temporary quotas on imports of Japanese chips. And the SIA is talking about filing an unfair trade practices complaint against Japanese companies. If there's a glimmer of hope amid all the gloom in Silicon Valley, it is that price cutting in the past has always had the effect of vastly enlarging the market for chips. But the debacle of the past year makes it doubtful that even a solid upturn will soon restore the profitability that industry leaders would like. (Business Week, 20 May 1985)

Semiconductor firms aided during slump by growing market for customized chips

National Semiconductor Corp., stung by an industrywide slump of electronic-microchip sales, is trying to grab a piece of the rapidly growing market for custom-designed chips. Douglas Ritchie, a National Semiconductor vice president who heads the custom-chip division, says business is booming in his corner of the company. "We're going the other direction," he says. "We're seeing an enormous number of customers, we are't going through any shutdowns, we are working overtime, and we're hiring people."

Mr. Ritchie says the company's customary chip operation contributed a "small but measurable" part of National Semiconductor's $435.4 million in sales last year. But he expects the division will account for 25% to 30% of the company's sales by 1990. National Semiconductor says it likes the custom products because they are relatively free from the wild cycles of shortages and gluts that roil the industry. Industry analysts say commissioning a custom-made chip can cost as much as $1 million, making buyers reluctant to cancel or reduce orders. At the same time, customers like the tailor-made parts because they make their products unique. As microchips are built into the electronic brains of an increasing array of consumer and industrial products, the makers of these products are eager to offer more specialized features than standard, mass-produced chips can provide. Some semiconductor users even have begun designing their own custom chips. For these customers, the semiconductor companies have become merely advisers and makers of the final products.

Custom-designed chips will account for about 20% of 1985's estimated $34 billion market for integrated circuits, up from about 17% five years ago, according to Dataquest, Dun & Bradstreet Corp.'s market-research unit. By 1990, they will capture about 25% of an $85 billion-a-year integrated-circuit market, Dataquest estimates.

This flurry of interest has been accelerated by a two-year-old computer-design technique that lets engineers tinker with chip patterns on the screen of a video terminal. The technique allows engineers who aren't semiconductor specialists to design circuitry patterns that will make a chip perform the special functions they want. In a typical arrangement, a customer sends engineers to a semiconductor company's design center. There, the chip maker teaches the visiting engineers how to use computer-design equipment and looks over their shoulders while they map out new parts. In many cases, the visiting engineers can utilize aspects of existing chips, helping keep down costs that would be generated by designing and then producing a chip from scratch.

Executives at semiconductor companies say these types of computer-design transactions are moving the industry away from just production and into the realm of service.

"I think you're seeing a change in the industry. A lot more attention is being paid to the marketing of products, rather than just development of products," says James F. McDonald, president of Gould Inc. The Rolling Meadows, Ill., company's Gould AMI division custom-designs semiconductors. "We see our business becoming much more service-oriented every year," says James Smaha, the National Semiconductor vice president who heads the concern's semiconductor operations. Some semiconductor companies are making their mark by specializing in custom-designed chips. LSI Logic Corp., a four-year-old Milpitas, Calif., concern, had $84 million in custom-chip sales last year, and has kept its ratio of orders to shipments above 1-to-1. That ratio, a closely watched barometer of the microchip business's health, fell to 58-to-100 industrywide for the fourth quarter of 1984.

But not all semiconductor makers have become custom-design converts. "Custom circuits aren't the best approach in as many places as people think," says Ben Anixter, a vice president at Advanced Micro Devices Inc., Sunnyvale, Calif. "You can always say, 'I can put a little widget here and a little gotcha there and make my system better.' But invariably that will cost you more than if you bought a standard part." And many chip companies that have custom-design operations aren't convinced that they are protected from the industry's erratic cycles. "I don't know that we've reduced the volatility," says Mr. McDonald, Gould's president. "You're still as volatile as the customer you're selling to." (The Wall Street Journal, 18 February 1985)

It's getting harder for computer gurus to sound wise

Nearly every article about the computer business has a quote from some omniscient-sounding market researcher. You may know the names: E. David Crockett at Dataquest, Egil Juliussen at Future Computing, Howard Anderson at Yankee Group. These folks always seem to know why something isn't catching on or what's likely to be introduced. By selling their information to computer makers and users, such experts spawned an industry that has annual sales of over $80 million. Top-tier researchers charge $1,000 to $1 million for reports, depending on how much detail a customer wants. But slower growth at the companies they cover is affecting the data gatherers, too: As the number of hardware makers dwindles, there are fewer customers. And those who do buy want more sophisticated work than many analysts traditionally provided. This slowdown may explain why some companies sold out to big corporations. Dun & Bradstreet's A.C. Nielsen subsidiary, for example, now owns Dataquest, and McGraw-Hill bought Future Computing last year. The idea was that deep corporate pockets could help finance better research. Other companies, however, claim that demand is brisk and don't want a corporate parent.

The key to success lies in understanding the changing market. "The guru business is over," says Richard J. Matlack, president of InfoCorp, a second-generation firm formed in 1982 by several Dataquest Inc. analysts. "In the past, some smart person sat on a pedestal making pronouncements about things. Now people want the raw numbers." Why the change? Partly because so many of the old shoot-from-the-hip predictions were dead wrong. Take InfoCorp. In 1982 it optimistically predicted that the personal computer market would have sales of $21 billion in 1986. This year that figure is well under $10 billion. Then there's Future Computing. In 1983 it decreed that 23% of all homes would have computers by 1985. Today, only 13% do. Companies that based their strategic plans on such forecasts are hurting, if not already dead.

"A lot of market research in new technologies has proven to be very bad," says Michael Hammer, president of Hammer Consulting Group in Cambridge, Mass. "The biggest product failures, like the Xerox Star and Apple's Lisa [two expensive personal computers for executives], had the market researchers lining up sheeplike in praise."

The gurus see things differently. They claim their numbers shouldn't be taken literally, but used as a rough guide. "It's generally a wise thing not to trust them implicitly," says InfoCorp's Matlack. "You can't predict the future. You can [only] predict trends." Howard M. Anderson, president of Yankee Group Research Inc. in Cambridge, Mass., is more strident: "Anybody who builds his company based on syndicated research should be taken out and shot," he says. "If I read in my own market research that a certain business will quadruple in five years, I wouldn't base a company on that without checking it out." Why have the numbers been so cockeyed? Mats Gabrielsson, chairman of Victor Technologies Inc., thinks he knows. "Everybody lies," he explains, describing the days in 1980 when he was a computer distributor. "The market researchers called the vendors and asked what they sold. When they called me, I tripled my sales because I knew my competitors were doing the same. In this business it is a source of shame to admit your true numbers. The problem is, everybody starts to believe his own hype."

The idea is to replace hit-or-miss surveys with more scientific methods. Dataquest and Nielsen, for example, audit the inventories of 500 stores. And Software Access International Inc. has joined with IMS America Ltd., which collects data for the drug industry, to audit personal computer sales monthly at 300 stores. All this burnishes the industry's image. "We put a lot of faith in Future Computing's flash forecasts of computer store sales," adds William V. Campbell, Apple's executive vice-president. Even the process of finding out what customers think is becoming more formalized. In June office automation expert Patricia B. Seybold will leave her family's consulting business to set up her own company. She had already signed on 2,000 computer users to participate in regular roundtable discussions, some held jointly with vendors.

But gathering numbers and forecasting are not the consultants' only important jobs. They have gained a reputation as conscientious middlemen who advise both manufacturers and potential equipment buyers. Says Matlack: "Companies like to use us as a sounding board." Manufacturers seek their opinions in hopes that the experts will lend credibility to product introductions. They know that when journalists need an opinion or assessment, market researchers are often the first people they call. "We frequently have key people in one week in advance to demonstrate new products and explain pricing," says Frank Pinto of Data General Corp. "That way the press will have someone to talk to."

As the information processing industry matures, these relationships are changing. "We've seen an enormous concentration, and we'll see more," asserts office automation consultant Amy D. Wohl. "On the one hand there is less use for consultants because there are fewer choices to make. But the games left to be played are much bigger games." The real question is how long the need for help with statistics and strategy can support so many outside experts.

Figure 4

MARKET RESEARCHERS WHO COUNT

Founder (year)	Revenues	Clients	Employees	Specialty
DATAQUEST INC. - SAN JOSE, CALIF.				
David R. Norman, William L. Coggshall, and Donald Miller (1971)	$35 million	900	380	All segments
FUTURE COMPUTING INC. - RICHARDSON, TEX.				
Portia Isaacson and Egil Juliussen (1980)	$7 million	1,000	120	Personal computers, retailing
INFOCORP - SAN JOSE, CALIF.				
Richard Matlack and Grant S. Bushee (1982)	$6 million	175	32	Personal computers, software
INTERNATIONAL DATA CORP. - FRAMINGHAM, MASS.				
Patrick McGovern (1967)	$30 million	1,000	380	All segments
YANKEE GROUP - BOSTON				
Howard Anderson (1970)	$10 million	400	90	All segments
GARTNER GROUP INC. - STAMFORD, CONN.				
Gideon Gartner (1979)	$14 million	1,000	150	IBM
WOHL ASSOCIATES - BALA CYNWYD, PA.				
Amy D. Wohl (1984)	Less than $1 million	1,000	6	Office automation
SEYBOLD CONSULTING GROUP - BOSTON, MASS.				
Patricia Seybold and family (1971)	N.A.	460	12	Electronic publishing, office automation
OMNI GROUP LTD. - NEW YORK CITY				
Randy Goldfield, Curt Laupheimer, et al. (1982)	$1.7 million	40	16	Office automation

DATA: BW

(<u>Business Week</u>, 27 May 1985)

<u>U.S. semiconductor firms step up pace of deals with Japanese</u>

Lost in the blitz of blandly announced deals between U.S. and Japanese semiconductor houses during the past year is that what has been negotiated is anything but ordinary. In fact, many of the alliances are staking out objectives that are far beyond the simple exchange of device technology or second-sourcing of parts (see figure 5). ...

One such agreement, often cited as an example for its potential significance, is the long-term comprehensive pact between Motorola Inc. and Hitachi Ltd. In Motorola's case, it could be doubly hard to reconcile close ties to Hitachi when the U.S. firm's top officials are calling for a 20% surcharge on imported goods - particularly on Japanese cellular communications gear that Motorola claims has an unfair price advantage in the U.S. ...

Recognition of a need for help in innovation could be the driving factor in the proliferation of deals between firms in both countries, says the U.S. head of a major Japanese company. "This is especially apparent in the computer industry, where technology is constantly being upgraded at a fast pace and, consequently, product life cycles are extremely short," says John Rehfeld, vice president and general manager of Toshiba Corp.'s Information Systems Division. "The Japanese computer and electronics industry until now has suffered from a lack of innovation and inability to quickly introduce new technology and new products as the market demands." Instead, Japanese firms concentrate on such strengths as marketing products with relatively long life cycles and improving their functions and reliability. Bringing together the specialties of both sides therefore means that "opportunities for doing business with the Japanese are greater today than they ever have been," he adds. Rehfeld often speaks on U.S.-Japanese trade topics, offering these remarks to the World Trade Center Association of Orange County, Calif.

Though most industry hands agree that U.S. semiconductor firms can use help in areas where the Japanese have forged ahead - CMOS design in circuits and, most of all, process technology - skepticism abounds about lasting benefits from the current round of tie-ups. One recent agreement that underlines potential payoffs to both parties surfaced in January between Toshiba and Intel. Through Toshiba America Inc., the Japanese firm will offer CMOS interface controller chips for connecting the bus of Intel's advanced Multibus II system with its single-board computers. ...

Figure 5

RECENT U.S. & JAPAN SEMICONDUCTOR AGREEMENTS

RCA Corp. – Sharp Corp.	April 1985	Share CMOS design and process technology
Intel Corp. – Toshiba Corp.	Jan. 1985	Toshiba is manufacturing and marketing Intel interference controller chips
Motorola Inc. – Hitachi Ltd.	Jan. 1985	Motorola will second-source Hitachi's 6301 microcomputer
Intel – Fujitsu Ltd.	Nov. 1984	Fujitsu will manufacture Intel's 80188 and 80286 microprocessors and the 8061 controller chip
Intel – Fujitsu	Sept. 1984	Agreement includes Intel logic design and Fujitsu layout for a new 8/16-bit I/O processor known as the 8089-2
Motorola – Toko Electric Co.	July 1984	Subcontracted bipolar fabrication in Japan
Standard Microsystems Inc. – Oki Electric Industrial Co.	July 1984	Nonexclusive cross-licensing of each company's patents and patent applications
Monolithic Memories Inc. – Fujitsu	July 1984	Monolithic Memories will second-source Fujitsu's B-series bipolar TTL gate arrays
Intel – Oki	June 1984	Oki will provide CMOS versions of popular Intel products
American Microsystems Inc. – Hitachi	May 1984	AMI will second-source Hitachi's line of codec circuits
Motorola – Toshiba	April 1984	Toshiba will second-source Motorola's C-Quam AM stereo decoder IC
Zilog Inc. – NEC Ltd.	March 1984	Zilog will second-source NEC's proprietary V-series microprocessors and peripheral controllers

SOURCE: INTEGRATED CIRCUIT ENGINEERING CORP

Texas ups 256K chip production in Japan

Texas Instruments has started mass production of 256 Kbit dynamic random access memory (dram) chips in Japan, despite semiconductor production cut-backs in the US. Texas may have achieved a 4 million chip a month output ahead of its Japanese rivals, according to industry sources in Japan. Texas Japan refused to comment on its semiconductor production volume, although it has confirmed that its semiconductor sales grew by 55% to 60% last year. Texas Japan is producing the 256 Kbit chip at its plant situated in Miho. north of Tokyo.

Early this year, the three leading Japanese chip makers, NEC, Fujitsu and Hitachi, said they wanted to reach the production level of 4 million 256 Kbit chips a month some time between April and September. The 256 Kbit chip is already coming on to the Japan market in quantity, resulting in a unit price of £7 to £8, half that of two years ago, when the first sample devices were delivered.

Other big Japanese companies aiming to produce the 256 Kbit in volume include Mitsubishi Electric.

Mitsubishi has recently announced development of a 256 Kbit complementary metal oxide semiconductor static random access memory chip, and a one megabit dram chip. (Computing the Newspaper, 14 March 1985)

and joins hands with Canon on high tech products

Canon Inc. has reached basic agreement with Texas Instruments (TI) on joint development of various high technology products. The companies will (1) jointly develop high technology products responding to the new age, (2) actively promote the exchange of engineers, and (3) form a project team for developing new products.

Both companies hope to secure an advantageous position on the world's intensifying high technology market by combining TI's semiconductor technology with Canon's optoelectronics and precision processing technology and by cooperation in new media machinery, equipment and computers. So far, TI has been provided with lenses and semiconductor production units by Canon, and Canon has been provided with semiconductors for cameras and desk top calculators by TI. Through the cooperation with Canon, TI will utilize Canon's optical technology and information machine mass-production technology, and can advance into the rapidly growing Japanese information industry market. ...(Chemical Economy and Engineering Review, March 1985)

Sharp joins RCA to make ICs

RCA and Sharp plan to invest over $200m in a joint semiconductor manufacturing venture in the US. The company is to be called RCA/Sharp Microelectronics Inc. The site is to be chosen shortly. Several sites are under consideration, according to an RCA spokesman. The company is to be 51 per cent owned by RCA, with the rest owned by Sharp. There are to be five directors from RCA and four from Sharp. Approvals from the US and Japanese governments are needed before the venture can proceed. (Electronics Weekly, 24 April 1985)

Siemens eyes the 32-bit market

Siemens may soon enter the 32-bit microprocessor market and is currently negotiating with Intel with which it already has second source agreements for earlier generations of chips. Juergen Knorr, vice-president of the West German manufacturer's components group disclosed here. In an interview with Electronics Weekly, Knorr said: "We are negotiating with Intel on this issue. We shall have to make up our minds about our strategy in this range of devices." Strongly indicating that Siemens will commit itself to the 32-bit sector, the Siemens Components chief added: "It's like having a car that goes at 150 kilometres an hour. You do not need that speed. But it means you can do 100 kph with ease." Likewise, added Knorr, the 32-bit microprocessor gives the customer extra power which he might not require immediately but could need later. "A lot of people will buy it is the price is right," he said. Knorr predicted: "Ten years from now telephone sets will have 64-bit microprocessors. Meanwhile systems houses are taking their decisions on the 32-bit device and how to use it. That's the big task - not making the chip but on how to use it."

Stressing the importance of the price of 32-bit microprocessors in determining the size of the potential market, Knorr said: "This type of market only stops or slows down if we have technical problems in manufacturing the products. As price degradation sets in and prices flatten out, the market comes to fruition."

Siemens will be one of the last major semiconductor companies to decide its strategy in the 32-bit market. Texas Instruments recently began sampling its TI 32000 family - principally in NMOS versions - to European customers TI is an alternative source for National Semiconductor's device. Motorola has made a similar pact with Thomson and Mostek for its 68020 family of 32-bit microprocessors. But these two latter companies have not yet started manufacturing. While Intel talks to Siemens about its 32-bit product, the American firm already has an alternative source arrangement with Advanced Micro Devices. Zilog is not expected to have its own 32-bit family ready until the end of 1986. (Electronics Weekly, 15 May 1985)

AT & T makes a second stab at the computer market

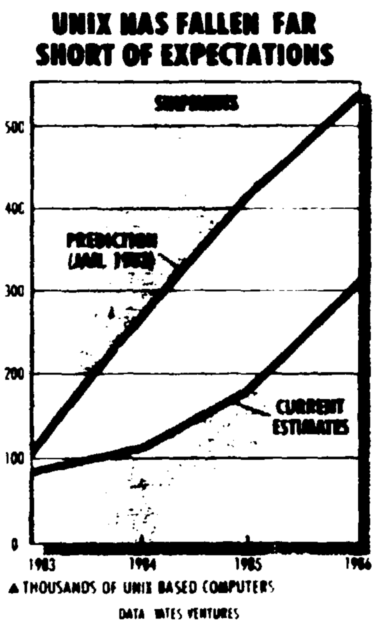
Last year AT & T jumped feet-first into the market for data processing equipment. But its products proved inadequate and its marketing strategy ill-defined. The result was disappointment. "We really hadn't sorted out precisely what customers needed and how our product line fit in," says a rueful Robert E. Allen, the new chairman of AT & T Information Systems Inc., which markets the computers. Now, AT & T is ready to write a different story. The company has revised its computer strategy to take better advantage of its strengths as a communications company. It will trot out a series of new products, including a powerful new personal computer. An updated line of minicomputers will follow by early summer, calculated to show critics that the company's vaunted technical prowess can be translated into competitive computer products ...

When AT & T sends its forces into the field this time, they will be equipped with a new game plan. The strategy still revolves around Unix, but now AT & T won't try to persuade customers to adopt it for general-purpose computing. Instead, Edwards has narrowed the focus to highlight Unix' superior communications capabilities. "Unix is really good at moving information around," he explains. That makes it particularly effective where IBM has always been weakest: distributed data processing. This technique, pioneered in the 1970s by minicomputer companies, takes computing tasks from mainframes and distributes them to smaller computers that can handle a department or division. The tricky part is to get these smaller systems to communicate with each other and with the mainframe. So AT & T is emphasizing Unix' knack for tying together everything from personal computers to mainframes. Although it is only a slice of the data processing pie, Edwards estimates that distributed systems represent a $10 billion annual market.

The revised Unix strategy could still backfire if AT & T's new products fail to ignite more enthusiasm. With more than 100 other companies selling Unix products, there is no particular reason to choose AT & T. And most ominous, IBM has added Unix as an option on systems ranging from PCs to mainframes. So although IBM still emphasizes its own ways to tie different hardware together, it is ready to offer the Unix alternative if customers insist. "AT & T still has to deliver price- and performance-competitive products that will convince people to buy their hardware instead of other Unix boxes," observes Peter R. Tierney, a vice-president at Relational Technology Inc., a Unix software company.

After a year of false starts, AT & T is in a hurry to prove its new products will measure up. "There's a hell of a lot of urgency to this," says Allen. "This is not a window that's going to be open forever." In an industry as fast-moving as computers, even a $33 billion company can't afford many more missteps.

Figure 6



(Business Week, 1 April 1985)

AT & T strategy includes Mbit production in '85

Sources close to AT & T suggest that the company's merchant market chip strategy includes having availability of a megabit dynamic RAM in volume, in Europe, this year. No other chip company in the world has, so far, said it will have production of Mbits this year. With Mostek, Texas and Motorola taking, by all accounts, a costly beating in the 256K market, AT & T's strategy looks suspiciously like America's last throw in staying in the commodity DRAM business. Horror stories of pricing on the 256K and 64K DRAMs - 256K business has been seen at under $3 and 64K business at under 30 cents - suggest that the only way in which DRAM manufacturers can stay in the business is to accelerate new product introduction. That means going for the Mbit. (Electronics Weekly, 5 June 1985)

Nixdorf to play AI shell game

Comparing the numbers of firms involved in artificial intelligence gives the impression that the U.S. is well ahead of Europe in the field. Comparing technologies, however, gives the matter an entirely different perspective. "Europe is at least on a par in system sophistication," maintains Bernhard Franz, who is responsible for sales and marketing of expert systems for Nixdorf Computer AG, FRG's largest computer producer. To back up his contention, Franz can point to the expert system that Nixdorf will be putting on the market this fall.

Called Twaice - for true wisdom, artificial intelligence, computerized expertise - the firm's first AI entry is a knowledge-independent expert-system shell. In it, Nixdorf's recently introduced 32-bit minicomputer 8832 serves as the delivery vehicle, working with a knowledge base that incorporates the user's expert knowledge. This base can be replaced by another base at any time should the application so require. The new system makes Nixdorf one of Europe's first classical computer manufacturers to have readied a complete package - with both hardware and software - for an expert system, Franz points out. Nixdorf has given the basic shell a price tag of 160,000 DM, a little more than $47,000 at current exchange rates. As for the knowledge base, it will require anywhere from a quarter of a man-year to as many as two man-years of time for experts to compile, Franz figures.

Another AI pioneer is Britain's flagship computer company, International Computers Limited plc, which markets an expert-systems building tool. Also operating out of the UK is Racal-Norsk Ltd., a joint venture between Britain's Racal Electronics plc and Norway's Norsk Data. The two companies have combined to produce a knowledge-processing system that can run AI applications in such industries as defense, education, petrochemicals, and finance.

In France, Matra S.A., a defense-oriented firm, has an AI system on the market for military training. The Centre National d'Etudes des Télécommunications and the Compagnie Générale d'Electricité are also looking into AI. The CNET wants AI for speech-recognition and synthesis systems; CGE's interest is for industrial and robotics applications.

Expert systems can be used as a means for reasoning, explaining, indicating status, documenting, and dialoguing. For Twaice, a typical application would be a system to find faults - and figure out ways to fix them - in complex equipment. The idea is to bring the accumulated knowledge of equipment designers and maintenance engineers into play for the less skilled. (Reprinted from Electronics Week, 25 March 1985)

Intel 32-bit MPU due this year ...

One of the events of the year will be the introduction of a single-chip 32-bit microprocessor from Intel. Unusually late, the company now says it will have the device during 1985 and has released some advance information. Though significant markets for 32-bit micros are not expected for a couple of years at least, the announcements of chips from National and Motorola - the 32032 and 68020 - in October 1983 and July 1984 respectively, have left Intel's announcement looking tardy.

Intel's 32-bit will come in 12MHz and 16MHz clock versions compared to National's 6MHz and 10MHz, and Motorola's 16.67MHz. Called the iAPX386, the Intel chip will address 4Gbytes of physical memory and 64T (Tera)bytes of virtual memory per task. Its performance will be "two or three times" that of the 286. The 386 is designed to work with co-processors. A numerics co-processor - the 80387 - aims to perform numeric calculations four times faster than the 80287. Other co-processors will be the Ethernet LAN chip - the 82588 - and the text co-processor chip - the 82730 - which are designed to work with the 386, off-loading the 386 of their specialised functions in order to increase overall systems performance.

The other attributes of the 386 which produce higher performance than competing 32-bit micros are, says Intel pipelined architecture and multiple on-chip descriptor caches. All the software - both operating and applications systems - written for the iAPX88 family will run on the 386 "without changes and at significantly higher speeds," says Intel. On-chip memory protection offers four "privilege" levels. Most closely guarded level is usually the space reserved for the operating system. Systems and applications software can go on the less "privileged" levels. On-chip memory management gives the possibility of segmented virtual memory and optional paging for physical memory management and swapping. (Electronics Weekly, 17 April 1985)

HP boosts US ai by $50m

Hewlett Packard (HP) will attempt to help spur the development of artificial intelligence technology through a $50 million grant to selected US universities. The Californian-based systems manufacturer will give away over 700 of its advanced engineering work stations in the HP9000 range and future products to up to 12 universities over the next three years. The package will include advanced software systems and development tools chosen to aid ai development.

The Massachusetts Institute of Technology (MIT) is the first university chosen to receive 20 work stations a year for the next three years, as well as software that includes the Unix operating system, a software development system and an artificial intelligence language. The new ai language, Heuristics Programming and Representation Language, has been used by HP researchers to develop two application programs. One allows programmers to more effectively monitor programmes while developing them, while the other one allows the use of natural languages to be understood by the computer. (Computing the Newspaper, 28 February 1985)

Fairchild plant shut as chip slump bites

The present over-capacity in the semiconductor industry has forced Fairchild Semiconductor to shut down its Healdsburg plant in Santa Rosa, California, with the loss of 200 jobs.

Semiconductor prices are down by as much as 50 to 75 per cent for memory parts, but by the third quarter of this year, the US semiconductor industry has optimistic hopes of showing a small plus improvement in sales of the order of 2.5 per cent.

Fred Zieber, who overseas analyst Dataquest's semiconductor market service, said that US semiconductor industry shipments for internal consumption were down 30 to 35 per cent. Out of a workforce of around 150,000 to 200,000 employed in the semiconductor industry, 20,000 have been layed off or put on short time.

However, strong growth of the order of 21.9 per cent is predicted for next year in the European semiconductor market, which lags the States by about six months and has not been so badly impacted by this latest recession. "The European market has been enjoying a much more stable situation, which means that they will suffer a much more moderate fall in business this year," he said.

The Japanese now have 40 per cent of the worldwide semiconductor market, put at $29bn, and they dominate the MOS memory market. (Electronics Weekly, 5 June 1985)

Solution offered for Apple's problems

The future of troubled Apple computers, once Silicon Valley's hottest success story, may lie in the hands of a small company in Utah. The firm, Dayna Communications, has designed a widget which makes Apple's Macintosh behave like a machine from IBM. The idea makes sense. Over the past 18 months, the Macintosh microcomputer has won a lot of fans. Its chief attraction is its "mouse", a hand-held control for moving the cursor across the screen. Users can select functions from a menu without bothering with the keyboard, and can also draw freehand sketches on the screen. Unfortunately for Apple, the Macintosh failed to take off as a standard tool for big business. IBM has set the standards for that market with its successful, but technically inelegant, PC. Programs written for the PC will not run on the Macintosh.

Dayna Communications unveiled its machine, which allows the Macintosh to run IBM programs, last week. The device, called MacCharlie, slots onto the computer's right hand side, increasing its width by about half. Another part fits around the keyboard to provide the 28 extra keys of an IBM PC.

The most advanced version of MacCharlie costs $1895, which would push the cost of a modified Macintosh to more than that of an IBM PC. Why bother? Dayna believes that people prefer to use Macintoshes, and that MacCharlie will make life easier for executives who have to choose a computer to standardise on. If MacCharlie does improve sales of the Macintosh, IBM has a way to hit back. Dayna concedes that IBM could doctor its software so that a modified Macintosh could not run it. But they say that even Big Blue would not play that rough. Apple itself is trying for a similar market. It has just launched a protocol converter which allows the Macintosh to operate as a terminal for an IBM mainframe. (This first appeared in New Scientist, London, 20 June 1985, the weekly review of science and technology)

APPLICATIONS

Computers in process control

Since the late 1950's automation has increased in all industries. This is due not just to the computer but also to advances in the equipment which the computer controls such as valves, pumps, etc. and in instrumentation. By the early 1970s the relay panels used to control chemical plants for example, were giving away to computer control. Many of these early systems used DEC PDP 8 and they had some drawbacks. In particular any mainframe or mini computer based system needed to operate in warm air conditioned vibration free rooms and they were very expensive to programme. The Irish dairy industry for example spent millions of pounds on reprogramming the computers supplied from Germany and Sweden which run its bigger butter and cheese plants. Only the wealthiest industries could afford this type of control. To the chemical giants like Du Pont, Dow, Merck Sharpe & Dohme etc., it was money very well spent. In the large food plants process computers also could be justified but in many other smaller plants process computers were just too expensive.

In America's smoke stack industries such as steel and cars, companies wanted to replace relay panel automation (bulky, difficult to change, unreliable) with some programmable system. However, unless the new system was robust and could operate on the shop floor and could be programmed by any card carrying union member, they were not interested. In 1974

Texas Instruments introduced their first programmable logic controller, the 5TI, which offered sequence control and fulfilled the requirements of robustness and ease of programming. Today no less than 164 companies sell PLCs, of which over 30 are represented in Ireland.

A typical 5TI controller costs around £3,000 for a full system where as now PLCs can be bought for as little as £300. At the other end of the scale PLCs are getting the "number crunching" capabilities of the process computers and at the top end of the scale are battling it out with process computers. The early PLC systems had low capability when it came to generating information, so when the Apple 111 arrived in the mid seventies many people felt great, here was a low cost microcomputer that could be cheap to buy, could do process control and generate information. Lastly for process control there are special purpose controllers which you will only use if you are building quantities of 20 or 30 machines, all very similar. For this type of system getting an Electronic Systems Company to design a special purpose unit for the application may be the most cost effective way to go.

Relay panels

Relay panels use large banks of relays to control and switch on and off equipment. Typically they were used for control of conveyors, for example on process plants. As food and chemical plants became bigger the relay panels became enormous and when a sequence had to be changed it was a big problem. It meant all changes had to be rigidly logged so the electrician could alter the wiring correctly. Relay panels only control digital signals, that is on/off signal from valves, level switches in tanks, temperature switches in pipelines, motors and so on. No control of analog signals was possible. By analog I mean any signal from the process which varies between 0-100%, for example temperature, pressure, flow, level etc. Other drawbacks relay panels suffered from were reliability and complete inability to generate reports (except by chart recorders) or to monitor the process and report faults.

Process computers

The very first use of a computer to control a process was by El DuPont. DEC's introduction of the first practical minicomputer, the PDP 8, opened up the door to the real possibilities. This led the large instrument companies to develop their own process computers aimed at overcoming the ergonomic problems associated with big control rooms in the oil, chemicals and public utility industries. Siemens, Honeywell, Foxboro, Kent and Taylor Instruments, already big suppliers of all types of instruments, developed very sophisticated control systems. Their computers could control a wide variety of analog as well as digital signal. They could monitor all signals from the plants and report upset conditions and could generate all types of reports on production rates, plant usage etc. Plants controlled by process computers also have a far superior safety record than those run manually. The Process Computers currently sell from £100,000 upwards including hardware and software. Many are based on DEC PDP/11-34 and latterly the VAX 750.

Typical applications are for waste treatment plant control and energy management. The software development is what cost all the money in these systems. Maintenance costs tend to be high (about 10% of cost or the system per year) as sequence changes must be made by skilled programmers. Although many process computers may have the same original parent (e.g. PDP11) they will be highly configured by the vendor to turn the basic machine into something operators in each industry find "friendly." For example, APV (UK) and Alfa Laval (Sweden) have many PDP 11 based systems in the Irish dairy industry but they are programmed completely differently to the basic PDP 11. If you want to change something you must go to APV or Alfa to get it done. Similarly Tuchenhagen have their Siemen based process computer which brewers can use, while the big U.S. instrument company systems use process flow diagrams to programme their machines, as this is what chemical engineers are used to.

Programmable Logic Controllers (PLC)

The process computers have three big drawbacks. One is cost, next is its need for a controlled environment and thirdly is its need for skilled programmers. These drawbacks were always going to keep the process computers out of the low cost control market and off the shop floor. Small plants, conveyor lines, packaging plants would rarely be viable for process computers to control. So in the early seventies various US manufacturers came out with PLC's, initially as relay panel replacements but also to control equipment. Texas Instruments were quickly joined by Gould Modicon, Allen Bradley, Square D, GE, and others in the PLC market. The Japanese saw what was going on and saw a niche for very low cost controllers £300) and Omron, Mitsubishi, Hitachi and others filled this gap.

At this stage most manufacturers offer PLC's varying in price from £300 up to approximately £20,000. So how do they work? Basically a PLC is simply a hardened, configured microprocessor, but a system to control mechanical equipment can be put together by an electrician or an engineer. Even a mechanical engineer could do the job. No programmers need apply!

Being designed for industrial uses a PLC will often have to take in signals from level probes, conveyor limit switch, thermometer etc. and "input cards" are available off the shelf which convert a wide variety of industrial signals into a format the PLC can understand. Similarly for output command signals, standard cards are available. For example a water flowmeter measuring 0 - 50 gallons per minute will emit an electrical signal of 4 to 20 mA. An input card will convert the 4 - 20 mA into a signal the PLC can process. The entire system is built up on a modular basis so if you need more inputs you just get an extra input card for example. PLCs are used in Guinness to control the kegging line where the environment is tough - plenty of vibration, heat and moisture, but that's what PLCs are designed for.

For £300 the very small PLCs only do on/off control and are used in small packaging machines, conveyor control etc. The £5,000 PLC can do analog control and high speed component counting and follow longish programmes, but it's not much good at generating reports. In the top of the range £20,000 PLC you get multitasking system which for example could control six pet food cooking retorts simultaneously. These latter units can provide a reasonable level of reporting and management information.

A number of advances are making PLCs more attractive than ever. First is their hierarchical structure where you can have a number of intelligent modules located on the shop floor controlling just their own sections, but all the time reporting to a master computer. This greatly reduces electrical wiring costs as against one big central process computer. The second big advance taking place with PLCs is their tying in to personal computers. In 1984 a number of PLC vendors began supplying equipment which could use the IBM PC to do all the data manipulation at which PLCs are usually poor.

Hence for example, a G.E. Series six PLCs, while controlling a section of a car plant, can be continually unloading information to an IBM PC to give reports on daily production counts, downtime analysis, output per workstation and the like. This is obviously going to be a very cost effective solution in the future.

<u>Personal computers</u>

There have been many attempts, some successful, at using personal computers in process control. The IBM PC, DEC Rainbow, Apple IIe have all been used for process control. They have, of course, the advantage that besides controlling the process they can run a huge array of other software. In my view a personal computer is unsuitable for industrial control because:

(a) They are not robust, nor are their floppy disks

(b) They need specialists to programme them.

It is important to remember that most industrial environments provide high levels of electrical interference and variability in supply voltages. Any industrial controller must be able to put up with this. In this country we have seen a number of efforts to use PCs for shop floor control and to my knowledge none have worked successfully over a long period.

<u>Special purpose process controllers</u>

Every so often applications come up where no "off the shelf" solution is acceptable. The PLC or process computer route may be too expensive or the personal computer route too unreliable. For example, if you were to make a batch of 100 machines with analog inputs and outputs and lots of information processing, a PLC solution could cost £5,000 per unit (90% hardware, 10% software) whereas a specially built control unit could cost less than £1,000 (50% hardware, 50% software), per unit. For example the IIRS recently built such a system for FDK, an Irish engineering company. Cost of milk collection from small farmers in the West is astronomical with big milk tankers going up country roads twice a day to collect a few gallons of milk. In an effort to reduce this cost a North Connaught farmers co-operation, a £50 million + business, decided to build an unmanned milk station with FDK. To this farmers would bring their milk and on presenting a plastic card (like a bank card) his milk would be pumped into a weigh tank, where it is tested for weight, sourness, temperature and also sampled. If everything is O.K. the milk is transferred into a cooling tank, where it can safety stay at 4°C for four days. Up to 30 farmers use each milk bank which is emptied every 3 days at present. No "off the shelf" controller could do this amount of control and data gathering at the target cost - £1,000. Only a special purpose unit would do the job. This took IIRs nine months to develop and debug with a software cost of £35,000. Hardware cost per unit is £350. So over 60 units the controller cost is well under the IR£1,000 mark. Obviously this unit is only using industrially hardened components.

The future

The computer side of process control continues to develop rapidly. One or two companies now specialise in providing the complete solution - the PLC for the production control and the mini computer taking data from the PLCs to provide the financial managers with the information they need. Mentec in Stillorgan for example, provide such a solution. In all process control applications the weak point is usually the instrumentation - the transducers and sensors in the field. The reliability and accuracy of instrumentation is still poor and this is where 80% of industrial control problems come from. The effort is now being put in to make these better and thus provide better quality information for the computer to control. (Electronics Report, Ireland, June 1985)

Australian metal diecasting technology launched

Called 'METLFLOW', the system was developed in conjunction with research into problems of molten metal flow and heat flow in pressure diecasting dies. This research was carried out over 10 years by a CSIRO team collaborating with metal suppliers, diecasting companies and the Australian Zinc Development Association. METLFLOW is being marketed in Australia and overseas by Moldflow Pty Ltd, an Australian-owned company which has already achieved international recognition for its plastics mould design software. Moldflow is offering a die design consultancy service and METLFLOW software is now accessible through the company's computer system via the OTC/AUSPAC international computer network. Later this year, the software will be made available on customers' in-house computers. With CSIRO assistance, Moldflow will conduct a training seminar for diecasting die design engineers starting on 25 March in Melbourne. A similar training seminar will be held in the USA around the time of the international diecasting congress organized by the American Society of Die Casting Engineers at which Moldflow Pty Ltd will have an exhibition stand.

A research team at the CSIRO Division of Manufacturing Technology wrote the METLFLOW software in Fortran for use on a range of 32 bit mini- and supermini-computer systems. To use the software, users must have a terminal, a plotter and a printer which can be connected in series to a host computer. Because the METLFLOW design procedure is significantly different to the traditional design method, the Division has produced user manuals to assist the designers apply the METLFLOW technology effectively. The METLFLOW design philosophy is based upon fluid flow and heat flow theory. It makes use of the computer's ability for processing complex information to calculate metal flow variables and thermal balance of the die. The geometry of the system is designed to minimize pressure losses and entrainment of air. The system's size is determined from calculations based on the capability of the chosen diecasting machine for pumping molten metal and on the requirements of the casting. A unique feature of METLFLOW is that it uses a 'zones-of-fill' concept to determine the optimum positioning of the runner (i.e. the filling channel) in relation to the die. This enables the designer to minimize the percentage of 'cold shuts' (surface defects resulting from solidification before the die cavity has filled) in the casting. The designer assesses the flow and thermal analysis data generated by the programme to confirm his original design decisions on the metal flow system.

Moldflow is establishing a CAD/CAM software development centre in the outer Melbourne suburb of Kilsyth. The 'software village' project, which is being supported by the Victorian Department of Industry, Commerce and Technology, should be up and running within the next few months.

There are, of course, differences between metal casting and plastic moulding: molten metal passes through the die gate perhaps up to 50 times faster than does thermoplastic material; the time taken to fill a die cavity that would produce a shape of similar size could well be 700 times less; and molten metal solidifies considerably quicker than does a thermoplastic. However, despite these differences, both offer the same advantages of reliability of commissioning and improved product quality and efficiency. For more information: CSIRO Division of Manufacturing Technology, P.O. Box 71, Fitzroy, Vic.3065, Phone (03) 418 0211. (CSIRO Industrial Research News, January 1985)

PCs revive aging blowmolder

A 20-year old plastics extrusion blowmolder destined for the scrap heap was saved by a PC system that replaced electromechanical timers, relays and temperature controls. Because of age, these controls began to break down and parts became difficult to obtain. The blowmolder makes 100,000 bottles a week at Calgon Corp.'s plant in St. Louis, Missouri, USA. During a schedules break in production, engineers ripped out the old controls and installed a PC system supplied by Eagle Signal Controls (8004 Road, Austin, Texas, USA). Heat was controlled by an E240 PC; 14 analog loops were configured for that purpose. A second E240 handled cycling control, as well as water and oil temperature control. The PCs are also capable of handling the expansion or controlling additional functions at a later time. Within hours, the blowmolder was started up, turning out bottles that passed inspection. (Industrial World, May 1985)

Chip has a nose for trouble

A US Defence research centre has come up with a chip that can smell the difference between different solvents, such as benzine, alcohol, methanol and cleaning fluid. As it can also detect water, one of its first uses will be to smell moisture which could destroy microchips in sensitive instruments (such as the guidance system of a cruise missile?) It will also be used to protect against leakages of dangerous solvents in factories and in analysis - although it can't yet detect gases such as carbon monoxide. (Technology Ireland, June 1985).

Automation may save U.S. farmers

The history of agriculture has been one of ever-increasing mechanization. In the U.S. in 1850, the typical farm fed five people. Today, it provides 70 human beings with more food than they can eat. Yet around the world, people go hungry, and every day brings 200,000 more mouths to the table. More to the point, agricultural production, like production in a factory, can be downright unprofitable despite a guaranteed demand for the product. So the overriding issue in agricultural economics is not whether more people need to eat, but whether the farmer can grow food for them without going broke.

The consensus at the Agrimation 1 conference, held in Chicago in February, was that in the developed world, simple mechanization has reached the point of diminishing returns. Adding another tractor or combine will probably cost the farmer more than the profit on the extra food he could produce. Consequently, the only way to reliably increase farm productivity is to make agriculture more profitable - which means automating the farm machinery itself. The advent of low-cost sensors and powerful microprocessors could make this automation possible.

Today, the most developed area of farm automation is in the remote control of stationary equipment. Considerable savings of time and money can be realized by, for example, feeding the parameters of a farm's field sprayers into a personal computer, which then operates the equipment from the living room. Compared with the automated navigation of equipment that moves - a difficult undertaking that is for the most part still in the research stage - controlling a fixed item is similar to any well-understood problem in industrial flow measurement and control. Though this similarity gives designers of industrial-control equipment a leg up in applying their know-how to agriculture, the farm can be considerably more hostile environment than the factory. ...

Since the $600 price tag for a single industrial flow meter can be prohibitive to the small farmer, Wood and his colleagues designed and built a transverse-axis turbine - offset from the sprayer pipe's center line so that large particles, such as chemical fertilizer, could pass freely. The turbine responds to flow variations by changing the inductance of a tuned oscillator circuit in the adjacent detector, with an electronic pulse generated for each pass of a blade. CMOS processors were chosen to interpret the information because they operate over a wide range of supply voltages (3 to 18 V dc) and are relatively immune to electrical noise. Digital filters were incorporated into the scheme to smoothe the pulse rates and give the operator an averaged display value, while remaining responsive to system variables. (Wood reports response times of a few tenths of a second.)

A potentially vulnerable part of this and any remote-control scheme that operates in real time is the data link between the sensors in the field and the home computer. One approach has been to run a wire along the sprayer hoses to an RS-232-C port in the computer. But the wire must be shielded from the elements, and the sensor must put out enough current (4 to 20 mA is typical) to overcome signal loss.

Another approach, is to write simple control software into a ruggedized processor located at each individual sprayer and dispense with centralized control entirely. A farmer would not be able to collect data instantaneously, "but that's not usually necessary for chemical monitoring or water management," Ksiazek says. "The advantage is that it's simple and cost justifiable over a 2- to 3-year period."

A cautionary note, however, is sounded by Maurice Johnson, vice president of research and development at Sunkist Growers Inc. "Dirt is a tremendous problem for precision sensors. We spent the R&D bucks to make a ruggedized integrated system that could gather information from the field for real-time control of [citrus grove] sprayers and fertilizer combines, but it was thumbs down." In Johnson's view, the time for computerized, integrated control of citrus farming is far off, "but automation in packaging is here now and getting bigger." At Sunkist, low-power X rays are used in an automated system that checks picked oranges for ripeness by measuring pulp density. Johnson notes that the system is inexpensive because off-the-shelf machine-vision equipment can do the work. But to expand Sunkist's capabilities in other areas of automation - most notably the inspection of its packaged products - the company may begin to design equipment for its own use.

Companies not previously involved in agriculture have already started producing automated equipment for the field. Octek Inc., a division of Foxboro Corp., has developed for agriculture a continuous on-line inspection system. The Octek 2200 vision processor evaluates a product's dimensions (including thickness), detects surface contaminants by noting discoloration, and inspects a package for cosmetic defects.

Though automated agricultural inspection for agriculture has passed from research into production, other areas of agriculture automation - mainly those involving motion - remain experimental One of these experimental areas is the robotic manipulation of tissue cultures - which has great potential for cost savings because about half the earth's foodstuff is transplanted before it is harvested. Heon Hwang, a graduate assistant in the Agricultural Engineering Department of Louisiana State University in Baton Rouge, reports that the simple robot in his project could transplant six pepper seedlings per minute. Though the typical human can transplant 32 plants in trays per minute, he says that several robots (here, an XR Series Mark II from Rhino Corp.) operating in a row would be cheaper than a human line.

Hwang's system consists of the Mark II (with five degrees of freedom and a gripper), moved by a servo motor with optical encoders for position feedback. An Apple IIe personal computer was used to programme and communicate with the robot's Intel 8748 microprocessor through an RS-232-C port. All the hardware is off-the-shelf, so total system cost stayed below $4,000.

Without sensors for vision or force, node points - where the robot can check its position using an optical encoder - must be entered into the program. This slows down the process considerably while the manipulator arm stops, asks itself where it is, and starts again. With sensors, Hwang speculates that the same robot could transport more than 40 seedlings per minute because its arm could move in an uninterrupted line. "But the expense would be very high with sensors and [their associated] minicomputers," he says. "And sophisticated features like force control and vision are maybe unnecessary, since for less money you can have many simple robots in one system."

Another application for automated motion in agriculture is the control of mobile field machinery, such as autonomous combines. This is an extremely ambitious undertaking and nothing of the kind yet exists, even in prototype. Project Pegasus at the Department of Electrical Engineering at the University of Tennessee in Knoxville seeks, more modestly, to convert a riding lawnmower to an autonomous machine that will navigate for itself, cutting grass as it goes. Thomas E. Swift, a project engineer, cites vibration "as the most serious problem in converting the lawnmower. Achieving the highest degree of fault tolerance required mounting the computer and sensor assemblies on shock-resistant platforms." The machine's intelligence resides in an Intel 8088-based single-board computer programmed in Forth, which Swift considers "ideal for time-slice information." The input from a number of sensors - each associated with a Zilog Z8 microprocessor - is updated several times every second.

So far, sonar plattoms have proven promising for obstacle detection, but vision systems - even solid-state ones - are yet unequal to the rigors of the field. "Sudden light changes and dust produce unreliable results," says Swift, "and the processing of visual data is too time-consuming for a microprocessor-based system". Without vision, the lawnmower's navigation could be handled by placing passive reflectors around the field's perimeter and using a radio-frequency signal from the mower to triangulate its position from the known angle between the reflectors. Swift reports that after much effort, "a lot has been learned about various subsystems [for providing a prototype autonomous farm vehicle], but no substantial progress has been made on the integration of the system as a whole."

"Automation will come and must come," says Roger Garrett, chairman of the Agricultural Engineering Department at the University of California at Davis. With all its difficulties, agriculture in the U.S. must automate to remain competitive. Otherwise, high costs will drive farmers - and even agri-business - out of business. ... (Reprinted from Electronics Week, 25 March 1985 (c) 1983, McGraw Hill Inc.

In search of the perfect bull

Computer dating has reached the dairy. For a modest fee of £5, the farmer completes a form detailing the attributes of the cow's perfect partner, and posts if off to Rickmansworth for a computer search for "Mr. Right." This new scheme has been launched by the British Friesian Cattle Society of Great Britain and Northern Ireland, the largest breed society in Europe, in an effort to help farmers choose mates for their cows which will result in more profitable and more productive offspring.

Cattle breeding has become increasingly scientific during the past 30 years. With the advent of artificial insemination (AI) services after the Second World War, it became necessary to devise methods of ensuring that the bulls used in the nation's dairy herds were genetically valuable. So bull proving schemes were initiated which involved comparing daughters of bulls with their contemporaries milking in the same herds. These efforts to improve the dairy cows have been very effective. Today's breeders are faced with a bewildering mass of figures describing the characteristics of daughters of all the available bulls. The comparative information about the performance of bulls' daughters is constantly changing. And a new international system of describing the physical characteristics of daughters - Linear Assessment for Type - was introduced recently in Britain. Many farmers have opted out of dealing with the intrusions of science by ordering "bull of the day" services from their local AI centres and trusting that they will get some improvement in their cows because all the bulls on offer have some merit. But the new computer dating services - Simplified Sire Selection - may give them a better chance of breeding the cows they want without spending hours in the office poring over figures.

In addition to minimum production requirements - that the bull's daughters should have produced certain levels of milk yield, fat and protein - the farmer specifies what they should look like, completing up to 16 boxes on the application form describing body, legs and feet, udder and teats. He can thus look for a bull which will, he hopes, compensate for specific weaknesses in his own cow. The computer at Rickmansworth then selects, from over 250 possible bulls, the closest to the farmer's requirements. The farmer then receives back from the computer information that shows how well each fits the specifications together with an indication of the cost and availability of semen.

French doctors linked by computer

French medical researchers have successfully monitored by computer the spread of four diseases throughout France. The researchers want to expand the programme to create the world's first national computerised epidemiological service. The French study was conducted by the biomathematics and biostatistics unit of the French national institute of health and medical research (Inserm). Doctors used Minitel, a small computer terminal given to French phone subscribers to access a computerised telephone directory. In the first phase of the study, 100 general practitioners all over France entered into their Minitels the age, sex and clinical diagnosis of patients with measles, viral hepatitis, male urethritis and flu. The latter two diseases have been epidemic in the past few years, but their spread has been hard to monitor. Alain Jacques Valleron, the head of the project, wants to use the computer network to block the spread of diseases as well as monitor their progress. This will require more data and the study is being expanded to cover 500 doctors' surgeries. Eventually, says Valleron: "We want to set up a tele-informative exchange between the participants, the local health authorities, the World Health Organization, border health posts, and so on." Such a network could issue alerts about epidemics in time for medical authorities to take action to halt its spread. (This first appeared in New Scientist, London, 9 May 1985, the weekly review of science and technology.)

Hearing aid on a chip

Getting the maximum value out of a hearing aid is for many people a frustrating experience. Hampered by ill-fitting devices, inadequate adaptation to background noise and high cost, many either do not buy the hearing aid or just leave it in the bureau drawer. But according to research audiologist Allen Montgomery of Walter Reed Army Medical Center in Washington, D.C., help is on the way. "It's inconceivable that with a multi-million-dollar hearing aid industry and the powerful computer technology now available, the two aren't married," he says. But not only is the marriage in the works, the children are already being planned. One of these up-and-coming technologies is digital signal processing, which entails placing silicon chip-based microprocessors into wearable hearing aids to more efficiently translate sound waves into usable energy. The first such hearing aids, expected to be commercially available within three to five years, should help the hearing impaired to better understand speech, Montgomery says, by simultaneously making sound more discernible and reducing background noise. A. Maynard Engebretson and colleagues at the Central Institute for the Deaf in St. Louis are working on a hearing aid that will employ a complex microcircuitry technique called Very Large Scale Integration. The technique, says Engebretson, will make it possible to design hearing aids that can be programmed to precisely fit the patient's auditory needs. In addition, such aids will be able to immediately adapt to changes in the characteristics of the sounds encountered. Current devices aren't custom made - they only roughly approximate the user's needs, Engebretson points out, and subsequent adjustments must be made manually.

Dextrous hand

The Center for Biomedical Design at the University of Utah and the Artificial Intelligence Laboratory at the Massachusetts Institute of Technology are developing a tendon-operated multiple-degree-of-freedom dextrous hand (DH) with multichannel touch-sensing capability. The goal is the design and fabrication of a high-performance yet well-behaved system that is fast and stable and that incudes considerable operational flexibility as a research tool. The paper reviews progress to date on project subtasks and discusses design issues important to hardware and control systems development in terms of (1) structures that contain tendons, actuators, joints, and sensors; (2) both pneumatic and electric tendon actuation systems; (3) optically based sensors that detect touch; (4) subcontrol systems that provide internal management of the DH; and (5) preliminary higher control systems that supervise general operation of the hand during execution of tasks and that provide integration of vision and tactile information. For more details contact: S.C. Jacobsen, J.E. Wood, D.F. Knutti, K.B. Biggers at the Center for Biomedical Design, Department of Mechanical and Industrial Engineering, University of Utah, Salt Lake City, Utah 84112.

Micros meet micro-organisms

Biotechnology is being revolutionised from its roots in baking and brewing to become a modern industrial resource. At the heart of this development is the University of Wales' Biotechnology Centre Swansea, UK - the major biotechnology research and development centre in the principality. It provides an interface between academic research and industrial practice, and it has helped to convert South Wales, once the bastion of heavy industry, into one of the UK's strongest biotechnology bases. "We've had to overcome biologists' general reluctance to apply new technology to their processes;" explains Dr. Rod Greenshields, director of Biotechnology Centre Wales (BCW). "However, we're convinced that electronics lessens the cost of experimentation and simplifies procedures. Even more important is the way computers control processes automatically. Research is often undertaken in remote locations, but our 'computer control of biological systems' project enables us to monitor those experiments from home. Such research has just been awarded a grant of £20,000 from the Department of Trade and Industry's Biotechnology Unit. We're fortunate that the grant is being allocated, because the Government has placed a moratorium on spending on innovation."

Commodore computers, BBC Micros and an IBM Personal Computer are used to control BCW's fermentation processes. (The IBM PC was won in a recent competition designed to find innovative applications for micros). Computers are far more accurate than traditional biological instruments, says Greenshields. They also enable a range of processes to take place simultaneously, such as indicating a micro-organism's acid/alkaline content, measuring the amount of gas within it, analysing how oxygen is stored within the bug and recording results.

An example of such an application is using a BBC Micro to monitor Greenshield's Malima fast fermentation system. This is used to recover waste metals from water. Metal tolerant microbes, such as the fungus Aspergillus, absorb the metals from a dilute solution within a fermenter. As the waste metal becomes embedded in the fungus the water is purified, and the BBC Micro indicated when this process is complete. The solid biomass is then ready for burning, during which the metal is recouped. Cadmium has already been successfully recovered by this technique, and BCW is now investigating its potential for conserving rare metal wastes such as gold and silver. From BBC Micro link up to integral microchip: BCW felt that the natural successor to Malima was a fermenter containing its own microprocessor. A prototype already in operation in the laboratory is due to be handed over to a national company next month. Originally six pieces of equipment were linked to a fermenter to control its process. In the prototype everything takes place in one unit.

Last year BCW established a subsidiary company, Eidawn Fermentation, to manufacture a range of fermenters complete with built-in micros. Circuit boards and software are being developed at University College Swansea's (UCS) microprocessor centre and, as there is only one other UK fermentation company in operation, the potential for growth is high. The fermenters will be sold at £3,000 each. With anticipated sales of 100 a year, a revenue of a third of a million pounds a year is expected. A new generation of automated fermenters is also being developed. These enable long distance monitoring to take place, so that scientists in Swansea can observe fermenters in action 150 miles away. A BBC Micro in Wales is interfaced with a Case modern computer which can send a signal down a telephone line. The signal is received by another modem linked to the microprocessor inside the fermenter. As a result the process is observed in action, modifications can be done where necessary and results can be summoned immediately. The system also has the added advantage of monitoring itself so that an engineer can be called immediately a part breaks down.

It is a joint venture between BCW, which constructed the hardware. Dr. Roger Marshall, a programmer at the University of Wales College of Medicine who developed the software, and a Cardiff biotechnology company, Cardiff Laboratories for Energy and Resources (Clear). Specialising in anaerobic digestion, the company uses fermenters to convert food and animal wastes into methane and pure water. The methane is used on site to fuel generators and produce electricity.

"By 1986 we will have developed the technique sufficiently to control fermenters in other countries," claims Greenshields. "The potential for growth is especially high in the Third World, and we're anticipating establishing a fermenter base in Pakistan. Automatic links will be established between them and Britain. The micro within the fermenter will interface with a Case modern computer in Pakistan. Then the signal will be fed down a telephone line to a local radar centre. From there it will be beamed via satellite to the British radar centre at Goonhilly Down. From there it will travel down a British Telecom line to the modem at Swansea, and the results of experiments taking place in Pakistan will be stored on our IBM Personal Computer." It is also anticipated that the technique will be sold to the US. As well as having sufficient remote locations to warrant automatic control, the telephone links are good. Greece and Egypt are other potential markets.

Back in Wales, BBC Micros are also used to check the accuracy of biological instruments. Probes are often unsophisticated and they have a tendency to wear out quickly, so the Micros are programmed to detect probe breakdowns and to correct any inaccuracies in their measuring. Finally, BCW is creating a biotechnological data base for Wales. In order to extend the IBM Personal Computer's memory capacity, it is to be upgraded into a minicomputer for this work thanks to a co-processor developed by University College Swansea's Microprocessor Centre. The database will include all biotechnological companies working in the principality, together with the type of equipment they use and the projects they're investigating. Academic research being undertaken at the University of Wales will also be featured so that companies interested in developing a specific aspect can link up with any academics cur-ently engaged in that field.

The bioelectronics project being undertaken at University College Bangor's Microbiology department is an example of database material. Bioelectronics is a study of the electronic properties of molecules. Such research could lead to the Development of new types of sensors for non-invasive diagnosis in medicine. This will enable cells to be examined at a distance thereby preventing any damage being done to the cell itself. It's also anticipated that there will be numerous spin-offs in the computer industry. Protein molecules are highly intelligent, and it's envisaged that a new generation of microchips will be made from those molecules. Cells naturally perform a range of tasks such as hormone production, nitrogen fixing and transforming molecules from inert to active substances. Scientists, however, find that the biochemical reactions are expensive and difficult to produce on a large scale. But after discovering the electronic properties of molecules they plan constructing hardware which will simulate the molecules reactions effectively.

Biotechnology is also active in the food industry. Clear is engaged in automatic monitoring of food production lines to ensure that food remains free from contamination. This project, funded by an £84,000 grant from the Department of Trade and Industry, is a joint venture undertaken with the British Food Manufacture Research Institute at Leatherhead. "A prototype machine able to detect microbial contamination in food will be developed by the late summer," according to Clear's managing director, Dr. David Stafford. "Monitoring in Britain will be done via BBC Micros, with IBM Personal Computers interfaced with the detection machine for international sales. We anticipate that 60% of our sales will be to the US." Software is being created at three centres: Clear, Thorn EMI and Candella Systems of Pangbourne. This process, with applications in the pharmaceutical as well as the food industry, has a potential world income of £3 billion.

<u>An inexpensive microcomputer system for solar radiation data collection</u>

Craig Peterson and Peter Lehman of the Department of Environmental Resources Engineering, Humboldt State University, Arcata, CA 95521, U.S.A. and Ronald Zammit, Department of Physics, Humboldt State University, Arcata, CA 95521, U.S.A have designed a simple and relatively inexpensive microcomputer system for compilation of an accurate solar radiation data base. The system is designed to transmit data to a large mainframe computer for permenent storage. This allows end-users easy access to the data along with statistical software packages usually available on large computers. The system takes readings of horizontal global solar radiation at five minute intervals throughout the day. The data are then adjusted to yield units of W/m^2 and are permanently stored on a DEC PDP-11 minicomputer in the university computer center.

Hardware requirements

The radiation sensor used is an Eppley Model PSP Pyranometer. This instrument outputs an analog signal of 10.56 microvolts per W/m^2 of incident radiation. The microcomputer consists of an S-100 data bus and six boards. These include a Z80 CPU, a real-time clock, 4K bytes of RAM, 2K bytes of ROM, an amplifier, and an analog to digital converter (A/D). The calibration of the amplifier and A/D determine the range of data the system is capable of measuring. At Arcata's latitude of 41°N, the horizontal, global clear-sky irradiance reaches a maximum of roughly 955 W/m^2 [1] at solar noon on 21 June. As a precaution against atmospheric effects which may increase the measured insolation at the earth's surface, the A/D's maximum digital output was set equal to 1016 W/m^2. This assigns a value of 8 W/m^2 to each bit of A/D output. The amplifier was then set to properly match the pyranometer output and the A/D input.

Software requirements

The microcomputer is programmed in machine code. This eliminates the need for a disk drive associated with the use of a higher level language. The machine code software consists of two sections: a data collection loop and a data transmission section. The program runs in this loop most of the day, collecting solar data and storing them in the microcomputer's 4K of RAM. At the beginning of each five minute interval, the program enters a small internal loop. Entrance to the loop is triggered by detection of either a five or zero at the clock's minutes port. Five insolation data are then input and summed. The sum is multiplied by eight to yield units of W/m^2 and divided by five to give an average. The input of five data and their subsequent division serve to reduce noise. The resulting datum is stored in RAM. Only when an input from the clock's days port indicates that the date has changed does control pass to the data transmission section.

The code program uses a serial port on the CPU card to transmit characters to RSTS, the PDP-11's operating system. The code program logs on to RSTS and runs a BASIC program called SLDT which inputs data and places them in a file. Inside the microcomputer, data are pulled from RAM, converted to ASCII code, and sent out the serial port one at a time. The memory pointer is used as a flag to indicate when all of the day's data have been transmitted. At this point, the code program transmits a minus one which tells the BASIC program that there are no more solar data. Two final data which represent the date are transmitted, and SLDT terminates. The code program then logs off RSTS and returns control to the data collection loop.

Conclusion

Timeshared minicomputers such as the PDP-11 cannot easily collect real time data. By using the system just described, in which the tasks of data collection and data storage have been separated, this problem is circumvented. The inexpensive microcomputer system collects data while its connection with the larger computer allows facile data retrieval and manipulation. (Solar Energy, Vol. 34, No. 2)

EEC body claims language initiative

A Common Market body is about to come up with a "major breakthrough" in computer-based language translation, following years of development work on Systram, a machine translation system, by the EEC's Inter Institutional Information Services. "It can now translate documents from English into French, English into Italian, English into German and French into English. Within a year it will be able to translate a variety of other community languages." The service is based on a computer in Dublin accessed through a terminal in Brussels.

One translation example from French into English read: "After the first studies undertaken since 1983, the specifications under development envisage the setting in place of a new budget management system and accountant facilitating the functions of director, of controller financial and accountant, and intended to put management tools at the disposal of the various persons in charge and end users". Operators are still having to do "some tinkering" to come up with the best translations. (Computing the Newspaper, 14 March 1985)

The new Oxford Disktionary

In 1989, the second and last printed version of the Oxford English Dictionary will be published. The OED was begun in 1884 and completed in 1928, with two several-volume supplements being brought out since. Currently, its 60 million-odd words are being typed into IBM-PC Juniors by more than 100 housewives in Florida as the OED goes digital. By 1990, the OED's publisher, Oxford University Press, hopes to have the complete dictionary available on one or two optical disks. If disks of sufficient capacity (to hold two gigabytes of data) are not available, the OED will go on-line via a database in the interim.

As reported last month, optical disks should be in production by then, and available cheaply enough to make the OED a realistic proposition for all schools, libraries and even private buyers. That, in itself, would be reason enough to computerise the dictionary. But the benefits will be much greater, as the sort of cross-referencing impossible in the printed form involves no more than a few key strokes at the computer. And not only will the OED be easy to update and reference, it will be considerably easier to add to as the publisher intends making it more visual and, in the longer term, a complete encyclopaedia. It will probably become the single most important work of reference in the English language - and the most accessible.

And Doomsday on micro

A project of similar proportions is currently being carried out on an even more hallowed tome as almost one million people, mainly school-children, partake in the BBC's Doomsday Project.

The original Doomsday Books, which will be 900 years old in September 1986 (when the new project is due to be completed), was a unique survey of the lands of Britain.

The digital version will be a two volume optical disk covering a macro- and micro-economic, geographic and statistical view of the UK, complete with maps, census, trends and local and national counts of many natural and man-made features such as telephone boxes, ponds, hospitals and hotels - complete with a selection of photographs. About 10,000 schools are involved in the survey: each is assigned to cover an area of about 12 square miles, gathering all the detail and writing the pen pictures from which this "people's database" will be partly constructed.

The finished product will be available for use with the BBC microcomputer and a Phillip's video disk unit, although it should also be fully interactive and available for use with other computers. (Technology Ireland, June 1985)

Revolutionary communications system for Third World

Two Ottawa men, working with teams in the US and Britain, are attempting to build a low-cost high-powered communications satellite to help transmit messages to help people in development projects in the Third World. The satellite, called PACSAT, is being modelled after an experimental computer now in orbit that was built largely by Larry Kayser, a manager for Bell Canada data networks, and Hugh Pett, a micro computer expert for the federal Department of Supply and Services. With the launch of PACSAT in 1987, a field worker will be able to ask agricultural experts thousands of miles away for help simply by typing a message into a battery-operated, lap-style computer attached to a radio transmitter. The answer can appear on the worker's computer screen the next day.

The project was co-ordinated through the space science program at the University of Surrey in Guildford, England. Volunteers in Technical Assistance (VITA), a private, US non-profit organization that helps to solve technical problems facing the people of developing countries and the Radio Amateur Satellite Corporation (AMSAT), a non-profit group of radio "hams" active in amateur space communication, were involved in its development. Mr. Kayser had been a "ham" radio operator who built parts for amateur satellites for many years before he became interested in using his skills to help Third World development. In 1981 he was asked by a VITA member to help build a computer that would revolutionize communications in the developing world. He was joined by Hugh Pett in August 1983.

Once in orbit, the computer in PACSAT is expected to have many uses, all aimed at improving communications in the rural Third World, where the lack of roads, telephones, electrical power and transportation services limit the effectiveness of development projects. Some of its more important uses include: greater and quicker access to technical information from experts; aid to local and international development agencies in monitoring the progress of their projects and keeping in touch with workers and farmers; and improvement in relief efforts in drought-stricken areas by co-ordinating the shipment of food and reporting information.

The satellite will be operated on earth by "ground stations", each consisting of a small personal computer, a simple transmitter-receiver the size of a portable radio, and a vertical antenna. Each station will be portable and battery or solar-powered. (Canada Weekly, 5 June 1985)

SOFTWARE

Software for genetic engineers

Genetic-engineers in need of versatile simulation and analytical capabilities will be interested in a computer software toolkit developed by Battelle-Northwest. The CAGE/GEM™ software toolkit incorporates computer-aided design and human factors engineering techniques with a choice of relevant genetic engineering databases. CAGE/GEM™ stands for Computer-Aided Genetic Engineering/Genetic Engineering Machine. The toolkit can reduce costs in nearly any industrial application in which genetic engineering is involved. Potential applications include food and agriculture, petroleum, pharmaceuticals, and chemical engineering industries.

CAGE/GEM™ gives genetic engineers a level of expertise that was previously unavailable. Scientists can use it to simulate and analyze the dynamic relationships between genetic elements and DNA sequences. This is seldom provided by conventional computer programs used in genetic engineering. ... (Battelle News, No.42, April 1985)

UK software lab scheme hinges on Alvey aid

Pending Alvey funding, the UK is to have its first centre for the study of the foundations of software engineering. The department of Computer Science at Edinburgh University is hoping to set up a Laboratory for Foundations in Computer Science. According to Professor Robin Milner, the venture will require a £5m investment over 10 years. The Professor hopes that Alvey will provide £1.5m of that.

This type of work has been going on at Edinburgh for 10 years, but now, said Milner, industrialists are really getting interested, hence the need to expand. The funding would go towards employing administrative staff, finding a new building and doubling the amount of researchers involved to around 50. Joint projects will be carried out with industry, and there would also be an industrial membership scheme which would allow people to come into the laboratory to take part in courses. (Electronics Weekly, 13 March 1985)

Chinese and Americans team up to make computer programs

Shanghai Software Consortium is perhaps the first of its kind in the computer industry. Based in San Francisco, USA, headed by an American, and employing 40 full time Chinese programmers in Shanghai, China, the company creates software programs at very low costs. The year-old firm expects to gross $6 million this year, selling programs that are 50 percent to 60 percent less than what U.S. firms would charge for comparable work. In addition to the president, there are five other Americans who supervise the programmers, provide customer support and liaison in China and the U.S. The software programs are mainly games and financial packages. (Industrial World, May 1985)

Software turns AT into AI machine

Anyone who wants to get involved in artificial intelligence but can't find the $50,000 to $100,000 for a Lisp machine will soon have an under-$10,000 alternative: an IBM Corp. Personal Computer AT and a software package. The software that will make it happen should be out in August, says Gold Hill Computers Inc. of Cambridge, Mass. The package contains an expanded version of Gold Hill's GCLisp interpreter, a GCLisp compiler, and impressive documentation, including text books and a user's manual. GCLisp, for Golden Common Lisp, is the firm's implementation of Common Lisp, a popular AI language getting serious consideration as a possible common dialect by AI practitioners. Common Lisp was designed by a large, diverse group of people affiliated with many universities, research institutes, and companies. Many firms have adopted it and are offering it now.

Gold Hill's superset of Common Lisp will address up to 16 megabytes of physical memory available for the PC AT. With the software, users can take full advantage of the machine's computational and memory-addressing capabilities, which are underutilized in many applications. PC ATs or compatibles with at least 3 megabytes of memory, a big-capacity hard disk, an Intel 80287 math coprocessor, and a color monitor are the recommended configuration for this poor man's AI machine. The GCLisp LM, as the new expanded version is called, provides a complete programming environment for the design and development of fairly large Lisp-based AI applications. The new GCLisp compiler will be used to reduce the run time of a completed program. Gold Hill suggests a single-unit retail price of $695 for GCLisp LM and $495 for the compiler. (Electronics Week, 25 March 1985)

European firms join up to aid Unix V

Six major European suppliers have given a boost to the portability of Unix System V by signing an agreement on future co-operation. The agreement, which was prompted by ICL, covers the development of a portable System V application development environment which will effectively increase several times the total market for any conforming application product. The signatories are ICL, Nixdorf, Siemens, Philips, Olivetti and Bull. The development work will be carried out without full time staff, but Keir Hopkins, head of ICL network services will chair the group. ... (Computing, 21 February 1985)

The students' choice for commercial computing

Established computer companies may have to change their ways because of the popularity of a piece of software called Unix, which enables their customers to run programs on different makes of computer. Up to now computer firms have dictated the way their more powerful computers are used because the programs they run have to be designed to fit in with the operating system, or master program which runs the computer itself. Each company designed its own operating system which was different from those of its competitors. But thanks to the enthusiasm of undergraduates in the US for an operating system called Unix produced in the late 1960s by Bell Laboratories, part of the American telecommunications company AT&T, the computer world is well on the way to adopting Unix as a standard operating system. The undergraduates liked Unix because it was easier to produce programs with. Unix was originally designed to help Bell's computer scientists run up software quickly and get access to it on a mini-computer shared by a group of scientists. Once they left university the students persuaded their employers to buy Unix. One of the key features of the operating system is that it has a so-called shell which enables programmers to create blocks of code which can be linked to each other and summoned by simple commands. Writers of programs do not have to hold an entire program in their heads and can play around with the separate elements that go to make up a complete program.

Because Unix was not owned by a computer manufacturer (at the time, AT&T was prevented by law from selling computers), it was adapted to run on many different types of computer. AT&T virtually gave away copies of Unix to academics. Unix was originally developed for mini-computers made by the Digital Equipment Corporation. Now, there is hardly a major manufacturer which is not committed to provide Unix with its computers. Most recently, IBM announced its plans to bring in Unix for a number of its machines.

The operating system is likely to be most widely used on powerful microcomputers. Unlike existing standard operating systems for microcomputers, Unix is what is called a multi-user operating system. That is, it runs systems shared by a number of users. In addition, Unix can cope with systems in which several programs are run at once, a set up called multi-tasking. Initially, Unix was ill-equipped for commercial computer use. There was no way of preventing unauthorised users getting at the system, for instance. Since then AT&T and other firms that sell Unix have improved the operating system, although it is still criticised for its lack of ability to cope with graphics and for the poor instruction manuals that accompany it.

AT&T is now pushing Unix hard. The company is trying to persuade the computer establishment to standardise on its latest version of Unix, called System V. In Europe, six computer firms, including Britain's ICL, have agreed to cooperate on developing programming aids for System V. ... (This first appeared in New Scientist, London, 9 May 1985, the weekly review of science and technology)

ROBOTICS

250,000 industrial robots for US

The robot market is finally taking off. US industry will buy some 250,000 industrial robots over the next ten years, about 60,000 of which will be able to "see", according to a new report. Prices of robots with vision capabilities, currently around $150,000 each, will fall rapidly, it is predicted. The report notes, however, that early robot vision systems have been plagued by reliability problems and design bugs, and vendors will continue to encounter considerable buyer resistance. The report, from International Resource Development of the USA, identifies fifteen serious contenders in the market for robot vision systems, and says that, although the market is finally taking off, there are far too many vendors aiming at it. Only about $20 million worth of robots were actually ordered last year, with about an additional $15 million being shipped. Delays in acceptance and payment are commonplace, and the report predicts that this will be the death of some smaller suppliers. General Electric, General Motors and IBM will soon buy out or push out most of the smaller firms as the market expands.

Most of today's vision systems use TV cameras or Charged-Coupled-Device scanners (CCDs), with the output passing through image and data processing systems. The robot's performance is strongly determined by the power of the signal processing electronics. The more simple signal processors need floodlighting or backlighting to enhance contrast between the work object and the background, but newer systems can work in ordinary sun or electric light. These developments are largely due to advances in image processing chips - most notably by NCR - and the vision capabilities of robots are expected to improve greatly over the coming years. (Electronics Report, Ireland, 17 June 1985)

Consumer-goods giants aim at Robotics market

Some of the biggest names in consumer electronics are under the spell of another potentially huge market - industrial robotics. Panasonic Industrial Co. led the way last year with the introduction of its Panarobo line of assembly robots. At the Robots 9 show in early June, a half-dozen other consumer electronics giants announced their entry into the U.S. industrial robotics market. Some are shooting at familiar targets, such as Nikon Instrument Group with charge-coupled-device cameras for visual inspection. Others are aiming for new sectors - Sony Corp., for example, with its high-speed robot for printed-circuit-board assembly...

Dieter Dowald, product specialist for automation technology at AEG Telefunken in Seligenstadt, FRG, stresses that his company is "not looking to fill a particular void in industrial robotics, but simply sees the overall market getting bigger, which makes room for us, too. And it's better to establish a name while the field is still growing."... Telefunken is stressing the ability of its inspection equipment to work in a factory's ambient light, which Dowald admits is more a carryover from the company's experience in military vision systems than in consumer electronics. But when a product must be manufactured and distributed in quantity, the company's experience in the consumer market and its recognized name will come into play, he says.

Sony is using its in-house experience in assembling components for video equipment to break into the U.S. assembly-robot market. Says Henry Otsuka, manager of Sony's production technology center, "We're actually aiming at two markets: one is in the area of light assembly for a variety of small firms; the other is in pc-board assembly." Otsuka believes a potentially large demand exists for simple, low-cost robots among companies whose products require the manipulation of relatively large components. Automotive subcontractors, for example, who assemble subsystems such as windshield wipers and dc motors, may form a ready market.

The intrinsically more challenging area of pc-board assembly is a new one for Sony, but the company's experience with cameras and TV equipment may give it an advantage over other robot firms that must integrate the required visual sensing from outside vendors, Otsuka says.

Jeff White, a marketing manager with NEC Corp.'s broadcast products division takes a more cautious approach than Otsuka. "For now, we just want to sell our cameras to systems integrators," says White. "We tried to get into the U.S. robot market a few years ago and it didn't work, so we're sticking with a product we know." Like Nikon, NEC is marketing its CCD cameras for visual inspection, but is also taking them a step further by seeking out original-equipment manufacturers who will apply them as robot sensors. White stresses that NEC robots are big in Japan (and NEC will be promoting a new line of them at the International Robotics Show in Tokyo this September), but that it won't be until next year that they are introduced into the U.S.

Market figures from the Robotics Industries Association, which sponsored Robots 9, support this analysis: sales of industrial robots to U.S. factories in the first quarter of 1985 were up almost 60% from a year ago. (Electronics, 17 June 1985)

Robots invade chemistry labs

Chemists invariably are fascinated when they see a robot manipulating flasks and test tubes. Some are excited by the prospect of automation taking over the tedious job of sample preparations, while others worry about losing their jobs to automatons. Little wonder, then, that laboratory robots, busily working at a dozen booths during Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, attracted throngs of chemists. They already employ computer power extensively to evaluate data developed during analyses of products manufactured in the chemical, pharmaceutical, food-processing, and petrochemical industries. Now they think it's high time to automate the tedious job of preparing samples.

Robots designed for analytical lab instrumentation systems differ considerably from their more popular cousin, the industrial robot used for printed-circuit-board assembly and for mechanical tasks on auto assembly lines, explains William Buote, vice president of research and development at Zymark Corp. of Hopkinton, Mass., USA. Industrial robots, he goes on, typically have placement precision of 0.01mm or better, but 1 mm is adequate for manipulating most sample preparations. And Buote adds, a 3-lb load is about all that is needed to move test tubes and containers from one work area to another. Another difference is in the software. Zymark has installed over 300 of its Zymate robotics systems during the past three years, says Buote, for such applications as polymer testing, trace-metal analysis, food analysis, and blood tests. A key reason for this success, he claims, is the menu-based EasyLab software that is designed for chemists rather than computer specialists.

At the conference, Zymark displayed a fully automated titration system - which automatically weighs, dispenses, and dissolves samples in the form of powders, oils, or liquids - interfaced with a Mettler Instrument Corp. DL40RC titrator. The robotic controller automatically selects potentiometric, amperometric, or colorimetric titration and then combines data (such as weights and volumes) from the sample with the titration results.

GCA Instruments and Equipment Corp., Chicago, USA, demonstrated its GCA/DK robot preparing a sample, weighing it, and conveying it to a GCA convection oven. Designed for biohazardous and radioactive environments and for the industrial lab, the system uses an IBM Personal Computer to communicate with the robot and collect data at various stages of the analytical tests. Other applications of robotics on display at the Pittsburgh conference were the automated Plasma II inductively coupled plasma-emission spectrometer from Perkin-Elmer Corp., Norwalk, Conn.; automated liquid handlers for diluting and dispensing from Gilson Medical Electronics Co., Middleton, Wis.; and a sample distribution and preparation system from the Hamilton Co., Reno, Nev., for handling molecular liquids.

Costs for laboratory robotic systems range from $6,000 for a liquid dispensing system to $30,000 and more for a complete set-up such as the one offered by Zymark. The investment pays for itself in fairly short order, maintains Gregory Wurst, of Tecan U.S., Chapel Hill, N.C. The payback for a $48,850 investment in a robotic pipetting station for a laboratory that serves a 680-bed hospital should come in less than three years, he says. For a large reference-lab installation, which would also cost close to $50,000 for the sample-preparation robotics, payback will come in less than 1.4 years, says Wurst. Zymark's Buote estimates that payback for robotics in the quality-control laboratory of large pharmaceutical firms could be realized after only weeks of operation. (Reprinted from Electronics Week, 11 March 1985, (c) 1985, McGraw Hill Inc. All rights reserved)

Robots in the construction industry

How robots and other automation technologies are and will be used in the worldwide construction industry is being studied by researchers at Battelle Memorial Institute's Columbus Division. The two-year study is intended to determine the impact on manufacturers, suppliers, contractors, architects, engineers and workers of automating both building and non-building construction sites, and is being supported on a group basis by a number of companies. According to Battelle's Rolland B. Guy, who heads the study team, focus is on mechanical robots that can be programmed to do a variety of tasks, ranging from laying bricks to spraying fireproofing materials. Also, researchers are examining use of remote-controlled equipment and partial robot control innovations, such as employing computer technology to relieve machine operators of selected tasks. The Battelle team is now identifying types of available equipment and factors influencing their use. Later, it will project growth of construction robots through 1995 in six countries - the United States, Canada, Federal Republic of Germany, Sweden, England and Japan. (Reprinted with permission from Industrial Engineering magazine, February 1985. Copyright Institute of Industrial Engineers, 25 Technology Park Atlanta, Norcross, GA30092)

Robot and laser cut auto part

The industrial robot's role on the production floor will be upgraded to "process manager" when a robot starts trimming dashboard components with a laser at a Ford Motor Company plant in Saline, Michigan, USA. Cincinnati Milacron (USA) is providing, on a turnkey basis, a robotic laser work cell for Ford to replace manual tasks of washing and trimming plastic dash components. A Milacron robot will control all processes within the cell, including the power of the laser and the speed, feed and position of the part during cutting. The output of a 500-watt CO_2 laser will be varied almost instantly, upon command from the robot, to trim off two layers of material without penetrating a substrate. According to Bob Bannister, manager of advanced robotic applications at Milacron, this is the first time that a robot shall control and process a part. Previously robots have been relegated largely to a reactive role, or used simply for material handling. This is also the first time, Bannister points out, that a laser has been applied in what had been a relatively low speed production environment, replacing conventional hand tools.

Development of the cell began with the Saline plant's automation engineers, who studied the hand trimming process then being used on two components: an instrument cl.ster pod and glove box door. Two layers of foam and vinyl were being carefully trimmed away by hand after the parts were molded. It was a time consuming process. The uniformity of the parts was only as good as the skill of the person doing the trimming, and a mistake could result in a scrap part or minor injury to the operator. The Versa-Lase V500 is a 500-watt, variable power, carbon dioxide laser made by Photon Sources of Livonia, Michigan, USA. The V500 is especially well suited to the trimming application because of its ability to deliver instantly a variable-power beam upon command from the robot. The power supply establishes voltage gradients that assure instant response to starting commands, even at maximum gas flow rates and current levels. The beam is circularly polarized, so energy absorption by the processed material is uniform, regardless of the direction of the material's movement under the beam. A power panel functions as the voltage distribution center to the laser, as well as the logic control center for interfacing with the robot's computer. The inc..sion of a digital-to-analog converter (DAC) in the control system enables much more of the robot's computing power to be tapped in the Ford application than is ordinarily used. The DAC allows the robot's computer to continuously adjust the power of the laser to match the speed of the part manipulation under the beam. The result is a uniform c.. every time, as well as complete control flexibility.

The complete work cell is programmed for two operations on two parts: washing and trimming for both the instrument cluster pod and glove box door. The cell can easily be programmed to handle other parts. According to Moore, even before the system is launched, additional parts (a steering column cover and an instrument cluster pod extension) are planned to be trimmed by this cell. In operation, an attendant puts an untrimmed part in a staging nest. The robot picks up the part and automatically programs the wash and dry booth and laser, based on the part it senses. The part is inserted in the wash booth and the robot manipulates it through both washing and drying sequences. This results in a better wash than was achieved before because the spray from the stationary nozzles now reaches into the tightest contours of the formed parts. After hot air drying, the robot moves the part into the laser booth for trimming. Afterward, the part is placed on a conveyor. The trimmed parts are highly uniform, with the robot holding tolerances to .010 in., compared to the manua operation. For more details, write Cincinnati Milacron, Industrial Robot Division 215 S. West St. Lebanon, Ohio 45036 USA or Circle No. 352. (Industrial World, May 1985)

COUNTRY REPORTS

Australia: $170m recommended for IT industry

A report to the Federal Government has recommended a $A170m five year national strategy to promote Australia's commitment to the information technology industry. The report, carried out by consultant W. D. Scott and Co., warns that without a Government-backed programme, Australia will slip further behind with lost opportunities for both local and export sales. Government aid, the report says, would enable a doubling of production and establish a total market worth up to $A6bn a year by 1992. The report was handed recently to the Minister for Science and Technology, Barry O. Jones, who said a comprehensive strategy is urgently needed to establish new job-creating high growth industries. Under the programme the Government would contribute a total of $A130m in funds with the remaining $A40m coming from the industry. It is believed this would lead to increased production of $A10.5bn over a 10-year period. Also put forward was a five point plan to give greater opportunities to local companies, including measures to stimulate growth and innovation, improved government procurement policies and advanced infrastructure. It would also involve the establishment of an Information Technology Council to co-ordinate the initiatives and to set up marketing and information services as well as information and special graduate fellowships.

Currently local manufacturers have about $A1.4bn of the total work market of $A365bn for information technology. By 1992 the world market will have increased to about $A800bn and without any action Australia's share will be about $A2.9bn. Implementation of the report's findings should lift Australia's share to about $A6bn by 1992, with $A1bn to $A3bn coming from the local market and the remainder in export sales.

The report took more than a year to complete and it knocks down the idea that Australia can hope to compete with other established countries in this field without specific assistance. It has identified several obstacles to growth in the sector at present including shortage of trained personnel, the small local market, and the low level of R&D. Another barrier to export sales identified by the group was the ultra-conservative attitude on the part of governments toward local products.

Coinciding with the release of the report Jones launched the prototype of a superchip which will be able to house the equivalent of 100,000 transistors. Developed by the Commonwealth Scientific and Industrial Research Organization's (CSIRO) VSLI design group in Adelaide, South Australia, the chip is powerful enough to recognize the simple human voice commands and direct other devices to carry out specific instructions. In a bid to commercialise the technology locally, a new company, Austek Microsystems Pty Ltd. has been set up by the former staff of the VSLI group. The company's director, Dr. Craig Mudge said several companies in Silicon Valley, California and Singapore have already expressed interest. (Electronics Weekly, 15 May 1985)

CAD design project benefits Australia

The Federal Department of Science and Technology will fund the development of a VLSI CAD workstation package aimed at providing local electronics companies with an inexpensive tool for designing their own LSI and VLSI custom chips. The department anticipates that the system will be particularly useful for the design of LSI and VLSI chips of low to medium density for specific industry applications. It can also be used for general purpose high density devices. (Semiconductor International, February 1985)

New Canadian centre to promote IT collaboration

An International Collaboration Assistance fund, run by the Department of Communications has been formed to secure for Canadian organisations an opportunity to promote work in Information Technology (IT). The Fund will provide $1m per year to private and public bodies for the international exchange of information and scientists, and is to promote joint research projects. The growth of IT systems generally is thus to be encouraged. (Outlook on Science Policy, Vol. 6, No. 12, (c) Science Policy Foundation).

French to furnish advanced IC technology to China

In order to win its recent contract to supply 500,000 telephone lines to the People's Republic of China, the French Government agreed not only to grant preferential credit terms but also to furnish advanced integrated-circuit technology aimed at the production of some of the key components required by the associated digital exchanges. According to both government and industry sources, the French have agreed to adapt the CIT-Alcatel E-10 exchange to operate with the Motorola 68000 microprocessor in place of its standard Intel 8086 chip and then to furnish the Chinese with a microelectronic research center capable of pilot production of a 3-micron n-MOS process compatible with the 68000. (Electronics Week, 29 April 1985)

China's plan for high tech

The key areas of activities identified for effective computerisation in China are:

- Develop the computer industry and application techniques, not primarily to save manpower but to improve the efficiency of operation and management of industrial enterprises in China the total of which is more than 400,000.
- Expand the software industry and improve the software development environment through better tools.
- Increase the number of software development units from the level of 30 at present to several hundred in the next 10 years.
- Maintain contacts and co-operation with the western world to develop export markets for software.
- Strengthen computer service organisations to keep pace with the manufacturing industry (the aim is for manpower in this activity to grow to one third of those engaged in the entire computer industry).
- Develop Chinese language information processing systems to speed up utilisation of computers and development of the computer industry.
- Improve computer training facilities in quantity and quality. This will receive top priority.
- Encourage the import of advanced technologies and promote technical exchange with other countries.

The historical perspective

China's present IT industry has facilities for computer development, production utilisation and maintenance in most of its provinces, municipalities and autonomous regions, except for Tibet. Specialised computer and peripheral production units have been set up. There are eight R and D establishments, 111 factories and 13 software consultancy houses. The total turnover in 1983 amounted to approximately $400 million - an increase of more than 70% from 1982. Well over 5,000 microcomputers and minicomputers and mainframe machines were manufactured in 1983. The production of portable calculators during the year exceeded 3.3 million units. Over 14,000 computer peripherals of various types were produced. By the end of 1983, there were over 4,000 large scale, medium scale and small scale computers and well over 30,000 microcomputers in China. Of these, fewer than 700 were imported.

China was an early starter in modern computing technology: its first computer group was formed in 1952. The Institute of Computing Technology, Academia Sinica (Ictas) was founded in 1956 as part of the 12-year development plan for Chinese science and technology. Work on the development of an electronic computer started in the late '50s. The first computer was developed jointly by scientific institutions and user organisations and was ready in 1958. The second generation started with the 109D, a transistor based machine built by Ictas in 1965. The Shanghai Institute of Computing Technology built an integrated circuit machine called the 709 in 1971. Ictas completed a 180,000 instructions per second machine called the model 111 the same year. These two machines marked the beginning of the third generation of computers in China. Work on computer families started in 1973 with the so-called series 100, a family of minicomputers. The first member of this series was completed a year later. The DJS 200 family of minicomputers was developed later. These machines were adaptations of models popular in the western world and were compatible with them. The DJS 200 machines used the same system software and could take full advantage of the standard software freely available for such machines. The advent of these machines brought about significant advances in computer production and utilisation in China.

Ictas completed the model 757, a vector processing machine capable of 10 million floating point operations per second (megaflops) in 1983. Building this machine took about eight years. The first Chinese supercomputer, the Galaxy, was also completed in 1983, with a speed of 10 megaflops. China became one of the few countries in the world to build supercomputers.

China has also been very active in research and development in various areas of pure and applied computer science. China has begun to provide software services to the rest of the world. Starting with data entry services it has moved up into export of applications software. Work on the development of microcomputers was started in 1975 in China and the first generation Chinese-made microprocessors were available in the late 1970s. The Chinese strategy centres on copy adaptation backed by strong local development efforts. Today, they even have a 16-bit IBM PC compatible micro, the New Great Wall 100, which also supports Chinese character processing. (Computing, 11 April 1985)

Japan is winning China's massive market

China is fast being seen as the potential market for industrial exports as mature markets elsewhere are becoming over-supplied. The prospect of more than a billion people demanding a more sophisticated lifestyle is irresistible to export-hungry companies. But, in spite of valiant efforts, such as the recent British trade mission led by Lord Young, the EEC's trade with China has been falling. US companies have fared better, but their performance has been patchy. The main beneficiary has been Japan. Japanese exports to China last year reached a record $7.2bn - nearly 50 per cent up on 1983. Meeting Chinese needs is breathing new life into state-of-the-art and well-established products from Japan and into several company's balance sheets. Most branches of engineering have been affected - from automotive to chemical production - but electronics most of all.

A survey published by the authoritative Japanese newspaper Nihon Keizai Shimbun shows that, of 43 Japanese firms questioned, all expected to significantly increase exports this year - by an average of about 60 per cent. Hitachi estimated its China trade would be up 68 per cent. This is not wishful thinking, as a string of firm orders testifies. In the first few months of 1985, Fujitsu secured a telecommunications order worth £100m for 30 digital switching systems. These will be installed in the Chinese cities of Jiangsu, Zhujiang and Fujian, probably by the end of 1987. And Toshiba has been awarded a contract to supply a 10-unit air traffic control radar system.

The Chinese have been eager to get hold of highly sophisticated Japanese technology. Sanyo and Fuji have just closed a big deal to supply amorphous silicon solar cells to China, which is trying to consolidate a network of stable industrial power supplies throughout the country.

Tokyo Keiki is in the process of selling the rights to its ultrasound scanners. It expects to give the Chinese enough expertise to produce about 100 scanners a year out of the deal, worth initially £1.6m.

But the largest market is consumer electronics, and the biggest sellers are colour TV sets: 2.8 million in 1984, a probable 6.5 million this year, and an estimated 10 million in 1986. Refrigerators and washing machines are also expected to be explosively growing markets.

Small wonder then, that the big Japanese electronics conglomerates have been attacking this market with gusto - and profiting from it. Hitachi, for example, earned about £200m in China in 1984 and will probably boost this to £450m in 1985. (Electronics Weekly, 24 April 1985)

Europe plugs chip image

A more favourable climate for European chip start-ups is on the way, says Matra Harris Semiconductor strategy boss Jean-Claude Reuflet, although there have been more than 50 chip start-ups in America during the last seven years against only three in Europe. Reuflet counts the three European start-ups as Inmos, Matra-Harris and Mietek in Belgium. He regards the Scottish start-up Integrated Power Semiconductor as an American start-up. Three catalysts are working to make European trading conditions more favourable for start-ups, says Reuflet. They are: changed attitudes of workers; changed attitudes of capitalists, and changed attitudes to nationalism.

The third attitude is crucial. "The European market overall is significant enough to support semiconductor start-ups," explained Reuflet, "but for a start-up to succeed it has to be international from day one. If you can immediately set up a sales network in Europe, you're OK. But in the past nationalistic feelings meant that Germany did not see a French source as a European source but as a French source, and being a French source impeded its sales in Germany." That attitude is changing believes Reuflet. "It's difficult for Europeans to overcome nationalistic feelings," he said. "Without them there would have been more start-ups. But conditions are now changing. Companies realise they have no chance if they do business only in their own countries. They are moving to make markets more European and less nationalistic."

A second catalyst was, said Reuflet, changing aspects of the manufacturing process. "The labour content in semiconductor manufacturing is coming down," he asserted, "and social attitudes to weekend working and nightwork are changing." Matra-Harris works its plants 24 hours a day, seven days a week. That is particularly important in the chip business where, said Reuflet, 65 per cent of the cost of a product lies in the manufacturing process.

The third catalyst promoting a favourable European climate for start-ups was, said Reuflet, a perception among capitalists that the chip business is a good investment. "I think capitalists in Europe now are more tempted by the return in the semiconductor business than they were 10 years ago," he said. Asked which chip product areas he thought a European start-up could profitably address, Reuflet said that he thought that the non-volatile memory market was too small, and that "America and Europe have lost to the Japanese in dynamic RAMs," but that the static RAM market was one that could be suitable for European companies. (Electronics Weekly, 9 May 1985)

EEC to consider parallel project

A £10 million centre for parallel computing could be operational by 1986 according to a proposal submitted to Esprit from Reading University. The proposal is supported by more than 20 companies, universities and research organisations. "We have had positive responses from Philips, Matra, Racal, British Telecom, Bull, Hewlett Packard, various universities and from the German laboratory GMD, in Bonn," said Reading's Dr. Philip Treleaven. "We have also had encouragement from the Alvey directorate, the French Research Council and the European Centre for Medium Range Weather Forecasting in Reading."

The proposed facility would have 64 tightly linked processors with a total power in excess of 500 million instructions per second. The Racal Norsk KPS has been named as one European-built processor that could be used as a building block. Switching circuits would allow the machine to simulate the wide range of parallel architectures to suit both number crunching and artificial intelligence. Programming languages would be Lisp, Prolog and Fortran.

Similar parallel computing test beds are being built at the Massachusetts Institute of Technology and at Japan's Icot Research Institute. Nothing of the kind yet exists in Europe. Longer term research in parallel computing may use Transputer chips. (Computing The Newspaper, 28 February 1985)

EEC's RACE project gets go-ahead

The first year's work on one of Europe's most ambitious ever high technology projects is set to get the go-ahead. The project, Research and Development into Advanced Communications Technologies in Europe (Race), could cost the EEC as much as £400 million to £500 million over the next five or six years. Its main aims are to lay down the specifications for an integrated digital broadband network spanning the whole of Europe, and to rationalise the development of major communications strategies and systems, including digital telephone exchanges which have cost Europe billions of pounds to develop over the past decade.

The Race project has been a touch and go initiative ever since it was first mooted in 1983 and won the approval of Viscount Davignon, the EEC commissioner for Europe. Right up to last week, three nations, which sources refused to identify, were set to pull out of the whole project unless concessions were made to fit in with their approach. Now a timetable has been set, along with a provisional budget, which, if all goes well, will lead to Europe truly entering the digital age. EEC officials believe the project is one of the most important ever undertaken by the Community. As one official put it: "The project is essential for European telecommunications, it is essential for European information technology, it is even crucial for the whole of the European economy."

Not surprisingly, there have been months of intensive political and technical effort just to get Race this far. Countries such as the UK are particularly concerned that there is no unnecessary spending or subsidising by the EEC, which is of course experiencing enough financial difficulties already. One of the arguments which brought the EEC countries into line was the sheer waste and expenditure which has already gone into telecommunications and which is likely to be repeated over again if action is not taken to avoid duplication. Europe, for example, has spent £6.7 billion on the development of digital telephone exchanges (not including Ericsson, the Swedish manufacturer), compared with expenditure of $3.5 billion by the US and Canada and $1.6 billion by Japan. Moreover, as much as $350 billion is likely to be spent by the national communications carriers (PTTs) on developing an infrastructure for telecommunications over the next 10 years or so. If only a small percentage of duplicated work is stopped then Race will have paid off.

The current timetable for Race is as follows. The European Commission is due to ratify the proposals for the first year's work this week. This work will cost an estimated £27 million, to be split between the EEC itself and industry, including national PTTs as well as major suppliers and consultants. For the first year it is proposed that studies will be undertaken into every aspect of standardisation of telecommunications, from wall sockets to value added networks, computer file transfer and cable transmission speeds. The scale of the work can be seen from the fact that the study period alone is expected to involve 350 man years effort.

EEC officials are anxious that even at this early stage the whole scheme must be seen to have commercial and realistic objectives - a condition which is certain to have been laid down by the UK Government if not most others. A public document is expected to be released soon which calls for all interested firms to state ways in which they feel they may be able to contribute to the projects. "The idea is that it must not be a bureaucratic effort but a fast moving industrial effort," said an EEC official closely involved with the project.

The next step is for the whole plan to go before the European Council of Ministers, which must agree to the funding. Sources indicate that Karl Heinz Narjes, the successor to Viscount Davignon as industry commissioner, has smoothed the way for the project at this political level, at least for the first year's work. Narjes has put Race forward for discussion in June. By late this year, initial work will have been defined. It is expected that most of the work will take place at different national locations and there will be no central laboratory at the EEC level.

By mid 1986 the EEC must do two things. It must get a second round of funding approved - something which, while not guaranteed, will prove easier after the first year's work - and it must decide what work is to go into Race proper. Following this, demonstrator projects will get under way, to produce implementations by the early 1990s. After this, the telecommunications companies will be incorporating the work into virtually every digital communications project in which they become involved, right up to satellite transmission.

The scale, and the benefits, of the work should not be underestimated. The whole of Europe's telephone network is at present unstandardised, built primarily on analogue switching systems and an increasingly outmoded cabling system based on twisted pair telephone wires. In fact, the system is on the whole so out of date that the telecoms companies will have to replace wiring anyway. It is therefore important that this opportunity to standardise be seized while it is still there. By use of enhancement techniques, it is possible now to send high speed data down a twisted pair line, but the technical limits are being reached. Even the latest developments, such as BTs integrated services digital network, using fibre optic cable, is essentially a narrow band system and will not prove flexible enough for future developments.

The EEC, while enthusiastic about such narrow band digital networks, foresees they will have to be superseded. Rather like the EEC's fifth generation project, it is trying to look beyond the emerging generation. "The idea is to start building from 1995. We are trying to build a conceptually more advanced system," said an EEC official. To do this, of course, it is necessary not only to identify every existing standard that might possibly have a part to play, but, moreover, to oversee how each national PTT and supplier implements these standards. (Computing The Newspaper, 14 March 1985)

Finland: new European source for silicon wafers

A third European source of merchant market silicon wafers is being set up. Based in Helsinki, Finland, it is called Okmetic, and will be managed by former Texas Instruments executive, Immo Seppanen. The firm will be the third European source in addition to Wacker and Dynamit-Noble. Although two other silicon crystal-growing operations are being set up in Europe - one by the US concern Monsanto and the other by the Japanese firm Shin-Etsu - it is expected that Okmetic's first production, planned for the second quarter of 1986, will be out before the other two get started. ...

Okmetic is supplying wafers with special oxygen contents, with special thicknesses, and polished on both sides if required. It also intends to sell wafers with the epitaxial layer on them, ones prepared for dieletric isolation processing, and, perhaps, ones where the carbon content is controlled. "Maybe carbon will become important," said Seppanen, "when the role of carbon is understood, which at the moment it isn't." Okmetic's expertise in crystal-growing derives from 10 years of research and development carried out at a Helsinki technical unversity under the direction of Professor Veikko Lindoors. That research has now proved successful to the point where commercial exploitation is thought likely to succeed.

Backing the operation with 83 per cent of the $10m required capital is the Finnish mining company Outokumpou. Nokia is putting up the rest. Seppanen reckons he'll need a headcount of 20 people to get to the break-even point for the operation at one million wafers a year. Okmetic will produce Czochralski wafers which are the more commonly used of the two different methods of growing silicon crystals. The other is called Float zone. Initially Okmetic is selling 4in. and 5in. wafers but will go to 6in. Target price for 4in. is about $10 and for 5in., $15. (Electronics Weekly, 13 March 1985)

India ponders tie-up to manufacture DG minis

India's Government is considering a deal between Data General (DG) and an Indian company to build DG minicomputers in India. This would be the second biggest such deal for DG in south and east Asia. The company has already signed a contract with China to open a plant there. Under the proposed deal, full computer systems and peripherals would be built by a company which already develops and exports software for DG.

Several computer companies have been excluded from the Indian market since legislation was passed in the 1970s with the aim of controlling the flow of foreign currency out of the country. IBM withdrew from India at the time rather than hand over a majority share of its Indian subsidiary to Indian ownership. ICL has remained in the country with a joint venture. ... (Computing The Newspaper, 14 March 1985)

Japan focuses on basic research to close the creativity gap

To the Japanese, scientific research has always been something that was easier to buy abroad than do at home: Japan became a formidable industrial power by brilliantly imitating and refining technology that it acquired from the West. Now, however, Japanese industry leaders have come to the sobering realization that licensing the research of others will not assure them a leadership role in advanced technologies in the future. As a result, they are launching a massive effort to develop a high-tech research base of their own. NEC and other Japanese manufacturers have completed more than 25 new industrial research laboratories during the past two years, up from just one in 1982. And this year, 15 more new labs will be opened. The new labs are tackling problems in virtually every area of cutting-edge, high-tech research. Hitachi Ltd.'s new lab, which will open in April, will look into the still far-out possibility of building so-called biochips, computer circuits made of biological molecules instead of silicon chips. And a facility that Canon Inc. plans to open in April will concentrate on artificial intelligence, computers that someday will be able to mimic human thought. Other companies are working in ceramics, robotics, electrically conductive plastics, advanced electronic materials, and the life sciences. And nearly one-fourth of the new labs are working in biotechnology.

Spurring the buildup in research is the nagging fear on the part of many Japanese executives that they have reached the end of an era. There is no longer a vast reservoir of technology in the U.S. and Europe that they can tap. The pace of research is accelerating, and the turnaround time for technology to move from the lab into commercial products is getting shorter than ever. At the same time, many of Japan's competitors are becoming less willing to license their technology. U.S. companies "are no longer interested in stabbing themselves in the back by giving up their technology to Japanese competitors," observes William V. Rapp, commercial counselor at the U.S. Embassy in Tokyo. To wean themselves from foreign technology, Japanese companies are beginning to jack up their R&D budgets. Last year, Japan increased the money it spent on R&D by more than 10% over the $24 billion the nation laid out in 1983. And spending for R&D is expected to rise at the same rate this year, topping $30 billion. "Even though we didn't know where we were going, we realized we had to hop on the bus quick," says Teruhisa Noguchi, director of Suntory Ltd.'s Institute for Biomedical Research.

Also climbing on the funding bandwagon is the Japanese government, which has played a smaller role in paying for research than has the U.S. government. About 70% of Japanese R&D spending comes out of industry's pockets, while American companies pay half the bill. But late last year, Japan's Ministry of International Trade & Industry unveiled plans for a $48 million program to encourage joint research projects between companies. And Japan's Education Ministry is already funding a program that allows industrial scientists and their academic counterparts to collaborate on government-sponsored research projects. Some 64 of these co-operative efforts were in 1984, and 140 more are planned for this year. ...

Japan's current emphasis, as a result, is almost entirely on product-oriented applied research. Japan grants more patents than any other nation, but few of them are basic - that is, not product-oriented. And Japan lags far behind the U.S. in published scientific research. A Japanese government analysis of scientific publications showed that the U.S. published 25 times more papers in materials and surface science, six times more in computer science, and five times more in life sciences. "It is still a dangerous environment for research in Japan," says Kazuhiro Fuchi, director of research at the fifth generation project. "Japanese managers don't have patience for basic research." Faced with a high-tech labor shortage, Japanese lab managers are turning to two groups that until recently were notably absent from Japanese laboratories: women and foreigners. Women, for example, will account for 20% of the nearly 900 researchers hired this year by Toshiba Corp. to staff its new $88 million semiconductor lab. Japanese companies are also looking overseas in the hope that outsiders can help to offset the cultural problems that hinder Japanese research. "Technology is international, but culture is local," says NEC's Uenohara. The number of foreigners working in Japanese labs is still small, however. There are just 15 foreigners on the research staff at Fukitsu Ltd. and only two at Toshiba - and all of them are Asians. Indeed, most of the overseas recruiting is aimed at luring foreign-educated Japanese back home, while foreign nationals are hired on short-term contracts, usually six months to a year.

Even the Japanese consideration of such unorthodox approaches is proof enough that the winds of change are blowing in Japan. And some observers are convinced that the push into research is already beginning to pay off. Toshiba, for example, is a front-runner in the race to market a computer memory that can store more than 1 million bits of data on a single chip. "Ten years ago at the annual International Solid State Circuits Conference, the Japanese presented only two or three papers out of 100," says Masaharu Toyama, senior manager of Toshiba's lab. "At the conference in New York this February, Japanese will present 49 out of 109 papers, and the most interesting ones will be Japanese." In Sendai, a small country town north of Tokyo, a university-industry collaboration at Tohoku National University is publishing 50 scientific papers a year. In the past two years, it has seen five major breakthroughs in materials sciences, including transparent and electrically conductive ceramics. "There is no doubt in my mind that the Japanese are doing world-class research," says Charles D. Graham Jr., professor of materials science at the University of Pennsylvania, who is one of a group of foreigners spending a year working at Tohoku.

American observers in Tokyo see the science buildup by the Japanese as both good and bad for U.S. industry. The National Science Foundation's Japan office acknowledges the possibility of benefits from a closer collaboration between U.S. and Japanese scientists but warns that Japan's expansion will make that nation an even more vigorous industrial competitor. Comments the NSF's Owens: "I wonder whether we will be in a position to benefit from future Japanese research developments in the same way they benefited from ours." (Business Week, 25 February 1985)

Figure 7

NEW JAPANESE LABS: THE FIVE BIGGEST

CORPORATE LAB	OPENING	COST (millions of dollars)	RESEARCH
Toshiba VLSI Research Center	1984	$88	Semiconductors, including chips with more than 1 million transistors, and materials, including gallium arsenide
Matsushita Electric Semiconductor Research Center	1985	80	Semiconductors, including chips with more than 1 million transistors
Canon Central Research Laboratory	1985	28	Optics, electronic materials, and artificial intelligence
Meiji Institute of Health Science	1984	20	Medicines, including immunotherapy drugs
Snow Brand Life Science Research Laboratory	1983	20	Medicines using microorganisms and enzymes

DATA: BW

Japan takes lead in VLSI tech

The Japanese demonstrated continuing leadership in advancing VLSI techniques at the 1985 symposium on VLSI technology. Hot-carrier phenomena emerged as the area of greatest interest at this 5th annual VLSI meeting attended by 510 experts from around the world. Some 120 were from outside Japan. This subject, which deals with the control of highly accelerated charge carriers, has attracted much effort - it reduces reliability of devices that have submicron feature sizes.

While Intel Corp and Texas Instruments, Inc. described details of their most advanced processes - for 1Mbit DRAMS - a conference committee co-chairman admitted that the Americans were at least a year behind the Japanese. The Japanese also continued to expand on their pioneering work in device structures especially in the areas of trench isolation and stacked or 3-D structures. Identifying some of the device degrading factors due to sub-micron structuring has itself been a major advancement, revealing that hot-carriers in MOS devices and wearing phenomena in thin dielectrics are as important to understand and control as have been the soft-error problems created by Alpha-Radiation.

So far, the research reported shows understanding of underlying physical phenomena which allow modelling of the phenomena, and of the resulting degradation of reliability and circuit speed. But the fabrication techniques proposed to eliminate the problems have not been proven. Degradations of speed and reliability can generally be eliminated by reducing the DC supply voltage which induces them. But this voltage reduction also reduces the switching time as the device drive is reduced. And the switching threshold voltages are also reduced, thus shrinking noise margins. (Electronics Weekly, 22 May 1985)

Irish Government to create supply base

The Irish Government has chosen the electronics sector as the starting point for a national linkage programme which the Industrial Development Authority (IDA) has been told to develop. The aim is to develop a successful sub-supply base in order that native Irish companies can maximise their supply of raw materials and components to multi-nationals setting up in the country with state grants through the IDA. This is part of the Government's determination that the electronics industry should be well-rooted in the Irish Republic to prevent pull-outs which could cause large job losses.

A new development division has been set up within the IDA to implement the programme and Dr. Bill Chambers of Molex has been recruited to co-ordinate the multi-national and state agency input to the programme. A special linkage unit has also been established within the institute for industrial research and standards to provide technical support. Other state agencies are also working closely with the IDA under Government instructions. ... (Electronics Weekly, 29 May 1985)

Philippine chips going down the scale

The electronics industry, considered a bright spot in the 1984 Philippine economy, has little chance of maintaining its rapid export growth this year. Electronics products, mainly semiconductors, contributed almost 25 per cent of the Philippine export earnings last year as the industry grew despite the shortage of foreign exchange to pay for imported components. But after topping the list for the fourth year in a row in 1984, semiconductors face much weaker demand this year because of a supply glut in Western markets. Exports of electronics products in 1984 reached US$1.33 billion, up by 33 per cent from the previous year's US$996 million, preliminary data from the National Census and Statistics Office show. For 1985, however, semiconductor producers expect the glut to result in slightly lower exports with the possibility of resuming the growth in 1986. The oversupply of the semiconductors was traced to the euphoria of the world's personal computer manufacture - among the top customers of the Philippines - who went on a buying spree in the end of 1983 thinking that their market was unlimited. Huge orders placed by personal computer makers at the time encouraged the semiconductor assemblers to boost production capacities by margins that outstripped the demand by up to 25 per cent, says Mr. Cristino Concepcion, President and Chairman of Stanford Microsystems Inc. The market for personal computers, however, weakened and the computer makers finally cancelled their orders. He is confident, however, that the industry can survive this glut as he believes other sectors of the electronics industry will take up the slack while the computer industry is undergoing a shake-up.

The Philippine electronics industry - predominantly labour-intensive operations of assembling or packaging semiconductors using imported components - has come a long way since the establishment of the first two electronics firms in 1969. During the boom period of the early 1970s, more companies were set up. Soon American companies were attracted to establish operations in the country. To encourage more electronics multi-nationals to set up in the Philippines, President Marcos issued an executive order in 1982 granting various incentives to semiconductor companies. The companies were required to finance an industry-wide training programme.

Semiconductors have consistently been the top export product since 1981 when the industry expanded from 3.4 per cent of total exports in 1975 to 15 per cent to become the top export product for the first time. Since then, there has been no looking back for the industry till this present glut. The electronics industry currently employ 5,000 workers. Obviously the most glamorous products being turned out by the local industry are the memory chips for computers, particularly the state-of-the-art 256K chips. A wide variety of these chips are being manufactured every year for different applications.

There is considerable excitement in the industry over the possible expansion of production to upstream electronic manufacture. Some part of the industry, however, seems to be unhappy over the lack of initiative on the part of the government towards such an integration. Mr. Vincente Chuidian, Chairman of the Asian Reliability Co. Inc., noted that the government policy has shifted from encouraging subcontracting in the 1970s to attracting offshore manufacturers who can guarantee output levels. "The policy move should have been to encourage Filipino semiconductor companies to go into vertical integration because that builds up your technology, it protects you from the cyclical downturns of the market and it earns you more value added because chip assembly is the low man in the totem pole when it comes to value added," says Chuidian. He cites the examples of Taiwan, Hong Kong, South Korea and Singapore to strengthen his argument that upstream integration is not all that difficult. The industry is also affected by the current economic condition prevailing in the country, the increasing value of the Philippine peso against the US dollar, unpredictable political situation and the impact of lower investment outlays made by the US electronics firms on Philippine operations. (Far Eastern Economic Review, reprinted in Asia-Pacific Tech Monitor, January-February 1985)

Republic of Korea gears its shadow mask plant

The first operational South Korean shadow mask producing plant marked another milestone in the nation's burgeoning electronic industry. This makes South Korea the fourth country in the world after the US, Netherlands and Japan to produce shadow masks, a vital component of the colour TV Braun tube. The Gold Star Micronic Co. which owns the business is now capable of turning out 6 million units of shadow masks and save some US$10m which earlier went into their importation. The plant located at Kumi Electronic Industrial Estate near Taegu, is owned 50 per cent by Gold Star. Its other owners are Samsung Group, Orion Electric and two Japanese concerns.

The firm has plans to step up the plant's production capacity to 22 million units a year by 1988 to meet the country's growing demand for shadow masks and save some US$35m in foreign exchange annually. ... (Electronics Weekly, 15 May 1985)

Spain:

With 1 January 1986 finally settled as the date for Spain's entry into the EEC, the electronics industry is nerving itself to meet the challenge of common market competition. Among the first to comment publicly was the Government's director general of electronics and informatics, Sr. Joan Majó, who had some encouraging things to say. "Spain is joining a market of 320 million consumers with an annual growth index of 12 per cent," he said. He added that there should also be an important reduction in production costs because Spain would now have access to cheaper raw materials. "And the EEC has regulations about their origins," he continued. "For example manufactured products will now have to have a certain minimum of components produced within the community and since Spanish-made components will now come within this category this will clearly be an advantage to the industry."

Research projects like Esprit in informatics and Race in telecoms would also be a source of benefit. Every year the EEC was putting more resources into this activity, while Spanish firms like Standard Eléctrica, Intersoftware and Eria, as well as the Autonomous University of Madrid were already subcontractors under the Race project. In 1986 there was to be an increase from 1 to 1.4 per cent in each nation's contribution from funds raised by VAT and Spain would have access to the improved resources made available.

"But Spanish companies will only succeed insofar as they are prepared to meet new problems with a strategy of attack," Sr. Majó emphasised. His remarks had obviously been intended to counter a certain amount of pessimism from the trade association ANIEL (Asociación Nacional de Industria Electrónica). A spokesman for the association said that the removal of protection for the industry could have a very negative effect. Leaders of the industry were worried that the need for legislation on standards could not only cause an invasion of products from other EEC countries but might also result in Spain becoming a dustbin for their obsolete products. ... (Electronics Weekly, 15 May 1985)

State decision aids Spanish software

Spanish software is being helped by the Ministry of Industry's decision to define it as a product rather than a service. This gives the mainly small firms producing it certain financial privileges in the shape of favoured access to the Industrial Credit Bank. Much of its development costs also rate for special treatment under regulation on research and development, while further financial measures to help software growth are also under consideration.

Nevertheless, according to PEIN, the national plan for informatics and electronics, the annual growth in el soft, software, between 1982 and 1987 will work out at 33.1 per cent, while el hard will increase by 37.5 per cent over the same period. This is surprising in view of the oft-repeated opinion that Spain's best opportunities lie in software, not only because of the economic difficulties in trying to match Europe's hardware growth, but also because of the present tendency for the cost of programming to rise while hardware prices stay steady. However, PEIN's main indication on software is an increase in exports to South America, taking full advantage of the common language. In 1987 this figure is expected to reach Pta 1,700m by which year domestic consumption will be some Pta 36,100m. (Electronics Weekly, 29 May 1985)

An Italian in Singapore

SGS Semiconductor, an Italian microchip-maker, wants to employ as few expatriates as possible at its two Singapore plants. At its new $50m factory - the first in Asia outside Japan to design as well as manufacture semiconductors - the specialised work of designing chips is done by 12 Singaporeans led by one Italian, who plans to give way to a local within a year or so. The team was part of a group of 50 people who spent a year in Italy learning about the design and distribution of semiconductors. The four plant managers, in charge of 1,750 people, are all Singaporeans.

The Asian semiconductor market, excluding Japan, is worth more than $2 billion a year and is growing faster than any other in the world. Cracking the Japanese market is the next priority in SGS's worldwide strategy. In 1984, the firm sold $4m of semiconductors in Japan. For the future, there is the China market to dream of too. The company's chairman Mr. Pasquale Pistorio, says that Singapore will play an increasingly important part in its plans. More than half of all the chips, by value, made in SGS's eight factories worldwide are produced in Singapore. Singapore's advantages to SGS as a manufacturing centre include the obedience and low absenteeism of its workers. The new plant will operate for 8,100 hours a year, against 5,100 each of SGS's two Italian plants. (The Economist, 4 May 1985)

UK: computing beyond Alvey

Firms and officials involved in the Alvey Programme are already drawing up a blueprint for a "sixth-generation" version of the government sponsored computer research project. What comes after Alvey will be discussed at a conference of Alvey participants to be held at Edinburgh University. The programme is due to end in 1988 and those involved are keen to put proposals before government for post-Alvey support as soon as possible. Thinking is divided. Some would like to see a programme designed to nurture the research seeds sown by Alvey into full blown products. Others feel that the programme should seek out new areas of research thrown up by the present work or areas overlooked by the original programme. Notable absentees from Alvey's present programme include supercomputers and gallium arsenide, a semiconductor material. Whatever happens, smaller firms will lobby for larger grants. At present they get only 50 per cent of their research paid for by Alvey, the same as large companies. The small fry argue that this makes it difficult for them to participate in the present Alvey set up.

Meanwhile, the future for some companies involved in the scheme, may lie with Japan. The Alvey Directorate has sponsored a trip to Japan this week by five British firms - British Telecom, Thorn EMI, ICL, Systems Designers and Logica. Technical experts from the firms will meet their opposite numbers at some of Japan's largest electronics companies to discuss the possibility of technical collaboration. The Alvey Directorate has had several approaches about Anglo-Japanese collaboration from Japan's Ministry of International Trade and Industry (MITI), which runs the country's Alvey equivalent. But so far these overtures have met with a cool reception. The problem is that the Japanese want to talk with British academics rather than British companies. They argue that their own programme is not commercial because intellectual property rights to work done by ICOT, the prime mover in Japan's fifth generation computer programme, are held by MITI rather than those companies whose staff work at ICOT.

The Alvey Directorate prefer to keep their academics under wraps because the intellectual property rights to their Alvey funded work reside with the academics' industrial partners. "We can't cooperate with Japan until we've got property rights organised," says Brian Oakley, director of the Alvey Programme. "The Japanese tend to say they are a non-commercial programme and that they won't cooperate with industrialists." Industrialists on this week's trip, the first of its kind to Japan, will be spying out the land for technical get-togethers. In the main, British firms are offering software expertise in return for hardware know-how. ICL has already teamed up with Fujitsu along these lines, buying in Japanese chip and disk technology to go with its own software. ...

A report from the Lords Select Committee on the European Communities criticises the Esprit programme for information technology research for its lack of coordination with individual national research programmes and its failure to give smaller companies a fair crack of the whip. The report says that no clear guidelines have emerged to prevent overlap between Esprit and Britain's Alvey programme, and that giving Esprit money to large companies "is a possible misallocation of funds" because Europe's "big 12" electronics firms are "usually cash rich". (This first appeared in New Scientist, London, 16 May 1985, the weekly review of science and technology.)

Alvey cash for speech recognition

Alvey has earmarked £7.8m for the development of computers capable of responding to human speech. Last week the directorate announced the approval of nine projects in the Man Machine Interface (MMI) field, in addition to the Plessey large scale demonstrator on machine assisted speech transcription (MAST). Total government funding will be £5.8m, £1.1m of which has already been allocated to MAST. The projects include four on automatic speech recognition, one on speech synthesis, one on basic algorithms and three on feature extraction. The biggest slices of Government money go to GEC, Plessey, University College, London, Imperial College and Leeds University who win £1.33m for their work on speech interface and phonetic algorithm, and to British Telecom, Logica and Cambridge University with £1.2m funding for the development of a voice operated inquiry system (VODIS).

Whereas many of the projects are based on long-term research feeding into the large scale demonstrator, VODIS is expected to be commercially lucrative fairly soon. The initial system will take the form of a speaker independent train timetable inquiry service, operating over BT's private switched network. The most controversial of the projects aims to develop Chinese language synthesis and recognition in an effort to beat the Japanese to a potentially huge market. The work, funded to the tune of £99,000 is headed up by Sindex Speech Technology which is already marketing a keyboard input Chinese word processor.

The current device uses a typed-in representation of the language to get out Chinese script, but Sindex consultant, Paul Thompson, claims that the same software could be used for voice input. Besides the commercial possibilities, the system is expected to act as a test bed for the English language system. With only 40 syllables in all, he pointed out, Chinese is a good experimental basis for other languages. The directorate is also due to approve three more projects in the MMI field, two of which will concentrate the development of standards in speech input/output and on developing ways in which users can assess the potential of various systems. (Electronics Weekly, 29 May 1985)

UK: chip problems cast a shadow over Inmos

Inmos again seems to be heading into problems following announcements of staff lay-offs and troubles with its Transputer microprocessor. In March, Inmos had to sack 86 workers at its US factory and cut the hours of its UK workforce by a fifth as business dropped into the red. A week later, Inmos revealed to a user group meeting that it was having problems squeezing memory onto its unique parallel-processing chip, the Transputer, and that the part was unlikely to be generally available until next year. However, Inmos has grown used to unflattering headlines in the six years since it was set up with aid from the Labour Government then in power. Inmos suffered public criticism over the political nature of its founding and over its unwillingness to open factories in areas of high unemployment. It was also hit by a lot of in-fighting within the UK electronics industry. The company's latest problems of staff lay-offs and short time working are a result of an industry-wide slump in demand which is hitting memory chip makers like Inmos particularly hard. The company is losing money at the minute but could bounce back into profit equally quickly when the expected turnaround arrives this summer.

The continuing delays to the prestigious Transputer project could be more serious for the long term future of Inmos, however. The Transputer is the brainchild of Iann Barron, one of the three co-founders of Inmos. Barron wanted to bring advanced ideas for concurrent programming down to chip level. The Transputer will be able to break up a task to process several parts at the same time. Barron was originally optimistic about having the first of a family of Transputers out on sale by 1984. But that date has slipped forward to late this year for samples and 1986 for useable quantities. Some of the delay has been blamed on the success of Inmos's high speed memory chips. A huge rise in US sales last year meant Inmos's production lines were at full stretch trying to meet the demand and work on the Transputer was pushed aside.

But Peter Cavill, Inmos director of microcomputer products, revealed at a recent meeting of users of the Transputer software language, Occam, that there have been technical hitches too. Cavill said that the development team has had trouble squeezing memory circuits onto the Transputer and the first product will have to be a compromise.

Inmos had been promising that the first Transputer would be the flagship IMS T424 - a 32-bit machine that can run at 10 million instructions per second with 4 Kbytes of on-chip memory. Cavill said that the Transputer which Inmos will be sampling in the autumn will have only 2 Kbytes of memory and customers will have to wait until perhaps the first quarter of 1986 for samples of the 4 Kbyte IMS T424.

A lot of people have been waiting patiently to get their hands on Transputers and at least three university teams want them as the building blocks for fifth generation computer projects. This view was echoed by industry analyst, Jim Beveridge, of Dataquest, who said: "Among the people I've spoken to, the Transputer has a good reputation and is eagerly awaited - especially by signal processing people. It's a huge chip and for that reason people aren't surprised to hear of delays; problems have got to be expected. Even 2 Kbytes of memory will be a lot more memory than there is on standard microprocessors so it's a big job Inmos is trying to do," he said. "The problem for Inmos is seeking a marketing window and it has to get some sort of product on the market soon before interest dies or someone else comes out with a similar chip," he added. "It's more important that Inmos gets something out rather than holding back until the original design is working," continued Beveridge. There is also intense interest in the chip from military and consumer product designers who see the Transputer as a valuable tool for digital signal processing applications.

Dr. Chris Jesshope, of Southampton University, is waiting for Transputers to prove the design of a supercomputer-like Reconfigurable Transputer Array machine which is at the moment under development. He said that while it is disappointing that the first Transputer will only have half the promised memory, he believes he can make do with the chip. Jesshope said: "Obviously if people were expecting the full 4 Kbytes of memory, then it could upset their designs. But I think most people would like to have something to work with sooner rather than wait for a long time for the fully specified part," he commented. (Computing The Newspaper, 11 April 1985)

Scotland: Very Large Scale Integration

A new breed of electronics engineer is growing out of the Scottish electronic industry's orientation towards Very Large Scale Integration. The big names in the world semi-conductor market are in Scotland: Motorola, National Semiconductor, General Instrument and NEC of Japan. Hughes Microelectronics and Burr Brown are also in the field of wafer fabrication. According to the Scottish Development Agency, nearly $400m will have been spent on developing

Scotland's fabrication base by 1986. This area employs 4,500 people out of the 42,000 in Scottish electronics.

But semi-conductors present a problem. The sector is in the words of the trade, too much of a mono-culture. There is a lot of manufacturing and too little design work. Nearly 80 per cent of UK integrated circuit output is from Scotland. An impressive figure, but if the industry is to really make its mark, more work is needed in the design and application areas for the industry, the planners say.

Signs of change have emerged however, and the much-awaited specialised engineer has arrived on the scene. "We are trying to change a mono-culture into a multi-culture," says one of them, Dr. John Grey, managing director of Edinburgh-based Lattic Logic. The company, formed in 1982, developed the world's first silicon compiler, a system which converts a function worked out in terms of random logic into the patterns for producing integrated circuits. Five companies have followed Lattic into this field - all of them in the U.S. The company is small, with a turnover of about £500,000 a year and has produced a number of software programmes for use by semi-conductor manufacturers or other equipment manufacturers.

The custom chip, known as Applications Specific Chips (ASIC) spurred Wolfson Microelectronics to move out of Edinburgh University this year to go fully commercial. Wolfson, under Dr. David Milne, its managing director, offers micro-chip consultancy, contract development and plans to handle everything from design to sales for customers seeking relatively small volumes of specialised integrated circuits. Wolfson's future is based on projection that the special chip is expected to form one third of the market this year and up to 50 per cent by 1990 as the range of electronics and applications continues to spread. Wolfson retains its contacts with the microelectronics research facilities of Edinburgh University, although it is independent. Milne feels that whatever the vagaries of the semiconductor sales in the U.S., the market in the rest of the world will continue to grow "with varying degrees of dynamism." (Financial Times, 1 March 1985)

USA: investing in high technology research

Research and development is the life-blood of high technology companies. Without it they wither and die within but a few short years. Unless a high technology firm can spend an average 7% or more of its revenues on R&D it will have a very hard time keeping up with the rapid pace of innovation. In some high technology sectors such as integrated circuits the ratio is even higher. What's more the amount of funding required to perform R&D on increasingly complex microchips, systems and software is escalating rapidly and only the largest corporations can afford to engage in sufficiently thorough R&D programs. Even IBM, which is estimated to have spent about $3 billion on R&D during 1983, is probably beginning to realise that it may be impossible to continue this level of R&D expenditure indefinitely. Since IBM spends more on high-technology R&D than most major competitors combined any slowdown in its spending will mean new uncontested market opportunities for its competitors. On the other hand the cost of advanced R&D is becoming so high that few if any of the competitors could afford it even if they could peer through IBM's traditional secrecy to identify the opportunities.

As a result the scene is set for further growth and proliferation of high technology R&D Limited Partnerships (LP's). These are specialised investment vehicles for funding research and development for specific high technology programs without straining the resources of the corporations that will benefit from the results. Although relatively costly, an LP transfers financial risk to a general partner and does not affect the profitability of its parent. Typically a high-tech R&D LP offers a tax shelter to wealthy individuals and institutional investors who are prepared to finance one or more specific R&D projects over a number of years. Investors can offset up to 100% of their contribution against tax on other income and are later rewarded through royalties on new projects which are taxed at the 20% capital gains rates, or through conversion into company shares at an effective price considerably lower than the going market rates. (Electronics Report, (Ireland))

Survey of microprocessors in use in USSR

Paul Snell has carried out an extensive survey of USSR microprocessor technology. His main sources were the USSR technical journals listed below the table (Fig. 8). Snell points out that when the survey was carried out only journals up to the end of 1982 were available and only 8-bit and 16-bit chips were mentioned.

USSR literature mentions four main families of microcomputers. The Elektronika-60 (6) is a 16-bit machine intended for production control and data processing. It can be programmed in Basic or Fortran and uses K581 and K536 chips. The Elektronika-S5 (6), (7), has five basic models using mainly the K536 chips but with one model using the K586 single chip cpu. The Elektronika NT (6) uses mainly the K587 cmos chip series. But the NT-80-01 uses the K1801VE1 single chip microcomputer designed by the Central Scientific Research Institute. There is also mention of the SM1800 micro, a recent addition to the SM minis compatible with the PDP11. (Computing The Newspaper, 28 March 1985)

Figure 8

Model	Technology	Wordlength	Notes
K536	PMOS (1)	6	14 chip in the set used in *Elektronika-60* and Elektronika-S5 microcomputers
K580 (KR80)	NMOS (1)	8	10 chips. Based on Intel 8080 set
K581	NMOS (1)	8	5 chips. Used in same computers as K536
K582	I^2L (1)	4	Intended for use in bit slice configuration
K583	I^2L (1), (3)	8	Bit-slice, 13 chips
K584	I^2L (1)	4	Bit-slice, 4 chips
K586	NMOS (2)	16	9 chips
K587	CMOS (1)	8	Bit-slice. Patented in the West. Used in the 'NTs' microcomputer family
K588	CMOS (1)	16	5 chips
K589	TTL (4)	various	9 chips. Bit-slice. Based on Intel 3000 series
K1800	ECL (2)	4	Bit-slice. 4 chips
K1801	NMOS (2)	16	Single-chip microcomputer 3 chips in set
K1802	Schottky TTL (2)	8	Bit-slice
K1803	(NMOS?) CMOS (5)	? 4-bit	Single chip microcomputer, no data available
K1804	Schottky TTL (2)	4	Bit-slice. 8 chips

Sources: 1. Vasenkov, A A, *Mikroprotsessornye BIS i mikro-EVM. Postroenie i primenenie.*, Sovetskoe radio, 1980, pp14-18. 2. Vasenkov, A A, Shakhov, V A, *Mikroprotsessornye komplekty integral'nykh skhem, Sostav i struktura. Spravochnik.*, Radio i svyaz', 1982, pp178-87. 3. Balashov, E P, Puzankov, D V, *Mikroprotsessory i mikroprotsessornye sistemy*, Radio i svyaz', 1981, p294. 4. *Radio Fernsehen Elektronik*, Vol 31, No 5, May 1982, pp280-3. 5. Mozhaeva, N B, 'Mikroprotsessory v narodnom khozyaistve' in *Pribory i sistemy upravleniya*, No 12, 1983, p37. 6. Balashov, E P, Puzankov, D V, op.cit. pp307-16. 7. Kuznetsov, V Ya, 'Odnoplatnaya mikro-EVM "Elektronika S5-21"' in *Proceedings of the symposium on microcomputer and microprocessor applications*, Budapest, 17-19 October 1979, Vol 1, OMKDK Technoinform, pp41-47.

Zimbabwe eyes dp to help shake off third world image

Zimbabwe is trying to shake off its Third World image by using computers in the run-up to its first elections under black majority rule. Zimbabwe has the second largest economy in Africa and is growing at a staggering rate, but circumstances have conspired to leave it almost totally without computers. All this is about to change with foreign exchange restrictions being relaxed for computers and a major drive to train the local population to write software.

Computers in Zimbabwe have been in suspended animation for almost 20 years. When Ian Smith made the Unilateral Declaration of Independence (UDI) in 1965 it effectively cut Rhodesia off from the rest of the world. A few bureau services using NCR and ICL 1900 machines had been set up before UDI and these were destined to be the country's only computer resource for the next 15 years. International trade sanctions stopped all legitimate computer exports. Illegal trade was also restricted by the shortage of foreign exchange. Any spare money was reserved for black market oil and weapon imports needed to sustain the war against black liberation movements.

Not much has changed since independence in 1980. The Mugabe Government has imposed drastic foreign exchange controls to stop investment, principally to South Africa, flooding out of the country. The consequence has been that companies in Zimbabwe cannot buy computers unless they have an overseas parent willing to donate some foreign currency. A few have been able to get foreign exchange allocations to buy equipment but until recently this has been on a small scale.

One third of Zimbabwe's foreign exchange comes from tobacco exports and in recent years the world market has been in decline. Suddenly prices have started rising and production has gone up after the end of a three-year drought which means the country is set for a small foreign exchange boom. The Government has already said it has $200 million more than it expected - a proportion of which will go to buying computers. The Reserve Bank of Zimbabwe has already set up a special committee dealing with applications for foreign exchange to buy computers.

The biggest problem is software, which can prove a constant drain on foreign exchange resources and cannot be maintained locally. The shortage of skilled progr ammers is acute. Programmers on short-term contracts from the UK have been brought in but they have proved an expensive option as they will only work in Zimbabwe if they can repatriate their savings, another drain on foreign exchange.

ICL is by far the largest computer company in Zimbabwe. It has decided to tackle the software shortage with a major training programme for locals. Local companies can send their staff to ICL to be trained as programmers and pay for the courses entirely in local currency. The main benefit to ICL is the so-called 'reverse razor blade principle'. If there is a vast pool of people who can write software for ICL machines, the company will have an unbeatable edge in selling hardware. Unfortunately for ICL, profits cannot be fully repatriated but a large pool of profit can be accumulated to take advantage of any relaxation of exchange controls. It will also have plenty of capital to invest locally to combat the threat of other large manufacturers wanting to take advantage of Zimbabwe's opportunity. IBM is rumoured to be negotiating with the Government to enter the market soon.

The next largest company is C.F. Tulley which is an offshoot from ICL. Digital Equipment is represented by distributor Protea which is aiming mainly at the growing banking and corporate office market. Perkin-Elmer, Wang, ACT and NCR are also represented by local distributors and as yet most are on a small scale.

The Government has shown its commitment to using computers by using a machine to co-ordinate the electoral register. Zimbabwe is probably the only country in black Africa which has the potential to be a market for the western computer industry. (Computing The Newspaper, 28 February 1985)

STANDARDIZATION AND LEGISLATION

UN Commission on Trade Law adopts model law on international commercial arbitration (Recommendations to Governments to review legal rules affecting use of computer records)

The United Nations Commission on International Trade Law (UNCITRAL) adopted a model law on international commercial arbitration that could prove as significant for business relations and the law and practice of international commerce as the Commission's earlier work on arbitration rules. For developed countries it will be a valuable stimulus to reappraise their existing law and arbitration practices. For countries that have not yet worked out a comprehensive system of their own, the law and its associated commentaries will form a valuable basis for legislation. At the conclusion of its eighteenth session, which lasted three weeks and attracted legal experts representing 72 countries and international organizations, the Commission also made several recommendations to Governments to review legal obstacles to the use of automatic data processing, and it received the completed draft of a legal guide on electronic funds transfers.

The use of automatic data processing (ADP) is becoming firmly established in many phases of domestic and international trade. Legal rules, however, are often based on pre-ADP (paper-based) ways of documenting these activities and may thus create obstacles to the use of ADP - for example by leading to legal insecurity or by impeding its efficient use where it would otherwise be justified. UNCITRAL considers that, because development of international trade has not noticeably suffered despite substantial differences in the rules of evidence as they apply to paper-based systems of documentation, there is no need to unify the rules of evidence regarding use of computer records. Nevertheless it also considers that there is a need to adapt existing legal rules to the developments in the use of ADP, at the same time providing the same or better legal security as paper-based documentation.

The Commission therefore recommended four things to Governments: to review the legal rules affecting the use of computer records as evidence; to review legal requirements that certain trade transactions or trade-related documents be in writing; to review legal requirements of hand-written signature or other paper-based method of authentication; and to review legal requirements that documents submitted to Governments be in writing and manually signed. International organizations elaborating legal texts related to trade were similarly recommended to consider modifying existing legal texts in line with these provisions. (United Nations Information Service, 21 June 1985)

ISO, IEC join for IT action

The International Standards Organisation and the International Electrotechnical Commission are to join forces on a "total action" in information technology standards. The recommendations of an 18-month study urging the two to pool their efforts in the information processing arena will be considered by the IEC and the ISO. But in anticipation of approval by both sides a committee of experts has already been established to set down the boundaries of activity of the joint venture and to work out a framework under which it can produce the necessary standards as quickly as possible.

The Committee, due to meet for the first time in Geneva this July, is headed up by IBM's Director for Standards and Data Security, John Rankine, and includes members from the International Telecommunications Union, the European Computer Manufacturers Association, Siemens, Bull and ICL. Dr. Lawrence Eicher, Assistant Secretary General of the ISO: "The idea is to put the ISO and IEC work in one basket under a common planning and processing system. It will also make it easier to co-ordinate our activities with governmental standards work on the International Telecommunications Union side."

One of the initial tasks will be the rapid completion of the seven-layer Open Systems Interconnect model for communication between different information processing systems. Eicher pointed out that while the ISO's TC97 committee has, for some years, been involved in the information processing side, the emphasis of the IEC (the oldest international standards organisation) has traditionally been on the hardware side. With the much-talked about merging of all the different aspects of the industry, he pointed out, a merging of the two interests seems the only sensible way forward. (Electronics Weekly, 29 May 1985)

International standardizing bodies

The Directory of international standardizing bodies has just been reissued in its fourth edition. Internationally, ISO and IEC are the only organizations specializing in standardization. In addition, however, several other international organizations publish standards-type documents in their specific fields. The purpose of this Directory is to give systematized information on international organizations whose principal activity is not standardization but which nevertheless deal with standardization aspects and consequently may be seen as a complement to ISO/IEC technical work. The Directory gives details, where possible, of legal status, membership, field of interest and activities. The activities of each body in the field of standardization are stated separately - starting year, subsidiary bodies concerned, subject fields of standardization, liaisons with ISO, type and legal status of the documents established by each body. (ISO Bulletin, June 1985)

TC 97: Information processing systems

This field is obviously among the most rapidly expanding in the whole ISO programme. At a meeting in Paris a sub-committee engaged in projects for information retrieval, transfer and management for Open Systems Interconnection had over fifty individual technical documents to be progressed. These projects related to computer graphics, operating systems command and response language, database languages, Open Systems Interconnection architecture and management and standards concerning protocols within OSI. (ISO Bulletin, April 1985)

US chip standard looks set

The big US semiconductor companies have thrown their weight behind a standard chip design format to bring order to the semicustom market. The standard, electronic design interchange format (edif), is now ready for official launch and will simplify the design of gate arrays, standard cells and other semi-customised chips. Edif is based on ideas pioneered by Texas Instrument designers at Bedford in the UK during the 1970s. They developed standard interfaces for in-house work so chip designs could be portable across the many different computers used. In 1983, the major US chip makers decided a similar standard was needed by the semicustom market so design work could be independent of work station and supplier. Two of the biggest work station makers, Daisy Systems and Mentor Graphics, joined chip makers, Texas, Motorola and National Semiconductor, in setting up the Edif standards committee. (Computing, 21 February 1985)

Joint ventures to urge ai standards

Two initiatives are underway for the standardisation of artificial intelligence (ai) languages although comprehensive standards are not expected for several years. A number of US vendors, including Texas Instruments and Digital Equipment (DEC), are reported to be collaborating to establish Common Lisp as the standard version of the Lisp language.

Meanwhile, in the UK the British Standards Institute is forming a group that will investigate standardising the rival programming language Prolog. John Rance, general manager of Racal-Norsk, a joint venture between Racal and Norsk Data set up a year ago to develop ai tools, said: "The complexities of the languages means that it is far too early for American

National Standards Institute standards to emerge". Rance predicted that this would not happen for "several years".

In the US Texas instruments introduced the Explorer, a Common Lisp-based symbolic processing machine for developing ai applications, at the end of last year. The Explorer is due to receive its UK launch in the second quarter of 1985. DEC also brought out its first ai tools last year, including a Common Lisp compiler, for the VAX computers. Rance said that Racal-Norsk, which has just sold its first Lisp-based Knowledge Processors, is working on a Prolog-microcoded machine, to be available later this year. (Computing The Newspaper, 24 January 1985)

Lawyer to discuss US Software Protection Law

The Institution of Electrical Engineers held a meeting entitled 'Data and Software Protection: an American perspective'. Michael D. Scott, an American Attorney specialising in computer law discussed this issue.

Various legal devices offer some degree of protection to data and software; for example, patents, copyrights, trade secrets and confidentiality. None is generally accepted as being totally adequate, and yet the importance of protection is undisputed, particularly with the growing use of personal computers. In the United States, the tradition of more frequent use of litigation has produced a large number of court decisions and a number of these have been followed in other common-law countries, notably Australia and Canada.

Mr. Scott, as well as being a practising lawyer, has written extensively in this field and is the publisher of 'The Computer/Law Journal' and 'Software Protection' in the US. (Computing, 28 February 1985)

Computer copyright

Software firms are claiming victory in a campaign for amendments to the Copyright (Computer Software) Amendment Bill. The bill will for the first time protect computer programs in Britain. The Federation Against Software Theft, an industry pressure group, says it has persuaded the bill's parliamentary sponsors to insert a clause making it clear that a program becomes copyright as soon as a programmer's fingers hit the keyboard. It does not even have to be put onto disk or other method of storage. One other peculiarity of the bill is that it contains no definition of what a computer program is. Earlier versions of the bill did contain a definition, but this has been cut out to prevent it from being made obsolete by changes in technology. (This first appeared in New Scientist, London, 9 May 1985, the weekly review of science and Technology)

SOCIO-ECONOMIC IMPLICATIONS

The follwing two articles seem to present contradictory opinions but are in reality complementary. While both papers were written at approximately the same time, early in 1984, their authors come from different schools of thought. Dr. Ponnamperuma advocates that the impact of information, disseminated by advanced communication technologies, is paramount for developing countries and supports the concept of the barefoot microchip; Prof. Skolimovski discusses the problems of an information society which, in his opinion, neglects the qualitative aspect over the quantitative collection of information which may lead to encyclopaedic knowledge, but does not foster judgement, wisdom or enlightenment. Our readers may want to draw their own conclusions.

Basic Science and the Developing World

by Dr. Cyril Ponnamperuma*

The very concept of a centre for advanced technology, named after the most imaginative science writer and futurist, Arthur C. Clarke,** who resides in Sri Lanka, in what may perhaps be descibed as a technologically primitive society, supported extensively and

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enthusiastically applauded by many learned organizations around the world, is a forceful testimony to the importance of science at its very frontiers of knowledge in the developing world. The establishment of an institute of fundamental studies in Sri Lanka in the hope that, eventually, such an organization would take its place among premier world intellectual centres such as the Weizmann Institute in Israel, the Tata Institute of Fundamental Research in India, the Max Planck Institute in Germany, to name a few, is not simply a mere dream.

A despondent scientist once wrote about his own country: "We see our science in the aspect best fitted to make us contemplate the past with humility and the future with despair". He was then describing his own country where over a period of 17 years, only 22 doctorates in Physics would be awarded. It was almost prototypical picture of scientific underdevelopment. Yet, he was describing the United States of America in the year 1876. But he saw hope in the army of physicists who were just about to be trained. History, of course, need not repeat itself. Times have changed and few analogies can be drawn between the United States of a century ago, confronting a superior Europe, and most of the Third World of today where the ratio of population to resources is entirely different. Yet the case cited by Robert Kargon is pertinent. Science will grow, once a local scientific community has put down its roots. This is at the quintessence of our thesis on science and technology transfer for development. I am also reminded of the physicist, Professor Cecil Powell, arguing in the early 1950s for the support of basic research in Europe. At that time, the United States was vigorously moving into the field of high energy elementary particles. European physicists were trying to obtain support for a Common European Accelerator which, today, exists as C.E.R.N. "In the long run", wrote Professor Powell, "it is most painful and very expensive to have only a derivative culture and not one's own, with all that is implied in independence in thought, self-confidence, and technical mastery. If we left the development of science in the world to the free play of economic factors alone, there would inevitably result a most undesirable concentration of science and scientists in too few centres, those rich in science become richer, and those poor, relatively poorer." This was the picture in the early 50s with the United States now far ahead of the European community. The disparity that exists is infinitely greater between the developed and the developing countries.

As a point of comparison, we have started off with the United States versus Europe in 1876, and Europe versus the United States in 1950. Yet science was not always raised as an important factor in development. Soon after the Second World War, when the United Nations Organization was going to supersede the League of Nations, the League's International Institute of Intellectual Co-operation wanted to find a successor to their efforts. The conference of allied ministers of education had proposed a UNECO, a United Nations Educational and Cultural Organization - there was no "S" in it. It was only in response to pressure from scientists, particularly in the United Kingdom, to rectify such an omission that an "S" for Science was introduced to make it the United Nations Educational, Scientific and Cultural Organization. As one might have expected, Julian Huxley, the first Director-General of UNESCO, made up for any previous hesitation. He quickly harnessed the resources of science. UNESCO put down roots into a growing world scientific community and began to promote the growth of science and development among the poorer nations of the world.

The spectacular achievements of science and technology such as landing a man on the moon or understanding the basic processes of life itself, have given us perhaps a feeling of utter confidence in science. There has been a rising expectation all the world over and a feeling of euphoria that science might produce the utopia of the next decade or at least of the next century. It is a hope that has been mounting high among the developing nations. We must however realize that science is no magic wand to wave over a poor country to make it a rich one. Science is necessary, but the process of implantation has to be different. It has to be a long and protracted march. The science must become part of the very fiber of life.

Science and technology are indeed an essential part of development. It has been said that one does not apply one's lungs to respiration, or one's heart to the circulation of blood, nor one's legs to walking. If we regard science and technology as a crutch, it will, at best, provide a halting gait. If we regard them as a transplanted heart, they will sooner or later be rejected by the receiver. Science and technology has to be based on an understanding. It cannot be imported, nor regarded as an external entity. It has to be an integral part of the activities of a nation.

By way of an example we might cite the case of India. The founding of the Tata Institute of Fundamental Research in India in 1948 began a long history of development. From the Tata Institute to the IITs to the Indian Atomic Energy Programme and the Indian Space Programme, we see a continuity. A miracle has been witnessed in a developing nation where science and technology has reached a level comparable to that of the more advanced nations of the world and where the benefits to mankind have been staggering. India is self-sufficient in food; the agricultural results of the Green Revolution have brought it to a point where the wheat fields of the Punjab resemble those of Kansas. ...

We are today at a point where, ironically, the only chance of survival for a developing society may be the use of the most advanced technology. Like Alice in Wonderland, who had to keep running faster to stay in the same place, the developing countries have to jump forward in order to keep up with the advanced world. We have seen the process of leapfrogging taking place in many instances. Nations have bypassed the railroad and have gone directly from the bullock cart to the airplane. Vikram Sarabhai, one of the pioneers of the Indian Space programme, stressed the importance of leapfrogging obsolescent technologies and, in some cases, going straight to the advanced ones. In a celebrated speech before the first UN Conference on Space in 1968, he said: "A developing nation following a step by step approach towards progress is landed with units of small size which do not permit the economic deployment of new technologies. Through undertaking ventures of uneconomic size, with obsolete technologies, the race with advanced nations is lost before it is started ... developing nations ... have indeed an advantage through not having an existing major investment in older technology."

Nowhere is the impact seen as greatly as in the field of communication. The opportunities for development and the impact of information is paramount in this field. To many poor countries, satellites, paradoxical as it may sound, have become essential. Satellites will make it unnecessary to build the elaborate and expensive ground systems, required in the past. Indeed, to the developing world, satellites could be a matter of life and death. Unless major investments are made in Space, millions are going to die or eke out miserable lives, according to Arthur C. Clarke. Most of these millions will be in the Third World. Let me explain this paradox. Because the first Comsats were small and feeble, it was necessary to build huge, multi-million ground stations with dishes 30 metres across. That situation is changing with explosive speed. Now that there are larger and more powerful satellites, ground stations can be much smaller and cheaper. As a matter of fact, all over the United States we see roofs of houses sprouting 3-metre dishes picking up scores of programmes from the communication satellites hovering in the sky. Soon these dishes will be less than one metre in diameter. It means that, eventually, a few large satellites can provide any type of service with telephone, telex, television, data computing facilities at a low per capita cost to almost every member of the human race. The telephone, like the transistor radio, may be considered the birthright of every human being.

The concept of the barefoot microchip being introduced to the village directly is a powerful one. What the electric bulb was a hundred years ago, the microchip is today. Would anyone deny the benefit of the bulb to those who sit in darkness? Could we not say the same of the microchip in the case of those who sit in the darkness of ignorance? Jean-Jacques Servan-Schreiber, in his book "The World Challenge", suggests a global effort that combines the financial resources of oil-exporting countries and the technological expertise of Japan and the US to mount a microelectronics-led assault on world poverty. The Government of France has recently announced the establishment of a new world centre for microcomputer science and human resources. A team of at least a hundred of the world's top experts and social scientists will create a series of pilot computer assisted education projects designed for use in developing countries. The concept of the electronic tutor is at hand. Perhaps the impact will be as great, or even greater than the invention of printing. A whole library can be held in the palm of one's hand. These electronic books will speak, or teach, a foreign language. They have plugged-in programmes that will provide tuition in any subject. They will be able to work 24 hours a day. Of course, no machine can replace a good human teacher, but no country ever has enough of these. When electronic teachers are available, they will be in the millions. Electronics tutors will cost no more than the pocket calculator of today. Solar powered, they would need no batteries. Properly designed, they would probably never wear out. Their cost would be negligible and even the poorest countries could afford them. We are thus on the verge of a revolution which will be engineered to use the availability of information and information processing.

As an example of a success story, we might turn to the Indian experiment, SITE (the Satellite Instructional Television Experiment). The challenge to India was to devise a system which would quickly provide the coverage of rural areas. As a result of an early experiment with 80 villages around New Delhi, the development potential of TV was clearly established. Traditional expansion of TV involved beginning in urban areas and slowly moving outwards to the rural areas. This is described as trickle down approach, where the most deprived receive the benefits last. Such a model is contrary to the aspirations and needs of a developing society. The myth of the trickle down theory in television was destroyed by the availability of satellite technology. The leapfrogging method avoided the intermediate steps, provided coverage at one stroke to the remotest village. The Satellite Instructional Television Experiment which has been described as the largest communication experiment ever undertaken involved direct broadcast to 2,400 villages. Some of these villages were literally lifted from the Dark Ages into the twenty-first century. It was a phenomenal success. This monumental undertaking could be a model for the application of educational television via satellite to the rest of the developing world. It was interesting to note that in most of these instances, instructional television programmes are preferred to pure entertainment. The villages were hungry for information.

A few definite conclusions can be drawn from this. Communications can play a definite role in accelerating economic development in promoting the social image in education and improving the quality of life of the masses. Appropriate technology for a developing nation in this instance may turn out to be the most sophisticated satellite technology.

In the field of agriculture and the life sciences, molecular biology is giving rise to a major revolution. The gene revolution is fast overtaking the green revolution. Contrary to our previous beliefs, Mother Nature is often wanton and wasteful. Under the broad rubric of biotechnology, new efforts are being made in gene splicing, tissue culture, cell hybridization, etc. to make the biosphere yield not two-fold but perhaps four-fold. If these dramatic changes can be made, no one need to go to bed hungry in the 21st century. Further, these breakthroughs can come from the institutes and universities of the developing world. We may reverse the direction in technology transfer if one major breakthrough, for example in nitrogen-fixation, could be made in one of our research institutes in the developing world.

May I summarize these few thoughts by saying that we need a quantum jump. Leapfrogging is the key word. The science that we use must be our own; it has to be implanted right at the very beginning; it must become part of our life. Thirdly, the appropriate technology may be the most sophisticated one. We would have no fear of that. And, finally, I might add one word on the question of science management. Once again, it has often been said by many wise men that in the developing countries we have scientists and the brilliant people. What we lack is the proper science management. Perhaps a new breed of science managers, the scientists themselves who have become managers, would help to create this environment. (Asia-Pacific Tech Monitor, September-October 1984)

Information - yes, But Where Has All our Wisdom Gone?*

by Henryk Skolimowski**

Since everybody talks about the information society, surely it must be around. But I do not see any Information Society worthy of the name society. Like Diogenes I have searches with my Lantern in various nooks and crannies for signs of the existence of the Information Society as a new social form. My search has proved disappointing. Well, yes, I see a lot of computers around. But this does not make a new type of society. I hear a lot of loose talk about the information revolution. But this does not make a new society either.

If we live in the information society, why are we so poorly informed? The President is not informed. We are not informed - at least as to how to live our lives. Evidently more is required than bits of information which we can store in computers. All those billions and zillions of tit-bits, stored in computers, can help us but little. In my humble opinion what is involved and what is required is judgement, wisdom, enlightenment. You do not make your judgement sharper and more mature by acquiring more bits of information. You do not make your judgement wiser by acquiring more bits, of whatever sort. You make your judgement wiser by becoming a wiser person. You do not acquire more enlightenment by acquiring more computer programmes. You acquire enlightenment by becoming an enlightened person - not a reservoir of information (for encyclopaedias serve this purpose) but a source of light. In all the three instances: of judgement, of wisdom, of enlightenment we deal with new qualities.

The information society deals only with quantity. The information society does not know the meaning of quality; computers do not, at any rate. Hence the Information Society (based on computer information) cannot help us to acquire quality: of judgement, of wisdom, of enlightenment. Whatever number of computers you take, they cannot make a new society. To conceive a new social design, or to invent a new society is a task much more difficult than splitting the atom or inventing the steam engine. During the last millenium, especially the last two centuries, western civilization has shown its prowess in technical inventions. We cannot claim the same power of inventiveness in the social realm. The social legacy of

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* Lecture given on 28 March 1984, in the series: Educating the Information Society, sponsored by Eastern Michigan University.

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technological change is something that we should really ponder over. I am talking about those social innovations that came in the wake of technological change, or were induced by it, in recent times. It would appear that the only new social innovation of the technological society is the shopping mall and suburbia. They were created inadvertently. They happened by default. The shopping mall functions in a way similar to that of the well in traditional societies: it draws people from the entire surrounding area. But there is a difference. While the traditional well was a vital centre for the exchange of information, of sharpening of wits, and a real social school for living, the shopping mall is a monument to non-communication, it dulls the mind by the appalling uniformity of goods, and is a school of alienation.

Suburbia is like the village in olden times. But while the village taught self-reliance and fostered gregariousness and conviviality, suburbia teaches isolation, dependence on gadgets, and prepares the ground for appeasement by drugs. Technological change has produced undesirable social mutants: the atomised family and the isolated individual who is in touch with the world by touching buttons but cannot be touched by his neighbours or be in touch with himself.

It seems that there is a law that governs technological change: the more sophisticated technology becomes the more it disengages us from life. The question is whether the recent developments in electronics and computers are an exception to this law. Are we closer to life and to ourselves as the result of the information revolution? Will we be closer to life if each of us possesses a personal computer?

Yet, many people behave, or at least say, that computers in the 1980s will be what drugs were in the 1960s - an extension of the self. The other day I heard Timothy Leary - the high guru of the 60s - expanding this very view. And so completely was he sold on the idea that computers are smarter than us, and that we are entering the phase of complete symbiosis with them, that I was taken aback - until the interviewer asked Leary the question: "We seem to have an abundance of information. But wisdom seems to be in short supply. Will computers supply us with wisdom?" To which question Leary responded without hesitation: "Yeah, yeah. In five years we shall have wisdom programmes. For 39 dollars you will be able to buy a wisdom programme and play a wisdom game with the computer." At this point I knew it was all rubbish. If you think that you can buy a wisdom programme, you do not know what wisdom is all about; and perhaps you never will if you accept it on the computer's terms.

Thus there is a great deal of loose talk and often plain rubbish going on about the greatness of the coming age of the computer. When I listen carefully to those exaggerated claims, often just laughable, I am persuaded (in my soul at least) that if the information society means buying wisdom programmes, going underground to live closer to nature, having everything done for you by computers and robots - then I want no part of it. I want society that engages me with life, not eliminates me from it. The columinist Sydney I. Harris put it so well when he said: "The real danger is not that computers will begin to think like men, but that men will begin to think like computers." Perhaps we have already started doing that. Hence all this loose talk about the coming greatness of the Information Society.

In what sense and to what degree can computers make us freer? The possession of information does not make you free. Do we communicate better with each other when we have computers at our disposal? Hardly. The essence of human exchange is the capacity to empathize with the innermost states of other human beings as well as an exchange of emotions, visions, things that make us uniquely human; the kind of things that cannot be easily, if at all, translated into objective bits of information. Let us assume that each of us possesses a personal computer which helps us with everything we do. Would this represent an extension of our freedom? I respectfully submit that it would not. On the contrary it would curtail our freedom. Let me explain.

Freedom is equivalent to the ability of exercising choices not outlined for you but chosen by you. Freedom is the privilege of being at one with your human nature. The more structured the environment the less choices (in the genuine sense) we possess. The computerized environment will be highly structured; one of the most structured in history. So structured will it, in fact, be that from the standpoint of traditional freedom, a perfectly computerized environment will be a form of electronic prison. Every exchange will have to be performed according to the rules of the computers; no room for spontaneity, improvisation, quirkiness, the unexpected, the unstructured. Furthermore, you cannot have freedom without exercising responsibility. You cannot exercise responsibility if everything is done for you. Freedom is the capacity to act when your action springs from responsibility. Your responsibility is annihilated when you are an appendage to computers and robots; and so is your freedom.

Let us look at the concept of responsibility in the context of the Information Society, and see whether the Information Society is likely to enhance our responsibility, or on the contrary, stifle it. Responsiblity is one of the most peculiar concepts of our language, and of our moral universe. It is very hard to define; even harder to live without. There is no logical necessity, or even natural necessity to assume responsibility. Yet we render ourselves less than human when we do not assume it. Responsibility is one of those invisible human forces - like will power - for which there is no logical or natural necessity, but without which human history is inconceivable. In the consumer society we want to escape from responsibility assuming that without it our lives will be easier and better; whereas in fact our lives become shallower and cheaper. Like faith, responsibility enhances the variety of our existence - when we possess it, or diminishes us when we lack it. What blood is to the body, responsibility is to the spirit.

To be human is to live in the state of responsibility. However, through the systematic separation of human beings from the cycles of nature, as well as through the process of delegating important decisions to experts, contemporary technology has been systematically disengaging us from life. Our lives have been made increasingly disconnected, atomized and trivialized. This particular aspect of present technology makes it more detrimental to the future of the human race that any particular technological disaster. Responsibility and technology must, at this time of history, be considered vis-à-vis each other. Technology which systematically deprives us of responsibility (by delegating everything to experts), represents the victory of evil. For if everything is done for us, if we cannot exercise our responsibility, we are no longer human. Responsibility is the cornerstone of our status as human and spiritual beings. You can now clearly see what my arguments are aiming at; to show that in so far as the Information Society (epitomised in the computers) takes over and deprives us of responsibility, and dwarfs our status as human beings. It is a pity, and indeed a blindness of our times, that the proponents of the computerised age never address themselves to this problem.

All society worthy of the name 'society' is human society, is society for us, humans, and not for smooth functioning of efficient computers. It may have dawned on some of us that what I am advocating is not so much the Information Society as the Wisdom Society. Our dilemma has been beautifully summarised by T.S. Eliott who said, some 50 years ago: "Where is the life we have lost in living? Where is the wisdom we have lost in knowledge? Where is the knowledge we have lost in information?" We need wisdom in order to be responsible. We need widom to manage our information. At present we have a super-abundance of information which we are unable to digest. As a society we are over-informed and under-enlightened. (The Ecologist, Vol. 14, No. 5-6, 1984)

GOVERNMENT POLICIES

Republic of Korea: Why it started a chip industry

Korea decided it needed a semiconductor industry for these reasons:

- to protect its electronic equipment industry from the effect of any interruption in the supply of chips from the US or Japan;
- because without a semiconductor industry a country can only develop its electronics equipment industry at the same pace as the people who supply the chips decide to develop them;
- to earn foreign currency;
- because they thought they could be very good at it;
- because the Korean electronics equipment industry would become less and less price and performance competitive the more it relied on foreign chips;
- at times of chip shortages, as in 1984, the Korean electronics equipment industry suffered through lack of supply of semiconductors.

Why not do as the British do and save themselves the bother and expense of manufacturing chips by buying them from the US and Japan? The answer, said Samsung's Jay Hyung Lee, is because: "Korea is still in a sense, a developing country. Our country's power over other countries is less than your country's. So if there are shortages they become insoluble." Don't they realise it's going to cost them an arm and a leg (US$750bn at the latest count) and they may not get anything back for years? "In our construction industry," replied

Jay Hyung, "when we started we made very heavy losses, but eventually we got it right. The semiconductor market is not going to go away. So long as you can supply it you can stay in it. We can exist in the long term in this industry. We have our own way of making it profitable." Who or what could stop Korea succeeding in the semiconductor business? "I don't think anything," replied J Hyung. "It's a world market, a growing market; we can all live together in it. J. Hyung has all the confidence of being a national of a country which can export steel to Japan. "So we're confident we'll be able to sell semiconductors into the Japanese market," he said. Did he expect tariff problems? "No tariff problems," he said. Did he expect approvals problems? "No approval problems," he replied. The big market for Samsung will, however, be America. And it was from America that Korea obtained the technological help to set up its semiconductor industry. "The US is our closest friend," said J. Hyung. He expects that 80 per cent of Samsung's chip output will be sold into the US market.

An outward and visible sign of Samsung's closeness to the US is the deal with Intel for the second sourcing of microprocessors. There is no more prestigious partner to have on the world semiconductor scene than Intel. With such a partner Samsung will not lack credibility, nor will it lack outlets. "We will use Intel's marketing outlets for these products [Intel-architecture micros]," said J. Hyung. Another US partner is the 1983 start-up by B.K. Marya - Exel Microelectronics. From Exel, Samsung has acquired E^2 technology. In October it will sell a second-sourced Exel 16K E^2 part and later on it will "probably" manufacture Exel's 64K. In DRAMs, it kicked off with a second-sourced part from a third US company - Micron Technology. That was a 64K, but its 256K and Mbit versions, both in development, are homegrown parts.

The Americans facilitated Samsung's entry into the semiconductor business, but it was the Japanese and, to an extent, the British who motivated it. The Japanese motivation came about because they are a dominant trading force in that part of the world, yet they have not been keen to let Korea in on their technology. The British motivation came when Samsung did a manufacturing deal with Sinclair for the Spectrum and realised that 40 per cent of the cost of the machine is the cost of the semiconductors. "That makes it quite an item," said J. Hyung. The conclusion the Koreans drew was that, if semiconductors made up so much of the cost of products, and if that proportion was likely to increase rather than decrease, then the domestic Korean electronics equipment industry could hardly be competitive if it relied on imported semiconductors. "We realised it was better to have our own production facilities rather than procuring our semiconductors from the cheapest source," said J. Hyung.

"Last year, for instance, it was very difficult to get a decent amount of chips in the world market. It put our electronics industry into a risky position." It is a key perception which even the British electronics equipment companies are at last beginning to accept.

Competitiveness with Japan spurred the Koreans into the semiconductor business because, as J. Hyung says, "The Japanese semiconductor manufacturers give a special price to their equipment manufacturers." The Koreans also perceived that: "Without a semiconductor industry you can't develop at your own pace." Accordingly, to compete with Japan in electronic equipment markets on both cost of manufacture and on performance, an indigenous source of semiconductors was vital. There was only one snag. The Korean electronics industry wasn't big enough to justify the huge investment in chip factories. "From the start," said J. Hyung, "we realised that it had to be export-oriented."

What makes the Koreans think they can succeed with this strategy? Five things:

. labour cost is lower;

. Koreans work with great diligence, which is a key factor in manufacturing semiconductors;

. Koreans work very hard, which means that eveything is done quicker than usual and a plant is up and running and producing revenue very soon, which cuts down the interest payments on the money you borrow;

. Samsung is an internationally respected conglomerate, which can borrow money in world markets at advantageous rates;

. previous successes in textiles, ship-building and steel.

Having decided to go for the semiconductor business, the boss of Samsung, Byung Chull Lee, personally initiated a strategy capable of creaming the NECs and TIs of this world. Byung Chull put in place a magnificently aggressive strategy, demonstrating that he understands the chip business and appreciates what it costs. Simultaneously, Samsung started building plants to produce three device generations - the 64K DRAM in a three-micron fab, the 256K DRAM in a two-micron fab, and the Mbit DRAM in a one-micron fab. The fabs for the 64K and 256K are both high-volume 20K wafers-a-month facilities at Suwon in Korea. The one-micron plant is a prototype line in Santa Clara capable of 8K wafers-a-month.

The Koreans appreciated that to succeed in the semiconductor business, they had to hit the market at the same time as, or ahead of, the Japanese and the Americans. "Japan and the US will introduce Mbit DRAMs sometime towards the end of next year," said J. Hyung. Accordingly the strategy of BC involves the Santa Clara plant running prototype Mbits in the first quarter of 1986, with a one-micron high-volume plant being started soon for volume production of the Mbit in the third or fourth quarter of 1986. Will that one-micron plant at Suwon cost the $200m that Intel's Andy Grove reckons is the cost of a one-micron plant? "I think around that level or a little less," said J. Hyung. So far, he added, the strategy has cost $300m. By the time the one-micron plant is up and running it will have cost, he said, $750m. By that time he hopes to be at break-even point on the revenue stream. But putting a strategy in place to produce three device generations simultaneously, Samsung protected itself from the vagaries of the world chip market. It is just as well it did so because the unexpected recession at the end of last year will have the effect of bringing forward the introduction of new chips across the world.

"The depression will accelerate other manufacturers to move to more advanced products," said J. Hyung. So Samsung will have its Mbit DRAM ready when the others have theirs. That doesn't mean the investment in the 64K DRAM was wasted. "Many customers in the US will want to keep on with the 64K," said J. Hyung. "We'll definitely be on the market with this product two years from now."

The rationale for that is: first, the knowledge about processing silicon that 64K production will impart; second, the fact that the lower manufacturing costs of the Koreans will, they think, allow them to produce 64Ks cheaper than anyone else in the world. It seems they want to be the last world manufacturer of 64Ks - always a lucrative slot to fill in any product line. This means that the 256K generation is likely to be short-lived. J. Hyung says: "The 256K will have a very short lifetime. We hope we'll make money on it but we don't know." This doesn't particularly matter because, although the company has built a complete new factory for the 256K, it will not be dedicated completely to that device in the way the 64K factory was. The Samsung strategy is to run 16K E^2PROMS, 64K CMOS SRAMs, "probably" 64K E^2PROMs, and possibly some of the Intel second sourced microprocessor chips in its new two-micron 256KDRAM factory. All these devices have higher prices and higher margins than 256K DRAMs are likely to command. Accordingly, these products should pay for the costs of building the two-micron facility. They are due out from the factory in October.

Having put in place this superbly aggressive strategy, the Koreans went about implementing it with single-minded purpose and dedication. At the end of 1982, Samsung set up the planning and projection stage. By the middle of 1983, it started building its three-micron 64K plant at Suwon. In August 1984, it got the plant into production. By the end of the year it was churning out 2m pieces of 64K a month. By February of this year it had hit the peak of 6m pieces a month - the fab's full capacity. Yield however can make that figure vary from 4m to 6m. That means Samsung ramped production from first silicon to full capacity in five months. That's never been done before anywhere in the world - ever. "Our plant manager didn't go back to his home for six months," explained J. Hyung. While the plant was being built, none of the workforce was allowed to take a holiday. The whole strategy was implemented at the same sort of speed as the US start-up companies operate at, with the expenditure of about 10 times the money which US start-ups spend in an equivalent time-frame. It is a formidable combination. Instead of the stock options and "enterprise culture" of the US start-up boys, motivation for the Koreans is more tribal - a sense that they are doing something vital for the future of their country.

Marketing of Samsung's output will be 80 per cent for the US, 20 per cent of South-East Asia, including Japan, and Europe. Timescales on allocation of product will be the same for Europe as for the US, said J. Hyung. This year he'll have only one high volume product - the 64K DRAM - but he expects to sell enough to produce revenues of around $70m for the full year. On pricing, J. Hyung assures us: "We'll be competitive, but not the price leader. We'll be flexible." Outlets, he expects, will be 50/50 through distributors and direct OEM sales. He sees the recession as an excellent time to learn about marketing in foreign countries. The entire Samsung Group did about $9bn last year, of which $3.5bn went for export.

Byung Chull in a profile of the group called "Samsung Today," recalls: "Following the dedication of a mammoth semiconductor plant in May, mass production of 64K DRAM chips began. One recent breakthrough was the development of 256K DRAM chips using our own technology.

Mass production of the chip is planned for this year." Later on, the same publication states the aim: "Samsung Semiconductor will ultimately develop into an enormous semiconductor enterprise of the largest scale in the world to produce 1Mbit DRAM chip, personal computers and microprocessors." (Electronics Weekly, 15 May 1985)

Electronics in Scotland

The electronics industry has provided a much-needed sunrise over the Scottish economy. Plants manufacturing semiconductors, personal computers or information systems are providing new light for a country often associated with grey industrial decline. It has brought jobs and helped change the often-defeatist attitudes about Scotland's economic prospects. But, unlike California's Silicon Valley which it so wants to emulate, growth has not been spontaneous. Some shoving has been necessary to get this industry going. More than 30 years since multinationals like IBM, Honeywell and Burroughs set up plants, opinions vary on how fast it is going and how much pushing is still needed from government backing. Growth is reaching the spontaneous take-off point. Companies are moving in to service the big names with skills, equipment and supplies. This is the type of proliferation promoters see as the sign of "critical mass".

Yet, some deeper doubts are being expressed. Hitherto, arrival of foreign companies and more jobs have been so welcome that it has been unfashionable, almost ungrateful, to criticise developments. Today, criticisms are heard about the way the industry is heading, possibly a sign of the strength of electronics in Scotland. There is talk of failure of expectations, structural problems, of misplaced incentives and fears of increased vulnerability in world markets.

But the impact of electronics still dazzles. It employs something like 42,000 people in about 300 companies. Growth is possibly faster than ever, with investment estimated at more than $1bn at 1980 prices. It ranks alongside Scotland's other sunrise industry, North Sea oil, as a fundamental force for change in the economy of a relatively small country of 5m people. Like North Sea oil, electronics is dominated by foreigners: most jobs are with big multinational companies. These have been attracted as a way of fostering growth of servicing companies, creating new managerial skills, and generating the vital jobs. Most important is the conviction that through these companies a new growth in indigenous companies would follow. It has not worked out quite like that.

The Scots are becoming good at inward promotion. To the envy of other countries - not to mention other parts of Britain - Scotland takes a highly efficient and imaginative approach to attracting foreign investment. Having a relatively small centralised economy makes it easy to pool resources and see the results quickly. The Scottish Development Agency, a quango which has taken a role in finding new directions for industry, teamed up with the Scottish Office to bring in the Japanese and Americans through "Locate in Scotland" campaigns. These combine the promotion of the SDA and the grant-giving capabilities of the Scottish Office. Working from a consultant's blueprint drawn up at the start of the decade, a selective approach has been taken to develop key specialities with good growth potential, like personal computers and semiconductors. Purely manufacturing companies in the U.S. and Japan have not been discouraged from moving to Scotland but those ready to encourage research and development receive the most attention.

The SDA says Scotland now has Europe's highest concentration of wafer fabrication for computer chips. This sector alone employs 4,500 and is expected to increase to 6,500 by 1986.

- Motorola, National Semiconductor, and General Instruments arrived in the late 1960s and early 1970s, and NEC, Burr Brown, Hughes Microelectronics followed.

- IBM manufactures more than 1m personal computers a year for the European and Middle East markets in Scotland.

- Wang Laboratories has opened a $55m office automation plant on the campus at Stirling University.

- Act is bringing on stream a $13m plant at Glenrothes and Digital Equipment is expanding its Ayr plant.

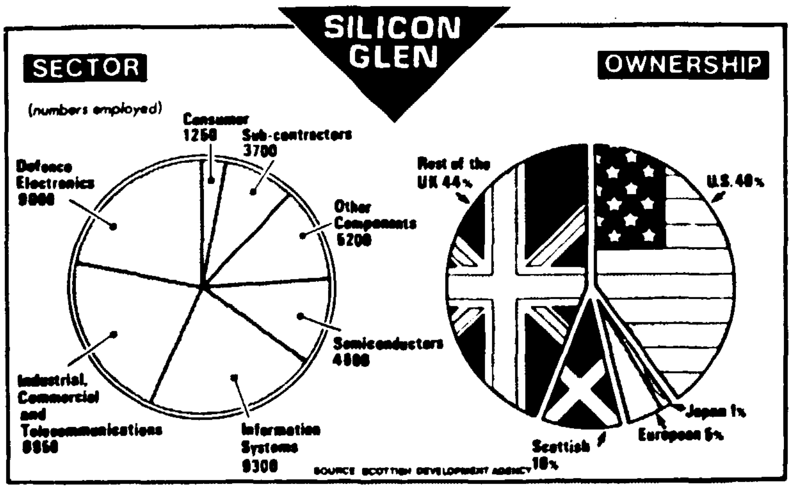
Yet, for a variety of reasons, the prospects for California-type growth in electronics are limited. Firstly, product development takes place on only a modest scale. Managers in many multinationals are not posted here to develop new equipment, so there is no reservoir of engineers working on new products who are ready to break away and make a better gadget by themselves. "The type of management often found in Scotland simply does not encourage the spin-off of engineers that is seen in California," according to one critic. Companies like

Hewlett Packard, NCR and Motorola are exceptions, with a local management encouraged to develop new lines. The number of indigenous companies that have spun off or grown alongside the big companies is also fewer than had been hoped. The SDA says 17 companies started between 1979 and 1981.

Because the industry still seems to require the stimulus of government through bodies like the SDA, it is the agency and Government which gets the criticism. The Alvey programme by the Government to develop the next generation of computer has been attacked by the Scottish Electronics Technology Group, a body of industrialists and academics, for putting too much money into big companies. They partly blame this lack of incentives for the limited number of home-grown companies. The changes in regional aid, reducing the amount of automatic grants available to incoming companies, also worries some companies. There are fears too that Scotland's heavy concentration on the personal computer and semiconductor market could also prove risky. Fluctuations in the market for both these products and the softening of the U.S. market could mean these two sectors are too exposed. Another shortcoming is the use which Scotland makes of the electronics industry. This remains an area of some exasperation for official bodies trying to preach new technology to traditional industries. A concerted effort is underway - and, regretably, needed - to push electronics at the off-shore oil industry in the next wave of developments of oil and gas fields. The opportunities for applications are there but the rate of take-up has proved disappointing.

Figure 9

SCOTLAND:



RECENT PUBLICATIONS

UNIDO:

Regional meeting for the initiation of a regional network for microelectronics in the ECLAC region (REMLAC), Caracas, Venezuela, 3-7 June 1985

		Language
	Aide-Mémoire	E S
ID/WG.440/1	The use of Public Purchasing as a Tool to Develop Technological Competence in Microelectronics prepared by E. Lalor	E S
ID/WG.440/2	Telecommunications and Information Technology in Latin America: Prospects and Possibilities for Managing the Technology gap prepared by M. Hobday	E S
ID/WG.440/3	Proposed Structure of the Regional Network for Microelectronics in the ECLAC Region prepared by the UNIDO secretariat	E S

ID/WG.440/4	Some considerations on the Content and Modalities of a Programme of Work for REMLAC prepared by the UNIDO secretariat	E S
ID/WG.440/5	Research and Development in Microelectronics in Argentina, Brazil, Mexico and Venezuela prepared by G. Fernández de la Garza	E S
ID/WG.440/6	Report on the UNIDO Mission Preparatory to the Establishment of a Regional System for Microelectronics in Latin America (REMLAC) prepared by G. Fernández de la Garza and M. Octavio	E S
ID/WG.440/7	Government Policy for the Data-Processing Industries in Argentina, Brazil and Mexico prepared by H. Nochteff	E S
ID/WG.440/8	Provisional agenda	E S
ID/WG.440/9	Annotated Provisional Agenda	E S
ID/WG.440/10	List of Documents	E S
ID/WG/440/11	Approach to Regional Microelectronics Co-operation Programme	E S
ID/WG.440/12	Report of the Meeting	E S
UNIDO/IS.539	Flexible manufacturing systems - an overview by John Bessant (document prepared in English)	

"The Semiconductor Industry - Trade Related Issues"*

Domestic government policies have played a significant role in the evolution and structure of the semiconductor industry and have often been the cause of trade frictions between countries. The study, now published, examines the dynamics of the industry, the rationale for government involvement and the effects of government policies on trade in this field.

The study points out the significant efforts by many governments to assist the development of the microelectronics industry, particularly to catch up with the technological level of the United States. In the case of Japan, policy was marked by coherence and co-ordination, but this was less evident in Western European countries.

The report warns that there is a chance of a spiralling increase in aids to the industry to match those of other countries and to reinforce the international competitiveness of the industry. An important factor which may help reduce frictions is the increasing degree of international co-operation and various ties between firms. Increasingly, as well, these ties are involving technology exchanges by firms which are on an equal basis, and thus differ from the various technological agreements which characterised the industry in the 1970s. This change is leading toa greater internationalisation which may tend to blur the importance placed, principally by governments, on domestic ownership and over-dependence considerations in the industry and, perhaps, increase the stress on ensuring that the domestic climate is conducive to the continued growth of the microelectronics industry.

The study forms part of the organization's work on trade in high technology products. It is published under the responsibility of the OECD Secretary-General. Journalists may obtain a review copy from the OECD Press Division, 2 rue André Pascal, 75775 Paris Cedex 16 (Tel: 524 80 89).

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* "The Semiconductor Industy - Trade Related Issues". 146 pages, OECD, Paris, 1985. ISBN 92-64-12687-2. Available from OECD Sales Agents.

Teleconferencing: the business alternative*

Using electronic rather than rail/air communication will certainly allow people at different and diverse locations to conduct business meetings without the wear and tear of travel, but may well create other challenges. This 56-page management briefing, an adaptation from "The Practice of Teleconferencing" (published in 1982 in "Telecommunications in the United States: Trends and Policies", edited by Leonard Levin) is an excellent introduction to audioconferencing and videoconferencing.

Although the author does not discuss computer conferencing, which may well spread faster than either of the two other media, he does warn that the state of the art is developing rapidly, and that those seriously interested in trying any of the new media need to read further. (ACCIS Newsletter 3(1), May 1985)

The Technology Scientific Foundation in the Netherlands, a non-governmental, non-profit organization established in 1979 and undertaking research activities in the area of technological change (including electronics and microelectronic technologicql progress related to metal-working and other labour-intensive production processes) announces several recent publications which are available on request:

- Flexible automation: a comparison of Dutch and Swedish firms, particularly as to CNC machine penetrations;

- North-South Interdependence: an economic-physical interpretation;

- The diffusion of new techniques;

- A simulation model to assess technology behaviour;

- The diffusion and effect in North-South perspective of computer-based techniques; and

- several papers prepared in connection with a project on micro chips in the metal-working industry of Latin America.

For more details or requests for these publications write to Dr. G. K. Boon, Technology Scientific Foundation, P.O. Box 1510, 2200 BE Noordwijk ZH, The Netherlands.

* Teleconferencing: New Media for Business Meetings, by Martin C.J. Elton. New York, American Management Association, 1982. (AMA Management Briefing series.) Available from: AMACOM, 135 West 50th Street, NY 10020 at $10.00.

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