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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

MICROELECTRONICS MONITOR

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Dear Reader,

I should like to take this opportunity to inform you that UNIDO has been converted into a specialized agency of the UN system and Domingo L. Siazon Jr. was appointed first Director-General of the newly independent UNIDO. Prior to his appointment Mr. Siazon has served as Ambassador Extraordinary and Plenipotentiary of the Philippines and Permanent Representative to the United Nations Office at Vienna as well as the International Atomic Energy Agency and UNIDO. The General Conference of UNIDO, consisting of 120 members to date, elected Mr. Siazon by acclamation at the first part of its first session held at Vienna in August 1985, for a four-year term, beginning 1 September 1985. He succeeds Dr. Abd-El Rahman Khane who has been Executive Director of the former UNIDO for over ten years. We all look forward to the leadership of the Director-General in piloting UNIDO in its new form. The General Conference will resume its first session at Vienna on 9-13 December 1985 to focus on the remaining transitional arrangements for the Organization.

Dr. Christopher M. Snowden of Leeds University has written a paper for us on the state of the art of gallium arsenide, a subject on which earlier issues of the Monitor have already reported. Parts of this paper are reproduced as a special review in section "Recent publications" on page 49.

On a personal note, this will be the last issue in which my name appears in the "Dear Reader" column. Since I will be retiring from UNIDO at the end of this year, from now on kindly address your inquiries, contributions etc. to the Editor of the Microelectronics Monitor, UNIDO. If you happen to be in India or wish to maintain correspondence with me, please let me know at the following address: Dr. G.S. Gouri, Khanapur, Belgaum District, Karnataka State, India.

I wish you all the best for the future and in particular a happy and prosperous 1986.

G.S. Gouri
Director
Division for Industrial Studies

Contents:

Compiled by the Technology Programme of UNIDO P.O. Box 300, A-1400 Vienna, Austria

NEWS AND EVENTS

UNIDO convenes Advisory Group of INTIB Users

The activities of UNIDO's Industrial and Technological Information Bank (INTIB) were reviewed by a group of user representatives who met in Vienna in September to look at INTIB's future course of action. INTIB was set up with the aim of facilitating and accelerating a greater flow of information to developing countries for the proper selection of technology. It started as a pilot activity in 1977 in four industrial sectors. Its results were reviewed by the Industrial Development Board of UNIDO in 1979 and its operation was extended to twenty industrial sectors.

Opening the meeting, the Director-General of UNIDO pointed out that a review of INTIB activities was timely in view of the exponential growth in information, the rapid advances in information handling and telecommunications, and the growth and diversity of industrialization in developing countries. It was also opportune in view of the impending conversion of UNIDO to a specialized agency.

The group recommended that a medium-term programme for INTIB be drawn up for, say five years, so as to enable INTIB to make a smooth transition in step with developments in information technology. In particular, INTIB should emphasize its function as a network including "centres of excellence" in developing countries. The concept of INTIB nodes in developing countries should be introduced and implemented systematically. With the installation of computer and telecommunication facilities as network lines, INTIB network could further evolve as an on-line network which could consist of data base providers or producers, data base vendors or operators, data base carriers and data base users. It was further recommended that INTIB should develop an overall international industrial information activity of UNIDO as the United Nations agency responsible for industrial development. An important component of the programme which could include industrial information policy and development of industrial information capabilities in developing countries, should be training and education of information specialists and users and also organizing workshops for information policy makers.

The group also felt that UNIDO should provide support to the developing countries for the establishment or strengthening of their national industrial information systems and services through the provision of consultancy services, technical assistance, specialized training programmes, promotional measures and other appropriate means.

The meeting agreed that INTIB's and UNIDO's information activity should be considered an essential element of the global information network on science and technology as recommended by the UN Advisory Committee on Science and Technology. The group recommended that in order to meet these goals UNIDO should support national efforts in the area of industrial information which represent the basic requirements upon which any network might be built.

UN sponsors workshop on microcomputer software applications

The workshop was organized by the UN Department of Technical Co-operation for Development and was held at United Nations headquarters in New York from 9 to 13 September 1985. It was attended by 23 participants from 18 developing countries as well as 10 lecturers and experts and 9 observers from invited organizations. The purpose of the workshop was to review together the latest developments in microcomputer energy planning software and to review the issues consistent with its use in the developing countries. A number of presentations on energy planning software were made such as DTCD (ENERPLAN), IDEA, ENVEST, EIS, LEP etc. A one day panel discussion was held on the last day of the workshop covering the technical, economic and legal issues e.g. software compatibility, choice between computer languages, hardware and software costs and legal and institutional issues.

United Nations University/Trinity College Dublin training programme

The School of Systems and Data Studies at Trinity College, University of Dublin, in co-operation with the United Nations University, runs an informatics project for which fellows, sponsored by UNU, are accepted for a six-months training programme commencing 1 January 1986. Each fellow is expected to select a specific study within the broad field of informatics. It is desirable that these studies lie within the present interests of the School, which include applied statistics; project planning; systems analysis; operations research/management science, management of information technology; and national informatic

planning. Specific studies include: current developments in operations research/management science software; techniques of computer analysis of remote sensed and other data in exploration and environmental monitoring; computer-aided learning; national information systems and services; small-scale library applications; portable microprocessor applications in agriculture, health and other fields.

The informatics project is administered by the Systems Development Programme (a Master's degree programme) of the School of Systems and Data Studies. The SDP forms an integral part of the Irish Government's growing programme of technical assistance to developing countries. SDP fellows are normally nationals of developing countries on secondment from their organizations. They include male and female officers of government departments, managers in business, finance and social institutions as well as teachers and researchers from universities and other educational institutions. An applicant for admission to the SDP should hold a good undergraduate degree or equivalent professional qualification, have appropriate work experience and a good command of the English language.

BOSTID: Microcomputers for Development

The Computer and Information Technology Council, Colombo, Sri Lanka and the National Academy of Sciences, Washington, D.C., USA jointly have published the proceedings of the First International Symposium on Microcomputer Applications in Developing Countries, held in Colombo, Sri Lanka from 4 to 9 November 1984.

This report is the first product of a major AID funded programme, Microcomputers for Developing Countries, which began with the above symposium. The meeting was co-sponsored by the Computer and Information Technology Council of Sri Lanka. The joint proceedings report on microcomputer activities in health, energy and agriculture, primarily in the Asia region. Another report will shortly be issued, drawing specifically on the information contained in these papers but from a broader perspective. This volume will be available in early 1986.

The next major event in the programme, will be the second symposium at which issues related to education and training will be discussed. This meeting will be held in Mexico, November 1985, and co-sponsored by the Mexican Academy of Engineering.

International Federation for Information Processing (IFIP)

IFIP's Technical Committee on Computer Applications in Technology (TC5) will organize the Second International Conference on Computer Applications in Production and Engineering (CAPE '86) in Copenhagen on 20-23 May next year. The objectives of the conference are to understand the trends and promote the advancement of computer-aided design, manufacturing, and engineering, production management, and the integration of these processes. Attention will also be focused on the specification, development, and documentation of such systems. A considerable part of the Conference will be devoted to industrial applications, socio-economic aspects and future trends of CAD/CAM/CAE/PM. Papers will be concentrated in four areas: computer aids and techniques, integration, industrial applications and future trends. The Conference will be preceded by a one-day tutorial offered by internationally recognized experts. Also, an exhibition of computers and data systems related to CAD/CAM/CAE/PM will be held in connection with the Conference. For further information write to: CAPE '86, c/o DIS Congress Service, 48 Linde Allé, Dk-2720 Vanlose, Copenhagen, Denmark.

TC5, in association with IFAC Technical Committee on Computers, is sponsoring the first IFAC workshop on "experience with the management of software projects". The workshop will be held between 14-16 May 1986 at Heidelberg, FRG. The workshop is intended to provide a forum for the exchange of experience between engineers involved in the management of software projects. Further information is available from VDI/VDE, Gesellschaft für Mess- und Regelungstechnik, P.O. Box 1139, D-4000 Düsseldorf 1, FRG.

SUNY runs new course on computer technology and applications for development

The Institute for Technology Policy in Development at the State University of New York (SUNY), Stony Brook, New York is organizing a short course on computer technology and applications for development which will held on 20 January to 7 February 1986 and will be repeated on 22 September to 10 October 1986.

The short course is especially designed to familiarize middle and upper level managers, planners and computer managers from developing countries with state-of-the-art computer hardware and software appropriate for developing country applications; to develop the expertise they will need for choosing appropriate technology options, purchasing and maintaining equipment, and to provide the technical training necessary for them to organize and manage specific applications in various sectors. The topics of the course will include

computers in developing countries, computer laboratory, computer applications, artificial intelligence/expert systems, laser interactive disks, management information systems and databases, software evaluation and selection, microcomputer hardware, maintenance of microcomputer hardware and software, computer manpower development. The participants will also be able to visit computer manufacturing facilities, software suppliers, and users of advanced computer technologies.

Applicants can address their requests for financial support directly to USAID missions in their countries, the UNDP, the World Bank, the Inter-American Bank, the Asian Development Bank or seek support from their governments.

For further information write to: Computer Short Course, Institute for Technology Policy in Development, State University of New York, Graduate Physics Building, A-134, Stony Brook, New York 11794-3825, USA.

It should also be noted that the International Law Institute, 1920 N. Street, N.W. Washington D.C. 20036 is giving a companion course on negotiation of hardware and software agreements on 12 February - 5 March 1986 and 27 August - 17 September 1985, respectively.

Sussex University launches seminar

The Institute of Development Studies at the University of Sussex at Brighton is launching a study seminar on "Microelectronics, Automation and Industrialization to be held from 4 November to 13 December 1985. The seminar concerns the implications of emerging automation technologies for industrialization strategies, particularly those in developing economies and includes lectures by specialists on the nature of microelectronics as well as visits to factories producing automation equipment and to a range of enterprises some of which make use of the most advanced automation technologies. The visits will enable participants to observe for themselves the effect of the new technology on inherited strategies of industrial and technological policy.

The PSI Microelectronics Applications Research Programme

The Policy Studies Institute, London has been implementing a special research programme on microelectronics applications in different fields. The aim of the research is to assess the form, extent and effects of current and prospective microelectronics applications; to identify the main factors encouraging and impeding their adoption; to appraise the government's measures to increase awareness and support applications; and to work out ways of increasing their effectiveness.

Projects already completed:

- Two major industrial surveys, each of 1,200 factories, to measure the overall extent of use of microelectronics, the form it is taking, the advantages and difficulties and the effects on jobs;

- A comparison of progress and problems in the use of microelectronics in industry in Britain, France and Germany based on parallel surveys in the three countries;

- Case studies of applications in products in 90 companies and of applications in production processes in 120 companies to assess the scope for applications, the extent to which it is being exploited, the factors affecting adoption and the impact of government support schemes;

- A survey of users of microprocessor training courses to get a consumer's view of their relevance and quality;

- A survey of offices to find out how far the new kinds of electronic equipment and systems are being installed, for what reasons and with what results; and

- A study of the implications of new technology for money, including cash handling, cheque processing, intelligent cards, point of sale and stock control systems, electronic funds transfer and home banking and shopping.

Work in progress:

- A study of the extent of acceptance of new technology at the place of work and the factors affecting it - an ESRC project arising out of the economic summit conference in Versailles;

- A study of the projects which received development support with a view to assessing the cost-effectiveness of this part of the government's MAP scheme for encouraging the use of microelectronics - for the Department of Trade and Industry; and

- A study of the effects of the Department of Trade and Industry's scheme to provide grants for technical consultants to investigate the feasibility of new microelectronics applications.

A number of reports have already been published and can be obtained from Ms. Elizabeth Worth, Policy Studies Institute, 100 Park Village East, London, NW1 3SR, UK.

NEW DEVELOPMENTS

Looking at CIMS

Computer-integrated manufacturing systems is the subject of a two-year series which began in January 1984 in Industrial Engineering, the journal of the American Institute of Industrial Engineers. Principal editor of the series is Dr. Randall P. Sadowski, Associate Professor, School of Industrial Engineering at Purdue University who had the assistance of the technical and systems divisions of the Institute of Industrial Engineers (IIE). The following is an excerpt of the first article in which Professor Sadowski introduced the topic of CIMS.

What is a CIMS?

A CIMS is commonly thought of as a truly integrated CAD/CAM system, encompassing all the activities from the planning and design of a product to its manufacture and shipping. It is a concept that combines existing technologies with the ability to manage and control the entire business. It is the underlying philosophy that is often desired in looking forward to the automated factory of the future. Selected elements of such a system are artificial intelligence, computer-aided process planning, computer numerical control, database technology and management, expert systems, flexible manufacturing systems, information flow, just-in-time concepts, material requirements planning, process and adaptive control, and robotics. Although a listing of key CIMS elements provides some insight into the contents of and direction in which these systems are heading, it does not provide a clear vision of the ultimate system. A closer examination of the acronym "CIMS" may be more revealing. "Computers" and "manufacturing", its key words, are generally well understood; it is the "integration" of these into a total "system" that poses the greatest obstacle. The goal of a CIMS would be optimization of the total business rather than optimizing individual components, which is what so often results in today's so-called "islands of automation". The addition of a second "M" has been considered to stress the importance of "management" in developing and implementing the system.

It is generally accepted that no true CIM system exists today. Although a few companies claim to be developing and implementing such systems, often the result is islands of automation. Further, many companies have found that implementation of these sophisticated systems has required large capital investments in equipment and personnel, and all too often the result is simply the ability of the manufacturing environment to find out more quickly that the system is not operating optimally. Logically, there are two major components of such systems: the hardware and the software. It is becoming apparent that system integration of these two components creates the greatest challenge. The ultimate CIMS is clearly a complex ideal whose realization will require a new philosophy and approach to manufacturing.

A CIMS requires a new perspective on the part of management - maybe even a new philosophy. A successful implementation requires a general understanding of the expected costs and benefits and the time frame in which they might occur. Cost estimates must include the planning, software, operation and personnel in addition to the hardware. The installation time frame of such a system covers a wide horizon, with a long-term rather than a short-term payback. The magnitude of such an undertaking requires a major and absolute commitment by management of the necessary time and resources, in addition to the acceptance of new approaches. Prior to making that commitment, management needs to address the question of whether or not a CIMS is appropriate for the company's manufacturing environment. Not every manufacturing firm will have or require a CIMS in the next decade. Many firms have already embarked upon the search for a CIMS and have found that available systems fall far short of providing all the required capabilities. The circumstances of today are very similar to those at the start of the MRP era in that the ultimate system has been envisioned, but is not yet available.

Stepping back in time even farther, it becomes apparent that the search for today's system was initiated by the birth of the modern-day computer. The advent of the computer has had a remarkable impact on the manufacturing environment. A review of this impact over time provides valuable insight into the potential success of new systems. The era of management information systems and material requirements planning provides many fundamentals for tomorrow's systems, as well as numerous lessons. The development of a completely computer-integrated manufacturing system could well benefit from these valuable insights. One valuable lesson learned from the past is the need to provide a substantial education programme that spans all levels within the firm. Often it is necessary to initiate this education phase prior to system implementation. The human element is frequently the determining factor in the successful adoption of a new system. The failures of the past have reaffirmed the importance of the planning stages. Planning for a CIMS requires new approaches to identify company needs and to realistically assess the data requirements. Then, special emphasis is required to incorporate modern database mangement and data integrity into it.

Essentially, a systems approach is needed to allow development of a comprehensive plan achievable in a given time frame. Such a plan must also be flexible, since the accelerated rate of technological development may well provide new advances during the implementation stage. This flexibility is significant, because not all the key components of a CIMS exist today in the desired form. It is hypothesized, however, that knowledge exists for the development of many of these missing components. For example, it seems logical that a financial and marketing interface could be developed with the commitment of the proper resources. It may even be possible to create the capability to accurately perform resource planning. Shop floor scheduling is a subject of current debate, and it appears possible that a workable system could be devised in the near future.

On the other hand, the link between the CAD and the CAM environments, computer-aided process planning in a truly generalized form, is still a product of our imaginations. Ultimately, these elements will be developed and implemented, but careful consideration must be given to such missing components in the development and implementation of the computer-integrated manufacturing systems of today. These unknowns reinforce the need for a strong management commitment and involvement in such an undertaking. The role of management needs to be closely examined, and a reorganization may be required to assure success.

Successful progress toward a CIMS centres around the need of the manufacturing firm to accurately and efficiently collect, analyze and report information. With today's proliferation of manufacturing information, this creates a potentially unmanageable problem. This classic information dilemma requires close scrutiny during planning phases to assure that system integrity is maintained. The inability to quickly and accurately capture and utilize key information has led to the demise of many past manufacturing systems. The natural evolution of new manufacturing concepts, coupled with advanced manufacturing technology, presents excellent opportunities for the company of tomorrow. Producing a low-cost, high-quality product with a just-in-time philosophy has become a common goal of industry. The "world-class" manufacturer will have to selectively incorporate existing systems and hardware with these new concepts and technologies into an integrated system.

The experience gained from the implementation of current flexible manufacturing systems has placed new emphasis on the selection and configuration of production and material handling equipment. Such systems have often utilized group technology methodologies to develop cells that take advantage of common design characteristics. These types of implementation have reinforced the need for integration. In progressing towards a CIMS, it will become necessary to alter the common manufacturing practice of defining as optimum the first solution that works, and instead to utilize an integrated approach to develop a "good" solution that is compatible with the total manufacturing environment. Such modern computer-integrated manufacturing systems are currently being discussed and developed within the manufacturing sector. The automated factory of the future is clearly on its way; the question that remains is whether or not we will be ready to embrace the concept with the commitment and knowledge required to ensure its success. (Reprinted with permission from Industrial Engineering magazine, January 1984. Copyright Institute of Industrial Engineers, 25 Technology Park/Atlanta, Norcross, GA. 30092, USA.)

The Transputer cometh

INMOS has announced the availability of the long-awaited Transputer family. The initial products are a range of evaluation boards based on the IMS T414, 32-bit Transputer, two versions of the Inmos link adaptor and a range of development software. Unlike conventional computers, which execute programs step by step, the transputer is designed to execute programs concurrently, handling many steps of a program simultaneously. This gives the potential to speed up program execution considerably. Internally the transputer uses RISC

architecture, which enables high performance to be achieved in a small silicon area. Simple operations like addition and subtraction take 50 nanoseconds and more complex operations like scheduling take less than one microsecond. Average transputer throughput is 10 million instructions per second. The instruction set is designed for the execution of compiled programmes and all instructions are one byte long, leading to very compact programmes.

The IMS T414 integrates a 10 MIPS32-bit microprocessor, four Inmos serial links, two kilobytes of fast static RAM, 32-bit memory interface and a memory controller onto a single CMOS VLSI chip. It costs $500.

It is designed to be used in electronics systems which require large amounts of processing power and may also be used as a conventional microprocessor. Even more important is its ability to interconnect collections of transputers via the serial links to form networks and arrays, thus creating extremely powerful multi-processor systems. (Electronics Report, October 1985)

Ion implantation

Semiconductors can be produced using machines that pump huge quantities of ions into silicon. The new technique will make it possible to produce microprocessor memories that contain several million transistors on 1 fingernail-sized silicon piece. New ion bombarding machines shoot 100X more ions at semiconductors, vs conventional hardware, and produce a tightly packed layer of oxygen atoms under the surface of a silicon chip. The technology can be applied to CMOS circuits, used from low-power chips. The new technology could be responsible for 10 per cent of world chip output in 1990, estimated at US$75 bil. The semiconductor industry's world turnover is US$20 bil/yr, with silicon chips in virtually every piece of consumer and industrial equipment. The new oxygen technology will produce chips using less power having a higher switching speed and containing more circuit elements. (Financial Times, 19 August 1985)

Deposit of insulating layers on semi-conductors

A team at the Electronics and Automation Laboratory of the Ecole Centrale de Lyon has patented an insulating deposit of alumina on a semi-conducting substrate. This layer, which reaches a resistivity of 10^{16} ohms/cm, makes a good dielectric. The alumina is deposited by reactive evaporation between 20° and 450°C. Eventual utility: mastery of components based on gallium arsenide (GaAs) and especially of indium phosphide (InP). These semi-conductors do not embody any insulating oxide such as silicon. These future components, of the semi-conductor insulating-metal type, will form the basis of micro-optoelectronics, using micro-wave signals and making possible rapid logics for telecommunications. It remains to integrate the components and also to master the drift of their characteristics. A leader of the Ecole Centrale de Lyon team tells us that stabilization of the coatings over time has not yet been achieved, although components processed in vacuo can be returned to the atmosphere without damage. (La Lettre de Sciences and Techniques, No. 61, June/July 1985)

Toshiba completes the tool for future chips

Japan's Toshiba Corp. has put the finishing touches on what it reckons will be the tool to process the next generation of chips - electron beam microlithography capable of drawing lines as thin as 0.25 μm (1 m is one millionth of a metre). Toshiba is confident that this will open the way for production of 64 Mbit DRAMs within 15 years. The company points out that although electron beam lithography has been tipped for some time to have the capability to delineate circuit structures well below one micron, the practicability is limited to around 0.5 μm lines. This is because of the so-called "proximity effect" - causing significant pattern deviation on the underlying silicon. Toshiba claims to have circumvented this by the simple expediency of repeatedly scanning the substrate but with relatively weak electron beams. The first scan, at about 30 per cent of normal strength, serves to shorten the development time of the electron sensitive resist which is used to coat the wafers. Following this, multiple weak beam scans ensure a sharp image with the smallest feature size at around 0.25 μm. Toshiba has used the lithographic technique to fabricate a prototype of what is probably the world's fastest CMOS oscillator with a propagation delay of 49 ps (1 ps is one millionth millionth of a second). (Electronics Weekly, 10 July 1985)

Optical discs for micros

Geac Computer Corporation Limited of Markham, Ontario, has developed one of the first optical storage interfaces for micro-computers. It allows personal computers to store and retrieve data from optical discs capable of storing more information than a large mainframe computer. Called the Gig-Attach, the device consists of a small circuit board that attaches to a single personal computer. It contains the special software needed for a personal

computer to emulate a terminal with MS-DOS operating software to access the optical disc storage unit. A single optical disc linked to the network can store up to two gigabytes (two billion bytes) of data. Only one unit needs to be installed because it acts as a gateway, allowing all personal computers on a business local area network to be hooked up to it. Each unit retails for about $1,195.

Geac, a manufacturer of mainframe computers for multiple transactions that require large storage systems, plans to develop a family of Gig-Attach products to work on a variety of personal computers. The first one is compatible with the PC/XT manufactured by International Business Machines Corp. of Armonk, N.Y. Geac is also developing an interface for Unix operating systems that will allow any user of the popular software to use optical disc storage. (Canada Weekly, 26 June 1985)

The fastest chip yet

US scientists believe they have created the fastest computing element ever - a transistor in which the electrical signal travelled from the input to the output of the device in just over 11 trillionths of a second at ordinary temperatures, and nearly twice as fast when cooled to the temperature of liquid nitrogen (77 degrees Kelvin). The device, made by Honeywell researchers in Minnesota, uses gallium arsenide which many believe will replace silicon as a semiconductor in the faster chips of the future. The development is seen as an important step towards the development of larger, more complicated chips which will be needed in applications ranging from supercomputers to the systems needed for the Star Wars programme. Gallium arsenide chips are particularly suited to these purposes because of their high speed and the fact that they are comparatively resistant to radiation.

Honeywell expects to transfer the technology it used to create its superfast chip to the production line by 1989. What it did was to build a 25-ring oscillator, a comparatively simple circuit consisting of 25 transistor switches connected one after the other, with the last switch joined to the first. Such circuits have been developed before, but Honeywell achieved the extra speed by a novel technique which aligns the electrode which controls the switch exactly with the circuit elements written onto the chip surface. Honeywell also claims that it can now make gallium arsenide chips with many similarities to the most popular technology for today's silicon chips, complementary metal oxide on silicon (CMOS). This technology offers the potential to combine the high density of silicon circuitry with the high speed and resistance to radiation of gallium arsenide. (Electronics Report, July/August 1985)

More money spent on the race for fast computers

An Anglo-French consortium led by the Royal Signals and Radar Establishment (RSRE) has won a contract worth nearly £3 million from the EEC's Esprit programme of computer research to develop a supercomputer over the next three years. Supercomputers are marked by their ability to perform many calculations very quickly. The group, which includes Thorn EMI and its chip subsidiary Inmos, Southampton University, a French hardware company called Telmat and a French software firm, Apsis, plans to develop a parallel-processing machine built with Inmos chips. The first computer, which should be ready in two years time, will operate at speeds of up to half a gigaflop, or 500 million floating-point operations per second. The computer will be used initially for computer-aided design and simulations involved in particle physics.

The group will use a processor called the Transputer, which is designed by Inmos specifically for computers that perform operations in parallel rather than one after another - the sequential processing of classical computing. The Transputer, which has yet to be produced in volume, is a 32-bit processor with its own on-board memory. The processor chip also has its own communications processing, which enables groups of Transputers to be connected together, co-operating on a single task. The consortium plans to develop a series of machines with between 24 and 1,300 Transputers in them arranged in clusters called supernodes. A similar machine called the Cosmic Cube is already under construction at the California Institute of Technology. In both systems, processors will be arranged in a cube with clusters of three processors at each corner. This arrangement reduces the distance between processors, improving the rate at which the processors work. Inmos will develop a special version of the Transputer that is tuned for floating-point calculations. A single Transputer is currently rated at 100,000 flops. Inmos hopes to upgrade this to as much as 1 million flops. ...

Another group, composed of researchers from Imperial College, London, and Manchester University with Plessey and ICL is building a parallel computer and writing software for it in a project called Flagship. A third group including ICL is developing a method of interconnecting existing processors to create parallel computers. The project is called

GRIP. Elsewhere in Europe, Siemens of West Germany and Bull of France have joined forces to produce yet another European supercomputer, in a move to break the monopoly of American supercomputer manufacturers. A second French firm, Matra, is collaborating with Norsk Data of Norway to construct a parallel computer from an array of processors, while Norsk Data has done a similar deal with the British company Racal and Reading University. (This first appeared in New Scientist, London, 1 August 1985, the weekly review of science and technology.)

Molecular electronics

Faced with the ultimate limit of technologies that use inorganic structures such as silicon and germanium, semiconductor researchers are exploring the possibility of performing electronic functions using mechanisms inherent in organic substances. Now more widely known as molecular electronics, the field is attracting attention from academic and government scientists, and with it, its share of controversy. To its proponents, the new field heralds superfast, superdense computers beyond the capability of any silicon-based machines. But the more conservative tend to think that talk about "bio-chips" is unrealistic hype. Nevertheless, this multidisciplinary field appears to have potential for the development of everything from versatile chemical sensors to extremely dense data storage. Work now being done in optical storage technology and two-terminal switching devices using organic compounds and molecular electronics is rapidly approaching the point of commercial exploitation. According to a recent study by Gorham International, a private research and technology assessment group in Maine, the number of workers engaged in the field of molecular electronics has increased by an order of magnitude over the last five years, and research funding, currently about $100 million a year, could reach $1 billion by 1990.

The research goes by various names: molecular electronics, chemical-based computing, biochips, biosensors, or nanoelectronics. Biochips, a term most serious researchers in molecular electronics scorn, refers to functional parts constructed using biological or organic materials and processes. Rather than using simple crystals of silicon, germanium, or gallium arsenide, the chips would be made from molecules of organic compounds. Some suggested advantages include potentially increased density, increased yield, ease of fabrication, low cost, and immunity to radiation and electomagnetic pulse.

If true, those advantages could correct many well-known problems with digital computers - namely, heat production, fault intolerance, and the slowness with which von Neumann machines handle some computations. In addition, based on current semiconductor fabrication processes and technology, feature sizes of components on chips appear to be approaching a limit around 0.4 μm, suggesting that chip density is approaching a limit, somewhere around 1 million transistors per chip ... (Reprinted from Electronics Week, copyright 1985, McGraw Hill Inc. All rights reserved.)

Biomatics, the fourth dimension in informatics

The Japanese Ministry of International Trade and Industry (MITI), will be allocating US$ 34 million in ten years to the development of a biocomputer that imitates functions such as the recognition of forms, which is a form of the human brain's logical reasoning, it is precisely the human brain that is to serve as a model for the development of the machine's architecture which, in addition, for studying the systems of neurons of primates, for the development of "noncontact, nondestructive" methods to analyze brain function and for studying the use of organic "biochips". (Bulletin IBI Press, No. 45, 2 September 1985)

CMOS is replacing bipolar technology

The new generation of logical circuits, CMOS (complementary metal oxide semi-conductor), triples the speed of the former circuits and thus matches the bipolar circuit technology while maintaining its traditional lesser consumption. MOS general technology to obtain integrated circuits follows the manufacturing principles of discrete MOS transistors, their polarization requires very little current, based on the action of the electrical field of the semiconductors, created by a metal strip separated by an insulating strip, similarly, in integrated MOS circuits, an insulating cover and an aluminium cover will be laid over the semiconductor wafer, depending on the nature of the semiconductor cover, positive (p-mos), negative (n-mos) and complementary (c-mos) circuits will be obtained.

By reason of its low consumption, CMOS technology adapts well to small and medium-sized computers, the present integrated CMOS circuits have already reached 10,000 gates, the large systems, on the other hand, have been using bipolar technologies of the ECL series (emitter coupled logic) until now, which have greater switching speeds, notwithstanding the bipolar semiconduction requires greater dissipation to prevent the heating produced by the current which constantly polarizes them.

Bipolar technology on silicon could continue longer for chips used in large machines, if a study conducted by Bell Laboratories is confirmed, according to which the gallium arsenide technology, foreseen as an immediate substitute, loses its advantage over silicon from 10,000 gates upwards. (Bulletin IBI Press, No. 43, 12 August 1985)

An expert systems expert

Mr. Alex d'Agapeyeff, ex-president of the British Computer Society and now chairman of its expert systems specialist group as well as adviser to the Alvey Committee (UK) has been a specialist in software for twenty-five years. During the last four years he has concentrated on expert systems. He is also author of a recent report on expert systems in the UK business published by the Alvey Directorate. Below is an excerpt of an interview he gave to Computing The Magazine elaborating on the subjects of fifth generation artificial intelligence and expert systems.

"When the fifth generation was announced, it did lead to a number of false statements and over-expectations. People tend to forget that the fifth generation was a Japanese term for their long-term developments towards a new kind of computer and there is no doubt that the FGCS project in Japan is dependent on expert system principles as its main form of software, ultimately for all purposes. But the complete version of that system, even if they maintain their timetable, will not become available until some time in the early part of the next decade. Meantime, expert systems are not a general application solution. They are a different form of software based on the specific know-how of a human expert which, despite some cynicism, does enable programs to be developed by one expert and modified by another. But extravagancies will always continue in any new technology and they will certainly continue in ours. AI is merely, in engineering terms, doing on a computer a task which if performed by a human would be said to require intelligence. Expert systems, on the other hand, are a subset of AI which has to do with programming from an explicit representation of a human skill; that is expert human know-how.

"The relationship between expert systems and decision support systems is rather more subtle. Expert systems for the most part only advise, they seldom actually do anything. In the present state of development they do not control major files or plant equipment. It may be some time before they can be extended to do that sort of thing although there is no inherent barrier (just time, effort and skill to produce the right software). They can contribute in a small way, quite early, on to decision support systems by providing those systems with explicit know-how to supplement the data that is coming from the conventional programs and make those programs intelligible.

"In some of the larger companies, they have gone further. They are trying to extend the integration of the knowledge with the information flowing from the measurements of the system. The management reports are made more specific to the decision-making of that management and include useful technical advice, leaving management to make the final judgement.

"On the different products available with expert systems, there are at least three types. The first of these is a new kind of programming language, and typical examples are Prolog and Lisp. These are most suitable for trained specialists. The syntax in all of them is awful, in my opinion. These languages are quite different from conventional programming languages and it would take a little time for someone who is a Cobol or a Fortran programmer to change over to Prolog or Lisp. I consider them quite unsuitable for adults without programming experience, although many students have become quite adept in them early on. Now one can write expert systems in which the knowledge is directly expressed in, say, Prolog. But that is not necessarily appropriate because it means that the users have to understand Prolog before they can understand the knowledge. The next step was the idea of producing what are called 'shells'. These are software environments like our XI shell, in which it is possible to express the knowledge in English or a sub-set of English. Finally, there is a very specific knowledge base, placed on top of the shell, which is sold as an application solution. There are not many of these available yet but they may come soon. Our first application product in Expertech will be our tutorial, which is an expert system on expert systems. It will explain the subject and its uses for the representation and sharing of know-how in a company. We hope it will be found interesting and more revealing than either the average tutorial or a text book on the subject.

"There is certainly a lot of overselling of expert systems, especially in the US, and a number of false hopes have been raised which have been subsequently dashed. One reason is that in the US much greter financial risks are involved. Expert systems have become important in defence, for example in electronic warfare, where applications ran out of puff using algorithms in conventional programming languages. It was found that the use of knowledge for this purpose was very potent and there are bombs that 'know' where they are supposed to land and can direct their own flight path. The result is that the defence department of the Federal Government has sponsored some very large and expensive expert

systems. These can lead to high expectations in order to justify the cost. Britain, on the other hand, has less experience of expert systems and has tended to concentrate on simpler applications which are easier for the average business to implement. Nobody pretends that this is the end of the road but it is possible to start with simple systems that produce rather modest gains, initially, but which are incremental. So having built up a knowledge base that works and is useful in a specific area, one can extend it gradually, rule by rule so that the knowledge base grows steadily both in terms of its size and the number of users. (Computing The Magazine, 13 June 1985)

Development of European expert systems

The most advanced field of sale of simple and economic expert systems is found in Western Europe. The exit of artificial intelligence from the laboratories has materialized into over two hundred European projects. These systems, based on the knowledge proper to a profession (medicine, chemistry, technical diagnosis, geology etc.), are capable of simulating the behaviour of an expert and to take or purpose adequate decisions, one of the problems which, according to specialized magazines, this type of project must overcome, is the fact that there are no more than 1,100 engineers in the whole world with the necessary knowledge.

In this field of artificial intelligence, university and laboratory studies on the representation of knowledge, approximative reasoning, logical combinations and motives for inferences have brought to light various expert systems in Europe, also in the less customary fields such as could be financial services and supports to the taking of entrepreneurial decisions.

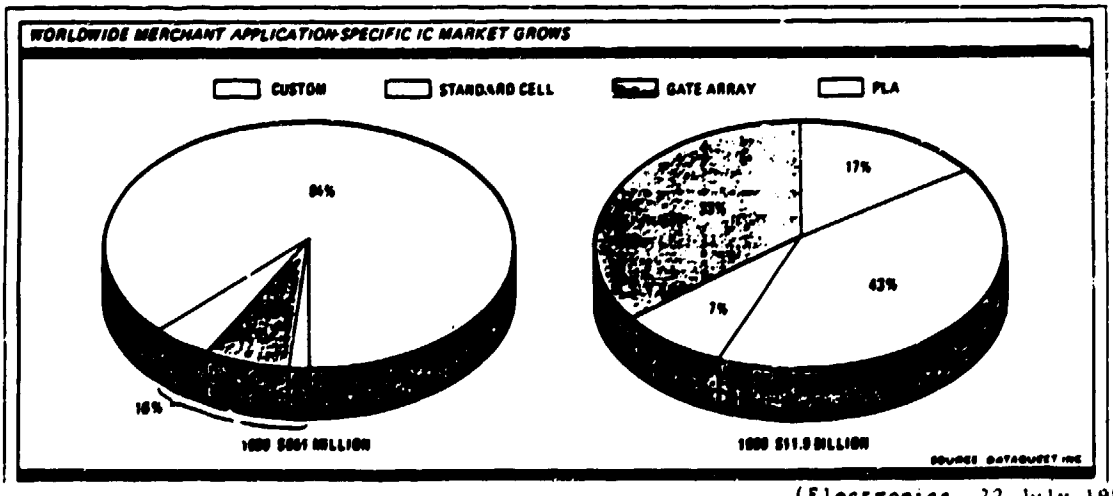
A number of examples of these projects may be mentioned: the Tom, a French specialized system in the diagnosis of tomato diseases, was developed with government participation and considers over 300 symptoms interconnected by a semantic network with 180 inference rules, still in the agricultural field, the British ICI proposes a product called Adviser which diagnoses diseases in agriculture, carries out economic analyses and proposes the use of specific chemical products, two Swedish companies, Epitec and Infologics are carrying a flood control system to completion together with the University of Madrid; mention may also be made, finally, of the different expert systems by means of which the European computer manufacturers are equipping themselves. (IBI Press Bulletin, No. 39, 16 July 1985)

MARKET TRENDS AND COMPANY NEWS

Application specific ICs

The market for application specific ICs will comprise 25-30% of the total IC market by 1990, according to A. Prophet, analyst, Dataquest. In 1985, the market for gate arrays will total $1 bil, the market for standard cells about $140 mil, $200-250 mil for programmable logic circuits and $1 bil for full custom ICs. By 1990, gate arrays will take a large share of the ASIC market, accounting for about $3 bil in sales. Full-custom circuits will grow about 80% to $1.8 bil. Integrated Circuits Engineering sees the total ASIC market hitting $8 bil in 1990 from $1.6 bil in 1984. Full custom will hit $2.5 bil from $775 mil. Semicustom gate arrays will hit $1.4 bilfrom $455 mil and programmable logic circuits $1 bil from $250 mil. The market for standard cells will rise from $90 mil to $2.5 bil. Article discusses design approaches for standard cells and gate arrays. (Electronics, 22 July 1985)

Figure 1



(Electronics, 22 July 1985)

Chip sales to go on dropping, says SIA

The US semiconductor industry will sell 25 per cent less chips in 1985 than it did last year following another month of weak and declining orders, according to the latest trade statistics from the Semiconductor Industry Association (SIA). The book-to-bill ratio, the ratio of new orders to invoiced deliveries which is calculated for US, European and Japanese semiconductor manufacturers, remained for the second month in a row, at 0.72 for July. Although new orders and deliveries fell last month, they compensated for each other in the calculation for the book-to-bill ratio.

Thomas Hinkelman, president of the SIA, said: "The semiconductor industry's lack-lustre orders picture continues to be the result of weak orders for the products manufactured by our end customers". Hinkelman added that new data from the US Department of Commerce in combination with the SIA's own findings had forced the association to revise downwards for the sixth time in the last 11 months its predicted sales for the US semiconductor industry in 1985. The new estimate is for sales at 25 per cent less than last year, at around $8.7 bn for 1985.

In spite of the continuing bad news for the semiconductor industry, semiconductor stocks have attracted a lot of attention from analysts who are confident that the industry will pull out of its troubled period. Semiconductor stocks have been rising at around 20 per cent in value per month through a new burst of interest by investors.

In July, a traditionally slow month, semiconductor shipments were $584.6 m, down 19.4 per cent from June. New US Department of Commerce data shows that orders for electronic equipment fell by 1.4 per cent in June to total $14.1 bn compared with May. Sales of computers and office equipment were weak in June, with only sales of scientific and engineering equipment showing a small improvement. (Electronics Weekly, 21 August 1985.)

US computer market

US computer suppliers are being urged to step up their marketing efforts in Europe to combat the slump in the domestic market. At the US National Computer Conference (NCC) in Chicago, delegates were given results from three different surveys all describing the buoyant state of the European market. The keynote speaker, Admiral Bobby Inman, chief executive and head of the NCC, a joint research effort set up by 21 companies, also told delegates they must improve their ability to compete in international markets.

Although the US market is still growing in comparison with other countries, during the show both IBM and NCR announced quarterly profit drops of 13%. Analysts and speakers at the NCC seemed at a loss to explain the exact reason for the severe slump that is in the industry. There seemed to be general agreement on one point, that the slump is not caused by a lack of cash or credit. A persistent theme has been the problem of networking and office automation. Even informed managers are holding off until the picture over standards and supplier credibility becomes clearer.

IBM made no new product announcements but issued a release outlining its commitment to Open Systems Interconnection and developing new networking products. The move is seen as another attempt to counter confusion over network standards... (Computing The Newspaper, 25 July 1985.)

Conflicting signals come out of Europe

Apparently conflicting signals from the semiconductor industry have proliferated over recent weeks, as European producers attempt to break out of the depressed world market for components by investing. Last week rumours were revived that GEC is poised to make a massive investment in semiconductors, and Ferranti and Plessey reaffirmed existing plans to increase capacity. These parallel major research projects by European producers Thomson, SGS, Philips and Siemens. Europe's situation is different for several reasons. Its current weakness in the world semiconductor market - European suppliers account for less than 10% of total sales - is partly due to under-capacity, which removes the need to slash production. But more importantly, European manufacturers are weak in the markets for standard components, which are hardest hit by cyclical downturns in the semiconductor business. One of these is the market for dynamic RAM memory chips where prices have collapsed from about $5 last year to 25 cents today.

"The Europeans are doing quite well in a downturn market because they serve home markets and niche sectors", says Peter Savage of US analyst Dataquest. "They are also less affected by the downturn in the US computer market." According to a recent survey by market research firm Admerca, specialised custom and semi-custom integrated circuits will account for 50% of

semiconductor sales by 1990, rising from their current level of about 15%. Most of the current European investment in semiconductors is focused in these traditional specialised markets. Megaproject, the massive £500 million scheme announced last autumn by Philips and Siemens, could provide an indigenous source of one Mbit and four Mbit memory chips by 1989...

But the relative buoyancy of these niche markets is attracting increasing competition from US suppliers, trapped by their heavy involvement in the market for standard chips. One example is the market for gate arrays, which until recently was dominated by Ferranti with its proprietary ULA product. Ferranti is now rapidly losing ground to US competitors, notably LSI Logic, which has a broad range of products on the market.

The growing interest in application-specific and custom chips in part explains why capital investment is increasing among semiconductor companies in both Europe and the US at a time of cutbacks in production and slack demand.

Analysts forecast an upturn in semiconductor sales from the end of this year, which would absorb additional capacity coming on stream in 1986/7. Although there is European investment to address the growing world markets for specialised components, increased competition from volume US and Japanese manufacturers will make it harder to maintain today's strength in domestic markets. The battle looks set to revolve around how much native equipment suppliers are prepared to pay for locally sourced components - the indications to date are no more than necessary. (Computer Weekly, 18 July 1985.)

More university link-ups

The gap between the European electronics industry and academic researchers has grown more narrow as both sides see the benefits of a closer partnership. Part of the reason for this change in approach is sheer economic necessity. As public funds for research have grown tighter in many European countries, university workers see more need to attract funds in the shape of sponsored research from companies to continue the operation of academic departments.

For their part, companies have paid more attention to creating mechanisms to tap useful results from the academic world. The motivation for this is, first, that companies in electronics and computing find more and more that pure research done in universities in areas such as semiconductor materials, advanced programming and novel computer architectures (the arrangement of circuits inside a machine) is relevant to products that they want to take to the market place. Second, the cost and complexity of much of today's computing research is such that only companies in the premier division of the world's electronics industry - these are mainly American companies such as IBM, Xerox and AT&T - can afford the facilities to do the work themselves. For those further down the league table - which means even the biggest European companies, such as Olivetti, GEC and Philips - the most practicable option is to turn for such pure research to the leading university laboratories and set up collaborative ventures.

ICL of Britain three years ago created University Research Council, funded with £500,000 a year, to cement contacts with leading computing departments in academia. The cash has sponsored individual research projects and paid for a series of seminars at which academic people and ICL staff can discuss subjects of common interest. By this mechanism, Mr. Mike Watson, technical director of ICL, says his company has struck up useful links with universities such as Oxford, Cambridge, Manchester, Kent, Stirling and Edinburgh and London's Imperial College. Such efforts do not always proceed entirely smoothly. Some leading academics in computing, at least in Britain, sometimes find it hard to disguise that they feel their own intellectual abilities are far above what the average researcher in industry has to offer. For their part, the companies may become frustrated at what they see as the leisurely attitude to research shown by some university departments which is out of step with industry's more urgent requirements regarding the development of products.

These difficulties notwithstanding, the closer links between industry and academia are illustrated by the rash of moves all over Europe to set up science parks and innovation centres in which companies (both established firms and fledgling enterprises perhaps started by academics themselves) can work alongside each other.

In West Germany alone, during the past year or so, about 50 towns or regions have set up or announced ventures of this kind, normally linked with an academic institute. West Berlin, for example, has a thriving innovation centre set up a little over a year ago in which small firms in areas such as computing, electronics and robots operate in premises rented by the city's Technical University. Nixdorf, one of Germany's leading computer companies, has also decided to set up premises on the site.

In Britain, Newcastle University took a pioneering step six years ago in setting up the Microelectronics Applications Research Institute (MARI) which acts as a bridge between the university's computing department and the world of industry. MARI is an independent research organisation with four members - the university, Newcastle polytechnic, Tyne and Wear County Council, and CAP (the software company). The institute has annual sales of £1.4 m and frequently calls upon people from the university or polytechnic to act as consultants in projects that it undertakes for industry. MARI is probably best known for its marketing of a product originally developed at the university's computing department and sold as "the Newcastle connection". It is a software protocol, which, for example, is used in some Honeywell, Burroughs and ICL computers and which provides for interconnection between these machines and other items of hardware made by different manufacturers. ... (Financial Times, June 1985.)

AI Pacts Signed

Several small companies striving to establish footholds in the so-called artificial intelligence market have sold equity positions to and signed marketing agreements with larger companies. Carnegie Group Inc., a Pittsburgh-based producer of expert systems software, sold a 10% stake to Texas Instruments for credit toward hardware and cash, among other terms not disclosed. The two companies also signed a three-year licensing agreement that calls for TI to fund research in exchange for access to Carnegie's software and expertise. Carnegie has also sold stakes of about 10% to Digital Equipment, Boeing, and GSI, a French company. Meanwhile, Intellicorp, a Mountain View, Calif., competitor of Carnegie's, has signed a joint marketing agreement with Hewlett-Packard. The two companies will push Intellicorp's KEE software on the HP 9000/300 series of desktop 32-bit micros. DEC signed a similar, nonexclusive marketing agreement with Artificial Intelligence Corp., supplier of the Intellect natural language database query package. A C-based version of Intellect will be sold by DEC on the VAX line of computers as a front end to DEC's RDB database manager. Finally, Raytheon, a large military contractor, has through its venture capital arm acquired a 14% stake in Lisp Machines Inc., Andover, Mass., for $4.5 million. The deal was part of a $12 million fourth round of financing for Lisp Machines, which has already sold equity to TI. (Reprinted with permission of Datamation magazine, copyright by Technical Publishing Company, A. Dunn and Bradstreet Company, - all rights reserved.)

A new script for chips

It is expensive to produce prototypes of new microchips. As technical advances make chips smaller, faster and more sophisticated, the cost goes up, not down. To recoup the investment, chipmakers need production runs of hundreds of thousands or more. That gives an edge to the biggest of the Japanese and the American chipmakers. This is fine when hundreds of thousands of chips are needed. But what to do when chips are required in smaller volumes? In the past, the answer has been to adapt a standard chip. This approach - semi-customising - is a compromise: such chips run more slowly and are more bulky than a start-from-scratch full-custom version would be, but they can be made more cheaply and swiftly.

Mr. Robb Wilmot, chairman of Britain's largest computer company, ICL, and a passionate pan-European, reckons he can make that compromise less unhappy. He is setting up an independent company, European Silicon Structures (ES2), of which he is co-chairman. ES2 thinks it can turn out prototypes of more-nearly-customised chips, called compiled-silicon chips, at around the price of conventional semi-custom ones but faster; perhaps in as little as two weeks. It will draw together expertise from across Europe and service an exclusively European market. The managing director is Mr. Jean Luc Grand-Clement, a Frenchman who was formerly with Motorola, an American multinational chipmaker. ES2's head office will be in Munich; its design centres in Paris, Munich, London, Milan, Stockholm and Edinburgh. It hopes to have 300 employees by the end of next year and 1,000 - and sales of $100m - within five years.

ES2 has already bought chip-design technology from Lattice Logic, a Scottish software firm; and it will set a team of 80 engineers to develop its own automated design techniques. Designing the chips will involve collaboration between ES2 and its clients, who will be computer firms, telecommunications companies, defence contractors and, possibly, universities and schools. The chips themselves will be produced by direct-writing, a process which omits the expensive and time-consuming step of constructing a mask for etching the silicon.

Direct-writing becomes uneconomical as production runs move into tens of thousands; but ES2 reckons that 90% of all gadgets that might use such chips in Europe's fragmented markets are produced in batches of less than 10,000. At those numbers, direct-writing should offer considerable savings. Also, computer hardware is becoming more specialised. It is much

cheaper and more efficient to embed programmes and operating systems in silicon than it is to run them on large, but largely redundant, general-purpose machines. All this, ES2's founders think, creates a market for low-run, low-cost chips. Dataquest, a market research firm agrees; it expects the market for compiled-silicon chips to grow faster than the industry as a whole. ... (The Economist, 7 September 1985.)

European agreement for microcomputers

An agreement of co-operation was very recently signed by Olivetti, Acorn and the French Thomson for the development and sale of personal and microcomputers intended for the education market. Also foreseen is the institution of a work group which is to proceed with the study of the areas of technical interest common to the three firms. All this ought to favour the development of a common European standard capable of competing with those of the USA (Atari and Commodore) and of Japan (MSX).

The European education market, according to estimates made by the experts, will be able to reach a potential absorption capacity of 10 million units by the end of the decade. The microcomputers of the second generation will be more and more powerful and it will therefore be possible to use them not only in schools but also in offices and homes, with the possibility of connecting them to telematics stations and to value added services. Their presence on this type of market will ensure future life to European companies.

Immediately upon having reached an agreement, the three companies expressed the hope of being able to involve also the software-creating houses. The latter, motivated by the prediction of the placement on the market by 1987 of a substantial quantity of new products, could become united in the project of the European companies. At present, the major part of the programs is written for the processors that encounter greatest favour on the market. This further favours their sale and creates a spiral that makes competition difficult for small companies. It is only by entering the market with a significant sales strength and with a complete product that it can be hoped to take a dominant position at international level. (Bulletin IBI Press, No. 51, 7 October 1985.)

AT & T joins forces with Japanese group

US telecommunications giant American Telephone & Telegraph (AT & T) is undertaking a joint venture with the Japanese Ricoh group to increase its hold in the Japanese telephone systems market. This follows the venture AT & T agreed last month with Japan ENS to provide access for its network services. The new venture will be 51% owned by AT & T and will transfer its technology to get the venture off the ground. Both moves indicate increasing interest by the US company in gaining a share of the highly profitable Japanese telecomms market following April's privatisation of the Nippon Telelphone and Telegraph state monopoly. (Computer Weekly, 8 August 1985.)

AT & T chip finds the million mark

AT & T has started producing memory chips which hold one million pieces of information, making it the first manufacturer outside Japan to deliver next generation memories. These memories are four times the size of a 256K RAM - the largest memory in mass production today - and open the door to dramatic price/performance gains in computer and telecommunications equipment, most of which currently uses 64K and 256K memory chips.

AT & T expects to begin full production early next year, but limited production is already underway and selected customers have received the chips for testing. AT & T will use the new memories in its own computers and PABX products but also sell them externally through its two-year-old commercial component sales division.

Memory chips account for a growing slice of total component sales and are forecast to grow from about $3.8 billion this year to $11 billion by 1989, rising from 19% to 25% of the total IC market, according to market research firm Dataquest. Japanese manufacturers currently have a monopoly of the emerging one Mbit market, led by Toshiba. (Computer Weekly, 12 September 1985.)

LSI Logic plugs into Europe

Step by step, the ambitious plans of LSI Logic, the U.S. based semiconductor company, are being pushed ahead in Europe and Asia. As part of its global strategy, LSI Logic selected Brunswick in West Germany earlier this year as the site for a DM 150 m ($52 m) plant to make custom and semi-custom chips by 1987. More recently, it linked with Kawasaki Steel in setting up a joint subsidiary to build a similar $100 m semiconductor plant in Japan by mid-1987. In addition to its U.S. operations, these moves will give LSI Logic strong regional bases from which to build up its already fast-growing business.

While some standard chip manufacturers have run into problems with the recent slowdown in sales, markets for custom and semi-custom chips have held up relatively well. LSI Logic is pressing on with its plans to meet what it expects to be strongly rising demand. LSI Logic is also planning to open more design centres in West Germany and other countries to provide software and other specialised support for customers to help them develop integrated circuits for their own requirements. ... (Financial Times, 20 September 1985.)

GE (US) looks for automation allies

General Electric (US) hopes to reach wide-ranging agreements with European industrial partners which could lead to partnerships in factory automation products during the next few months. GECQ has already signed up with France's Mors company for the development of programmable robots. Meeham is seeking annual growth in Europe for his company of between 15 and 20 per cent. ... (Electronics Weekly, 16 October 1985.)

Fairchild 32-bit entry

Another 32-bit microprocessor entry was made by Fairchild Camera & Instrument Corp. This chip promises to be a top performer, but will not do battle with the numerous general-purpose units coming into the field. Sources indicate the new chip has about 250,000 transistors on a single die which is 100,000 square mils in area. It will be built on a CMOS process with 2-micron design rules, two layers of metal, and two layers of polysilicon.

The product is strategically positioned to be an optimum choice for many engineering and scientific applications, those now priced around $20,000. It will have a RISC (reduced instruction set) architecture with hardware designed to run a few simplified instructions as rapidly as the silicon circuit state of technology can execute them. Gate delays are reported to be around 2ns. ... (Electronics Week, 25 September 1985.)

APPLICATIONS

Factory Automation

Two and a half years after setting up world HQ in Dublin, Hyster Automated Handling Systems Ltd. has launched the first fruits of its research. These are a series of vehicles - the Movematic series - that move around factory floors, according to pre-programmed instructions. They carry heavy parts from warehouses to production areas, or from one production area to another like a sort of mobile conveyor. These driverless mini-trucks can be used almost anywhere in the warehouse. At its simplest, an automated guided vehicle (AGV) may be used to collect and deposit pallets at various locations within the warehouse. In a more complex application, the vehicle may be used in a production area as a work platform replacing conveyors or transporting work in progress. Many car assembly companies transport car chassis about the plant on an AGV, and add the various parts as required to complete the chassis. 'In the final analysis, autonomous AGVs can be custom designed to meet any warehousing requirement,' says Hyster.

There are few limitations to the areas where AGVs can be used. They are particularly useful in environments which have been found unsuitable for humans to operate, says Hyster. It has installed automated products in environments which are below freezing temperatures. The AGV can work continuously, interfacing with other production processes without any interruptions. AGVs are becoming part and parcel of factory automation. Hyster summarises their attractions thus:

- Productivity is boosted as AGVs bring material to the right production area at the right time, releasing other machinery and manpower.

- Costs are cut, since stock and work-in-progress is reduced. AGVs are claimed to simplify production scheduling and inventory, for an AGV system enables managers to control materials transportation in 'real time'.

- AGVs can form part of a flexible manufacturing system. ... (Technology Ireland, October 1985.)

PLCs

The role of programmable logic controllers (PLCs) increases daily in industry as companies, through their managers and engineers struggle to be more efficient and competitive in the face of rising costs. In this continuous race, PLCs cut the cost of control systems;

replace counters, timers, relays, the associated internal hard wired items in control cabinets; and reduce them down to small compact units. They are also capable of a very wide range of functions (digital, analogue, valve position, drum timer, etc.), they can be relatively easily reprogrammed - no need to rewire cabinets and change hardware - and they give a limitless possibility of plant wide expansion, so that better control, lower cost, and greater flexibility can be achieved progressively.

Any company in the process field - indeed anyone who makes or uses machines bigger than a few horsepower - must seriously examine the use of these new tools. With their basically simple architecture, using I/O modules to connect to the plant and the PLC brain, and a programmer similar to a pocket calculator to enter the programs, these systems give instant and flexible control to the plant connected to them.

The development of the Programmable (Logic) Controller can be regarded as a replacement of some former systems, but with a whole range of new possibilities. It is advancing the scope of the old, and creating new opportunities in industrial engineering that seem to increase as each new range of products is released. Just what is a programmable logic controller? 'Programmable' is used in the general computer meaning of the word. It also includes the possibility of frequent changes in a program, if so desired. 'Logic' also comes from the computer world, as used in the electronic circuits of the PLC (it changes the abbreviation to PLC, and makes it distinguishable from PC for Personal Computer. Most manufacturers, however, leave the 'logic' out of the name). 'Controller' hardly needs a definition, since a PLC can be used to control almost any function in a plant, once a signal is fed from the plant item to a terminal in the PLC.

As well as examining which one of the vast range of PLCs will be most suitable for his or her requirements, a first time user must remember that each item of plant will have to produce a signal acceptable to the PLC. All items have to be fitted with a transducer, to convert valve movement, pressure, temperature, and any of a host of plant readings, to a digital or analogue signal for transmission to the PLC and to receive the outputs. (Technology Ireland, October 1985.)

Deciphering Millwide Management Systems

Millwide automation, millwide control, and millwide information systems were among the major topics discussed at Pulp and Paper Automation 85, sponsored by Southern Pulp and Paper, May 21-23, 1985. "The major driving force behind millwide systems has been the need to improve productivity and increase profitability," said Jack Ross, marketing manager, pulp and paper industry, Process Managements Systems Div., Honeywell, Inc. To maximize productivity and profitability, Ross said mills should combine microprocessor-based and computer-based process management with business management systems. Ross explained that integrated mill management provides the costs of producing a ton of product and breaks those costs down into individual components. "Operators and supervisors can therefore control efficiencies and costs, rather than flows, temperatures, and pressures," he added.

Ross sees three obstacles to an integrated millwide management program: the challenge of tying together different systems; the difficulty of showing an adequate return-on-investment (ROI) for automated systems; and the lack of development of applied software to meet complex manufacturing problems. Integrating systems of programmable logic controllers, millwide information systems, supervisory process systems, and EDP business computer systems is a formidable task. Efforts to meet this challenge are coming in the form of millwide architecture, the universal window concept, and a family of gateway interconnects, Ross said. Ross believes that control system vendors should work with mills to establish a long-range, millwide plan that projects a sound ROI. "Justification of individual projects should consider the project's role in this long-range plan, as well as short-term returns," Ross said. Finally, although control systems lend themselves to a packaged approach, software requirements of millwide automation are considerably more complex. Vendors must work more closely with mill personnel to customize their systems to mills' needs.

"The grandiose approach to millwide automation will be a failure," Dean Forseth, director of pulp and paper marketing, Measurex Corp., said. He advised mills to think big, but start small, using a modular building block approach. ... (Paper Trade Journal, August 1985.)

New dyehouse computer-control system

The system, developed by the Melbourne-based company Industrial Computer Systems Pty Ltd. (ICS) in association with the CSIRO Division of Textile Industry, has been installed in the Division's textile mill in Geelong. Automated systems for the control of dyeing machines

are now an essential feature of modern dyehouses, offering improved production, reduced energy consumption, easier reproduction of shades and optimum use of dyes and chemicals. The new system offers flexibility at least equal to those currently available commercially. It is capable of providing multiple machine control simultaneously, and is expected to have applications for process control in other sectors of manufacturing, e.g. batching and mixing, chemical processes, flow control and speed control.

In recent years, several highly sophisticated systems capable of controlling complete dyehouses from a single command point have been marketed worldwide. The ICS/CSIRO system is the first Australian system developed for industrial dyehouses. .. (CSIRO News.)

CAE for footwear company

A computer-aided engineering system enables an athletic footwear company's research and development team to design and manufacture its product in-house in a more precise, quicker and more secretive approach than previously used. The Research and Development Lab of Nike, Exeter, NH, USA turned to a computer-aided engineering system in 1978 to design its running shoe midsole and outsole designs. The company officials were looking for ways to get as much of the work done in-house as possible and to enhance the company's high-tech image.

The R&D unit uses the CAD/CAM system for midsole and outsole mold design and manufacture. The midsole is the portion of the sole unit which provides cushioning and protection, while the outsole is the bottom of the shoe which comes in contact with the ground. The design and manufacture process starts with a conceptual drawing from an in-house designer in Exeter. The R&D unit then creates a fully detailed drawing on the computer display screen in 2-D or 3-D. Once the designer has approved it, the engineers grade the shoe up or down for the various sizes. Engineers at Nike have the option of using a standard size of nine as a starting point, and scaling, or grading, from there. Shrinking or stretching the design is done automatically by the computer, while the complicated task of adding waffles (rubber grids on the bottom of the shoe for traction) is accomplished interactively. When the designer is finished and the geometry of a part has been determined, the engineer calculates all the stops and curves, and creates a file of the manufacturing data. The complete file containing instructions telling the tool where to cut is then transferred, either by loading onto the memory of a connecting terminal, or by punching onto paper tape, to the milling machines located three floors below the design center.

The basement of the Exeter facility is devoted to mold manufacturing, thus keeping the midsole and outsole design-to-manufacture cycle in-house. Exeter has three milling machines which take the instructions from the completed files and duplicate the tool motions. The computer generates all the tool locations to cut a particular piece. If a new mold needs to be made, the program is already in place, saving time and money. Before automation, Nike's design process was similar to that of most shoe companies. Someone from Nike would take a detailed drawing from the engineer, submit it to an outside mold shop and wait several days for the shop to cut the mold. Any changes in the design had to be done by hand and then sent back to the mold shop. (Reprinted with permission from Industrial Engineering magazine, December 1984, Copyright Institute of Industrial Engineers, 25 Technology Park/Atlanta, Norcross, GA 30092, USA.)

Technology enters European jurisprudence and legislation

Interesting telematics systems for the filing of data that concern both the juridical and legislative activities of individual countries and sets of rules or sentences of an international nature are being formed in numerous European countries. France has set up a number of databases in which all of the country's laws and ministerial directives, as well as the relative jurisprudence, are being filed. Industrial and labour relations, also of an international nature, are being stored in a file called "Labour", a giant file which contains all the data relative to the jurisprudence of the cassation and constitutional courts, as well as internal laws of a financial nature. Belgium has undertaken an interesting process of data filing concerning not only the doctrine, the jurisprudence and the laws and amendments of the country, but with a view to the medium-term future, has created databases on international bankruptcy law, on laws concerning food additives and on the legal and doctrinal literature of numerous European countries. It has made provision, as well, for the filing of laws passed by the European Parliament. Also Great Britain and Ireland have constituted databases that mainly involve the country's legislation. The former has, in addition, given the green light to a Patlaw file that collects international legislation on patents, copyrights and unfair competition.

Italy, as early as 1973, founded an Electronic Documentation Centre (CED) of the supreme court of cassation. The system, called Italgiure, in consideration of its connection on a national scale to over a thousand terminals, whose number will shortly be increased by 500

units, presently answers 4,000 queries daily. Access is possible to the database by lawyers, magistrates, universities, financial traders and citizens who want to consult sentences, tax laws and regulations which, in some cases go back as far as 1940. The file also contains the most important sentences by the court of justice of the European community as well as those by the Court of Auditors and the Council of State, as well as Italian and foreign publications that concern jurisprudence and an overview of national labour contracts. Also documentation of a juridical nature on ecology has been filed. We recall that the Argentinian government has utilized the Italgiure system, adapting the relative software, thanks to active collaboration of the Intergovernmental Bureau for Informatics (IBI) and to the operating needs inherent in the constitution of its own legislative file. (Bulletin IBI Press, 2 September 1985.)

Expert calls for ai help to beat crime

A leading police expert has called for the use of artificial intelligence (ai) systems for solving crimes. Barrie Irving, director of the Police Foundation, said that police computers already in use did not make a detective's work any easier. 'Piles of computer information output land on inspectors' desks every day but they do not provide any answers just pose more questions. The average system can do only marginally quicker what people used to do by hand.' He added that ai or expert systems could be used to help the police reach the right conclusions about a case. 'With current advances in the field of ai it should be possible for a system to be modelled on a top CID experts,' Irving commented. 'Some years ago there was a serious miscarriage of justice when three boys were convicted of murdering a male prostitute,' he said. 'The detectives concerned drew the wrong conclusions from the evidence. The subsequent enquiry showed that this could have been avoided if a database could be assembled on known cases of strangulation.' Irving stressed that expert systems for the police were being held back because of the force's 'natural suspicion' about the effectiveness of the computers. (Computing The Newspaper, 17 June 1985.)

Expert Systems For Hire

For non-standard as well as for complex problems, engineers frequently have to seek an expert's advice. But in developing countries, expert advice for unique engineering problems lies miles and, often, months away. Today developments in artificial intelligence promise to bridge the distance. By creating computer programs that provide portable expertise to engineers (or, in the future, to financial planners, accountants, managers, etc.), artificial intelligence will shortly be able to solve thorny problems anywhere. Dubbed 'expert systems', these new programs work by focusing experiential knowledge culled from experts but without an expert having to be present. And along with portability, they have the potential to raise the level of performance of even non-specialists, to avoid the problems associated with inexperience and even to educate students. The key element of these new systems is knowledge. Their knowledge-base stores rules of thumb, facts, models and a general knowledge about a class of problems collected from human experts. With only a general control strategy, expert systems solve each problem uniquely and in their approach replicate aspects of human thinking which other computer programs cannot attempt. It was only recently, however, with the increase in power of microcomputers that it has become possible for expert systems to penetrate environments less sophisticated than the university or corporate office. Now the specialist's state-of-the-art knowledge can be brought to an engineer wherever he may be.

In the Civil Engineering Department of MIT, one expert system for personal computers has already been written. Entitled RECON1 (Reinforced Concrete), it was made in BASIC for the IBM PC by Professor Jerome Connor and his staff to verify the design of reinforced concrete beams. RECON1 is only the first of a proposed series. Other application areas, such as a stress analysis tutor, are being considered for development. The project intends to develop a stock of portable computer, expert systems that will solve real civil engineering problems by very simple means and thus, though more powerful, be as accessible as an engineering handbook on a shelf. When the library is complete, technologists will have a body of powerful, expert knowledge waiting to solve specific civil engineering problems wherever and whenever the need arises. (Technology and Development, MIT, Summer 1985)

Informatics and fashion

International talks were held in Paris on "the new technologies and fashion". Designers, clothing manufacturers and suppliers of computerized equipment met at round-tables, conferences and equipment exhibitions. There is an awareness that the computer will also revolutionize the fashion world. Software and specialized equipment make it possible for the artists who create style to function like professionals of the textile industry, careful of the needs of production. To keep designs in an external memory and then add variations the next season, lowers the cost price of styles. To conceive images

generated by computer and utilize them later in fabrics renews the decorative motifs and finishes with the practice of cyclically taking the same motifs as has been done for two hundred years. To draw forms and make corrections on the screen shortens the long dialogue, around sketches, that designers and industrialists hold when creating a collection. Three-dimensional computer-assisted designing, developed by French university researchers and industrialists, make it possible conveniently to display various positions and automatically to generate patterns. What is more, a prototype may be obtained if the connection is made to an automatic production line. (Bulletin IBI Press, No. 42, 5 August 1985.)

Computerized anatomy and psychoanalysis

An American firm based in Dallas (Texas) is presently testing a series of programs that will make it possible to establish the origins of a number of the most common neuroses as well as to suggest the relative diagnoses. This is taking place while, in London, a laser videodisk system is being developed which will make it possible for medical students to carry out anatomy experiments in the absence of natural subjects.

The latter system is constituted by a laser disk, a keyboard and a video screen. About fifty programs for the videodisk are being implemented. They provide a wide choice of study courses to follow at their various levels. It will be possible for every student to advance through his programs, skipping the analysis of subjects already familiar or of little interest. Moreover the possibility of displaying, of moving, and of checking the images of organs or of tissues being examined could provide a stimulus for students obtaining little motivation from analyses on real subjects. It has also been pointed out that it will be possible widely to apply such methods in areas, e.g. developing countries, where the infrastructures necessary for anatomical experiments are in short supply.

Until now the use of the computer in the phychoanalysis field had been limited to the examination of the results of diagnostic tests. But from now on, they will be utilized also to ascertain patients' personality characteristics through quizzes and questions prepared and evaluated by the selfsame computer. The numerous tests run have revealed a number of important advantages of the computer over the analyst. First of all its anonymity - the scrupulousness and the absence of criticism guaranteed encourage many patients to total sincerity and a complete trust in the machine. After a series of tests and questions, the patient is given a diagnosis and relative therapy. Of course the ill persons are followed up by doctors and their progress evaluated until total rehabilitation. (Bulletin IBI Press, No. 46, 21 September 1985.)

The deaf computer is beginning to hear

IBM has just launched a prototype of a system that identifies and writes with 95% accuracy the series of spoken phrases which use a previously established vocabulary of up to 5,000 words. A start has thus been made in solving with limitations the difficult problem of the multiform structure of spoken information, with many words articulated and affected at the beginning or end, as well as wide pronunciation variations.

The product, prepared to facilitate and control of informatics systems with spoken input, takes many simultaneous phonetic factors into account, beginning with a first probabilistic identification of the flow of sounds, sampled every 5 ten-thousands of a second, against a set of phonetic samples from the same speaker, which the latter has introduced into the computer earlier by slowly reading a long standard text. This learning system resembles the practice of guiding the arms of a robot the first time through their trajectory, at the hand of experts, thereby introducing the data without having to calculate them. This system is not then based on unknown phonetic or physiological rules regarding the production and comprehension of speech. This characteristic of the "black box" will make possible a great many applications, beginning with the direct dictation of mail, the broad dialogue with machines or the final overcoming of deafness. ... (Bulletin IBI Press, No. 45, 2 September 1985)

Informatics and the blind

Versabraille appeared on the market in 1981. After two years of circulation in a closed circuit, the apparatus manufactured by the American firm Telesensory has found its place in a program developed by Institut Nazareth et Louis Braille of Montreal (the regional centre for the rehabilitation of the blind). Versabraille offers the unseeing the supports they need most to carry on their studies or their occupations.

Versabraille P2D is an intelligent terminal which stores and processes data. Its cassette system is able to record up to 400,000 characters in Braille. Versabraille comprises a keypad with 7 keys representing the conventional Braille typewriter keyboard -

eleven function keys make possible the text search and location operations. Moreover, a touch-page marked with raised points reproduces the Braille symbols and serves both to enter and to retrieve data. This page, functioning like a screen, allows the fixing of twenty characters at a time. Versabraille can be connected to any microcomputer and allows two-way communication. Interfaces make possible the transfer from Braille to printed text and vice-versa. Some users communicate via a modem.

Those responsible for the program nevertheless acknowledge that what the blind need most is the possibility to have access to databases and the diffusion of books by computer support, in the face of the apparent indifference of those who invent software. As far as the potential market the unseeing could represent is concerned, the Institute is undertaking research studies to favour the social integration of the unseeing by facilitating their access to education and employment. (Bulletin IBI Press, No. 43, 12 August 1985.)

Medical on-line directory

The American Medical Association is co-operating with the federal Centres for disease control (CDC) and the John F. Kennedy Institute for Handicapped Children to create a bulletin board of disease alerts to be beamed to doctors via Med/Mail, the electronic messaging service of Minet (GTE Telenet's Medical Information Network). CDC will supply information on recent developments in diseases such as AIDS and toxic shock syndrome. The John F. Kennedy Institute will supply a directory of resources for serving developmentally disabled persons. This on-line directory, which can be accessed by geographic region, includes name, address and phone number of contact person, as well as the service offered and the payment system. Further information can be obtained from: Jane F. Coughlin, American Medical Association, 535 North Dearborn, Chicago, IL 60610, USA. (ACCIS Newsletter, 3 September 1985.)

Micros to survey nutrition

To overcome the inadequacies of conventional nutrition surveys, a Canadian man-and-wife team of nutritionists has devised a programme for use on portable ultra-microcomputers. Such surveys vary widely in complexity and scope depending on the goals desired, the technical expertise available and as always, the financing. Who wants the information revealed by a nutrition survey and why? In developing countries the planners in ministries of health normally have four major aims:

- to determine the prevalence of protein energy malnutrition or other forms of malnutrition, and plan or evaluate remedial programmes;
- to screen victims or determine priority groups in need of food aid during famine or disaster/refugee relief operations;
- to provide nutrition status information as a component of composite health surveillance or general development indicators; and
- to reveal the nutrition impact of traditional practices or of changes in such customs as a result of planned or inadvertent social change.

For many nutrition survey purposes, anthropometric measurements of young children, particularly weight and height, are often the main or only source of data. Such data, when compared with age-specific growth standards, are used to determine the nutrition status of the surveyed population.

In addition to obvious, ever present logistical and economic constraints, two inadequacies of conventional nutrition survey methodologies are consistently evident. The time elapsed between the initial visit of the survey team and the report of survey results to national authorities can range from months to years, particularly if the data are analysed outside the country. Delays in remedial programme planning and action are then inevitable. In addition, it is usually not feasible to provide an accurate situation analysis on-site. This tends to limit the possibility of profiting from local knowledge about causes of the current nutrition status; precludes survey workers from making further enquiries based on locally acquired knowledge; and limits the team's ability to make intra-district/regional comparisons and provide preliminary reports to district or regional authorities. The advent of electronic calculators, computers as such, and wall charts has not solved these problems. Battery- or solar-powered calculators require manual equation input which is time consuming during data collection, prone to error and distracts the operator from observing the child being measured. The on-site calculation of a composite analysis remains relatively time consuming. This time would be better spent getting to know the locals and discussing the situation analysis, if it were already available.

Computers have, of course, greatly facilitated in-country data analysis, but where they require grid or generated electricity they cannot operate in non-electrified villages.

Wall charts, while useful for screening purposes and of low cost, do not provide a composite analysis and are subject to imprecision.

To overcome these difficulties Kripps and Harrison developed the Nutrisur programme in 1983-84 and field-tested it in Laos. Its advantages are that:

- weight-for-age, height-for-age and weight-for-height analyses for each child are determined instantly upon input of the measurements, are shown on-screen and printed;
- composite analysis of these three standard parameters in standard age groupings for the completed sample is produced in five minutes and printed in multicopies;
- data may be printed and stored on microcassettes and automatically file-coded; and
- a maximum single sample size of 100 children aged 0-60 months is possible.

The speed with which a complete analysis of the child's nutritional status is made available to the researcher is a major advantage of the system. It was found that it took only five minutes after the collection of the data in the field for a complete breakdown of the child's nutritional characteristics to be displayed. Another is that critical cases of malnutrition can be attended to at once. (Development Forum, October 1985.)

Monitoring desertification

A computer-based model for the creation of maps showing the status, rates and risks of desertification has been successfully tested. The model, which describes desertification as a function of a number of ecological, social and economic variables, uses Landsat imagery and digital data as a primary source of information. All input data is registered to suitable map projections and integrated into a geographical information database for further processing. The system outputs maps with an acceptable degree of accuracy and has the advantage of being more rapid than traditional assessment methods.

It is expected that the system can be used to assess the impact of man and climate on the ecologically vulnerable arid and semi-arid areas of Africa. The preliminary studies for the project covered several areas in the Sudan, Kenya and Tunisia. The model has been developed by several Swedish government agencies in co-operation with the University of Khartoum, Sudan. (Bulletin IBI Press, No. 53, 21 October 1985.)

Biosensors

In the wake of the biotechnology revolution, scientists and engineers are increasingly aware of the advantages of allying bio-systems with other, compatible technologies. One emerging new area is what's broadly described as bioelectronics. This involves exploiting biological systems by coupling them to electronic devices. The most significant of these are biosensors. These may have as important an impact on analytical methods and techniques over the next decade as the other biotechnological processes will have on chemical manufacture.

Biosensors are one of the three major bioequipment growth areas identified by the US organisation, Creative Strategies International. The coupling of electrochemical devices to biotechnology offers a very exciting future especially to countries whose research capability is limited. The development work involved in producing specific devices would suit small laboratories or research groups working in close co-operation, and primarily involved in process research oriented towards other areas of biotechnology.

To some extent, the new microbial sensors described in this article could be considered as a miniature fermentor from a research/theoretical point of view at least. For example, the basic information required for biosensor design, using immobilised cells or tissue, (that is, using techniques involving the physical confinement or localisation of the cells) is no different to that required for other process developments (product formation, for instance), especially in such technical areas as mass transfer and metabolic regulation within the matrix. The development of biosensors seems to have an unlimited potential in process control, and will probably be an integral part of the process design of the future.

First, why have biosensors been developed, and what advantages have they over conventional technologies? Determining specific chemical compounds in multi-component liquids (for example, biological fluids, microbial cultures and so on) is a complex operation which often requires complicated purification procedures. These factors limit the scope of

current analytical methods, and impose severe restrictions in areas where in-line process monitoring is advantageous.

The areas constrained by these restrictions include fermentation processes, environmental hazard or pollution evaluation, the use of artifical organs or even evaluating physiological responses to medical treatment. All these areas would benefit from developments in bio-electronics. ...

Particular uses for these new analytical tools have to be investigated. Biosensors are specific sensors, and consequently a given system is unlikely to have a wide range of applications. However, the versatility of the basic principles will allow a range of adaptations to cover diverse applications. But each application will probably have a dedicated sensor. A number of reports describe the performance of biosensors. One study shows how microbial electrodes are applied to analyse effluent from a fermentation factory. The concentration determined by the microbial electrodes agreed well with that established by conventional methods. Another study claims that a microbial sensor designed to determine methane was able to detect concentrations approximately 10 times lower than those detected by gas chromatography. A further report demonstrated that the response of a research group's bacterial electrode was linear beteen 10^{-4} and 3×10^{-3} M histidine, while another experiment demonstrated a response to concentrations of glutamine as low as 2×10^{-5} M. Phosphate concentrations as low as 8 mM have been detected with a photomicrobial sensor for the selective determination of phosphate, and an aspartame microbial sensor detected concentrations as low as 7×10^{-5} M aspartame.

Thus there is little doubt but that microbial sensors can be extremely sensitive to very low concentrations of chemicals. Interferences introduced or induced by compounds other than those for which the electrode was developed can occur. ...

The feasibility of a microbial sensor has only begun to be shown at laboratory level. Implementing the basic information to design a system which will be commercially acceptable is a much more complex operation. First, the market potential for the device must be examined. Indeed the need or requirement may have to be generated through education. Success will depend on the biosensor being perceived as more accurate, more specific, easier, faster or cheaper than alternatives.

Over the next decade there will be exciting advances in electrochemical sensors. These will include developments in ion selective electrodes (ISEs). Developments such as chemically sensitive field effect transistors (CHEMFETs) for in vivo monitoring, ion-selective field effect transistors (ISFETs) as well as coated wire electrodes (CWE) are on the cards. Advances will also occur in other directions, based on the fact that sensor specificity derives from the biological reaction. This has been shown by systems based on affinity binding called bio-affinity sensors, and also immuno-sensing systems with electrochemical detectors in which antibody-antigen complexation triggers the release of an electro-active marker. (By Dr. Aiden J. McLoughlin, Department of Industrial Microbiology, University College Dublin, reprinted from Technology Ireland, October 1985.)

Grolier puts an entire encyclopedia on disk

An entire 9 million word encyclopedia has been placed on a compact optical disk by Grolier Electronic Publishing and can be accessed by most personal computers. Users can search for a particular subject or word or a group of words in the Academic American Encyclopedia in less than five seconds. This can be done using an IBM PC or compatible microcomputer or the Atari 520 ST linked to any manufacturer's CT-ROM disk drive, in an adapted audio optical player system. Grolier will be selling the new product for $199 through computer retail outlets in the US from October 1985. (Computing The Newspaper, 27 June 1985.)

The art of mapmaking becomes a science

A map of a town that gives details not only of the layout of houses but who lives in them and the position of the water pipes underneath would stretch to its limits conventional mapmaking technology. So a company in Cambridge (UK) turned to the computer in an effort to create maps that can contain a wealth of written information as well as diagramatic detail. Applied Research of Cambridge came up with a system that it hopes to sell to bodies such as local authorities which want a modern way of gaining access to the huge amount of building-related data that they may already store in different archives. The company's first sale was a £500,000 system, based on seven Tektronix terminals and a Prime computer, installed at the Wallingform offices of South Oxfordshire District Council. With a keyboard, people in the council's planning department can call up from a memory a map of a specific part of the district. Together with this, they can obtain written information about, for

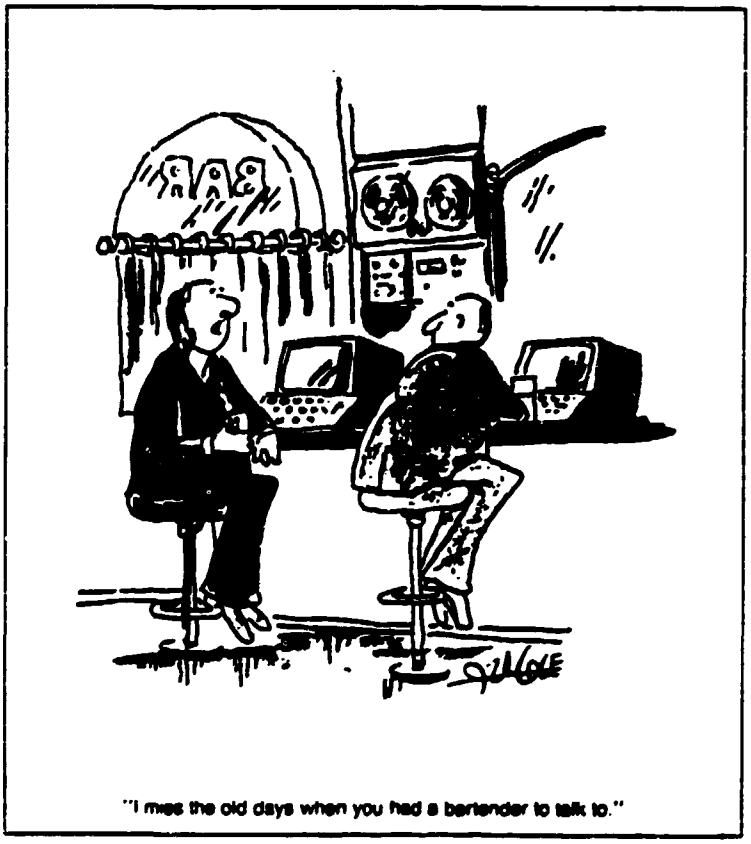
instance, drainage pipes or applications for new buildings that might affect specific houses in the area. Applied Research, which has annual sales of about £6m and is in the process of being acquired by McDonnell Douglas, the U.S. aerospace giant, has sold similar systems to the Government's Ordnance Survey in Southampton and to the Swindon-based Water Research Centre, a body owned by Britain's water industry. (Financial Times, 18 April 1985)

Sandia delivers 10,000 silicon chips for Galileo

Sandia National Laboratories has completed delivery of more than 10,000 radiation-resistant silicon chips for NASA's Project Galileo flight to Jupiter scheduled for launch in May 1986. The chips - microprocessors, memories and custom integrated circuits - were turned out at DOE's Center for Radiation-Hardened Microelectronics (CRM) at Sandia Labs and delivered to the Jet Propulsion Laboratory (JPL) at Pasadena, Ca. The chips are designed to operate in the severe radiation environment the spacecraft will encounter first during its 390 million mile, 2-year trip, and then after it reaches Jupiter's atmosphere.

Radiation hardening, a process perfected during the past 15 years at Sandia, involves fabricating components in extremely clean surroundings and chemically and physically altering their electronic structure so that the degrading effects of radiation on the chips are slowed. The chips must withstand a total dose exposure of 50,000 rads of radiation. (DOE This Month, July 1985)

(Datamation, 15 June 1985)



"I miss the old days when you had a bartender to talk to."

* * * * *

The following is a contribution received from a reader of the Microelectronics Monitor in India, in answer to our request for news from developing countries. Since one of the aspects of UNIDO's work is to strengthen local capabilities and encourage applications suited to developing country environment, we are publishing the following description of a PC system for water treatment plant control including chemicals regeneration cycle. Similar contributions from developing countries are welcome. We would like to emphasize, however, that mention of a firm or equipment does not imply endorsement by UNIDO.

Indian firm specializes in microprocessor systems in water treatment plants

Water treatment plant processes constitute a large number of sequential operations, each operation here referred to as a step of pre-determined time duration, during which pre-determined combinations of valves are opened/closed and a number of pumps switched on/off. The complex sequencing, timing, and combinational logic control functions that are thus required are best handled by the new generation of microprocessor-based control systems which are known as Programmable Logic Controllers (PLCs) or just PCs. PCs imply a wider

range of programmable control functions, not just those related to timing, sequencing and combination logic. SYSTECH offers sophisticated, reliable PC systems for industrial applications, of which water treatment plant control is but one application.

If we consider the case of a chemical fertilizer plant, the boiler feed make-up water will normally be demineralized at the rate of 100 cubic metres per hour. The plant consists of two or three chains of the following vessels: pressure sand filters; activated carbon filters; cation exchangers; anion exchangers; and mixed bed exchangers.

Depending on the quality of the water to be treated, there may be both weak and strong acid cations in series followed by weak and strong base anion in series. In some plants, a battery of base exchange softeners for providing the cooling water make-up requirement, is also included. Most of these plants have an 18 to 20 hours treatment cycle, followed by a regeneration cycle, which again is followed by a treatment cycle. A regeneration cycle is again a sequence of timed steps. In each step a number of valves open or close so as to direct the flow of water and chemicals to the main exchanger vessels from the feeder vessels. Simultaneously a number of pumps and blowers start for a fixed time, in a particular sequence during the regeneration process. All these vessels have their separate sequence of regeneration with chemicals, preceded by washing, and followed by rinsing.

The PC here controls the entire process of regeneration of each of the vessels which are associated with the water treatment plant. In one typical water treatment plant there are 21 such vessels, out of which five are pressure sand filters, and four each of activated carbon filters, cation exchanger, anion exchanger, and mixed bed exchanger. There could be (defined by the process engineer) six or seven regeneration sequences for the independent exchange vessels. Out of these, one or more may require to be executed at the same time. Here the PC could decide, depending on the input, which particular regeneration sequence it has to execute and for which vessels.

Now let us consider the situation wherein the chemicals used for water treatment are costly and the user does not wish to waste any. In this case the regenerate chemicals are passed from the exchanger to the other (after a number of regenerations) to economize on the chemical consumption. This leads to an increase in the number of process steps in a regeneration sequence: one independent, and another in conjunction with some other exchanger. For small-sized plants, having one or two vessels, the regeneration sequence is usually done by relays in conjunction with electro-mechanical timers. But even here SYSTECH microprocessor-based systems are competitive, and offer a number of operational advantages. For larger sized plants, where the number of vessels involved are more, and the sequence of regeneration could be complex, it is much simpler to use SYSTECH PC systems rather than relays.

SYSTECH PCs as applied to the water treatment technology simplify the entire process. In a typical case, the PC scans the operator panel which is in the control room. Then, depending upon the status of the various switches which are set up by the operator, the controller (PC) selects the appropriate regeneration sequence of that vessel. As said earlier, the regeneration process is a sequence of steps, where a number of valves open or close so as to let in water and chemicals into the exchange vessel, so as to bring the vessel to its original strength.

SYSTECH specializes in custom-engineered microprocessor-based systems and offers total hardware-software package, back-up with commissioning and after-sales service support. For information write to SYSTECH Pvt. Ltd., 124/C Brabdvana, Upp. Kamala Nehru Park, Pune - 411 004, India.

SOFTWARE

"Integrated" software

The software industry is prone to fads and fashions. This year's flavour has been "integrated". The word has been worked to death as much as graphics, user-friendly, and other words employed in peddling software have been worked before it. Integration is, like most computer buzzwords (viz "user friendly interface") an off-putting term for the dazzlingly simple truth that applications should work together, even to the point of passing data between independent pieces of software.

Behind the rush to integrate lies a new breed of user. The computer industry has been able to sell software on its own terms to the first-time user, but "once bitten, twice shy" holds good. The people who bought standalone micros and struggled with them know about the

pitfalls of poor support, and getting "locked in" to obsolete software. They are already wise to the issues, having been enthusiastic enough to learn to program and immerse themselves in the technicalities.

Anyone willing to travel that loop has already bought, so now the software vendors are faced with a less willing, and more demanding new generation of first-time users, which will not buy for the fun of it: they are only interested in solutions. Like the exacting second-time users, they expect software products to be well presented, well documented, attractively packaged, and professionally supported. They expect them to work, as well, which still, sadly, isn't to be taken for granted, though marketing has improved immensely. People are increasingly nervous about buying untried sometimes unfinished, products from companies which might disappear overnight. So the big companies are becoming bigger (which often slows down technological advance) and taking a larger slice of the market. Correspondingly the cost of developing software is greater, and firms with ideas have to seek venture capital to carry them through.

In fact, longer established companies are in a much better position to weather the storm, because they have a wider base of interests. Many of the larger companies have done well out of the Alvey funding (£350m) which is Britain's answer to Japan's Fifth Generation project. The Alvey projects so far seem to have little immediate commercial spin-off. But they are opening up new areas of co-operation, and pushing forward such developments as expert systems and IPSEs (Integrated Project Support Environment). The mood is all for sharing of resources, and companies seem at last to have jettisoned the "Not Invented Here" syndrome in favour of resource-sharing.

In the middle of the market place there is another movement fostered by the demand for portability and a common basis for programming: the over-debated Unix operating system owned by AT&T, and already backed by dozens of manufacturers. The hype surrounding Unix has not helped the system establish itself as front-runner for the rising generation of multi-user systems.

Some commentaries on the subject have aligned Unix against single-user operating systems (CP/M and PC-DOS, MS-DOS) and even large-scale operating systems such as IBM's MVS/XA. This is misleading and unhelpful: if Unix had any competitive target it was the standalone mini-computer market, which has now largely given its backing to the adoption of Unix as the standard environment. All that remains is for buyers to make the necessary endorsement by buying multi-user systems; there is enough choice. But in effect there is a pregnant pause (possibly "stagnant" would be a better description) while the Unix marketeers and IBM eye one another across a flock of potential customers. Attention has centred on Unix as the pivot in AT&T's challenge to IBM's supremacy in the computer market. The flock is waiting to see whether IBM will join the shepherds or turn wolf before it decides which way to run; so far the company has paid lip-service but not put commercial clout into a movement which can only benefit AT&T. For buyers the issue is clouded still further by the way in which the communications market is developing. However, in the US there are positive signs that the Unix operating system is beginning to fulfil its promise and is at last taking off.

The transparency and translation tools which are appearing thick and fast accentuate another issue. The software industry is now mature enough to carry on enormous weight of investment in current and historical systems. Users simply cannot afford to jettison that investment, so the speed at which the technically possible and the desirable become commercially sensible has slowed. The small innovators go to the wall, while the giants adapt their ideas and survive. (Electronics Weekly, 24 July 1985.)

Negotiating Software Contracts

As the cost and importance of software continues to escalate, more and more users are recognizing the value of pursuing agressive contract negotiations. This user activism is a healthy development, but it won't accomplish much unless users know which issues are important and what strategies are effective at the negotiating table.

The essential issues in a software contract vary from deal to deal, depending upon such factors as the source and nature of the software involved. The most basic factors include:

- whether the software is packaged, custom, or a combination of the two;
- whether the software is an operating system or an applications program;
- whether the software is proven or new; and
- whether the vendor is financially sound and experienced.

Despite these differences, some key points should be considered in virtually any software agreement. Figure 2 provides an abbreviated checklist of the more important issues. Figure 3 deals with most frequent causes of failure in software transactions.

Figure 2

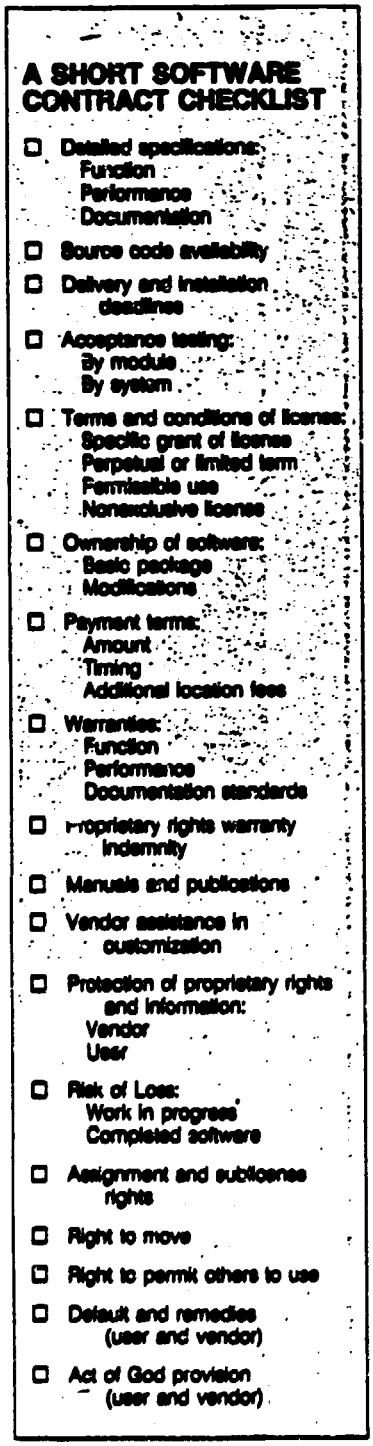
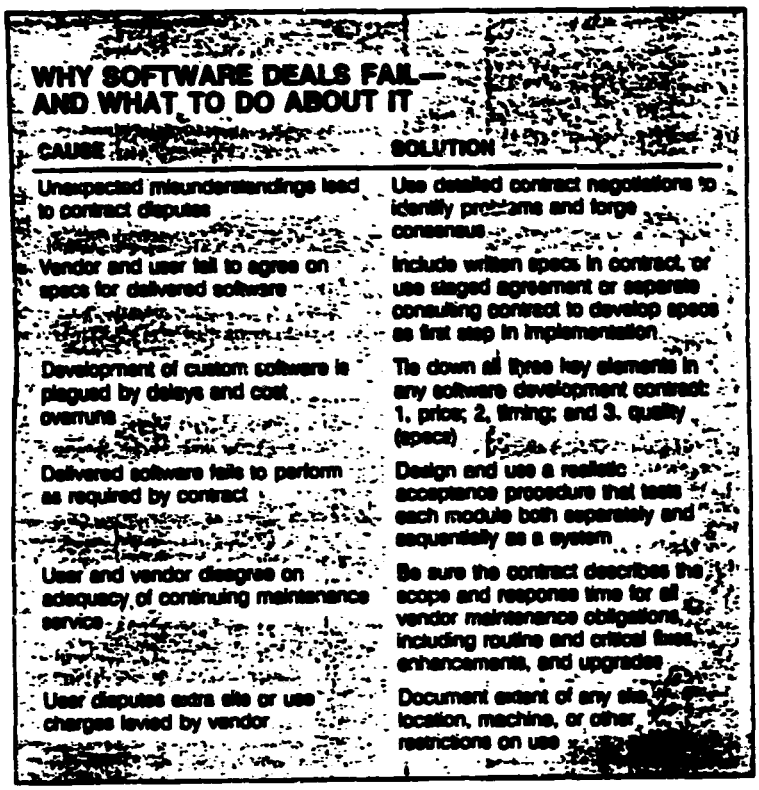


Figure 3



WHY SOFTWARE DEALS FAIL—
AND WHAT TO DO ABOUT IT

CAUSE	SOLUTION
Unexpected misunderstandings lead to contract disputes	Use detailed contract negotiations to identify problems and forge consensus
Vendor and user fail to agree on specs for delivered software	Include written specs in contract, or use staged agreement or separate consulting contract to develop specs as first step in implementation
Development of custom software is plagued by delays and cost overruns	Tie down all three key elements in any software development contract: 1. price; 2. timing; and 3. quality (specs)
Delivered software fails to perform as required by contract	Design and use a realistic acceptance procedure that tests each module both separately and sequentially as a system
User and vendor disagree on adequacy of continuing maintenance service	Be sure the contract describes the scope and response time for all vendor maintenance obligations, including routine and critical fixes, enhancements, and upgrades
User disputes extra site or use charges levied by vendor	Document extent of any site, location, machine, or other restrictions on use

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Software Protection

A design team at Ryerson Polytechnical Institute in Toronto, Canada, has developed a system that they claim will prevent unauthorized copying or use of software. The prototype device for the software authorization system (SAS) has been developed at the Ryerson Centre for Industrial Development. The SAS system consists of a small box. The user inserts a card with an authorization code that is validated and matched by a special program built into a single chip. The microprocessor-based system prevents a user from operating a personal computer unless he possesses a special authorization card (called the key) and inserts it into the lock correctly. There is a unique key for each piece of software run on the machine. Because of the needs for multi-tasking and local area networks, a single lock can accept up to 19 different keys. The program is "encrypted" into the chip during manufacturing.

A study released by the Association of Data Processing Service Organizations, based in Arlington, Virginia, USA estimates that personal computers users illegally copy one version of software for every version sold. The study says this copying amounted to a US$600 million loss for software companies in 1984 and $1.3 billion overall loss since 1981. (Canada Weekly, Vol. 13, No. 16, 17 April 1985.)

IBM software

IBM expects its software sales to reach $33 bil by 1990, vs corporate revenue of $100 bil. IBM PC sales totaled $4.3 bil in 1984, but PC software sales accounted for only $150 mil. Of the 3,000+ PC packages available, only 10% were IBM's. Thus far, corporate end users have been reluctant to switch to IBM offerings, unless the software features more than just the 3 famous initials, i.e., a real benefit. Independent software developerss are generally taking a wait-and-see attitude toward Big Blue's foray into the applications field, but also noting that, due to its size, IBM could pose a serious threat. IBM's entry into the micro software market has included the strongly-advertised Assistant Series, developed by Software Publishing, and the Personal Decision and Business Management Series from Information Programming Services. However, the cornerstone of its strategy is TopView which, with both multitasking and windowing, offers potential as a truly integrated product for corporate users. Another key to its overall software strategy will be providing communications among all of its systems, from micros to mainframes. Attachment products for the Personal Decision Series are the first step in that direction. (Information Week, 18 March 1985.)

Health

A software package called "Clinical Microcomputer Applications for Developing Countries" has recently come to our attention. The package is written especially for use in areas where medical services are often provided by paramedical personnel, and offers:

- diagnosis and treatment information for prevalent and difficult-to-diagnose diseases;
- family planning, high-risk pregnancy, immunization and nutrition information; incidence and prevalence reports for epidemiological surveillance; recordkeeping of medical and supply inventories for management decision making, for resupplying, and for use monitoring.

The package was developed as a collaborative effort between National Capitol Systems and Medical Logic International, using an interdisciplinary team of physicians, nurses, health systems analysts, and computer programmers. The modules are being translated into Arabic, French, and Spanish. For further information contact Douglas Mackintosh at (703) 671-3360 or write to: National Capitol Systems Inc., 5203 Leesburg Pike, Suite 1601, Falls Church, Virginia, 22041, U.S.A. (Development Communication Report, Summer 1985.)

MODULEF - A Modular Finite Element Program Package

The development of a general-purpose modular finite element program package is an impressive project centered at the Rocquencourt branch of France's Institute National de Recherche en Informatique et en Automatique (INRIA). This package, called MODULEF (for modular finite element), has been developed by members of Club Modulef, which was created by INRIA in 1974. The package, written in Fortran 77 and comprising about 2,000 procedures and 200,000 cards, is maintained at INRIA and disseminated to members of the club. The capabilities of the package and the number of members in the club are continually expanding. Researchers and practitioners interested in using finite element procedures to solve various engineering problems from heat conduction, to static and dynamic elasticity problems, to fluid mechanics problems, are likely to find this package very important. ... (European Science Notes, October 1985.)

EDIF set for launch

An advanced version of a computer language designed especially for electronic engineers will be launched in the middle of next year. The language has been around in an early form since last March and it is aimed at allowing the free exchange of electronic design data within and between systems and between manufacturers and designers. The new version will include behaviour models, procedural constructs, PCB layout, component libraries, tests of analogue circuits and other technology. The original version covers gate arrays and structural cell design interchange, such as between designers and foundries. The language is called Electronic Design Interchange Format (EDIF) and it has been written by three electronic engineers.

Since the steering committee for EDIF was formed by six initial companies in 1983, the project has grown and there are now more than 5,000 individuals who have expressed an interest and over 1,000 company names on the mailing list. So far about 1,250 copies of the language have been distributed since it was released.

One of the three originators of the idea - Robert Rozeboom, vice-president and head of design automation at Texas Instruments in Dallas - flew to Scotland as part of his world mission to explain the interchange solution to technical audiences. At a Department of Trade and Industry presentation at the National Engineering Laboratory at East Kilbride, he said that the hours spent on EDIF so far amounted to four man years of informal meetings and 12 man years of public effort - time valued at more than £1m. "And private money goes a lot further than public money", he said.

Rozeboom said that the development programme had been launched by a group of competitors because they were frustrated by the lack of standards in that sector of the industry. They agreed to pool their technical resources and attack the problem of transferring IC information. The main criteria were that the new language should have a neutral format with no restriction to public access; it should provide comprehensive wide-channel links and should act as a "stepping stone" to transfer information between CAD databases. "We were very sensitive to the fact that the industry had to support this new language", he said. "We wanted academic input and we wanted to move as quickly as possible to solve what we saw as a real world problem. EDIF should provide a clean link between databases. The companies are free to decide what information they want to transfer; EDIF only says how to do it", he said. In general, EDIF is designed to enable exchanges between two dissimilar systems such as different CAD, CAE or CAD/CAM systems, possibly even on different computers.

As a neutral data format EDIF is entirely system independent. It can be used as an archiving system for product design, remaining usable even though user systems and hardware may have changed thus giving protection against system obsolescence. But the designers claim that the most significant and cost-saving advantage of EDIF may be in either reducing or avoiding re-work. It is intended to have standard interfaces to VLSI and PCB design and manufacture and in areas such as simulation, system testing and component libraries. One advantage is that EDIF can be machine-read and generated giving it considerable potential for improving efficiency and productivity in the industry. It is also "human-readable" to a considerable extent. File based and LISP-like in appearance, it is envisaged that EDIF could become as common in electronic engineering as schematic layout and circuit diagrams today.... (Electronics Weekly, 9 October 1985.)

The Logo language in Colombia's rural classrooms

Tests are being carried out in Colombia on the introduction into rural areas of the computer as teaching hardware. In the pilot school of Neomocon Cundinamarca, the Logo programming language is being used with a group of children in a level ranging from the second to the fourth elementary grades. This experiment will make it possible to learn much of great importance to allow the different national bodies to take decisions on the use of microprocessors in the Colombian educational system. At a more concrete level, it also familiarises the rural school teachers with the use, scope and limitations of the utilization of the computer and allows consideration to be given to the impact it has on the learning and the creative abilities of children.

In general, the presence of the computer in the classroom has resulted in three orientations: to teach a programming language to the children (the least interesting); to use the computer as a teaching aid in order that the child may learn subjects at a rate suited to his level of capacity; and, finally, to give priority to the development of the child's creativity and intelligence. The two last considerations are those chosen in this Colombian experiment, which is based as much on the software developed by the experimental team itself as on the characteristics proper to the logo language.

The Logo language was conceived by the team headed by Seymour Papert, a mathematician and informatician who had worked in Geneva with the famous teacher Jean Piaget. According to the theories of the latter, the development of intelligence is seen to be favoured more if the child makes attempts himself and corrects his own errors than if he listens to examples. With the Logo language applied to education, the child keys in instructions to draw geometrical figures on the screen, thereby creating a computer program without noticing it. This type of exercise favours, with the discovery for himself of the elements of basic geometry, the development of his mathematical reasoning and of all of his intelligence. (Bulletin IBI Press, No. 41, 28 July 1985.)

Esprit suffers from software famine

The EEC's £325-million programme of research into advanced chips and computers, known as Esprit, is short on bright ideas for software research. Officials in Brussels have been forced to extend the deadline for bids for contracts from software researchers. Last week, the EEC announced details of the latest batch of projects that it will be funding. Although 15 of the 95 projects are in the software field, there was little interest in the relatively new area of software engineering. This is concerned with the techniques, equipment and management methods used in large program-writing projects. In an attempt to pull in more proposals, Esprit is offering an additional £10 million on top of the £20 million that has already been committed to software.

The aim of software engineering is to establish standard ways of writing programs that will not only enable the programs to be written quickly and accurately, but also allow them to be transferred from one project to another. Esprit is looking for collaborators prepared to develop new methods of measuring the accuracy and performance of programs and to investigate ways of producing programs on one machine that can then be run on one of a different make. Esprit is also short of partners prepared to produce systems that combine many aspects of software engineering.

The head of Esprit's software technology, Pierre Cunin, is keen to interest telecommunications authorities such as British Telecom in his projects, because they are involved in big computer projects that could benefit from better techniques for producing software. But he is not allowed to tout for business. (This first appeared in New Scientist, London, 3 October 1985, the weekly review of science and technology.)

Japan

The Japanese Association for Informatics Promotion, affiliated to the Ministry of Industry and International Trade (MITI), the promoter among others of the fifth generation informatics projects, has just launched the SIGMA project. This calls for the investment in five years of US$100 million to multiply the Japanese software industry by four. The project foresees the construction of a special computer for the development of programmes as well as a network for informatics engineers with one thousand access points in addition to data bases of ready-made format to be included in programmes along with other pertinent methodological information. (Bulletin IBI Press, No. 47, 9 September 1985.)

ROBOTICS

Robotics manufacturers continue to prosper

Amid the general gloom in the electronics industry, one sector continues to prosper: robots. This month, the Robotic Industries Association reported that U.S. robot suppliers are experiencing impressive growth. Record shipments were posted in 1984: 5,136 units valued at $332.5 million, a gain of 68% in units, and 71% in dollar value over 1983. New orders in the first quarter of 1985 totaled 1,834 robots valued at $185.7 million. The jump in new orders resulted in an industry backlog of 2,918 units worth $427.3 million, more than double that of the same period a year ago. The strong backlog, the RIA says, virtually ensures another record-breaking year for the U.S. robotics industry. He estimates that about 16,000 robots are in use in the U.S., up from 6,300 at the end of 1982. (Electronics, 24 June 1985.)

U.S. robotics industry

The U.S. robot industry had a good year last year selling $338m worth of systems to U.S. industry. The current tally of robots installed in factories is 14,500, according to the Robotic Industries Association, which sponsored the Robots 9 Exposition and Conference held in Detroit, Michigan. However, there are problems. Systems integration heads the list and it is becoming evident that the U.S. robotics industry is splitting into two distinct groups, according to Peter Cohen, an analyst with International Data Corp., based in Framingham, Massachusetts.

He sees "out-of-the-box" robot producers who will supply end users with in-house engineering capability and the growing band of system engineering firms. Their road to success will depend much on competitive costs and effective distribution networks. The other sector will be the total system vendors who will be selling direct to the end users but will need extensive financial resources committed to developing specific applications. Together the two groups should, if they get it right, says Cohen, be supplying a market worth anywhere between $700 and $900m by 1990.

Like any new industry, growth has been a problem because of its fast rate over the past few years. It has spawned a large number of companies many of whom have been chasing the same business, according to Laura Conigliario, a financial analyst with Prudential Bache Inc. of New York. This has brought difficulties with market forecasting, she told industry representatives at an RIA/SME seminar which ran alongside the exposition. She forecasts revenues for the industry in 1985 of $495m but this includes all systems attached to robotics such as machine vision, a market of $35m on its own this year. ... (Electronics Weekly, 26 June 1985.)

Robotics in Italy

While European automobile manufacturing companies are showing every greater interest in Italian robots for the automation of their car factories, new materials for super lightweight robots are being tested at the University of Milan.

Epoxy resin, carbon fibres and other materials are being used for the creation, in the laboratories of the Politecnico, of robot prototypes. The characteristic that distinguishes them is that, through the utilization of such materials, the form of the pieces, contrary to what had been happening heretofore, takes on greater importance than their mechanical size determination. Industrial design, in a nutshell, has become part of robot engineering.

The first prototype that has been made in this way, a manipulator robot that has a very low production cost and is used for small precision assembling, has only one fourth the weight, dimensions remaining equal, of the previous model made from steels and other

conventional materials. The moment is thus approaching when it will be possible to use robots, not only for assembly, but also for finishing and other precision work.

According to a statement made by the director of General Motors' Antwerp offices, the strength of Italian technology, based on the competitive nature of prices, on the simplicity and flexibility of the systems and on proven reliability, will receive a new impulse from these most recent innovative applications.

In the meantime, Italian technology continues its success among European carmakers. A famous French company is already busy designing the factory of the future using forward-looking systems of two Italian engineers, while the robotics systems of two Italian companies have been adopted in Germany for the assembly operations in another important automobile industry. (Bulletin IBI Press, No. 41, 29 July 1985.)

2,750 robots in France

To coincide with Inova, Afri* published statistics on French robotics. With 2,750 programmable robots, France remains in second place in Europe, fourth in the world. At the head is Japan (21,000 robots), the United States of America (13,000) and the Federal Republic of Germany (6,600). France is ahead of Italy (2,600), Sweden (2,400), the United Kingdom (2,255), Belgium (860) and Spain (518). Last year about 840 new robots were installed in France, an increase of 37 per cent, and 115 machines were exported. Forecasts suggest a French stock of 4,000 robots by the end of this year. The recorded industrial applications concern handling (920 robots), spot welding (700), arc welding (346), assembly (302), paint-spraying (206), mould-finishing (55), inspection and tests (27), bonding (14). To this can be added about 100 robots of various types including mobile robots for operations and 70 robots in the education and research field. It is surprising that this latter figure is not higher, since 100 educational robots built by Sirtès and AID are being delivered to schools this year. About a quarter of the robots are serving in small and medium-sized enterprises of less than 100 employees. These Afri figures are naturally disputed. Maurice Duron in his Lettre de la Robotique (No. 35, February 1985) is of the opinion that the French stock lies between 2,100 and 2,300 machines only; he does however specify that this consists of robots currently "employed" and not the total of those purchased over the last 15 years or so, some of which are no longer operational. The conclusions of the periodical Axes Robotique (No. 10, February 1985), which conducted a direct inquiry among manufacturers and suppliers, are even more pessimistic: only 1,857 robots in service compared with 1,980 last year.

Better information on robotics for the public at large

According to two American studies by Future Computing and IRD, the market in non-industrial robotics is going to double this year. Forecasts for 1994: American markets in educational robotics will be $1.2 billion; robotics in support of the handicapped and the aged: $225 million. Leisure or hobby robotics, on the other hand, will reach a ceiling at only $48 million. This is a long way from the optimistic figures announced two years ago by the same consultancy firms: $2 billion for domestic robotics. Those forecasts have had to be revised downwards in the same way as those relating to personal data processing with regard to electronic games. A seminar and exhibition organized by Afri* focused on the markets and on the technologies involved. The occasion was marked by a report on educational robotics which appeared in the June edition of Science & Techniques: it will cover the whole range of available robots, "tortoises" and programmable mobile machines and mini-machines with numerical control for education. (La Lettre de Sciences et Techniques, No. 61, June/July 1985.)

Automated vision, a nucleus of research and investment

General Motors, the automobile giant and more and more that of US robotics, already holds 15 (with option for 30) of five small opthalmatics or automatic vision companies, namely: View Engineering, Robotics Vision Systems, Diffracto, Applied Intelligent Systems, and Automatix. General Motors is financing projects in each of them, projects whose exclusive rights are held for a year and a half before benefiting from acquired author's rights. GM wishes to set the pace of present blind robots towards systems capable of visually integrating their surroundings and of analyzing it more intelligently. Though not yet profitable in financial terms, this development is beginning to acquire flexibility and quality.

Ford, for its part, also holds 17 of Synthetic Vision System (SVS), with the specific aim of accelerating the inspection operations at its factory for the microprocessors built into its cars.

The economic factor continues to have considerable weight in company decisions to equip productive systems in general and robots in particular with vision. A vision system costs

US$ 30-50 million today, only to combine it with robots that may already be worth less than US$ 20 million. Despite this considerable value added, Vision Systems already represented a trade figure of US$ 60 million in the U.S.A. in 1984, with increases greater than 40 per year, which could bring this market figure to 600 million dollars by 1990. (Bulletin IBI Press, No. 53, 21 October 1985.)

A device to make robots even more keen-eyed

Systems that allow industrial robots to "see" keep getting better and better. Early robot vision systems could only identify objects if they were positioned just so. The most advanced - and expensive - systems have already overcome many of those problems. Robots can now even reach into a bin of jumbled parts and pull them out, one by one.

The latest advance will permit robots to pick the right component out of bins containing many different kinds of parts. Under development at Siemens, (FRG) it runs on a souped-up personal computer. Researchers in the electronics giant's Munich factory-automation laboratory say the system, which should cost about $28,000 to build in quantity, can identify and retrieve up to 100 different parts. Siemens is now putting prototypes in its factories to see how they perform at such tasks as assembling small motors. The key is a special video preprocessor that looks for the abrupt changes in contrast that occur along a part's edges. It the pins down the lines representing the edges to a width of just one pixel - a series of single dots on a video screen. This minimizes the data that have to be analyzed and enables the PC to identify a part in as little as half a second. Moreover, the system is not thrown off by the uncertain lighting conditions on the factory floor. (Business Week, 29 July 1985.)

Molten sodium will lubricate robot arm

Taylor Hitech is adapting its articulated robot arm, developed for gas-cooled nuclear reactors, to work within the molten sodium coolant of a fast-breeder reactor. The sodium, which can reach 650°C, will lubricate the arm's bearings. The Lancashire company's design is a semi-articulated chain of links which can coil in one direction but which form a rigid beam when extended. One application for the arm in a fast-breeder reactor will be to carry an ultrasonic "camera" which is being developed by the UK Atomic Energy Authority. Sound can penetrate liquid sodium, and the "camera" is intended to supply three-dimensional pictures of the inside of a reactor. The company is looking to alloys already employed in the nuclear industry to supply the basic materials for the arm. Most of the suitable alloys are based on titanium. Philip Robson, Taylor Hitech's sales director, says: "The problem is how to turn structural alloys into bearing alloys. The liquid sodium will fill all the gaps in the bearings, so we will have to consider choosing the reactor's cooling fluid as a lubricant". The articulated robot arm, as deployed in a gas-cooled reactor, has a reach of 6 metres out from the axis of the point at which it enters the reactor. Payload at full reach is 30 kilograms and the arm is claimed to repeat any action with an accuracy of ± 1 millimetre.

Taylor Hitech has brought its experience in the remote control of robots in nuclear environments to the production of pharmaceuticals. It has developed with Beecham, a sterile packing room in which a remote-controlled robot fills and weighs kegs of drugs. People cause 80 per cent of the particles found in a clean room, says Taylor Hitech. Removing the human element from drug packaging allows a more aggressive cleaning of equipment (with toxic gases for example). The robot in the clean room is clad in what looks like giant bellows. The bellows can expand and contract as the machine moves through its tasks. The bellows prevent particles from the robot contaminating the clean room; they also prevent the gases that sterilise the room damaging the robot. The sterilised equipment needed to package and sample the drugs is placed in a plastic container. The container is sealed to the wall of the clean room and the equipment is pushed into position beside the robot. An air flow towards the robot helps to minimize contamination during packing. (This first appeared in New Scientist, London, 6 June 1985, the weekly review of science and technology.)

A rough life for a robot

From Sweden comes news of an application ideally suited to robots. A Gothenburg-based company, Robo-Sieve AB, has designed a robot to remove sedimentation products automatically from sewage plants. This summer, the company is introducing a new robot designed to keep small-scale sewage plants and industrial settling basins free from sludge. Conventional methods require either mechanical scrapping or manual cleaning in empty basins. The new machine, reported to be a simple looking robot, is said to be the first major innovation in this malodorous field for 50 years. (Technology Ireland, July/August 1985.)

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* Afri (Association française de robotique industrielle, French Association for Industrial Robotics.)

COUNTRY REPORTS

Australia

Research/industry collaboration produces an advanced chip

The single CMOS (Complementary Metal-Oxide Semiconductor) chip replaces approximately 10 standard chips that operate a complex 'Phased Shift-Keyed' data encoder which is generally used in conjunction with a radio transmitter to provide high quality data signalling. Its extremely small size (5 x 5 mm) and low power consumption make it suitable for battery operated, hand-held, portable two-way radios. This was the first fully Australian custom gate-array IC to go into commercial production from a design completed independently of the fabricator, Amalgamated Wireless (Australasia) Ltd. (AWA). It is the culmination of collaboration involving an advanced college researcher, the CSIRO Division of Manufacturing Technology, Raywood Electronics and AWA.

The designer is Mr. Jim Lambert, a Principal Lecturer in Electrical and Electronic Engineering at Swinburne Institute, who was given access to equipment and software facilities at the Melbourne laboratory of the Division while on a 6 month professional experience program. Mr. Lambert's success helps bridge the gap between custom microchip research and custom microchips for commercial production. In the past, detailed design has usually been carried out by specialists in chip fabrication plants.

With this approach to designing chips tailor-made for new Australian products, rather than relying on off-the-shelf microchips that are just as available for overseas manufacturers as they are locally, small innovative Australian companies would have an opportunity to compete on world markets. Another advantage is that the designer doesn't have to compromise by modifying the functions of devices to suit the limitations of imported stock chips. His custom chip may be configured to implement the desired function.

Mr. Lambert concurs with the view that custom-integrated circuitry is the corner-stone of the future electronics industry in Australia. He feels that if Australia doesn't harness locally based microelectronics expertise with appropriate management skills the country's electronics industry will not have the strength to compete on the world market. (CSIRO News, March 1985.)

Australian silicon venture

Pechiney, the French state-owned conglomerate whose products range from chemicals to aluminium, has joined forces with Pioneer, the Australian oil and cement group, to produce silicon in Tasmania. Pechiney will have a 40 per cent stake and Pioneer 60 per cent in this joint venture which involves an investment of $A34m (£17m). June 1987 is the target date for bringing on stream a foundry with a capacity of 12,000 tonnes a year at Electrona, near Hobart. A second foundry is likely to be built later. Pechiney at present produces 75,000 tonnes of silicon in metallic form out of a world total of 500,000 tonnes, which puts the French company in the second-ranking position behind Norway's Elkem.

The Australian venture is particularly important to Pechiney, which wants to strengthen its position on markets in the Pacific and Far East. This ambition requires production presence in the area - which the tie-up with Pioneer now provides. Thanks to the input of French technology, Australia now becomes the region's biggest silicon producer outside the Chinese People's Republic. The electronics industry takes 10,000 tonnes of the 500,000 tonnes of silicon produced worldwide each year. Aluminium alloys, the major activity of Pechiney, account for 330,000 tonnes, chemicals 130,000 tonnes and photovoltaic devices take 1,000 tons.

Pechiney and Pioneer have also signed a co-operation agreement on future projects involving silicon covering Australia, New Zealand and other parts of the Asian-Pacific region. (Electronics Weekly, 24 July 1985.)

Austria

Austria and high tech

VOEST, Austria's state-owned steel works, signed a $285 million agreement with Japan's Oki Electric Industry Co. to design and manufacture ICs in Austria. This is following an earlier joint venture with Gould AMI, American Microsystems Inc. which began production in 1983. The VOEST-Oki plant was to have been built on a site in the province of Styria; however, the local authorities refused to grant the necessary permission on the grounds of

risks of environmental pollution based on strong resistance from among the local population. Now VOEST has to negotiate for another site. Meanwhile critical voices have been heard about setting up a second IC manufacture at a time when the semiconductor industry is no longer a profitable business and the VOEST-AMI venture is incurring losses and has had to lay off employees. The Siemens subsidiary at Villach, Carinthia is in a better position as the production site for the 256-K chips. There, a turnover of AS 1 billion is earned with some 1,400 employees.

The government has also asked advice from scientists and technologists as to Austria's chances to join the high tech bandwagon. It was estimated that as much as AS 20 billion would be required for R&D purposes in high technologies such as microelectronics, genetic engineering and new materials. This is far beyond Austria's budgetary means. Thus there is no way Austria could compete in fundamental research. However, it was also stressed that this did not mean that Austria's researchers and enterprises would have to refrain altogether from high tech. There is plenty of scope for research into new applications.

Belgium

... The Interuniversity Microelectronics Center (IMEC), Leuven, Belgium, is part of a comprehensive program to promote education, research and applications of microelectronics and related technologies. The idea is to make Belgium an attractive place for industrial companies in these fields. IMEC will be a state-of-the-art laboratory for R&D in microelectronics five to 10 years ahead of industrial needs. The laboratory, which will be operational in January 1986, will be built in Leuven close to the Katholieke Universiteit. The total investment is $40 million, half for equipment. This initial investment is funded by the Flemish Government in Belgium. The annual budget including capital equipment, operating expenses and personnel is estimated to be $20 million.

IMEC also has set a goal to improve education in microelectronics. An accelerated program for VLSI systems designers was started in 1983. They are collaborating with 10 institutions of higher education to train highly qualified microelectronics specialists to meet future industry need... (Reprinted with permission from Semiconductor International Magazine, June 1985. Copyright 1983 by Cahners Publishing Co., Des Plaines, Il. USA.)

Brazil

Brazilian robotics: a policy of co-operation

The Brazilians are at present launching a robotics plan and wish to establish mixed companies with foreigners. This is reported by Louis Bach, the manager of the French office of Actim at Sao Paulo. Twenty-two Brazilian enterprises in the mechanical engineering and electronics field are authorized to conclude such agreements; they are receiving aid from the Special Secretariat for Electronic Data Processing. The Japanese, Germans and Swedes are already to the fore. Hitachi is linking up with Villens, a mechanical engineering enterprise; Mantec, a Siemens subsidiary, with Varga (machine tools) and Maxitec (CNC electronics); Reis with Taunus (machine tools) and MCS (EDP); Asea with Vasconcellos (mechanical engineering) and Prologo (EDP). To make French robotics known, Actim and Afri are to hold a Franco-Brazilian meeting at the end of this year. Meanwhile French industrialists may put proposals to the Sao Paulo office. We may mention that ten or so Brazilian firms are manufacturing robots, including EB Projeto (6 axes - painting), Sul Mecanica and All Sistema (2 and 4 axes), Elemp (7 axes), Mixertec (3 axes - 20 and 50 kg), Petersen (foundry), Atos (numerical control for robots), ... Engemac-BCM (5 axes - 10 kg - assembly), etc. Research in robotics is carried on at Espiritu Santo University, Sao Paulo, by Paulo Fiaria Santo Ameral's team. Lastly Sobracon, a Brazilian numerical control company, is helping to get the robotics plan under way. (La Lettre de Sciences & Techniques No. 61, June/July 1985.)

China

ITT Semiconductors Group signs technology-transfer agreement with China

Following a recent $4 million technology-transfer agreement between the Chinese Electronics Import and Export Corp. and the ITT Semiconductors Group, China will begin production of ITT tuner diodes this September in a discreet-devices factory in Tianjin, an industrial town 70 miles south of Beijing. Production of the tuner diodes - for very-high and ultrahigh frequency TV applications - will be on ITT-supplied and -installed equipment and with personnel trained at Intermetall GmbH, the U.S. group's lead house in Freiburg, FRG. Initially, ITT will supply the materials, including the silicon, needed for device fabrication. ITT is banking on follow-up deals involving parts for entertainment electronic applications, an ITT strength. (Electronics, 24 June, 1985.)

China's educators share satellite space

Chinese educators have begun using spare capacity on Intelsat satellites to broadcast advanced courses throughout China. The project is called SHARE (satellites for health and rural education). It is designed to demonstrate new ways in which satellite communications can improve standards in education, particularly in developing countries. SHARE was dreamed up two-and-a-half years ago by Joseph Pelton, director of strategic policy at Intelsat. The organisation runs the project jointly with the International Institute of Communications, an independent, non-profit body. The scheme was planned to run from January 1985 to April 1986, with six hours of nationwide broadcasting every day. But according to Jim Stevenson, chair of the project's advisory council (and head of educational broadcast services at the BBC), it has got into its stride only in the past six months. Now, with half a dozen programmes in the pipeline and another 42 in hand, Stevenson and his colleagues are to ask Intelsat to extend the project for a further year.

The Chinese effort is the first of an initial group of four projects to demonstrate SHARE. If it succeeds, a permanent service may begin in 1986. "SHARE programmes are chosen with the idea that they should continue," Stevenson said. One criticism of the Chinese demonstration is the expense of using satellites. As the programmes are simply a scaled-up version of Britain's Open University, would it not be cheaper to send programmes in video tapes, for example?

Stevenson, however, promises that future programmes will be more technically adventurous. He plans to design an interactive system to offer opportunities to exchange as well as receive information.

The first of these is a programme that begins in Africa this month. It is sponsored by the American Society for Microbiology, and is intended to bring African countries up-to-the-minute information on monoclonal antibodies, immunodiagnosis, food microbiology and virology. Stevenson's dream is to extend the project to universities throughout the world. "Scientists could plug in once a month, have an hour's conference on the state of the art. That would really be a most interesting use of satellites." (This first appeared in New Scientist, London, 19 September 1985, the weekly review of science and technology.)

EEC

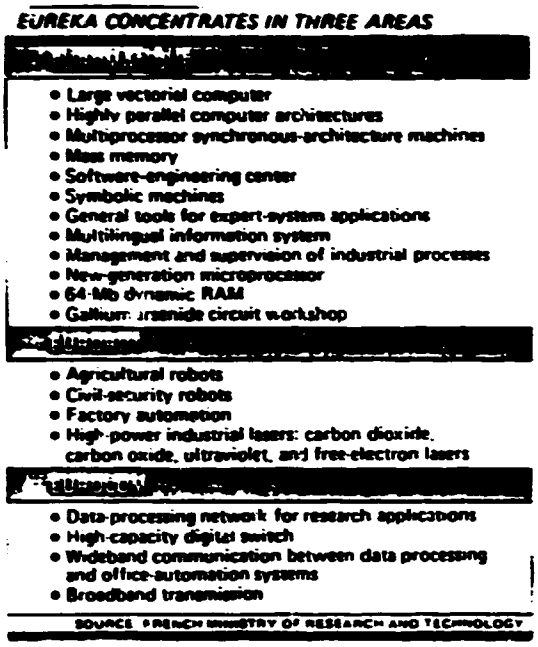
Esprit approves joint plan

The Common Market Esprit Programme has given the go-ahead to one of the biggest colloborative artificial intelligence research projects yet mounted in Europe. The £6 1/2 million effort will be led by STC's Idec software house and work is expected to start in early September. The initial contract, which will be 50% Esprit-funded, is likely to cover two years, with an extension to five years to be negotiated. The other members of the team are the Polytechnic of the South Bank and the University of Amsterdam, BP subsidiary Scicon and its FRG counterpart SGS, and the French Software house CAP Sogeti Innovation (part of the CGS group). The two academic bodies have already carried out a pilot study over the past year. The title of the scheme is a methodology for the development of knowledge-based systems.

According to STC Idec's artificial intelligence manager Derek Eden, the plan is not limited to producing an expert systems shell, of which there are many. "We will be taking an all-embracing look at development methods - the deep knowledge approach." The project, like the UK Alvey Programme, is not going to plump for either Prolog or Lisp, the two rival languages, but aims to support both. (Computer Weekly, 22 August 1985.)

Green light for Eureka

The European Community is almost falling over itself in its efforts to counter Japan's MITI-backed high technology onslaught, and the Community's non-computer related, broad-based technology research project, Eureka, has received the go-ahead from Europe's four largest electronics firms. Philips, GEC, Siemens, and Thomson, have said that they are prepared to map out a plan for Eureka within the next six months. A Philips spokesman said: "In order to make a success of this programme, all trade barriers must be lowered simultaneously. Standardisation must be ensured, and there must be co-operation between important principals - such as national PTTs". At the same time, the Community has decided to press ahead with steps to co-ordinate research and development within the 10 EEC member states by setting up a European Technology Community. (Electronics Weekly, 3 July 1985.)



(Electronics, 22 July 1985.)

Eureka's first European industrial agreement

The industrial phase of the Eureka European research project launched by President Mitterand in April, has gotten its start with an agreement between the Norwegian Norsk Data and the French Matra for the development of a compact vectorial computer within a period of three years, as opposed to other European research programs in which collaboration between enterprises is limited to the precompetitive stages, the claims for the Eureka projects are to arrive at saleable products. It is desired in this case to produce a super minicomputer capable of developing a processing speed of several hundreds of megaflops (millions of logical operations per second). In order to achieve this objective the experience of Norsk Data in the architectures of multiprocessor systems is being combined with that of Matra in vectorial architectures and in the design of VLSI CMOS chips. Norsk Data and Matra were already linked by an earlier collaboration agreement which included commercial, production and development aspects.

As opposed to European programs such as Esprit (informatics), Brite (spread of peak technology to traditional industry) and Race (telecommunications), which are limited to the ten member countries in the European Community (EEC), participation has been invited in Eureka also of the future EEC members such as Spain and Portugal and of countries such as Austria, Finland, Norway, Sweden and Switzerland. (Bulletin IBI Press, No. 41, 28 July 1985.)

High-tech training for Europe

The European Community has launched £41.6m hi-tech education and training initiative, which is vital to Europe if it is to keep [illegible]east of the US and Japan.

Under the first phase of the programme [illegible]987-89), a network of universities is being set up to work in close co-operation with hi-tec[illegible] firms throughout the 10 countries in an effort to boost higher education in the Commun[illegible]. The programme is to become a permanent initiative, and strong emphasis is being p[illegible]ced upon retraining people in order to raise the general skill level.

Funding will be available to companies in the form of 350 fellowships to selected employees, enabling them to attend universities in their own countries for periods of six months at a time. A mobility allowance of £4,680 is also being offered to candidates. (Electronics Weekly, 31 July 1985)

European computer-integrated manufacture

The Open System Architecture (OSA) for Computer-Integrated Manufacture (CIM) has until now been the broadest and most ambitious precompetitive joint development project that the 17 firms have presented with regard to Esprit (European Strategic Program of Research in

Technology). The German firms AEG-Telefunken, Dornier, MBB, Siemens and the University of Aachen; the Belgian Philips; the British BAEC and GEC; the Danish CRI; the French Bull, CAP-GEMINI-SOGETI, CI [illegible]CATEL and SNIAS - the Italian ITALSIEL and SELENIA-ELSAG; the Dutch Philips (as [illegible]ed with ATT) and European IBM (through the German subsidiary) wish to develop a produc[illegible]n the next five years that will be costing some 250 man-years and 150 million US dollars.

This association for research purposes of informatics, telecommunications, aerospace and engineering companies and of university laboratories wishes to develop a prototype system whose hardware and software will make it possible to integrate the in-plant control and manufacture of products. Until now the computerization of the same had achieved islands of automation by means of incompatible hardware units in the areas of control, design and production the diversity of the products made by the participants in the project points to the same's opening - that is to say, the interconnectability of equipment items by means of local or general networks and the utilization of sophisticated software for overall optimization. ... (Bulletin IBI Press, 12 August 1985.)

Hungary

Hungarians train Third Worlders

For several decades now, Third World countries have had little choice but to stand on the sidelines and watch the industrialized world's race to constantly better computers and expand their uses. It now looks as though the developing countries have a chance of testing their own capabilities in that field for only a modest sum.

Such optimism is prompted by the initial conclusions of a recently completed UNDP-assisted project for the development of computer data processing for professional and teaching purposes. The project was carried out in collaboration with the Government of Hungary. An original method of gaining access to computer technology, devised jointly by UNESCO and the Hungarian enterprise Samalk, will give the developing countries, for the modest sum of US$10,000, the opportunity of joining the club of those familiar with the secrets of computer data processing. At a price that can be afforded by the smaller developing countries, Samalk proposes to set up a system of data processing by industry, commerce, schools or scientific and technical libraries.

Samalk's "brain" consists of 200 highly qualified scientists and specialists, all of them doctors or professors of science. This intellectual resource has enabled the organization to satisfy promptly requests for computer software covering a wide variety of applications, from the management of industrial production, the rational use of raw materials and the management of human resources, to the design of computer programmes for agriculture. Samalk is run along commercial lines as far as operations in Hungary are concerned, but adopts a different policy when providing aid to developing countries within the framework of an international organization: "In that case, we do not set out to make any profit at all," explains Dr. Gyorgy Matok, director of the Hungarian section of the Unesco project. There are thousands of libraries in the developing countries which cannot afford to set up information retrieval systems, and which would therefore be interested in an inexpensive solution to their problems. The project proved that such a solution was possible through the use of microcomputers. Moreover, systems of this type can be set up within only a few months. Samalk's Study Centre employs 90 full-time teachers, and organizes 35,000 hours of lectures per year. Now Samalk is passing on what it has learned to others. Over 2,000 people come every year from 30 different countries. (Development Forum, October 1985.)

India

India to Build Entrepreneur Parks

The Government of India has selected Bhopal, Bangalore, Bombay and Ranchi as the four centres in the country where science and technology entrepreneurs parks would be located. The main objective of the science and technology entrepreneurs parks (STEP) is to expose graduates and science postgraduates to industrial culture and enterprise. The project will cover students graduating from various educational institutions, who have been motivated to establish enterprises. The STEP will also cater to entrepreneurs who have already set up industries and wish to make use of the various facilities of the STEP in order to improve the quality of their products. (Asia-Pacific Tech. Monitor, May-June, 1985.)

India's railways to be computerized

Canada has negotiated a contract for US$500 million to computerize the Indian railways in 18 months. This includes US$136 m for central and peripheral IBM or compatible hardware,

US$318 m for communications and US$50 m for railway traffic software. The immense project includes a double central computer, three regional computers, nine traffic exchanges equipped with supermini-computers and terminals in all the main railway stations of the railway network with the most track of any country in the world.

At the same time, it seems that negotiations between the Indian electronic department and IBM (which abandoned the Indian market 9 years ago in rejection of Indian financial participation in its activities as required by Indian law) have almost been concluded for the production of software exclusively for export, thereby taking advantage of the facilitations made law by the Indian Government to promote the employment of local informatics personnel (total foreign ownership of software companies, free import and export, reduction in bureaucratic controls).

IBM also appears to be ready to participate in the plans for great informatics expansion by the Indian oil and natural gas commission, which has set itself the goal of acquiring 5 superprocessors and 36 minicomputers in five years, some of which American, some Indian and some Soviet equipment. In addition to the railway system already mentioned which the Canadian supplier has developed on IBM products, IBM aspires to participate in INDONET, the gigantic data network that is to connect the entire country.

Many of these projects form part of the massive international aid promised by 14 countries two months ago to Prime Minister Gandhi in the Paris meeting of the Aid to India Consortium "to launch it into the high technology 21st century". The aim of this consortium is to compensate for the reduction in World Bank assistance (from US$2,500 m in 1984 to US$300 m this year), due in part to China's entry, by means of bilateral aid involving various countries in the amount of US$4,000. France appears to be the largest bilateral co-operator in the telecommunications area, followed by Italy in gas pipelines and the USA and Nordic countries in various projects in which informatics forms an important part. (Bulletin IBI Press, No. 46, 2 September 1985.)

Italy

Italian programme

Italians have established a National Research Program that addresses VLSI technologies and architectures, and technologies for compound semiconductor devices. The strategy for this program calls for a strong co-operation between industry, manufacturers and users, universities and the National Council of Research Laboratories. The thrust of the program will be on medium-term results, addressing technologies and tools rather than products. This program is designed to complement other programs that Italy participates in, including ESPRIT. The VLSI part of the program will cover basic technologies for MOS processes in the range of 1.5 m, CAD tools for implementing new design styles and a variety of architectures and VLSI designs. To increase industry-university co-operation in the design area, a multichip project will be established to reduce the cost of silicon implementation. In compound-semiconductor areas, the research effort will concentrate on GaAs material and processes; a test vehicle will be developed for microwave (signal and power) and optoelectronic (optical communications and optical processing) applications. (Reprinted with permission from Semiconductor International Magazine, June 1985, Copyright 1985 by Cahners Publishing Co., Des Plaines, Il. USA.)

Korea

Korean chips on the block

The declining chip prices have caught the Samsung Semiconductor and Telecommunications Company, Republic of Korea's pioneer in memory integrated circuits, on the wrong foot. It is reported that the company has drastically cut down its monthly production of 64K DRAM chips from five million to three million. According to some sources, the company is even contemplating a total cut in production of 64K chips to tide over the unexpected downfall in prices. To compensate, Samsung has raised the production of 16K chips and is pulling all efforts up to start the production of its prestigious 256K DRAMs at the earliest. The event has reactivated the controversy over the country's semiconductor industry, which seemed to have died down when Korea jubilantly claimed to be the third nation to independently develop 64K DRAMs. The prices have now dropped from US$3 each in December 1984 to US$1.20 each. Industry circles were mostly concerned about the financial squeeze caused by excessive investment into MOS (metal oxide semicondictor) memory chips such as the 64K and the 256K DRAMs. This concern has been accentuated ever since the price of the "super chip" plummeted.

The government ascribes the misfortune that has befallen the Korean chip manufactureres to their inopportune investment. "A super chip has a comparatively short life cycle, about four years. Korea's investment into the 64K DRAM chips was untimely because there was a worldwide shift from 64K DRAMs to 256K DRAMs. Competition, both in pricing and facility investment, is now steep and the market is temporarily dwindling", maintain officials at the Ministry of Trade and Industry (MTI). The United States and Japan poured a lot of money into MOS chips during the last two years thus causing a glut. Korea's concentration on this field, the experts feel, was thus ill-timed. (Asia-Pacific Tech. Monitor, May-June 1985.)

Malaysia

National announces closure of Malaysian plant

National Semiconductor is to close its IC assembly plant in Seremban, West Malaysia and will lay off most of the 1,000-strong staff by next month.

The closure was announced in Kuala Lumpur by Max Stanton, vice-president, National Semiconductor Asia Pacific, who said that following the closure of the Seremban plant, National would concentrate its Malaysian IC assembly operations in its plants in Penang and Malacca.

According to Stanton the Seremban assembly facility is being closed because the plant could not fit in with National's increased efficiency manufacturing strategy, the Japanese Kanban or Just in Time system pioneered by the car giant Toyota. Limited space and technical factors would prevent the Seremban plant from adopting the system fully and consequently its production load will be shared among National's other off-shore assembly plants in Asia. The continued vertical integration of National's plants in Penang and Malacca which includes increasing the number of ICs tested on site for direct shipment to customers would provide the economies of scale needed to ensure the company's long term growth in Malaysia, Stanton said. The Just in Time strategy which minimises the need to hold large IC inventories halves the lead time between receipt of an order and shipment from 31 days to 15 days. ... (Electronics Weekly, 18 September 1985.)

Malaysia to Set Up Electronics Centre

The Malaysian Government will set up an Institute of Microelectronics System soon as a training and research centre for electronics. Datuk Amar Stephen Yong, the Minister of Science, Technology and Environment, stated that this was a part of the efforts to devise a national microelectronics programme. He said that the envisaged programme was aimed at formulating strategies and pooling resources of the government and the private sector to develop the Malaysian microelectronics industry. Such efforts, according to Datuk Yong, were necessary as the government wished Malaysia to produce microchips in the future instead of assembling microchip parts as was being done at present. He also spoke of the need to evolve an intensive computer education programme to overcome the weakness in computerization in the country. (Asia-Pacific Tech. Monitor, May-June 1985.)

UK

Alvey plans to plug architecture gaps

The Alvey Directorate plans to inject about £20 million into computer architecture projects to plug gaps left by its other initiatives. Computer architecture was not one of the main subjects listed by the directors when the national programme was launched nearly two years ago. Now Alvey has decided that it is too important to be left out and a strategy document on the topic is to be circulated with the forthcoming issue of the Alvey newsletter.

The main thrust will be towards Manchester University's Dataflow and Imperial College London's Alice project, now brought together under the title of "Project Flagship".

It is believed that Flagship will provide a suitable vehicle for both artificial intelligence and software engineering projects. The Alvey directors show a new confidence in the theoretical basis of Prolog-type programming and think that Flagship is needed to take full advantage of its likely results.

Among the ideas which are expected to attract Alvey funds in the next three years are three "exemplars" in the area of knowledge manipulation. The directors are presently considering proposals for applications such as a very large general purpose database (such as a phone directory), a complex deduction system and a real time control effort, perhaps in civil aviation. (Computer Weekly, 25 April 1985.)

Transputer makes working debut

INMOS gave the first public demonstration of a working Transputer system at the Sigraph '85 Computer Graphics Show held in July in San Francisco.

Dubbed the Meiko Computer, 104 16-bit Transputers were operating in parallel to drive a highly computational task drawing a complex graphics display. The system was put together in a matter of days by Inmos spin off company Meiko Bristol and used the first pre-production transputer parts made available by Inmos.

The cost of each MIP of processing power in the Meiko computer is calculated at $250 each. The demonstration system also used the new colour look up table graphics chip from Inmos, the IMSG 170, which makes use of the same CMOS production process as the Transputer and is seen as clearing the way for full scale production of the Transputer later this year. ... (Electronics Weekly, 31 July 1985.)

USA

The Spectacular Promise of Supercomputer Centres

Sifting through photographs of the stars in search of clues to the origins of galaxies demands excruciating patience. Analyzing the millions of pinpricks of light in just one photo takes a computer three weeks. And Princeton University physicist, Edward J. Groth, has hundreds of heavenly photos to study, with more pouring in every week. But next year, when the first images of galaxies never seen before come in from a government telescope launched into deep space, the tide will turn in Groth's favor. He'll be able to analyze the photos with an ultrafast "supercomputer" that will zip through the task in a mere hour. That will give him the once-unthinkable luxury of re-examining interesting photos and will increase his chances of spotting new information. The computer will be the soul of a new supercomputer research center in Princeton, N.J. - one of four seeded by the National Science Foundation last March. The centers will put the world's most powerful computers at the fingertips of academic researchers for the first time. By the end of the decade, the NSF and others will have pumped $469 million into the program.

Beyond expanding the frontiers of university research, the centers should hasten the transfer of new technology from academia to industry. "The centers will radically change the kind of university science that gets done", predicts Donald W. Anderson, director of academic computing at the University of California at San Diego, the hub of another NSF supercomputer center. Using the center's supercomputers, researchers expect to fill knowledge gaps in such fields as physics, mathematics, chemistry, and biology. Until now, university researchers could only dream of tackling problems that required vast numbers of calculations - even though truly pathfinding work usually calls for just such number-crunching. But with access to machines up to 1,000 times more powerful than the minicomputers they normally use, scientists will be able to solve many of these complex problems.

The first supercomputer center will open late this year, and researchers are already clamoring for computer time. The John Von Neumann Center for Scientific Computing in Princeton is evaluating more than 500 proposals from the 12 institutions it will eventually serve, including Princeton University. In the interim, the NSF has purchased more than 5,000 hours of time on the supercomputers already in operation at government and industrial sites. Industry should reap a handsome bounty from the centers. Today it can take years for research to filter from campus labs into business. But by 1990 "there will be university projects that have been instantly transferred to industry", asserts Nobel laureate Kenneth G. Wilson, director of Cornell University's supercomputer effort, the Center for Theory & Simulation in Science & Engineering.

THE MILLIONS ROLLING IN FOR SUPERCOMPUTER RESEARCH CENTERS

Five-year budgets (1986-90), millions of dollars

	National Science Foundation	Universities and states	Corporate contributors*	Total
CORNELL	$22	$12	$95	$129
[illegible]	44	22	50	116
[illegible]	70	31	23	124
[illegible]	80	25	15	100

* Figures represent each center's goal for corporate contributions, including the value of equipment and personnel donated by computer vendors.

DATA: PARTICIPATING INSTITUTIONS

STANDARDIZATION AND LEGISLATION

ISO and IEC prepare to join forces in the field of information technology

The two major world organizations responsible for producing international standards, will combine forces to provide urgently needed standards for the field of information technology. This move, bringing together existing standardization work in ISO and IEC, was prompted by the increasing integration of the technologies that make up the information technology sector - microelectronics, telecommunications, computing and information processing.

Speaking at the IEC General Meeting in Montreal recently, Mr. Alexis Dejou, the IEC President and Mr. D.G. Spickernell, the ISO Vice-President agreed that international standards were urgently needed to facilitate interconnection and communication between a wide variety of equipment, e.g. personal computers, word processors and a host of other industrial, commercial and domestic systems.

A joint ISO/IEC committee already has the necessary plans for the operation well in hand. The IEC Council, composed of representatives from 42 countries, has given approval for the joint effort. Approval from the ISO Council, which acts on behalf of ISO members from 75 countries, is expected at its meeting in September this year. In the meantime, a committee of experts from ISO and IEC together with experts from the two major consultative committees of the ITU (International Telecommunications Union) start work this July. This committee will determine the structure and operating procedures necessary to produce needed international standards for this area. The joint ISO/IEC operation is expected to achieve improved management and co-ordination for the total international programme. It will also help to avoid duplication of work and maximize the use of the scarce manpower in this field. (ISO Bulletin, No. 7, July 1985.)

OSI standards

There have been numerous recent reports in the computing press referring to Open Standards Interconnection (OSI) and OSI standards, but as yet there has been little factual information on the development and availability of these documents. The OSI initiative, undertaken by the International Organization for Standardization (ISO), is now reaching fruition, culminating in the availability of internationally-agreed drafts for OSI, LANs and computer graphics. The two ISO Committees responsible for OSI, Technical Committee 97, Subcommittee 6 (Layers 1-4 and LANs) and Subcommittee 21 (Layers 5-7 and computer graphics) have been responsible for the development of these drafts.

Because of the necessarily stringent, but rather ponderous procedures for obtaining formal international approval of ISO drafts for ultimate publication as ISO standards, the BSI Technical Committees have decided to make relatively stable approved ISO drafts available by publishing them as BSI Drafts for Development (DDs). This achieves the optimum combination of user (of the DD) confidence and speed of availability. Thus a DD is effectively a pre-standard which is made available for the guidance of those who need to know the current 'state of the art', even allowing for the fact that the ISO draft may change prior to the publication of the ISO standard.

The timing of the availability of the DDs reflects not only the level of technical stability of the document, but also the necessity of making advance information available. Thus certain important documents may be made available at a somewhat earlier stage than normal, and where this is the case, suitable explanatory information will be given in the national foreword. (Computing, 18 July 1985)

Digital, the first American manufacturer to accept ISO standards for computer networks

Digital is the first US manufacturer to announce its intention to make its model of computer network, Digital Network Architecture (DNA), comply with the standards of the open system interconnection (OSI) of ISO (International Standards Organization). ISO aspires to achieving that the standardization of data interconnection protocols permit the connection of different makes of computer hardware to a public package-switching telephone network.

Digital has announced that it will develop the part corresponding to level 5 (dialogue between different tasks) in three years and will alter the corresponding part of its network to levels 6 (data handling and format presentation) and 7 (task treatment and application resources). Temporarily, while concluding the former, it will implement communication programs between both systems. As regards the remaining levels, it has announced that it will develop software corresponding to level 4 (correct information transmission) and that it

will follow the recommendations of CCITT (International Telegraph and Telephone Consultative Committee) with regard to messages i.e. standards x25 on public networks and x400. The former covers the first three levels of ISO's model, from setting up virtual circuits and connections to the correct communication by modems and telephone lines.

To round out this standardization effort, Digital has announced that it will support the MAP standard (Manufacturing Automation Protocol) version 2.1 in the domain of industrial networks. (Bulletin IBI Press, No. 41, 29 July 1985.)

The problems of computers that don't talk on the shop floor

A group of 18 European companies including GEC and British Aerospace is to spend £10 million over the next three years working out how to couple up the computerised equipment used in manufacturing industry. The project is part of the EEC's Esprit program of advanced computer research. The lack of standardization in how computers communication with each other is now recognised as a major barrier to computer-integrated manufacturing (CIM). The new research into so-called CIM architecture will propose a set of standards covering computers used in design, administration, sales, management and manufacturing. The standards will reach from systems that serve management at the top down to the wires that carry the chatterings of robots on the factory floor.

American companies, led by General Motors and the Boeing aircraft company, have already begun work on standards for manufacturing industry and are well on the way to persuading the equipment makers to adopt a standard for communications called the Manufacturing Automation Protocol and the Initial Graphics Exchange System, which provides a format for exchanging product data between computer-aided design systems. Bernard Lorimy, from the French software firm CAP Gemini Sogeti, who heads the architecture project, denies that the European team will end up duplicating the American work. "We are starting at the top and working down; they are starting at the bottom and working up, hopefully we will meet in the middle." British Aerospace, however, believes that a European standard is vital because the American systems are out of date, and in any case it would be bad for European industry to rely entirely on American developments. (This first appeared in New Scientist, London, 1 August 1985, the weekly review of science and technology.)

Fortran fights for its future

Fortran authorities are trying to break an impending block by IBM and DEC on the modernization of the language. The American National Standards Institute's committee on Fortran, the world's second most used language and first choice for scientists, is mobilising support for a new standard which the two biggest manufacturers have opposed. IBM and DEC have objected both to the size of the planned definition and to the "deprecation" of certain statements; that is, marking them for deletion in the 1990s. Some experts have suggested that the manufacturers are seeking to avoid the cost of upgrading.

If they vote against publication of the standard, major users may adopt an alternative such as the US Defence Department's Ada. The DoD has recently begun a bid to enforce ADa on its suppliers. IBM's technical relations manager Keith Williams says the deprecated list would "transform" the language and pose compatibility problems for users with large investments in existing programs. He says the language should not become too large in case it loses popularity. (Computer Weekly, 18 July 1985.)

ICL and Europeans push Unix standard

Europe's major manufacturers are set to force an industry standard with Unix where the US telecommunications giant AT & T has so far failed. The top firms are ICL, Bull, Siemens, Olivetti, Philips and Nixdorf, all members of the X/Open Group which promotes Unix as a standard software environment. They have backed a comprehensive range of international and de facto standards designed to provide their combined user base with a Common Applications Environment for Unix. AT & T has limited its activities to promoting the Unix System V standard, but the European manufacturers seek to provide users with a full range of features that will make full portability for applications software possible. ICL heads up the X/Open Group and is leading the way in implementing its recommendations. ICL is to launch versions of Unix for its 2900 and Series 39 mainframes early next year.

The other manufacturers are understood to be backing recommendations made in the Group's X/Open Portability Guide Overview, the full version of which is due for publication some time in August. Two companies likely to benefit most from the group's recommendations on suitable standards are Relational Database Systems and Micro Focus. (Computing The Newspaper, 27 June 1985.)

UK copyright Bill has fast success

The private members' Bill to amend the copyright law to cover software had its final Commons reading last week. It is expected to receive the Royal Assent which means it should be on the statute book by the end of September. This represents a big success for the Federation Against Software Theft (Fast) and the computer industry lobby behind it, perhaps a unique case of the industry uniting to succeed in changing the law. It has also been accomplished with no more than a nod of approval from the government itself.

Fast says it will not be retiring at the end of this campaign but will continue to ensure that the benefits of the change are reaped in full. ... (Computer Weekly, 11 July 1985.)

US act protects UK chips

UK microchips are now protected from piracy under changes in US copyright laws. The temporary two-year protection agreed under the US Chip Protection Act is part of an international strengthening of laws to safeguard chip designers. So far the US has granted one year's protection to Japanese, Dutch, Australian and Canadian manufacturers. The UK had been given two years because its laws appear to be the strongest.

The US Chip Protection Act was passed in June to give designs ten year's protection. Under ordinary US copyright laws, only blueprints are protected and rivals were able to get away with copying the final product. (Computing, 29 August 1985.)

Computer law Newsletters

Growing interest in computer law has created a market for newsletters aimed at users, vendors, and their lawyers.

COMPUTER LAW AND TAX REPORT
Warren, Gorham & Lamont Inc.
210 South St.
Boston, MA 02111
$78
Monthly. Primarily for users. Covers new laws and offers general advice. Written by New York attorney Esther Roditti Schachter.

COMPUTER LAW MONITOR
Research Publications Inc.
P.O. Box 9267
Asheville, NC 28815
$49.50
Quarterly. For users and vendors. Summarizes and comments on court cases. Edited by Buffalo attorney Patricia A. Hollander.

COMPUTER LAW NEWSLETTER
Bigelow & Saltzberg,
100 Tower Office Park
Woburn, MA 01801.
$300
Bimonthly. Focuses on developments in Massachusetts and the Northeast.

COMPUTER LAW REPORTER
Computer Law Reporter Inc.
1519 Connecticut Ave, NW
Washington, DC 20036.
$550
Bimonthly. Reprints recent decisions and carries articles discussing legal issues and laws. Primarily for lawyers. Edited by Gary J. Rinkeman.

COMPUTER LAW STRATEGIST
111 Eighth Ave., Suite 900
New York, NY 10011
$165
Monthly. For lawyers, users, and vendors. Explores issues and offers practical advice. Edited by Julian S. Millstein of Brown, Raysman & Millstein, New York.

COMPUTER LAWYER
Law & Business Inc.
855 Valley Rd.
Clifton, NJ 07013
$175
Monthly. In-depth articles, primarily for lawyers. Edited by Miles Gilburne of Blanc, Gilburne, Williams and Johnston.

COMPUTER NEGOTIATIONS REPORT
Sunscape International Inc.
1513 E. Livingston St.
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SOCIO-ECONOMIC IMPLICATIONS

IT to oust 'clerical army'

Armies of clerical staff doing routine repetitive work for the Civil Service may be replaced by computers. The prediction came from Anne Mueller, senior civil servant who was drawing a picture of 'the Civil Service in the year 2000' at a conference of civil service accountants. Mueller, head of the management and personnel office, said emerging technology could allow some work to be done at home. And she added that the technological changes 'would have fundamental consequences' as they already had in checking VAT returns, Customs & Excise forms and the register of property titles.

The changes had all led to greater job satisfaction, 'as well as improved efficiency and quality of service', she added. Mueller said she believed IT would increase the effectiveness of civil service management by providing for more comprehensive and up to date information. It should also be 'a positive force for obtaining better value from limited public resources', she said. She envisaged the Civil Service contracting more towards a more flexible and professional workforce. Mueller said the present rigid grading structures had to be changed and that people's skills had to be redeployed. Massive changes will have to take place in many areas. (Computing The Newspaper, 27 June 1985.)

Skills gap hits innovation

A shortage of qualified staff is the single largest factor hampering the world's major manufacturers, according to an international survey of top industrialists. Although this shortage is not new, it is surprising that senior executives think it more significant than either high interest rates or trade unions. The survey also highlights differences between the Japanese and everyone else in perceptions and attitudes.

The survey was carried out among 176 chief executives and company directors in nigh technology businesses ranging from communications and computers to machine-tools and medical equipment. The firms are based in Japan, the US, West Germany, Britain and Belgium. The survey is called Attitudes to new technology - an international survey and was conducted by MORI on behalf of PA Technology a consulting and research organisation. Twenty-two per cent of the people questioned felt that the lack of qualified staff was the main constraint to the development of new products and processes within their company. None of them thought that high interest rates or trade unions were barriers to innovation. But government regulations were picked out by some US executives. The shortage of qualified staff is particularly acute in Britain and Japan. The Japanese are also worried about the quality of their staff and described them with phrases like "lack of creativity" and "mediocrity". "They blame it on the education system but they don't know whether selection filters out the creative or whether the system itself stops people from being creative," said Dr Gerald Avison of PA Technology who has studied the results of the survey.

According to Dr. Avison, the replies show the Japanese to be far more aggressive in their use of technological developments than the western countries. "They would use it to focus on new products, face up to the competition and do research rather than using it in defensive attempts to reduce production costs," he said. Absolutely none of the Japanese senior executives said that they would adopt defensive measures while one-sixth of the British ones would. The survey also found that a Japanese company was five times more likely to have a board director responsible for keeping the rest of the board informed about new technology than a western company.

And while the Japanese were generally opposed to shifting universities away from basic research and towards applied research, everyone else was in favour of it. "This is a time bomb," said Dr. Avison. "In 10 years we may have no basic developments to apply. We could become assemblers and not creators. Ultimately we could become an offshore island that is completely dependent on technology from Japan." The survey shows the Japanese to be confident: they are more worried about domestic competition than foreign competition while much of the West views Japan with concern. (Electronics Weekly, 18 September 1985.)

GOVERNMENT POLICIES

The government of Bangladesh is playing an important role in electronics development *

Bangladesh is one of the least developed countries in this region. Although it is a small country of 55,598 sq. miles (143,998 sq. km), Bangladesh has a comparatively very large population of about 90.7 million people. On the one hand, it has been bending all its efforts to arrest the population explosion, while on the other it has been utilising all possible means to boost up food production to ultimately attain self-sufficiency in food. As a result of its continuous endeavours, the population growth rate has shown a downward trend, while the food production has reasonably increased, in spite of droughts and onrush of floods.

Though the industrial sector is relatively small, contributing only 8.8 per cent of the GDP, it plays a strong supportive role in the country's agricultural and infrastructural developments. In a country like Bangladesh having a very low per capita income and a heavy population pressure and agrarian base, development of industrial sector holds the major longterm hope for alleviating both poverty and guaranteeing high-level, self-sustaining income growth.

Considering the importance of the development of industrial sector of the country, and in order to give a new dimension and greater thrust to it, the government has taken a number of steps. There has been progressive disinvestment of the industrial units which, following the independence, had to be taken over by the government for management. Industrial investment schedule has been reframed and a new industrial policy with a series of incentives and promotional measures has been introduced to reactivate the industrial sector particularly the private sector industries.

The basic objectives of this new industrial policy are to:

(1) expand the manufacturing sector with increased participation of private sector;

(2) limit the role of public sector to the establishment of basic, heavy and strategic industries;

(3) encourage investments to move away progressively from assembly to intermediate/basic industries;

(4) protect and promote local industries by reasonable tariff measures and/or banning imports where there is adequate domestic capacity; and

(5) develop indigenous technology base and encourage judicious application of appropriate technology.

Other notable features of this policy are:

(1) a more simplified sanctioning procedures and decentralisation of sanctioning powers;

(2) creation of Investment Assistance unit (one stop service) for providing wider service facilities to the investors regarding processing of project, acquisition of land, arrangement of power/gas, issuing of ad hoc licence for raw materials import, etc.;

(3) increase of sanctioning power by loan giving agencies and other sanctioning authorities; and

(4) foreign participation in joint venture projects on mutually beneficial terms and conditions. ...

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*/ This report was presented at the Ninth General Assembly of the Asia Electronics Union on 4 September 1985, at Tokyo, Japan, by Mr. Shamsul Islam. Mr. Shamsul is a chairman of Bangladesh Electronic Manufacturers Association.

As far as electronic industry is concerned, Bangladesh is still in the beginning stage. But there has been growing awareness about the importance of this industry in particular both in the public and private sector. Recently government has undertaken trade and industrial policy reform programme, to find out ways and means to develop electronics industries in the country particularly export-oriented electronic industries to generate its export earnings. A Technical Committee has been formed in this connection to prepare and submit recommendations on the basis of which a policy decision will soon be made by the government. The development of electronic industries in the country is still limited to local assembly of radio receivers, radio-cassette recorders and televisions. At present more than 60 units have been sanctioned with a total capacity of 795,000 sets for assembly of radio receivers, radio-cassette recorders and about 22 units with a total capacity of 120,000 sets for assembly of television sets.

Apart from this, a local company has been in operation in joint collaboration with a Swedish company. Its activities include etching, printing and stuffing printed circuit boards, winding of transformers and other assemblies. Its assembled products are electric fencers, Ni-Cd battery chargers, dry type electronic transformers and digital high voltage testers. The raw materials are supplied entirely by the foreign partner which also takes up the entire output for marketing in Europe and the USA.

In Bangladesh there is enough scope for development of electronic industries and it is expected that more and more industries will soon be coming up in this sector to avail themselves of the opportunities and facilities offered by the government. As regards organisational structure in the electronic field in the country, the Ministry of Industries is the main government body which lays down the general policy of industrial development including the development of electronic industries both in the public and private sectors. The implementation of the government policy and programme rests with the Director General of the Department of Industries so far as the private sector is concerned. In the planning commission of the government, the Industries Division, which deals with industrial planning and development is mainly engaged with relevant studies and planning for the future, while the business of formulation of policy statements and guidelines on science and technology and the follow up of their implementation devolves on the Science and Technology Division. The noteworthy developments in this country in policies and activities in electronics fields may be summarised as under:

There are seven TV stations in Bangladesh covering almost 90 per cent of the total urban and rural areas. Besides Bangladesh has six radio broadcasting stations including a few relay stations. The principal objective of this expansion of TV and Radio network is to meet the extensive mass communication needs of the country.

There has been considerable progress in the extension of telecommunication network in the country. The Bangladesh Telegraph and Telephone Board has already set up VHF, UHF and microwave network throughout the country and whatever area still remains uncovered will soon come under telecommunication network. An electronic exchange for central telex system has been set up, while international dialing system has also been introduced. The programme for having electronic exchanges in the principal cities is also being gradually implemented. A significant step forward in the telecommunication field has been the establishment of a satellite earth station with Intelsat standard A at Bethbunia. Another earth station with Intelsat standard B has been set up in the outskirts of Dhaka.

These projects have greatly strengthened its telecommunication efforts. The establishment of a domestic satellite communication system is also contemplated. A public sector enterprise - Telephone Shilpa Sangshta is now manufacturing subscriber's set, PABX and telephone exchange equipments of electro-mechanical type in joint collaboration with Siemens of West Germany. With rapid development of stored programme controlled (SPC) switches, the existing electro-mechanical system is becoming obsolete and hence the existing factory is being changed over to electronic switching factory, keeping side by side the production of electro-mechanical equipment for sometime to cater for the need for rural and smaller capacity exchanges.

The electronic factory will also produce electronic components for the manufacture of exchange equipment and for meeting the demand for other local industries manufacturing electronic gadgets.

In respect of research and development activities, the programme of the institute of electronics located in the outskirts of Dhaka may be mentioned whose broad objectives are as under:

(a) Promotion of R & D in electronics;

(b) Providing electronic installation, testing, servicing, quality analysis and quality control needs;

(c) Training of electronic personnels; and

(d) Small-scale fabrication of electronic equipments.

In the country there are few noteworthy training facilities. The existing training facilities in the electronics fields are grossly inadequate. A student intending to receive education in electronics can have a three-year course on electronics from polytechnic institutes after passing Secondary School Certificate examination. There are, however, only a very limited number of such institutes in the country where electronic courses are available. As the Islamic Centre for vocational training and research is nearing completion at Dhaka under the auspices of the Organisation of the Islamic Conference. This centre will impart training in various trade crafts including electronics where technicians from Islamic countries are expected to be trained. But whatever training facilities there are in the country in the field of electronics, these are not enough to bring out highly trained professionals needed for electronics industry. It has, therefore, always been proposed that a regional institution sponsored by the Asia Electronics Union should emerge as a centre where postgraduate training facilities in electronics will be made available to the developing countries to enable them to acquire appropriate technology for achieving speedier development in the electronics fields. (AEU, October 1985.)

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Economic Commission for Europe (ECE)

SC.TECH./R.178/Add.1
Current Developments in Science and Technology Policies: Policy issues associated with the introduction of electronics in some industries. Note by the secretariat.

The document was prepared for the Thirteenth session of senior advisers to the ECE governments on science and technology, held at Geneva, 16-20 September 1985 who looked at micro-electronics based systems in manufacturing such as flexible manufacturing systems (FMS) which are increasingly identified as being key technologies for enhancing productivity and international competitiveness in industry. Government programmes in some ECE countries as well as in Japan are reviewed.

"Microcomputer Statistical Packages for Agricultural Research," Working Paper No. 17 by Thomas Stilwell. This 23-page paper is one of many from the Michigan State University series, International Development Papers. Nine statistical packages expressly designed for agricultural research are described therein. Single copies are free for AID personnel and Third World requesters, US$3/copy for others. It can be ordered from: MSU International Development Papers, Dept. of Agriculture Economics, 7 Agriculture Hall, Michigan State University, East Lansing, Michigan, USA, 48824.

A low-cost microcomputer program designed by scientists from MSU and the Agricultural University of Norway, supported by A.I.D.'s Alternative Rural Development Strategies Project, is now helping African scientists to design, manage, and analyze agricultural research experiments. With only brief training, MSTAT can be used by persons with no previous microcomputer experience, and can be run on most microcomputers. Training and software materials are available in English, Spanish, and French. For a brochure on the technical and general features of this program contact: Russell Freed, Institute of International Agriculture, 101 Agriculture Hall, Michigan State University, East Lansing, Michigan 48824. (517/355-0174) (Development Communication Report, Summer 1985)

A REVIEW OF THE STATE OF THE ART OF GaAs RESEARCH*

Christopher M. Snowden**

Introduction

Recent advances in gallium arsenide technology have led to a dramatic increase in interest in using gallium arsenide (GaAs) integrated circuits in a wide range of applications. Initial interest centred around analogue applications, and the early 1980s saw the birth of a new generation of GaAs monolithic microwave integrated circuits (MMICs). Current trends however, suggest that the development of high speed digital ICs will dominate GaAs technology.

Gallium arsenide has several properties which lead to superior high frequency/speed performance when compared with silicon. Gallium arsenide has a higher low field electron mobility than silicon, which allows electrons to reach a peak velocity in excess of twice that of electrons in silicon. Furthermore, in very small devices (sub-micron) the phenomenon of 'velocity overshoot' allows even higher velocities to be obtained (up to five times those achieved in silicon devices). Another advantage of GaAs over Si is that devices fabricated using n-type material have the property that sub-micron epitaxial layers grown on semi-insulating GaAs, exhibit mobilities approaching the bulk value. This contrasts with silicon where thin layers grown on insulators exhibit substantially lower mobilities than the bulk value. It is this feature of n-type GaAs which gives GaAs transistors lower parasitic resistances and higher gains than similar silicon devices.

Digital integrated circuits fabricated in GaAs offer advantages in speed, power dissipation, operating temperature range and radiation hardness when compared with silicon. GaAs digital integrated circuits have the high speed capability required for very high-speed computers, high data rate communication systems, and high-speed wide-bandwidth measurement systems. Space and military applications take advantage of a radiation hardness which extends beyond 10 megaRADs for GaAs ICs. Silicon MOS circuits generally fail around 10 kRADs - the best silicon circuits withstand 1 MRad. GaAs ICs have been operated over the temperature range -200 to 300 degrees Centigrade, and consequently circuits have been developed to take advantage of this temperature range for use in combustion engines and other hostile environments.

Gallium arsenide discrete analogue devices first appeared with the introduction of the transferred electron oscillator (Gunn diode) in the early 1970s. This two terminal device which is capable of generating power at microwave frequencies was rapidly incorporated into microwave sub-systems and is still used extensively in both commercial and military applications. Interest in using GaAs spread wih the widespread introduction of the GaAs MESFET (Metal semiconductor field effect transistor) which is used in a wide variety of microwave applications up to 40 GHz.

The demand for integrated sub-systems led to the development of analogue GaAs MMICs, for applications such as direct broadcast satellite (DBS), receiver front-ends and phased-array radars. The first commercial GaAs analogue IC was introduced by the Harris Corporation in February 1984. Up to the present time the drive to develop analogue MMICs has not matched the effort put in to the rapidly expanding digital field. This can be partly attributed to the well funded research and development programs dedicated to digital GaAs research (such as the DARPA program in the USA).

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* This article is an excerpt of a paper prepared by Dr. Snowden for UNIDO which will be published in a different series and will be available upon request.

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The speed advantage of GaAs over silicon has led to the rapid development of GaAs digital circuits. Considerable effort in the United States, Europe and Japan has already resulted in the development of nanosecond access time 16 kbit GaAs RAMs. Research in the USA and Europe has been aimed largely at military applications and commercial communication systems, whereas strong investment by Japanese companies has been directed towards the rapid development of fifth generation computers.

The recent development of heterostructure transistors (HEMT, MODFET or TEGFET, and the HBT), which promise operating frequencies upto 100 GHz has already been exploited with the development of very high speed digital ICs capable of operating well in excess of 10 Gigabits per second. The very high demands placed on fabrication technology by these devices (some of which require layer thicknesses of less than 100A and contact widths of less than 0.2 μm), has in turn led to increased efforts in developing better crystal growth, molecular beam epitaxy (MBE), dry etching techniques and high performance electron beam lithography.

Another expanding area of application for GaAs and related compounds lies in the field of optoelectronics. Solid-state sources and detectors are key components in fibre-optic communication systems. Research into developing integrated electro-optic sub-systems has already begun.

Performance of GaAs integrated circuits

Although GaAs has substantial advantages in terms of power dissipation, speed, operating temperature and radiation hardness, there are other factors which must be considered when comparing the relative merits of silicon and gallium arsenide. In particular the complexity, reliability, availability and cost are important factors in determining the best choice of technology. Recent developments in distributed parallel processing using VLSI silicon technology have tended to offset the immediate speed advantages gained from GaAs in a number of computing applications. However, there are many applications where parallel processing is not applicable. Specifically, bit stream processing, which incorporates error detection and data correlation, and data acquisition and sampling systems for wideband signal processors are not suited to parallel processing. Future systems will inevitably exploit the best attributes of each technology, and GaAs and Si sub-systems will be incorporated into areas which make the optimum use of their capabilities.

At the present time, the relative maturity of silicon technology allows much greater levels of integration to be achieved than is possible in GaAs. CMOS digital circuits with over 100,000 gates are already available, whereas GaAs technologies only extend to tens of thousands of gates at the present time. Hence, although the level of IC complexity is increasing rapidly for GaAs and GaAs/AlGaAs technologies, system designers still do not have the high-density, high-level functions available from silicon VLSI/VHSIC technology.

The market for GaAs ICs

The market for digital and analogue GaAs ICs is developing rapidly. A recently released report (Electronic Trend Publications) forecasts an increase in demand from the current $60m worth of business to $1.6 billion by the year 1990. Gallium arsenide ICs are being developed for a wide variety of applications, ranging from specialised very high speed digital signal processors for military applications, to high-volume consumer requiremens such as direct-broadcast satellite receivers (DBS) and fibre-optic communication links. At the present time military applications represent 76% of the overall market. It is predicted that this figure will drop to 30% by the end of the decade with a corresponding increase in the DBS and communications market to 35%.

Up to the present time the microwave communications market has been dominated by discrete component technology (in particular GaAs MESFETs have an important role as low noise amplifiers). Small-scale GaAs integrated circuits are currently being introduced and pre-scaler (frequency divider) circuits are already available. Medium-scale integrated circuits such as data-multiplexers, demultiplexers, variable-dividers and pattern generators are at pre-production stages. These MSI circuits have an existing market and are economically viable because of the reasonable yields possible.

The GaAs IC industry has up to now been driven by military requirements, where high speed digital and high frequency, light weight analogue circuits are required in high technology defence systems. Signal processing and phased-array radar applications require GaAs technology to achieve the specifications required by the military. Research in the USA has led to the production of 16 kbit RAMs and 10,000 gate arrays.

The demand for higher speed logic and memory for computers has stretched silicon technology to the limit and although current research into new types of silicon devices promises to extend the speed capabilities of existing technology, GaAs ICs have already been produced which provide the necessary improvements. Silicon central processor units are being developed with over 5 million gates. Since the CPU cycle time is limited by the propagatin delay between components, it is necessary to pack the components as closely as possible in addition to maximising their speed of operation. The consequent increase in packing density and size of component leads to a problem in disposing of the heat generated within the CPU. Again GaAs has the advantage over silicon that it has lower power dissipation as well as faster switching speeds. Impressibe developmens in GaAs digital IC technology nave been reported by both Japan and the United States. The Japanese have already presented results for 4 kbyte RAMs fabricated using HEMT technology for ultra-high speed operation.

There is considerable speculation that GaAs ICs will follow the path of silicon integrated circuits towards high-volume, low-cost production. However, many applications for GaAs ICs are relatively specialized and hence it would be expected that most GaAs IC designs would not be required in very large volumes. It may be that the market for fast GaAs logic and memory ICs will justify large-scale production (but not on the scale of silicon), but it is unlikely that a wide range of analogue MMICs will be required in large production quantities (with the possible exception of DBS circuits). As a consequence of the requirement for limited supplies of specific types of GaAs ICs, custom reseach, design and development will be necessary for many systems applications.

GaAs IC research

Research on gallium arsenide integrated circuits has been largely concentrated in the United States and Japan, although there has been substantial activity in European countries. The USA and European countries have recently concentrated research on digital integrated circuits. The US Government has decided through the Defense Advanced Projects Agency (DARPA) to set up GaAs foundries with $45 million from the Government and a further $22 million being drawn from private industry. Companies such as Rockwell and Honeywell are key members of the group involved in this concept. The ESPRIT program in Europe has provided support in some areas for GaAs IC research. In Japan, the Ministry of International Trade and Industry has been responsible for stimulating GaAs IC research and development. Japan's main interest, in contrast to other Western countries lies in a largely non-military area, developing commercial fifth-generation computer technology. Japan's research is again dominated by digital requirements and impressive results are already being reported at conferences.

Research on analogue ICs appears to be lagging behind the better funded digital area. The absence of strong government support has generally led to research being motivated by private venture funding for commercial aims (DBS etc.) or hopeful military contracts (phased-array).

Materials, design and fabrication of GaAs Integrated Circuits

GaAs integrated circuit technology has matured to the point at which companies in the United States, Japan and Europe achieve consistent yields on small production runs of MSI GaAs ICs. This reflects advances in the quality of material, improvements in fabrication technology and the development of sound design principles. The recent upsurge in GaAs IC 'foundries' and the rapid drive towards GaAs LSI and VLSI technologies demonstrates the significant advances being made in these areas.

Design rules for GaAs ICs are becoming established and many companies now offer foundry facilities. Advanced computer aided design techniques (CAD) are being developed, which are capable of accounting for the special characteristics of GaAs, which make the design rules differ from silicon. This work is particularly important for small-scale devices.

In the area of design and characterisation there has been significant collaboration between industry and research institutions such as universities. Examples of centres offering these services to the GaAs IC industry are to be found at Leeds University (Microwave Solid State Group), Sheffield University, Glasgow University, Nottingham University, Cambridge and UWIST in the United Kingdom. In the United States, universities at Illinois, Cornell, North Carolina State and Massachusetts Institute of Technology have extensive research programs aimed at improving the technology and developing accurate computer models for characterising small geometry GaAs devices. Japan has a number of universities which are investigating high speed GaAs devices. In particular, the Universities of Tohoku and Hokkaido have recently reported results on optimised design considerations for MESFETs [1] and high speed devices [2]. Cornell University have recently described a research project on the optimum design of MBE low noise monolithic amplifiers, carried out in collaboration with COMSAT Laboratories [3]. Sophisticated computer modelling

techniques have been developed at Leeds University [4] and North Carolina State University, supported by UK and US electronics industry. Both groups have used two-dimensional finite-difference numerical models to examine the operational (dc and large-signal ac) characteristics of short gate length (sub-micron) GaAs MESFETs for MMIC and GaAs VLSI applications. The numerical models have been used to develop improved analytical models suitable for use in IC computer aided design applications. The two-dimensional simulations are also being used to study the effects of variations in device geometry and material parameters.

The future for GaAs integrated circuits

Gallium arsenide IC technology is developing rapidly, with semiconductor companies investing increasingly in this area. However, GaAs digital technology may still have some way to go before it is widely accepted by the electronics manufacturing industry. A recent presentation by R.W.Keyes of IBM, Yorktown Heights, USA, at the European Solid State Circuits Conference (ESSCIRC), indicated that whilst IBM are investigating GaAs technology, they do not regard it as a substitute for silicon high speed logic at this time [5]. At present no major breakthroughs are being reported for silicon technology, and although designers continue to make smaller and smaller geometries and higher packing densities, dramatic speed improvements for silicon ICs are unlikely.

Current research confirms that GaAs logic gates with gate delays of the order of tens of picoseconds, tens of micro-watts power dissipation and very wide operating temperatures are a reality, and that improvements in performance of one or two orders of magnitude are possible for digital computers and communications systems. As the technological aspects of GaAs ICs are resolved the implementation of GaAs IC technology will remain a market driven issue which will depend on the requirements for faster high performance systems. It is likely that GaAs IC sub-systems will find applications where their speed, power, temperature and radiation hardness can be utilized in conjunction with existing silicon technology, rather than as a complete substitute for it.

The projected rapid growth in the GaAs IC communications market for satellite receivers, fibre-optic links, mobile telephones and data aquisition/processing will put even greater emphasis on the immediate need to resolve manufacturing difficulties. Improved packaging and testing techniques must be developed and the long-term reliability of GaAs ICs assessed.

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