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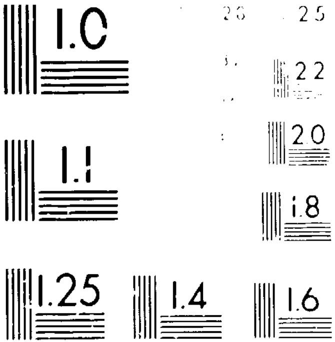
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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

MICROELECTRONICS MONITOR

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Dear Reader,

The end-of-the year issue of the Monitor comes out at a time of busy activities of the UNIDO secretariat which is expanding its already well-established programme in microelectronics. The next in the series of regional meetings on the implications of microelectronics for developing countries will be the joint ECWA/UNIDO meeting scheduled to be held in March 1984. Also in March a meeting is planned of representatives of intergovernmental and non-governmental groups engaged in the application of information technology for development to discuss with the secretariat ways and means of harmonizing their work programmes and, at a later stage, develop joint projects. The possibility of creating a regional network of microelectronics application centres in Latin America is being looked into following the recommendations of a high-level team of experts. A series of state-of-the-art studies of the microelectronics industry in selected developing countries is under preparation with the objective of promoting regional co-operation. A project for software for optimization of cane sugar production is under way. More detailed information can be found inside this issue.

In the IC industry a certain trend towards semi-custom ICs is noticeable. Market analysts believe that by the end of this decade semi-custom circuits (or specialized ICs) will account for over 50% of the semiconductor business. Two ways of production compete with each other: the gate array approach (cells on an existing array are interconnected in a new way) and the standard cell approach (a new combination of proven, standard cell designs are put on a chip). This trend is illustrated by news from the industry (see section on market trends).

Readers are reminded to fill and return the questionnaire attached to the previous issue No.7; the information will help UNIDO in further developing a 'user-oriented' work programme in this specific area.

With the publication of this issue the Monitor completes the second year of its existence; a special report on developments in these last two years has been prepared for us by Dr. John Bessant of the Brighton Polytechnic, which is attached as a special supplement. It highlights technological as well as market changes continuing at a rapid pace and gives a glimpse of the future, dominated by fifth-generation projects.

May I take this opportunity of conveying my own as well as my colleagues' best wishes for a prosperous and peaceful New Year.

G.S. Gouri
Director, Division for Industrial Studies

Inside this issue:

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

NEWS AND EVENTS

State-of-the-art studies on microelectronics in selected countries commissioned

In connection with the recommendation of several international symposia that UNIDO undertake steps towards the creation of an international centre for microprocessor applications, a start was made by commissioning country level studies in a number of countries in Latin America and Asia; it is intended to extend this programme to include selected countries in Africa. These studies while focusing on the actual situation in the countries will also highlight the areas in which the countries need regional and inter-regional co-operation as well as those areas in which the countries could contribute their own facilities and expertise to such co-operation.

We will report about further developments in the next issues of the Monitor.

UNIDO fields expert mission on setting up regional microelectronics centre for Latin America

A high-level expert mission arrived in Caracas, Venezuela on 20 November to review the possibility of establishing a regional centre for microelectronics applications for Latin America and the Caribbean. The expert team considered the possibility of locating such a centre in Venezuela using the existing facilities of the Fundación Instituto de Ingenieria in Caracas and recommended it as a centre of excellence specializing in certain facets of microelectronics technology within a Latin American Microelectronics Network (REMLA) to be created. This proposed scientific and technical co-operation network among centres devoted to microelectronics in the different countries of the Latin American and Caribbean region would link together scientific and technological capabilities, hitherto dispersed, and thus help them to keep abreast of international development in this field.

ECWA/UNIDO expert meeting to look into development of microelectronics in the region

As a joint effort, UNIDO is co-operating with ECWA, in organizing an expert group meeting with the objective of reviewing major issues relating to the application of microelectronics in the countries of the ECWCA region and suggesting a programme of action for future development in this field. Specifically, recommendations will have to be made for national, regional and international actions relating them to the proposed ECWA work programme in this field. The meeting for the ECWA region follows similar activities organized by UNIDO for countries in the ECLA region as well as Asia As inputs into the ECWA/UNIDO meeting two UNIDO consultants will prepare reports based on their findings during missions undertaken to Abu Dhabi, Egypt, Iraq. Jordan, Kuwait, Morocco, Saudi Arabia, Syria and Tunisia. One of the consultants covered the state-of-the-art of software and computer applications while the other was concerned with the state-of-the-art of microelectronics applications in the region.

The meeting is planned to be held for one week in the first half of March 1984.

The Geneva summit: TELECOM-83

The World Telecommunication Exhibition and World Telecommunication Forum, being held every four years, took place in Geneva, Switzerland, from 25 October till 1 November 1983. It was the Geneva "summit" of the United Nations declared World Communications Year 1983. TELECOM-83 with the general theme - "Telecommunications for all" is recognized as the world's largest and most prestigious meeting of communications specialists. World Telecommunication Exhibition gave the opportunity to the international communications community to make comparisons and provided information useful for the appreciation of which new telecommunication services to develop and which new systems and products to choose.

World Telecommunication Forum assembled a "brainstrust" of several thousand top executives, representing ITU Member countries, administrations, manufacturers, etc. Thirty-four sessions with over 200 presentations enabled participants to hear, meet and question industry and government leaders on current and future developments of international telecommunications. Part I of the Forum offered presentations by prominent figures in the economic sector as well as the telecommunication field. The list of speakers included government leaders, chairmen of the board, senior corporate managers and chief scientists from government and industry. They discussed the technological and infrastructure requirements of industrialized and developing nations. Part II of the Forum was a far-reaching technical and scientific symposium with wide-ranging appeals. It introduced to the specialists the advances made since Forum-79. Part III of the Forum dealt with the legal aspects of telecommunications related, in particular, to the ever-increasing transnational exchange of data, information and broadcasting.

Organized under the auspices of the International Telecommunication Union, TELECOM-83 provided an excellent opportunity to share information on the progress achieved and to discuss issues crucial to further developments in the field of telecommunications.

Computers to be used in search for natural resources

The United Nations Committee on Natural Resources asked United Nations Secretary-General to focus on remote sensing in identifying, exploring and assessing natural resources as well as the application of computer technology in mineral exploration and development. The Committee also called for an extensive study on the use of computer techniques in exploring for and developing of natural resources in developing countries.

Asia Electronics Union

The Asia Electronics Union jointly with the Indonesian Telecommunication Association (APNATEL) organized the Asia Electronics Symposium from 19 to 21 October 1983 in Jakarta. The eighth General Assembly of the Asia Electronics Union was also held at this occasion. The subjects of the agenda of the Symposium were: latest developments of telecommunication technology; computer software; and application technology transfer.

British computer society to help developing countries

Two specialist groups within the British Computer Society (BCS), the Information Retrieval and Developing Countries groups, have recently met to plan activities designed to help developing countries. During 1984 a number of seminars are to be organized at which practical and inexpensive methods of improving scientific and technical information transfer will be discussed. The proposed themes for the seminars are: the information needs of developing countries; hardware, software and telecommunications, education and training programmes; and policy-making for the information technology. The British Council is to assist with the promotion of the seminars. Representatives from developing countries will be invited to participate in the workshop-type seminars and it is expected that the proceedings will be published. For further information write to: Alan A. Benjamin, Chairman, Developing Countries Specialist Group, 9 The Chequers, West End Lane, Pinner, Middlesex, United Kingdom.

IFIP '83 meets in Paris

The International Federation for Information Processing (IFIP) met in Paris on 19-23 September 1983 for its Congress which is held every three years and includes a major exhibition of computer systems and service. More than 2,000 delegates attended over 100 sessions covering formal methods; dataflow design; VLSI architecture; logic programming; database design and the social implications of computers. IFIP as of 1 January 1984 will have 44 member organizations including regional groupings, representing a total of 49 countries. The permanent secretariat is located in 3 rue du Marché, CH-1204 Geneva, Switzerland (telex 428 472).

IFIP is a multinational federation of professional and technical organizations (or national groupings of such organizations) concerned with information processing. From any one country only one such organization - which must be representative of the national activities in the field of information processing - can be admitted as Full Member. IFIP was founded under the auspices of UNESCO in 1960 following the first International Conference on Information Processing in 1959. It has established official relations with the World Health Organization (WHO) and maintains informal relationships with other members of the United Nations family.

The aims of IFIP are to promote information science and technology by:

- fostering international co-operation in the field of information processing;

- stimulating research, development and the application of information processing in science and human activity;

- furthering the dissemination and exchange of information about the subject;

- encouraging education in information processing.

The proceedings of the IFIP congresses are published and form a comprehensive library of development in information processing as well as the current state-of-the-art. Information Processing '83, the proceedings of the 9th World Computer Congress Paris, September 1983, is available at a price of Dfl. 260 (member price Dfl. 125) from North-Holland Publishing Co., P.O. Box 211, 1000 AE Amsterdam, The Netherlands.

IFIP publishes an annual Information Bulletin as well as an IFIP periodical called Computers in Industry.

IFIP has set up a special Committee on Informatics for Development. The Committee's charter was approved at the 1979 general assembly held in London and its present chairman is Dr. R. Narasimhan of the National Centre for Software Development and Computing Techniques, TATA Institute of Fundamental Research, Bombay, India.

The aims of the Committee are:

a) to consider the methodology of applying appropriate informatics to development and to foster interdisciplinary activities on related problems;

b) to work with the Technical Committees in identifying and studying the particular technical problems of less developed countries:

c) to provide a technical forum for individual specialists from countries where professional societies still do not exist, and to assist in establishing professional societies there;

d) to promote IFIP technical activities and events in developing countries;

e) to assist UNESCO in the implementation of the resolutions of the first Inter-governmental Conference on Strategies and Policies for Informatics (SPIN);

f) to interact with international, intergovernmental and non-governmental organizations which are concerned with development, in particular:

- providing financial assistance to appropriate scientists and specialists from less developed countries to enable them to attend scientific meetings;
- preparing publications for use of informatics in less-developed countries;
- organizing the exchange of scientists and specialists between less-developed and industrialized countries.

The scope of the Committee is:

a) analysis of information environment and definition of informatics;

b) analysis of aspects and components of development;

c) identification of the role of informatics in development;

d) identification of measures to determine the level of development in informatics in various countries;

e) elaboration and analysis of micro and macro informatics models;

f) establishment of priorities in education applications, research and development of informatics in different countries;

g) identification of appropriate informatics technology;

h) study of social, economic and cultural consequences of introduction of informatics and transborder information and data flows.

Semicon/Japan exposition and technology symposium

The exposition staged under the sponsorship of the Semiconductor Equipment and Materials Institute (SEMI) and supported by the US Embassy in Tokyo was held at the Tokyo International Fairgrounds from 1-3 December 1983. Some 500 leading companies from Japan and the United States participated. Following the exhibition the SEMI Technology Symposium '83 was held featuring technical papers on VLSI lithography, dry processing and thin film processing. In addition, the symposium continued the communication and co-operation that began last year between the eastern and western countries involved in the semi-conductor manufacturing industry.

* * *

Note by the editor:

The following news items have been excerpted from the sources indicated except for a few articles on subjects of specific interest which have been reprinted in full with the kind permission of the respective journals. In view of the wealth of material available on the subject, by necessity, this has to be rendered in the Monitor in an abbreviated form and is intended only as a means to highlight a market tendency, technical development etc.

NEW DEVELOPMENTS

'Biochips' may be the brains of tomorrows computers

Growing computers from living bacteria in vats of nutrients? Replacing silicon chips with protein molecules? Packing a thumb-size computer with 10 million times the memory of today's most powerful machines? When a handful of scientists began proposing such apparently farfetched ideas a few years ago, they were met with raised eyebrows and incredulous stares from their peers. The concept of using organic molecules such as proteins to make computers - which was promptly dubbed the "biochip" - was dismissed by most experts as idle scientific speculation or, worse yet, pure fiction. But rapid advances in genetic engineering, chemistry, and physics are turning skeptics into believers.

"Making [synthetic] proteins is still science fiction," concedes Kevin M. Ulmer, research director for protein engineering at Genex Corp. He was one of the first scientists to believe that it would be possible one day to fashion molecules into computer circuits instead of printing circuits on silicon chips. "But," he insists, "it will be science fact sooner than anyone thinks." Ulmer heads a group of scientists at the Gaithersburg (Md.) biotechnology company that was set up with a $16.5 million grant from Allied Corp. to explore ways of modifying proteins to make useful products that do not occur in living organisms. And, he says, "I can see a concrete path pointed at computer memories and logic circuits."

A growing number of other scientists now agree that Ulmer's idea of building a molecular computer is possible and may even be feasible. In mid-October, the National Science Foundation (NSF) sponsored a four-day conference on chemical computers at the University of California at Los Angeles. That meeting drew 35 scientists from around the world, including Nobel prizewinning physicist Richard P. Feynman and representatives of such companies as Du Pont Co. and Texas Instruments Inc. Other companies, such as International Business Machines, Xerox, Hughes Aircraft, and Bell Laboratories, are following the technology closely. Although discussions at UCLA centered more on how scientists might tackle the problem than on reporting experimental results, many agreed that chemical computers will be built. "There's no reason we can't handle the problems," says Michael Conrad, a biologist and computer scientist at Wayne State University and one of the meeting organizers.

What makes chemical computers so interesting is the remarkable reduction in computer size that would be possible. In the early 1970s computer makers could store only 1,000 bits of data on a memory chip. Now such devices can hold 256,000 bits, and by the late 1980s each should be able to store more than 1 million bits of information. While semiconductors may be able to handle increasing circuit densities for the next several years, some computer engineers foresee a time when chips may reach their memory limit.

Some of the groundwork needed to turn molecules into computers has already been laid. Scientists are experimenting with organic chemicals that display electrical properties like those of some computer components. But they have not found all the chemicals needed to mimic the devices used in building a computer, so at least some of these will have to be synthesized. Building the computer from those components will require the ability to assemble new molecules atom by atom. "We need the same capability with little molecules that we have with the macroscopic world today," says Genex's Ulmer. ... (However, the conference strongly supported the development of bio sensors, sensory devices based on protein that would recognise patterns. These could be linked to computers which would provide the analysis.) (Business Week, 28 November 1983.)

One step chip production

Chipmakers are puzzling how to produce the VSLI (very large-scale integrated circuit) chips that will act as computer brains by the end of the decade. Whereas today's 64k dynamic random access memories can hold roughly 64,000 bits of computer information, the chip of the 1990s will hold 16 megabits - 16m pieces of information. The task, as with earlier chips, is to find a production method that gives a high yield of usable chips. A discovery just made at Toshiba's R&D laboratories at Kawasaki, near Tokyo, brings success one big step closer. It could also cut the costs of making existing chips. ... The Toshiba men used a laser technique. They covered the silicon wafer with an aluminium mask and put both into a vacuum chamber filled with chlorine gas at one tenth of atmospheric pressure. They then directed a xenon-chloride gas laser through the mask. They found that the laser splits the chlorine gas molecules into chlorine atoms, which then react with the silicon surface to form silicon chloride gas. Even better, that vaporisation causes a very precise etching. It is so precise because, Toshiba says, the chemical reaction between chlorine and silicon does all the etching work, and that reaction occurs only on the irradiated surface. His team does not really understand why it works, but it does. Other laser efforts using thermal reactions (i.e., melting) had always had some dispersal of heat, and thus imprecise etching. But there is another advantage the Toshiba scientists had not anticipated: the laser process is so precise that it does not need the laborious procedure of putting photo-sensitive film on the wafer, exposing it and so on. When it is introduced, the number of production steps will be cut from seven for each chip-pattern to just one. Toshiba claims that at current prices this would cut the cost of a set of chip-making equipment from about Y400m ($1.7m) as now to about Y100m, and the running costs would be only a tenth of present ones. Not that Toshiba is about to replace all its chipmaking equipment with the new process though.

There are still snags to be overcome. First, the etching process is far too slow. Second, precision quartz lenses, or a mirror system, are needed to direct the laser for the really fine etching needed for 16-megabit chips, and these have not yet been perfected. (The Economist, 17 December 1983.)

Bare chips

Manufacturers are beginning to replace the caterpillar-like dual in-line packages (DIPs) with bare chips, which are silicon dice that are glued directly to printed circuit boards. Though this obviously eliminates the packaging step in semiconductor assembly, bonding is still necessary, and it is still carried out in the Far East. Bare chips are being used in boards for video game cartridges and home computers. An unusual manufacturing flow developed to support this technique. The Photocircuits' Riverhead division of Kollmorgen Corp., Aquebogue, New York, starts the flow by producing small, additively plated [printed circuit] boards, shipped to IC producers like Motorola, TI, American Microsystems Inc., National Semiconductor, and General Instrument. These firms in turn send the boards to offshore facilities - typically located in Korea, the Philippines, Hong Kong, or Singapore - where custom read-only-memory [ROM] chips are epoxy-die-bonded and then ultrasonically wire-bonded to the boards. The boards are then tested and shipped to video-game and home computer manufacturers, which have found that the chip-on-board cycle costs less than their original method: wave-soldering the same chips, packaged in plastic DIPs, to boards of the same size and then testing them. The bare-chips method saves money only when other components are not attached to the boards. (Global Electronics Information Newsletter, October 1983.)

Optical memories

Devices that use light instead of electric currents will form the basis of tomorrow's big computer and communications systems. The wiring for such systems is already commonplace: optical fibres. Now, from giants on opposite sides of the world, America's IBM and Japan's NTT, come two new ideas for optical memories. Potentially, each could produce devices capable of storing several hundred million bits of information per square centimetre.

Both ideas hinge on the optical properties of dyes. A dye has a particular colour because it absorbs light from a particular part of the spectrum: it is opaque to light of that colour. Tune a laser to produce light of the appropriate frequency and the light will not pass through the dye. Suppose you had a sheet of a colourless material (e.g., glass) divided into tiny squares in a grid, and you wanted each square to act as a memory location for one bit of digital information. You could decide to colour some squares with a dye (to represent a binary 1) and leave others transparent (to represent a binary 0). You could then read off the stored information by scanning the material with a laser tuned to produce light absorbed by the dye. Any square in which the light was absorbed would be read as a 1; any through which the light passed would be read as a 0.

The basic idea behind both the NTT and IBM systems is that simple. The hard part has been to find a fast and efficient way of writing on to the squares of the grid - in other words, of colouring them. The Japanese and Americans have found different solutions. Each has its advantages and disadvantages. The Japanese researchers colour their squares by using a laser to initiate a reaction between two chemicals that are, by themselves, transparent. In the simplest version of their device, the two chemicals are deposited as ultrathin layers (a micrometre, or a thousandth of a millimetre, thick) on a transparent base; and sandwiched betweeen the two is a still-thinner layer of another transparent material. To colour a square, a laser is focused on to the layer in the middle of the sandwich, melts it and allows the chemicals on either side to mix and react. Tiny coloured dots are formed with a laser pulse lasting about three millionths of a second. A second laser, tuned to the frequency of the light absorbed by the colour, is used to detect the presence or absence of a coloured dot in any square.

The minimum size of the dots the first laser can create is about one micrometre in diameter. So the simplest NTT device would have a storage capacity of 100m bits of information per square centimetre. Fortunately, this can be increased by using multiple layers sandwiching different colouring reagents. The NTT men have already demonstrated a two-colour system. In theory, up to eight different dyes could be used to produce eight differently coloured dots, stacked one on top of the other, in each square of the grid; each could be detected by a laser tuned to the particular frequency of each colour. Such a device could store 800m bits of binary data per square centimetre.

A snag with the NTT approach is that the memory device may be written on only once. There is no way of erasing a coloured dot once created. On the other hand, the Japanese researchers reckon the coloured dots should last for at least 10 years. One application of such a write-only device would be for large reference databanks.

IBM's device is erasable. The American researchers create it by beginning with a coloured material and then using a laser to 'bleach' dots into the dye. On the face of it, this approach does not seem suitable for a high-density storage device. Bleaching, you might assume, can create only one 'colour' - a transparent dot in place of a dyed one. Not so. The reason, and the cunning part of the IBM system, lies in the molecular structure of the coloured material. It is a solid non-crystalline material: that is, one with a highly jumbled molecular structure. When a dye is incorporated into such a material its molecules wind up sitting in all sorts of different-shaped holes. And this changes their optical properties. Instead of absorbing light of only one (or a very narrow range of) frequency, different molecules in different orientations absorb distinctly different frequencies And this fact can be exploited to store more information. Because the dye molecules absorb a range of different frequencies, a powerful laser can be tuned to one frequency and zap molecules that absorb in that frequency, creating holes at that frequency; another can be tuned to do likewise at another frequency; and so on. (The dye is such that, when a molecule absorbs light, it undergoes a reaction that makes it colourless.) A less powerful laser, which can be tuned from one frequency to another, can then detect the presence or absence of holes at each frequency. The IBM scientists have discovered a material that can accommodate up to 10,000 holes of different frequencies in each square of its grid. So, in theory, an IBM device could store over 1 billion bits of binary data per square centimetre. The weakness - and strength - of the IBM approach is that its device will function as a memory only at very low temperatures; it must be cooled with liquid helium, an expensive proposition. The reason is that, if the non-crystalline material is allowed to warm up, the dye molecules within it will begin to move about and fill up the previously created holes. The flip side of that coin is that the device can be erased. All you need do is deliberately heat it and start again. (The Economist, 3 December 1983.)

Smart dopes

Microelectronic chips have a lot of different uses, and how well a chip is suited to a particular use often depends on the physical properties of the semiconductor material it is made of. One such property is the band gap, which measures how much energy is needed to kick loose an electron so that it can create an electric current by flowing through the semiconductor. A chip designer is normally stuck with the band gap characteristic of the semiconductor. But it is now becoming possible to make chips with band gaps suited to different uses. One way is to combine different materials in a single chip: the mixture produces a blended band gap. These composite semiconductors are called superlattices.

Another way is to introduce impurities into a single semiconductor material. This process is known as doping, and is already used in the production of chips to give them the conductive properties they need. Normal chips, however, are doped only a few times. It is possible, if the doping is extended and systematized, to produce chips with adjustable band gaps. Chips produced in this way are, confusingly, also called superlattices. Superlattices produced by doping, however, may have some advantages over their namesakes made by blending different semiconductor materials. Unlike a composite superlattice, a doping superlattice can be made from any semiconductor. This opens the way for a wider range of devices. And the bandgap of a doping superlattice does not have to be fixed when the chip is made: it can be changed later on electronically or with light.

The properties of a doping superlattice were predicted in 1972 by Professor Gottfried Dohler of the Max-Planck Institute in Stuttgart. The first one was made in 1981, seven years after the first composite superlattice. Doping superlattices are made by depositing alternating layers of negatively and positively charged regions of impurities on a chip. The thickness of each layer can be varied, but averages about 150 atoms. If extra electrons are introduced into a normal semiconductor chip, they disappear quickly - typically within a billionth of a second. But electrons introduced into a doping superlattice, either directly or by shining light on it, last an amazing thousand seconds - a thousand billion times longer than normal. Their longevity is due to the separation of negatively- and positively-charged layers. In a normal semiconductor, negatively-charged electrons and positively-charged "holes" (created by atoms being short of an electron) quickly migrate to each other. But because of the layering in a doping superlattice, they can reach each other only very slowly. This produces a buildup of electrons in positively-charged layers, and of "holes" in negatively-charged layers. The result of these two kinds of buildup is that both the positive and the negative charges are reduced - and thus the band gap, too, is reduced. The reduction in the band gap depends on the amount of energy introduced into the chip.

The advantages of an adjustable band gap would be greatest in optical systems. The band gap determines the lowest frequency of light that a semiconductor can absorb, so an adjustable one allows tuning of optical detectors. It also fixes the frequency of a light-emitting diode or a semiconductor laser. It would often be helpful if these could be changed while a chip is operating. Professor Dohler himself thinks that doping superlattices will prove best for integrated optical electronic systems. An adjustable band gap would allow a complete system, including a laser light source, modulator, amplifier and detector, to be made out of a single semiconductor material. Another big advantage is that doping superlattices are not as fussy as composite ones, which are best made with semiconductors like gallium arsenide whose composition varies readily. Doping superlattices can be made of any semiconductor. Including everybody's old favourite, silicon. (<u>The Economist</u>, 1 October 1983.)

<u>SOI circuit technology</u>

Mitsubishi Electric is developing silicon on insulator (SOI) technology which will achieve large LSIs by putting ICs on top of ecah other - a type of three-dimensional LSI. The main technology of SOI is to grow single silicon crystals on the isolated silicon surface. This technology has been achieved by a vertical use of laser on many silicon crystals to create the single crystals. Due to this easy control, electrical shortages and leakages are eliminated. The result is very thin SOI devices. By using this method, 280 pico-second delay time per cage for 19 CMOS Rings (converters) can be achieved. This speed is about 10 times faster than the present speed of the usual CMOS and also about four times faster than previous SOI devices which were developed by ME.

Mitsubishi says that this SOI technology has not only excellent application for the future of layered ICs, but it will also be very effective in obtaining faster speed for CMOS and will eliminate latch-up. The company will produce a new range of CMOS by using this technology. Application will also apply to a vast range of products such as operators for flat display and so on. At present, IC technology causes an integration of transistors and thyristors using a silicon surface which consists of many, not single, crystals, consequently it is called two-dimensional IC. In using this technology, even at its most advanced, it is said that the maximum integration will be four mega- or 16 mega-bits. For this reason, future technology will follow the layering method.

An important part of this three-dimensional method is that each of the IC surfaces should be covered by oxide or nitride and must be perfectly isolated electrically. On top of the isolated surface a single crystal is made which is required for the production of the next IC. However, if the chemical method is used only multi-celled crystals are possible. Up to the present, the development of SOI technology was as follows: Multi-celled crystals are made on the surface of the isolated material by using CVD. This is followed by the selection of deviation and islands are made of the multi-celled crystal. For purification a laser beam, electron beam or very narrow heater is used to separate each crystal and once again clear crystals are produced. This method is used to obtain SOI structures or to make N-channel MOS transistors.

However, in the case of all these methods, there is nothing that can be used to control the direction in which the crystal grows. The end result is that many single crystals exist in the same island. Consequently, what is described as a scratch or crystal dislocation occurs between each of the tiny crystals within the island. Often a channel occurs and into this channel electrons are able to escape. The result of this is electrical leakages or shorts, often described as a 'short channel effect'. Therefore, in order to get rid of this short channel effect, the width of channels must be more than three microns. That means that the most important technology was to control the scratches between each crystal or control the crystal dislocation.

The new SOI technology developed by Mitsubishi still uses laser to remake the crystals. However, by using the laser vertically, ME is able to melt the crystal making one crystal of the size required, controlling the electrical path ensuring it travels through the gate and does not enter a channel. As a result, Mitsubishi is actually achieving the same width of gate and channel. It seems most likely that the SOI structure will be the most effective three-dimensional technology which will be used in the 1990s. However, SOI technology is also applicable in order to achieve both high integration and a fast speed. (Electronics Weekly, 17 August 1983.)

A little extra circuitry on chip and special software lets VLSI test itself chip by chip and board by board

Testing digital large-scale integrated circuits and the printed-circuit boards built around these complex semiconductors at present requires more extra baggage than is convenient - computer-controlled automatic test equipment, plus the extensive software base on which this equipment depends. The next generation of chips and boards will snarl the testing problem further, since circuit nodes will be even less accessible than in the case of LSI. In fact, the possibility of very large-scale integrated circuits and boards that simply cannot be tested at all has become a real worry. An attractive solution to this problem is the concept of self-testing. In self-testing, a chip or a board loaded with chips actually is made to test itself without the aid of external equipment or software. ...

... A very recent piece of action in the expanding self-testing field combines LSSD and Bilbo (built-in logic-block observer) features, developed by the Institute for Theoretical Technology, Aachen, Federal Republic of Germany. Storage Technology Corp., Louisville, Colo., has developed an LSI self-testing method using LSSD circuits already designed onto a gate-array chip. Pseudorandom test patterns are generated by combining some of the LSSD shift-register latches into a shift register of maximal length. Then the pattern responses of the on-chip logic are analyzed by a Bilbo-like built-in signature register. Another important extension of self-testing is the Microbit (for microprocessor built-in test) concept developed at the Corporate Research and Technology division of Siemens in Princeton, N. J. In this self-testing technique, two Bilbos plus a small amount of test circuitry must be added to a microcomputer board. Also, a special test program is stored in the processor's programmable read-only memory. The program sequentially tests all portions of the microcomputer.

Questions remain, however. For instance, can a design using a self-testing technique actually produce a chip that is fully testable? A new software set from Comsat General Integrated Systems Inc. in Austin, Texas, can provide the answer to that question where it is most needed - at the designer's work station. This software is an adjunct to the Tegas computer-aided design program that is widely used in chip design. When an engineer employs it to evaluate a design, he or she gets immediate feedback both on whether there are any parts of the design that cannot be tested and on the difficulty of performing tests. Armed with this knowledge, the chip designer can modify the design before capital is spent on prototyping. Further, the software can then pass the testability results to the program-generation portion of the package so that it may create a test program. If this program is downloaded to, for instance, a read-only memory, the ROM can be incorporated on a self-testing board. (Electronics, 10 March 1983.)

Microchips from disappearing silver

New lithographic resists for the next generation of microchips could be made by an unusual light-induced process that causes silver and copper to dissolve in chalcogenide glasses (non-crystalline compounds of sulphur, selenium or tellurium). If a thin layer of silver (20 nanometres) is evaporated onto a layer of arsenic sulphide glass (60 nm), and then exposed to light, the silver disappears. Analysis shows that the silver has dissolved in the glass, travelling up to 20000 nm along the direction of the light beam. Sideways diffusion of the silver into unexposed regions of the glass in less than 10 nm. Furthermore, the boundary between the metal-doped glass and undoped glass in the direction of travel remains sharp.

Japanese scientists were the first to realise that this effect could be exploited as a resist for making microchips. They noticed that the undoped chalcogenide glasses dissolved in dilute alkali but the metal-doped glass remained insoluble. Patterns can be produced by exposing the silver-coated glass to light through a mask, removing the silver from unexposed regions with dilute acid, and dissolving the undoped glass below. The exposed areas remain intact. Because there is negligible lateral diffusion, patterns with line widths as small as 100 nm can readily be produced. (Polymer resists in use today are limited to about 1000 or 2000 nm.) The ultimate resolution may be as small as 10 nm.

Conventional polymer resists also run into problems when they are deposited into reflecting surfaces such as aluminum. Light reflected back from the surface during exposure, interacts with the incoming light to produce interference patterns within the resist film. This gives uneven exposure which affects the resulting patterns. Chalcogenide resists are opaque. They absorb all the light so there is no reflection. Chalcogenide resists can be developed after exposure, with a "dry" plasma etching process instead of "wet" alkali solution. Scientists from Bell Labs in the United States found that unexposed germanium-selenium glasses etched over 350 times faster than the metal-doped glass in a carbon tetrafluoride plasma, much better than most conventional resists. As the material can be deposited by vacuum evaporation, another dry process, it is ideally suited to a completely dry technological procedure - something that chip manufacturers are seeking. The glasses will dissolve copper as well as silver, a property that might be attractive to makers of printed circuit boards, who etch patterns into copper. (New Scientist, 11 August 1983.)

New testing concept development

Researchers at the Battelle Centres de recherche de Genève have developed a new approach to integrated circuit testing. According to Battelle, as the complexity of integrated circuits increases and customer requirements for high reliability become essential, the integrated circuit (IC) testing problem becomes more and more acute. The four conflicting criteria are: manufacturing throughput, final production yield, IC production cost (manufacturing and testing) and in-service reliability.

Feasible compromises require innovative solutions to:

- reduce the non-detection probability i.e., the probability of selling a defective IC;

- reduce the false alarm possibility; i.e., the probability of scrapping or recycling a good IC;

- reduce the relative IC testing costs, as a percentage of the total IC production costs;

- reduce the IC testing time, as a percentage of the total IC production cycle time.

For high reliability IC's (e.g. device classes B, C, M, S from MIL-STD 883B, MIL-M38510), the standard non-destructive test procedures include a suitable combination of screening tests. These tests should include internal (pre-cap) and external visual inspection, electrical testing and environmental testing (e.g. stabilization bake, temperature cycling, centrifuge, seal, burn-in etc.). This should also be supplemented by statistical lot acceptance sampling plans. One of the more fundamental constraints of current IC test procedures is the fact that most screening tests listed are implemented in sequences, at many different stages of the manufacturing process.

Battelle's solution to this is to design a single test station and the corresponding procedures Imaging, electrical and some environmental tests are carried out together. The test station design may vary according to the location in the manufacturing process. Based on general information about circuit design rules, electrical rules, layout and defect types, as well as testabilty and physical properties of an IC/sensor family, Battelle can study the advantages and feasibility of alternative integrated testing procedures. Battelle can also draw on its interdisciplinary capabilities (optoelectronics, artificial intelligence, materials, physics) to propose prototype designs for integrated test stations in collaboration with the user for introduction in an operational environment. Battelle can also carry out the experimental validation of some custom software and/or sensors for these integrated test stations. (Reprinted with permission from Semiconductor International Magazine, August 1983. Copyright 1983 by Cahners Publishing Co., Des Plaines, IL.)

One gigabit of memory on a single chip

Nippon Electric Co. (NEC) has developed a magnetic memory device concept which it claims will make it possible to store 1 gigabit (1 billion bits) of information on a single chip 1 cm^2.

The concept takes advantage of magnetization of a single-crystal garnet film. NEC already has carried out successful experiments to prove the basic operation of the concept in co-operation with Professor Susumu Konishi of Kyushu University.

In contrast to conventional magnetic bubble memories, which store information in the form of "1" or "0" corresponding to the presence or absence of cylindrical bubbles generated on the surface of a single-crystal garnet film, the new memory device concept permits storage of information by making "1" or "0" correspond to the presence or absence of "twists", called "Bloch Lines" (the magnetic regions in which magnetizations in two directions come into contact with each other) in the magnetic domain wall around the bubbles. The Bloch Lines can be densely arranged in the magnetic wall around the bubbles - almost 100 times more than the bubbles in a magnetic bubble memory, therefore, production of large capacity memory devices will be possible, claimed NEC.

A memory using the new concept will require no mechanically-driven memory mechanisms. In addition, it can access information as fast as magnetic discs, floppy discs or magnetic tapes and its memory capacity can be in the gigabit class, which is large compared to semiconductor memories. Another obvious major advantage is that the stored information is nonvolatile. (Reprinted with permission from Semiconductor International Magazine, July 1983. Copyright 1983 by Cahners Publishing Co., Des Plaines, IL.)

Strained-layer superlattices

Scientists at Sandia National Laboratories are involved in the development of a new class of semiconductors called strained-layer superlattices (SLS). These SLS semiconductors consist of multiple layers of lattice-mismatched crystalline materials that have a crystalline quality comparable to pure bulk material. With SLS semiconductors Sandia scientist expect to be able to design electronic devices with enhanced performance.

Alternating layers of different types of ultra thin crystalline material are grown to form the SLSs. Under normal conditions the atomic spacing of the alternating layers would be different. However, due to the thinness of the SLS layers, the atoms of non-alike layers align easily by elastic strain during the growth process. No imperfections between layers result from this process. These layers are five thousand times thinner than a sheet of paper and this thinness allows the crystalline structure to strain uniformly compensating for the normal mismatch rather than generating defects that degrade or destroy electronic and/or optical effects.

Presently, Sandia Labs is using two specialized processes for growing these very thin layers: molecular beam epitaxy (MBE) and metal organic chemical vapor deposition (MOCVD). The composition of the SLS layers come from the Group III and Group V elements of the Periodic Table. Dr. Robert Biefeld was the first scientist at Sandia Labs to grow SLS material back in the spring of 1981. The material was gallium arsenide phosphide-gallium phosphide (GaAsP-GaP) strained-layer superlattice grown by MOCVD and proved to have the optical properties described by Dr. Gordon Osbourn of Sandia Labs in his theoretical studies of these SLS structures.

To date, work at Sandia Labs has concentrated on theoretical studies, growth of materials, and measurement of electronic and optical properties. Construction of devices has been largely limited to very simple semiconductor devices, namely diodes. Sandia made the first SLS devices and was the first to dope SLS material as n- and p-type. Researchers at Sandia believe further progress with SLS material will lead to development of many new types of devices. Initial emphasis will likely be placed on opto-electronic devices rather than integrated circuits. Recently researchers at University of Illinois, Champaign/Urbana, and Varian Associates have published work on SLS materials. (Reprinted with permission from Semiconductor International Magazine, August 1983. Copyright 1983 by Cahners Publishing Co., Des Plaines, IL.)

IBM scientists find new superconductor

IBM scientists have discovered a new class of organic superconducting material. This is only the second class of organic materials ever observed to become superconducting. The IBM material can, in addition, be made with a variety of chemical and structural variations that permit systematic study of the factors conducive to superconductivity in inorganic materials. The materials are in the general class of organic solids called donor-acceptor charge transfer salts. The donor part is a molecule called BEDT-TTF. The acceptor part is the anion ReO_4. Like a variety of related donor molecules, the BEDT-TTF molecules form linear stacks, each associated with a column of ReO_4. Electricity is conducted through the stacks. Three slightly different conducting forms of BEWDT-TTF with ReO_4 have been prepared at IBM's San José Research Labs, but only one became superconducting. These materials show a variety of properties as their temperature and pressure are changed. They are variously metallic conductors, insulators, and superconductors Small changes in structure or composition seem to determine which state has the lowest energy, and is therefore most stable, at a given temperature and pressure. The IBM work showed that $(BEDT\text{-}TTF)_2ReO_4$ becomes superconducting at a pressure of 4000 atmospheres, at a temperature of about two degrees above absolute zero. Higher pressures lower the transition temperature, but the material does not become superconducting at all at lower pressures.

The question is: can the superconducting transient temperature be raised by developing materials that make the transition at a lower pressure? The elusivity of the superconducting phase in these materials is also shown by work carried out at the Institute for Molecular Science in Japan. Scientists there prepared similar materials with ClO_4 as the acceptor, but found no superconductivity. These materials, as well as the IBM non-superconducting ReO_4 phases, seem to have more interaction between adjacent stacks of donor molecules. This could be related to the absence of superconductivity. (Electronics Weekly, 7 September 1983.)

Specialty chemicals

Chemical manufacturers that are losing money on bulk petrochemicals are turning to specialty chemicals for profit. Most popular are the "electronic" chemicals needed for making microchips and the printed circuit boards on to which the chips are mounted. There are some 30 chemical processes involved in various aspects of chip-making today. This is not an easy market to serve, however. Electronics manufacturers naturally want ever-cheaper chemicals. At the same time, they demand chemicals that: make the chip-building process more reliable; enable more circuits to be packed on to individual chips, for the next breed of superfast computers; and allow the chips themselves to be packed together more densely. ...

Earlier this year, America's Monsanto introduced a new wafer that keeps oxygen molecules clear of the surface on which chip circuits are drawn. The wafer has a polycrystalline silicon backing that tends to draw the oxygen down to the base of the wafer. There its tendency to attract metal contaminants is a positive advantage.

America's Union Carbide is manufacturing purer polysilicon, the raw material from which silicon wafers are made in the first place. Polysilicon is usually made from chlorinated derivatives of silane gas (a mixture of silicon and hydrogen). The chlorinated gas is heated and decomposes, leaving a deposit of silicon. Snag: the hydrogen chloride acid given off can corrode or contaminate the polysilicon. The obvious solution would be to use pure silane gas instead of the chlorinated ones. Union Carbide says that it has now developed a way of making the silane gas cheaply enough to produce a competitively priced polysilicon from it. A plant using the new process should come on stream by late next year. Outsiders wonder just how cheap the Union Carbide process really is. Under contracts from the American energy department, the company itself is looking at other potential ways of making purified polysilicon more cheaply still.

Other areas of chip-making that chemical companies are working on include:

- Resists. Up to now, the etchants used to create circuit patterns for chips have mostly been wet chemicals. In order to draw finer circuit lines, chip-makers are turning to dry etchants instead. These dry etchants can badly damage conventional resists, so chemical companies are trying to develop tougher ones.

- Chemical "earths". Chip-makers are keen on creating more closely packed circuits. But these are more susceptible to outside electrical interference. So new chemicals are being developed to act as miniature earths, to leak away unwanted electrical charge.

In connecting up different printed circuit boards, conduction pathways are laid in gold. Gold, of course, is tough and an excellent conductor. It is also expensive. America's Dupont has recently developed a palladium-nickel alloy as a substitute that costs roughly a quarter as much as gold. The palladium in the alloy gives it toughness; the nickel makes it a better conductor. The new alloy is now being tested in the American market. New resists for circuit boards are being investigated because the conventional dry resists do not allow fine metal conductance pathways to be crammed together with sufficient accuracy. One bet is that it will be necessary to switch from dry resists to liquid ones. Switzerland's Ciba-Geigy has already developed one such compound. Other companies are also looking at liquid resists - including Du Pont, itself the leading manufacturer of today's dry resists.

One way to get more chips packed more closely together is to stack them up instead of laying them out in only two dimensions. One problem is to dissipate the heat that tight stacking would generate. In collaboration with computer makers, Du Pont .. looking at ways of engineering chips into heat-dissipating ceramics. It reckons that a ceramic stack could pack the same number of chips into a space about five times smaller than could a printed circuit board. (The Economist, 13 August 1983.)

Substrates Review: Silicon, Sapphire and GaAs

"Silicon Valley" gets its name from the dominance of silicon technology in the world of semiconductor device fabrication. Silicon is only one of several dozen materials which possesses semiconductor properties, yet none of the other materials has challenged silicon as the leading semiconductor material. For those old timers in the semiconductor business there are memories of when silicon was not the dominant material. In the 1950s, the early days of the semiconductor industry, germanium was the most common material. Gradually, however, in the latter part of the 1950s and the early 1960s, silicon assumed its dominant role in semiconductor device fabrication. Silicon has a number of characteristics which has made it such an attractive semiconductor material. One of the key reasons for its primary role is its abundance, second only to oxygen in weight percentage of the earth's crust, 28%. This makes silicon cheap in comparison to other semiconductor materials. For example, a square inch of silicon costs approximately 85¢ compared to anywhere from 4 to 30 dollars for a square inch of gallium arsenide (GaAs). Other than the economic advantages, silicon possesses a unique combination of chemical, physical and electric properties which makes it the overwhelming choice for semiconductor device fabrication. For instance, one of the reasons for going away from germanium to silicon was that germanium devices could not operate at temperatures above 85°C whereas silicon devices can operate at temperatures up to 200°C. Furthermore, the oxide of silicon (SiO_2) is an electrically insulating material and forms a very good protective layer. Silicon also is comparatively easy to use for device fabrication which is partly due to silicon processing technology being fairly well along on the learning curve.

Other materials are being used for semiconductor device substrates, but their use is limited to special applications. One of the most prominant alternative substrate materials is GaAs which is being used for optoelectronic and microwave device applications. Sapphire substrates have been used for many years but have not seen wide-spread use, although at times there was hope for silicon-on-sapphire technology to play a significant role in device fabrication. Other substrate materials are available but these three constitute the most prominent in device production today.

Gallium arsenide

In its present state GaAs technology is a long way from being a mature process technology, but as the use of this material increases so will the knowledge surrounding the processing of the material. Dan Rose of Rose Associates, Santa Clara, California, foresees a steeper growth curve for GaAs as compared to silicon. He does point out that this can be attributed in part to GaAs being only a very small segment of the total substrate market. All the GaAs substrates sold in 1982 had a dollar value of only $24 million compared to $922 million for silicon substrates. As stated above, projections are for a healthy increase in GaAs substrate usage, going from $24 million now to $112 million in 1986. However, even in 1986 GaAs substrates will only make up a very small percentage of the semiconductor wafer market, between 5 and 7%. The Japanese and United States projections on the usage of GaAs substrates differ considerably due to a difference in philosophy on how to achieve high-speed computers and other devices. The Japanese see GaAs as the way to develop high-speed computers, and consequently their projections are higher than the United States forecasts. According to some industry sources GaAs substrates are forecasted to make up between 10 and 20% of the Japanese substrate market. United States device manufacturers believe that they can achieve the desired device performance from silicon technology.

Mike Eamen of Morgan Semiconductor, Garland, Texas, believes this reliance on silicon technology on the part of the United States manufacturers for high-speed devices is a mistake. He states one of the reasons for this lack of enthusiasm by United States manufacturers for GaAs is that there is a great amount of capital dollars invested in silicon technology which makes them reluctant to move away from this technology. On the other hand, the Japanese are eager to spend the capitel dollars needed to advance GaAs technology for high-speed devices. Furthermore, silicon device speeds can be stretched nominally up to those of GaAs devices, but yields will suffer because it is difficult to make the devices with silicon materials whereas it would be easy with GaAs materials.

The obvious difference between GaAs and silicon is that while all the atoms of the silicon lattice are the same, the GaAs crystal lattice consists of alternating atoms of gallium and arsenic. This structural difference has significant effects on the electrical properties of the two materials. Because of these electrical difference, GaAs n-type FETs have a higher performance than their silicon counterparts and conversely Si p-type FETs have a higher performance than those of GaAs. GaAs is a direct band gap semiconductor which makes it ideal for LEDs. The chemical properties of GaAs make it significantly more difficult to process, the primary parameter of interest being the vapor pressure of arsenic (As) which limits the processing temperature unless special techniques are employed. Lastly, GaAs is mechanically a very brittle material which often makes handling a nightmare.

There are basically two techniques for GaAs crystal growth, Bridgman and liquid encapsulated Czochralski (LEC). For a detailed discussion of these techniques see "GaAs Bulk-Crystal Growth Technology", in the June 1982 issue of Semiconductor International. Important factors to consider with respect to these two techniques are that the substrates grown have two differences as a result of the respective growth technique. The Bridgman crystals have dislocation densities of 10^3 to $10^4/cm^2$ which makes them better suited for LEDs, laser diodes, and other optoelectronic devices. LEC-grown GaAs has dislocation densities of between 5×10^4 for 2 in. wafers and $5 \times 10^5/cm^2$ for 3 in. wafers. Because of the greater dislocation densities of the LEC-grown GaAs, it is used for microwave devices and high-spe-d digital devices. Larger area Bridgman wafers also have higher dislocation densities.

Another important difference between the substrates grown by the two different techniques is the resultant shape of the substrates. Bridgman grown substrates have a characteristic D-shape. Presently these are available with areas ranging from 1.5 $in.^2$ to 3.5 $in.^2$. LEC yields the more traditional looking round substrates which are available in diameters up to 4 in. However, most of the demand is for 2 in. and some are using 3 in. In terms of square inches, Bridgman grown substrates make up between 60 and 70% of the market and LEC 30 to 40%. Lead times for GaAs wafers are running at 6 to 8 weeks according to several of the suppliers of GaAs substrates.

Silicon

The processing technology for silicon is by far the most advanced of all the semiconductor substrate materials and there are rigorous specifications for silicon substrates as documented by the Semiconductor Equipment Materials Institute (SEMI). The big question revolving around silicon substrates is their size. A quick glance at the industry might indicate a simple answer that device manufacturers are going to larger and larger wafer sizes. A more careful examination would indicate that not all sectors of the industry are going to larger wafers. For instance, many manufacturers of discrete devices are still using the smaller diameter wafers (3 in. or less). This shows up as a fairly constant market share for these smaller diameter wafers. There are many small silicon wafer suppliers who specialize in these smaller diameter wafer sizes. Virginia Semiconductor, Fredericksburg, Virginia, supplies smaller diameter wafers ranging up to 3.25 in. for the diode and transistor market. These wafers are grown using the Czochralski method but they do some float zone small diameter high resistivity wafers as well.

Although there seems to be a continued demand for smaller diameter wafers, the industry has been moving to larger diameters. Presently the industry is dominated by 75 mm (3 in.) and 100 mm (4 in.) wafers, but the trend is pointing to 125 mm (5 in.) and 150 mm (6 in.) wafers in the not-too-distant future. Already it has been reported that Texas Instruments has been discussing with equipment vendors the possibilities of achieving 200 mm (8 in.) wafer technology by 1985. Right now one of the stumbling blocks in going to 150 mm (6 in.) wafers is there are some processing areas in which the existing equipment cannot handle them. IC manufacturers who are going ahead with 150 mm fab lines are either filling the equipment gaps with in-house built equipment or approaching equipment vendors to ask them to develop equipment capable of handling the larger wafers.

Economic factors. The 1981-1982 downturn in the semiconductor industry affected most aspects of the silicon wafer industry, including the transition to larger wafer sizes. Many IC manufacturers held up converting their 3 or 4 in. fab lines to 5 in. because of the recession. Because of the slowness in the semiconductor industry over the last two years, the supply of wafers has outpaced the demand. Many silicon wafer manufacturers are only producing at 70 to 75% of their capacity. Even though manufacturing costs have risen, wafer prices have stayed constant since 1980 mostly due to the over capacity. Some of the smaller silicon wafer suppliers see the possibility of a price increase in late 198. or 1984 if the industry continues to recover. However, they feel the giants in the industry, Monsanto and Wacker, must lead the way in this regard. Lead times in the industry are between 5-8 weeks. However, small suppliers such as PCA, San José, California, can give lead times of a couple of weeks for prime wafers and even lower lead times for test wafers. Total worldwide square inches of silicon wafers used in the semiconductor industry will show a pickup in 1983 and show further gains through 1986, according to Dan Rose. In 1982 the worldwide use of silicon wafers was 1152 million in.^{2}, of which the United States accounted for 563 million in.^{2} or just about 50%. The United States market is made up of both captive and merchant manufacturers. Merchant manufacturers supplied the industry with 309 million in.^{2} which is 55% of the total market. By 1986 it is estimated that merchant suppliers will garner 60% of the total United States market.

A key to the production of silicon wafers is an uninterrupted supply of polysilicon, which is the pure form of the raw materials for single crystal silicon growth. According to most silicon manufacturers there is a glut of polysilicon right now. There are two factors which have created this glut, one being the slowdown in the semiconductor industry and the second an increase in the polysilicon production capability. Even with the glut, polysilicon prices have remained stable with perhaps a slight decrease over the last year.

Single-crystal silicon growth. Single-crystal silicon growing is a well-developed process and is done in one of two methods, Czochralski or float zone. By far the Czochralski method is the workhorse of the industry. In fact, float zone techniques are used only to produce silicon wafers for specialized applications. Float zone wafers are high in resistivity and purity which is needed for infrared detectors and high-power devices. Both Virginia Semiconductor and Rockwell International manufacture float zone wafers.

For a review of the Czochralski method see "Silicon Crystal Growing: Needs vs. Equipment", in the February 1982 issue of Semiconductor International. Parameters of concern in growing silicon crystals with the Czochralski method are doping levels, dislocation densities, electrical properties, and impurities. The first three of these parameters are routinely satisfied whereas carbon and oxygen impurities are of major concern. Shin-Etsu Handotai of Japan (S.E.H.) was one of the first silicon wafer manufacturers to pay close attention to the oxygen and carbon impurities in wafers. Consequently they have been able to make inroads into the United States market. This is also an area in which NBK has specialized. The demand for low oxygen and carbon content wafers is still only a small part of the total silicon wafer market.

Another specialized area of silicon wafer production is epitaxial wafers. In this area Semimetals, Westbury, N.Y., produces silicon wafers with an epitaxial layer grown on top.

Sapphire

Silicon-on-sapphire (SOS) technology has been around since the mid-to-late 1960s but has generally remained more a technology for specialty applications. One of the key factors restricting its use has been the cost involved in sapphire substrates. The present cost of a square inch of sapphire is $7-10 compared to 85¢ for a square inch of silicon. The sapphire wafer market was under the $1 million mark for 1982, small in comparison to other materials such as silicon. SOS technology does offer some advantages which have been recognized and utilized by a select few IC manufacturers. SOS technology is able to fabricate silicon islands which are isolated electrically by either sapphire or oxide. This eliminates the need for guard bands or p-n junctions used for isolation in conventional silicon technology. The net gain of SOS technology permits potentially greater component densities. Electrically, SOS eliminates the concern about parasitic effects which plague other technologies.

As stated, the major factor limiting silicon-on-sapphire technology is the cost of the sapphire substrates. The high cost can be attributed to both the growth and preparation of the material into finished wafers. Two methods of growing sapphire are the Czochralski and the edge defined film fed growth (efg). Like silicon and GaAs, sapphire can be grown in round crystals by the Czochralski method, but the slicing of the ingots into wafers results in considerable material loss which drives up the price of the wafers. The alternative method is to pull a continuous ribbon of sapphire from a shaping die. The die determines the thickness and width of the crystal. Ribbons are scribed into square wafers which can be further processed into round wafers. According to Kevin Lonie of Saphikon, Milford, New Hampshire, most of the wafers sold are in the round form. With respect to wafer diameter he says that the greatest demand is for 3 in. There is some demand for 4 and 5 in. wafers as well as 2 in. wafers. Saphikon and Union Carbide, San Diego, California, are the big suppliers of sapphire substrates to the semiconductor industry.

Conclusions

Other materials such as garnet and GaP have been used as substrate material but on a very limited basis. Garnet, for example, has been tied to the bubble memory market which has a relatively slow growth rate. The garnet market is around $2 million per year. For the forseeable future silicon will remain the life blood of the semiconductor industry. GaAs presents the only significant alternative material now and in the near future, yet it too is only used for special applications.

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Fifth Generation: The dangers of reliance on artificial expertise

Rapid development of expert systems has been obscuring many of the serious doubts entertained by academics and computer professionals alike about both content and desirability. Expert systems are the outward visible symbol of the fifth generation effort and currently represent its commercial sharp end. Venture capital companies have been falling over themselves to fund new firms, while universities have been busily setting up spin-offs to exploit their own research, and even long-established giants like ICL and IBM have not remained unmoved by the fever. While such systems are not new, and have been working with varying degrees of success for some time, it is the key role given to the development of intelligent knowledge based systems (IKBS) by the Japanese, United States and United Kingdom artificial intelligence (ai) communities that has brought them into such sharp focus. This drive to a marketplace estimated at many hundreds of millions of dollars over the next few years has obscured many of the serious doubts entertained by academics and computer professionals alike. These range from technical worries to more fundamental questions about deskilling of work, or the larger issue of political and social desirability.

At recent prominent computer gatherings - like that organised by the International Federation for Information Processing (Ifip) in Paris last month and at the recent SPL Fifth Generation Conference - the critics have been fighting back. To evaluate the arguments for and against the widespread diffusion of expert systems, it might be helpful to look first at an 'approved' definition. Last June the British Computer Society (BCS) committee of the specialist group on expert systems came up with the following: 'An "expert system" is regarded as the embodiment within a computer of a knowledge-based component, from an expert skill, in such a form that the system can offer intelligent advice or take an intelligent decision about a processing function. 'A desirable additional characteristic, which many would consider fundamental, is the capability of the system, on demand, to justify its own line of reasoning in a manner directly intelligible to the enquirer. The style adopted to attain these characteristics is rule-based programming.'

Paradoxically, this BCS definition contains a lot of the major pc of departure for most of the critics. Professor Manny Lehman, professor of computing science at Imperial College for example, attacks the emphasis here on rule-based programming in logic as exemplified by one of the front-runners in its development, Prolog. 'A fundamental issue that has not yet been faced up to is the degree to which human beings make jumps to conclusions on a basis that can't be expressed in logic - whether using Prolog or the rest. Important deductions often arose from human beings having sharp enough wits to notice what information was missing,' he stressed. 'Knowledge will always be limited in any situation, but inferences are still made. Therefore the widespread use of expert systems with knowledge bases two to three times larger than at present involves a threat that man can't afford.' Lehman insisted that work on both 'correctness' of databases and the management of change within expert systems needed to proceed at the same time as the technical developments. 'I am pleading for the development of quality control techniques before we rush to sell to the world.' ...

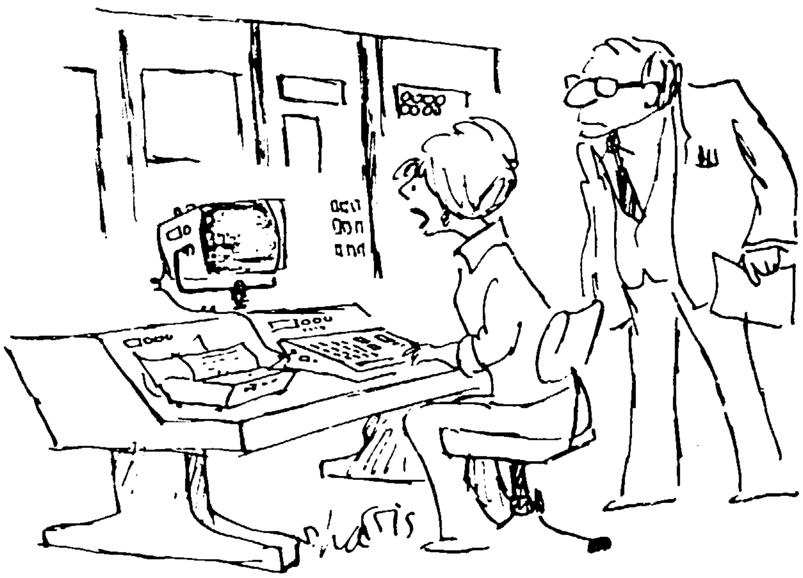
The need for some sort of international co-operation and possibly even a moratorium on some areas of research is underlined by others like Professor Kelly Gotlieb of the University of Toronto who sees the likely impact of expert systems as enforcing existing distinctions based on class education, and money. 'The limited success in introducing computers to the larger population through schools for example, has been by and large to re-enforce the existing structures. Expert systems and artificial intelligence in general are likely to be no better in effect.'

Gotlieb agreed with D. Dennett's (Dept. of Philosophy, Tufts University, Mass.) fear that intelligent systems could also be used as a tool of a new 'intellectual imperialism' against Third World countries by creating an 'abject dependence' on a technology that must be purchased from, and serviced by, the technologically developed nations. The gap between those who have some control over their lives and those who are largely at the mercy of others would thereby increase.

One ray of hope in the gloom was offered by Kristen Nygaard from the University of Oslo, who is currently working on a new approach to expert systems which could allay many of the fears from professionals and others about de-skilling, social control, and the validity of the information base. Nygaard has good credentials for such work since he has spent 10 years working with trade unions, and was involved in one of the first trade union projects in Norway designed to build an understanding of information technology in the context of the world labour movement. The Sydpol project, System Development and Profession Oriented Languages, which he is currently working on, is a move away from the unions to the white-collar professions, but the approach could have far-reaching implications if it succeeds. 'Increasingly, people are involved with building systems who are removed from the area of expertise. There is a considerable danger that the current concept of expert systems will lead to centralisation and commercialisation of knowledge. Who is going to define what is relevant?' said Nygaard. 'It would be very easy to turn round such systems and use them for social enforcement. The professions will be very seriously affected and a whole profession could be undermined. More and more people will need specially oriented expert systems,' Nygaard added.

The two- to three-year project, which brings together researchers from Sweden, Denmark and Stanford University, is not an attempt to build yet another high-level language, he emphasized - 'That is too simple an approach.' Instead, the team will try to isolate the essential features of a profession, then identify the concepts relating to data processing and see how they can be integrated. Nygaard is anxious to keep the project free from the domination of computer people, who, he feels, have a strong set of conceptual models they are likely to enforce on it. The research team is deliberately multidisciplinary, including social anthropologists, psychologists and linguists.

'Our approach will be very close to the way we worked with trade unions - with the stress on participation and discussion.' ... (Computing, 31 October 1983)



"The computer is claiming *its* intelligence is real, and *ours* is artificial."

(American Scientist, September – October 1983)

MARKET TRENDS AND COMPANY NEWS

"National computers" to be out by 1990

Between now and 1990 the computer industry will change in a number of ways. It will become recognized that there really is no such thing as a national computer. The computer might be assembled by a company whose equity is 100 per cent owned by a given government or within a country, but the hardware will be international with components from at least two or three countries being incorporated in the system. This means that the "Buy British" and "Buy French" exhortations will be even more open to question than today because, certainly as far as the hardware is concerned, the national content will be minimal. We will clearly see further growth of the Japanese encroachment. We talk about it today, we see it happening; but in the period I am referring to it will be highly developed. We may well see a situation where virtually all RAM chips come from Japan, with odd exceptions such as the United Kingdom government-backed Inmos venture.

Essentially, the trend in hardware will be to various forms of licensing agreements, with the United States and the Japanese the main providers of hardware. Obviously, indigenous suppliers will try to put in a quota of locally produced components. But there is little doubt that the vast majority of hardware will be manufactured by American or Japanese companies. To emphasize this hardware trend, I think the position will be that, regardless of whether the device is a low-cost, chip-based terminal or a major manufacturer's mainframe, it will contain a much larger proportion of internationally made elements than hitherto. Therefore, no vendor, including the Americans and Japanese, will have a major fully localized - that is one country made - hardware product series. I have always forecast that the minicomputer was in for a bad time, that it would be the margarine between the mainframe and the micro. There is little doubt this is happening. We have already seen the beginnings, and, by the end of the decade that the traditional mini that we knew five years ago, will be dead as a commercial DP box.

Another important trend in our industry is that instead of providing only the hardware and its operating system, manufacturers now aim to market a wide range of applications and similar software as well. The traditional mini suppliers who sell low-cost, high performance hardware with substantial discounts to third parties or software houses, now realize that they can no longer be involved with such discounting. These minisuppliers are beginning to realize that their future is in the sale of applications programs and allied software. We all forecast that the revenues produced from hardware would go down. However, I do not think that many people realized how necessary it would be to boost revenue by means of software and applications programs. Or how difficult it is to do this effectively.

To those who doubt this argument, let me point out that even IBM realizes that it has been hoist by its own petard. For years IBM's strength was the vast quantities of software available from software houses. Many a user has stated that one of the reasons why they were buying IBM hardware was the abundance of software available, albeit not produced by IBM. This is now causing IBM a major worry because it realizes that, even allowing for reduced hardware costs, the argument is true. To offset this problem it will have to get fully into the software business at the applications level. This will not only be a major exercise for IBM, but will also place in jeopardy many of the software houses which have made a highly successful business out of being complementary to IBM's policy.

Distributed processing has so far failed - that is, if we talk about true DDP (not dispersed processing), meaning mainframe linked direct to other mainframes and minicomputers. Not many such systems exist today. This is because of many things - the cost of telecommunications lines, availability of suitable hardware and software, provision of trained people and the difficulty of control. But by the end of this decade, if not before, we will see all the appropriate ingredients. Lines will be available, networks will be established, but, probably more important powerful, low-cost computers will be with us and therefore, at last, we will be able to have the best of both worlds. I believe large mainframes will be needed, particularly in database and number crunching environments, but also for handling the effective distribution and processing of data. This will be done in conjunction with a major central computer complex, giving control and cohesion to the system, but making processed data available to the remote elements of a network. And these elements themselves will be quite powerful computer units, able to communicate with all other units in the network, either directly or via the central mainframe. Thus we will achieve what everybody has desired and, company politics apart, we ought to be in an ideal world.

Probably the most important ingredient when discussing the future of mainframes, minis and micros is cost. So far, most suppliers of medium to large computers have introduced new hardware at about the same price as earlier models, but with three to four times the power. This means that prices have remained high. In the future we see the power going up by the same orders of magnitude, but costs will come down. (This article is based on a speech by Bill Read, Sperry vice-president and general manager, computer systems operations, at a recent seminar.) (Computer Weekly, 4 August 1983.)

CMOS market

New-generation CMOS semiconductor chips require less energy and generate less heat than other chips in current use. The technology has been around for a decade, but its cool speed and reliability demonstrate a breakthrough in semiconductor technology. While CMOS chips will account for only 10 per cent of the 1983 world's $15 bil market, by 1990, they will hold 50 per cent of the projected $60 bil market. For many years the CMOS circuits were more costly and slower than the favourite NMOS chips and development lagged in the United States. At end-1970s, the Japanese demonstrated that CMOS chips could economically be made to run as fast as their NMOS counterparts. In 1979 Hitachi introduced a low-power very fast static 4K RAM chip using CMOS. The Japanese created a CMOS static RAM market and controlled 90 per cent with sales amounting to $325 mil in 1983. The United States controls 60-70 per cent of a $1 bil market for CMOS logic chips for telephones and switchboards. (Technology Update, 22 October 1983.)

Equipment industry to grow

The semiconductor equipment industry is benefiting from the surge of consumer spending and is expected to grow 30 per cent/yr through the next 5 years. The industry is divided into three segments; wafer processing, assembling, and testing. The most competitive sector is photolithography and GCA is leading the pack with a machine called a stepper. The stepper is finding more favour than the scanner, which is believed not to be precise enough for most 256K production. Many customers base their equipment selection on service because the equipment is extremely delicate and could cost $5,000/hr for down-time. Automation may be one of the industry's next developments since it could reduce the need for service and help eliminate human error in production. Fortune 10/3/83 pp. 86-88 (Technology Update, 22 October 1983.)

Sun sets on Silicon Valley

The sun is about to set on the birthplace of the world's sunrise industries. To emphasize the point a United States congressman wants to build a high-tech museum to commemorate past achievements in microelectronics in Silicon Valley in California, where it all started. Apple Computers, a pioneer of microelectronics, announced plans to set up a rival centre to Silicon Valley 35 kilometres down the road. It has bought a large part of Coyote Valley where it plans to build an "Apple Campus". Three other big names in computers, IBM, Tandem, and Verbatim, also intend to move to Coyote Valley. The museum, meanwhile, is billed as the first in the country to be devoted to the history of high technology. Ed Zschau, the congressman who heads the campaign, wants $32 million for the scheme. The museum would take three years to plan and five years to build. (New Scientist, 14 July 1983.)

Packard packs its bags in Silicon Valley

The flight from California's Silicon Valley grows apace. The latest firm to tire of the electronics Mecca is Hewlett Packard - the third biggest corporate spender on electronics research in America, after IBM and AT & T - which has plans to disperse the work of its research laboratory in Palo Alto. Britain is one of the places that the company is considering as a site for a branch office of the Hewlett Packard Laboratories, which currently employs about 1000 people.

Hewlett Packard's idea of transferring basic research out of the United States is a sensitive issue. Although Doyle is also looking at France, West Germany and Japan, he is by no means certain that such a move would be successful. It would be resisted by the company's American scientists and could result in duplicated effort. Doyle, himself an expatriate Briton, believes that European university research is on a par with that at American universities, with the exception of fields like high-energy physics, where the United States is ahead. What concerns Doyle is that Hewlett Packard should be able to set up the same sort of close links with academe as exist with American universities. To a certain extent, Hewlett Packard is prepared to buy these links. The company's $500 million budget for research and development in 1983 includes some $30 million in gifts to American universities. Doyle said that his company, which gains 30 per cent of its revenues from sales outside the United States had not been as generous with researchers abroad as it had been with those at home.

Hewlett Packard is also involved in collaborative projects with the Massachusetts Institute of Technology and the Stanford Research Institute involving artificial intelligence software and the design of advanced semiconductor chips. The company is also involved in the Semiconductor Research Co-operative, a group of computer firms who contract work out to universities. (New Scientist, 22 September 1983.)

Aggressive IBM is beating PCMs for European market

IBM is winning the battle for European market share, and will continue to do so at the expense of its plug-compatible rivals, according to a Frost and Sullivan report, The IBM Market in Europe.

Shortened product cycles, and the ability to outclass competitors on research and development are among the factors behind this trend. These are coupled with the company's release from the United States anti-trust suit which, says Frost and Sullivan, means "the company is now accelerating its level of market aggression." The face of IBM is changing, spurred by increasing competition from Japan and the revamped AT & T operation which is pushing the company towards intense product development, entry to new markets, flexible pricing policies and a more co-operative attitude to secondary suppliers and value-added houses. Against these attempts to gain an even larger slice of markets which IBM largely dominates already, says Frost and Sullivan, the plug-compatible manufacturers (PCMs) can do little except try to establish market niches where they are seen as providing more complete products or better services. "At stake is a market for data processing hardware worth nearly $6 billion in 1982 shipments," which according to estimates in the report, will rise to above $16 billion by 1987.

The conflict between IBM and the PCMs has become most apparent, according to Frost and Sullivan, in the large-scale systems sector. Traditionally, high profit margins and a conservative product development policy gave other suppliers the chance to compete effectively. Fortunately for IBM only Amdahl and National Advanced Systems have become well established in Europe, and the release of the upgradable 3083 range came as a body blow to Olivetti, BASF and ICL, the report concludes.

The IBM 308X architecture, the king-pin of its big mainframes, forms a market estimated to be worth $3 billion between now and 1987. Other suppliers will find it increasingly difficult to get a share.

The old formula used by the PCMs of 20 per cent more power for 10 per cent less cost is increasingly being met by IBM itself, reports Frost and Sullivan. In the slow growth medium-scale systems market, all true PCMs will gradually lose market share, with the exception of Nixdorf which has established a firm base in Europe, particularly the FRG. IBM will "gradually claw back" from its low share of the distributed systems market with minicomputers such as the 8100, although its greater success will tend to be restricted to "major systems," concludes Frost and Sullivan. (Computer Weekly, 20 October 1983.)

United States personal computers

The long-forecast shake-up in the overcrowded personal computer industry arrived with a vengeance last week. Texas Instruments announced that it was pulling out of the home computer market and ending production of its 99/4A home computer. A day later, the International Business Machines Corporation (IBM) unveiled its Personal Computer Junior (PCjr), the project previously codenamed the Peanut and the cause of turbulent trading on the stock market for the past two months.

IBM's PCjr, which will be on sale early next year, will cost $700 and is designed to complement the company's more powerful Personal Computer which has already captured more than a quarter of the market for machines in the $1,000 to $5,000 price range. The basic machine will have 64 kbytes of memory but a 128 kbyte version with a disk drive will be available for $1,300. A key selling-point will be the fact that the PCjr is compatible with the Personal Computer, so that buyers who already use the Personal Computer in their offices will be able to use many of the same programs at home. (Nature, 10 November 1983.)

8051 fever

America's makers of semiconductors were whining last year about Japanese competition. Not now. They are too busy. The Semiconductor Industry Association reported orders of $992m in October, more than 200 per cent higher than a year earlier. Shipments were worth $617m, almost 50 per cent higher than in October, 1982.

Business is, indeed, terrific. But beware of the extreme boom-and-bust cycle that the chipmaking industry usually goes through. The best measure of the balance between chip supply and demand is "lead time". This is the average time between the placing and the filling of an order. In periods of high demand, like now, lead times of some products lengthen. For the chip now in shortest supply the lead time is 36 weeks, up from three weeks last year. When lead times stretch out like that, customers tend to panic.

There are two characteristic results. First, overbooking which makes the chart of semiconductor sales zigzag like an electro-cardiogram. Customers place the same order with every manufacturer, hoping that one will produce chips before the others. This multiple booking creates a shadow demand that chipmakers have a hard time interpreting. It usually results, a year or so after the boom begins, in stacks of unsaleable inventories in chipmakers' hands and a sudden sharp downturn in demand. The second consequence of customer anxiety is that a grey (and often black) market in scarce chips develops in Silicon Valley during every boom. The scarce chip this time is an 8-bit microprocessor called the 8051, which is made by Intel, Advanced MicroDevices and Siemens (with Signetics soon to start production). The 8061 is used for telecommunications devices and computer disk drives. The companies that make it were selling it earlier this year for about $8. With the chipmakers' best customers already being rationed, the price for the 8051 from spot sellers of questionable virtue is said to be about $200.

The squeeze was not supposed to happen this time. Semiconductor companies made heavy capital investments over the past two years getting ready for this boom. But nobody counted on IBM's rapid success in the personal-computer business. The Big Blue is said to have ordered some 3m 7-chip sets for its personal computer. The main device in those sets is Intel's 8088 microprocessor. It is made on the same production lines as the 8051 chip, which has thus won the distinction of being the world's hardest-to-get chip. (The Economist, 10 November 1983.)

Chip design

Chipmakers, whose integrated circuits have transformed so many other industries, are beginning to feel the impact of their own inventions. More powerful computers and cleverer software are allowing customers to design chips to their own needs instead of making do with off-the shelf, standardized versions. Optimists reckon customized chips could account for half of a $40-billion-a-year world-wide chip market by 1990 (they took over 10 per cent of a $18-billion-a-year market in 1980). And many of the prizes may go not to the present chipmaking giants but the fleeter-footed firms used to dealing in small volumes and to packing their products with services. The ease and cheapness of simply stringing together standard chips outweighed the inefficiencies when the chips themselves were not highly integrated. They do not always today. Because each chip now packs in so many circuits, along with the circuits he wants, a user's systems designer is saddled with lots he does not want. In some systems now 90 per cent of the chips are doing only 10 per cent of the work.

Technically, the ideal solution would be a fully-customized chip. But the design of such a chip can require up to three years and $500,000 - plus the services of a fully-fledged circuit engineer. There are probably fewer than 2,000 such engineers world-wide. The alternative is to let systems designers have a go at creating semi-customized chips; there are about 400,000 of them. That requires three things: the provision of software and machines to aid them to design chips; advice and some design help; and facilities to make the chips once they have been designed. Some companies are specializing in one of the fields; some are trying to do all three. In rising order of sophistication, the tools being offered include:

- Programmable logic devices. Made by California's Monolithic Memories and Signetics, these enable designers to alter the way a chip functions by literally "blowing" some of its circuits. Each logic circuit, or step in the chip's thinking progress, is equipped with a fuse.

- Gate arrays. These chips are produced with a standard complement of logic gates (on-and-off switches) but without connections among the individual circuits. Using a computer, a designer can specify the way in which he wants them wired up to suit his needs. Gate arrays are expected to remain the best-selling semi-custom chip for the rest of the 1980s. Britain's Ferranti was an early champion of arrays and still claims nearly a fifth of the semi-custom-chip market with them. But it is now being challenged by California's LSI Logic on its own turf; headed by Mr. Wilf Corrigan, an expatriate Briton who used to run Fairchild Semiconductor, LSI opened a design centre for gate arrays in Britain earlier this month.

- Standard cells. These enable designers to choose among previously-designed blocks of logic, memory and processing units stored in a computer's memory and to specify which ones he wants wired up how. Leading firms in standard cells are California's VLSI Technology (in which computer-maker Wang recently bought a 15 per cent stake), American Microsystems, and Zymos.

- Cell compilers. These are computerized systems based on a design developed by Professor Carver Mead of the California Institute of Technology and Dr. Lynn Conway of Xerox's Palo Alto Research Center. A cell compiler allows a systems designer to define only the broad outline of the logic he wants for his chip; the compiler itself does the tedious job of translating the specified functions into a detailed circuit layout. VLSI Technology and another Californian company, Silicon Compilers, both offer systems now and Ferranti plans to provide one in 1984. Western Electric, AT & T's manufacturing arm, is preparing to offer a software programme called PLEX that will do the same job as a compiler. But the market for such systems may remain small for some years; they are difficult to use. (The Economist, 17 December 1983.)

Intel plans $100 1Mbit bubble

For the first time a one-megabit bubble memory system chip-set will cost under $100. That's the promise of Intel Corp. as it tries to pop the lid off the commercial equipment market for non-volatile memories. Today, Intel starts a two-year price reduction programme for its BPK70-4 one-megabit bubble storage chip-set that guarantees its price will be under $99 in the fourth quarter of 1984. Today, the volume price was lowered to $199 with another reduction to $149 promised for the first quarter of 1984.

This new pricing programme for volume users is almost a repeat of the one Intel carried out from late 1980 to last year. When the BPK70 bubble memory kit was introduced in 1979, it cost $2,500. But the 1980 guarantee programme dropped it to $995, and in two steps to less than $300 last August. This chip set includes the bubble chip, controller, formatter, current pulse generator, predriver, and two transistors. That first pricing programme was to stimulate a sluggish bubble memory market growing far slower than any of the producers of industry experts had forecast. Now, Michael Eisele, product marketing manager of Intel's magnetics operation, says the first price guarantee programme was successful, stimulating use of bubble memories in environmentally harsh applications. Many of those uses are in industrial and military data acquisition equipment, especially at remote outdoor sites like oil wells, seismic recording stations, and air-borne systems.

But now, the far greater markets in commercial telecom, computing and office equipment is what Intel is after. The firm is far enough down the learning curve on its one-megabit bubble memory products to begin attacking the lower price requirements of these larger markets. But while the price will drop during this new price slashing programme, the unit volume requirements to get those prices will increase.

The current $199 price requires an order of 5,000 pieces. The $149 price for the first quarter of 1984 will require 10,000 pieces, and the $99 price for the end of 1984 will require 25,000 pieces. However, that schedule does show some loosening up of unit volume requirements, since the $295 price announced in August, 1982, required 25,000. Intel estimates that the 1983 total market for bubble memories will be slightly over $100m with some two-thirds of that used in harsh environment applications. By 1987, Intel estimates the total market will grow to about $500m, with some 60 per cent of it being used in commercial equipment. (Electronics Weekly)

R & D partnerships in the United States

By raising private venture capital from limited partners looking for tax advantages, big corporations can band together to fund massive, high-risk research efforts like the target projects of Japan's Ministry of International Trade and Industry.

Limited partnerships would permit companies to co-operate on common research problems and raise interest-free money without tapping R & D budgets. Venture capitalists would be limited partners, thus qualifying for two tax breaks: an immediate 50 per cent write-off on their investment and capital-gains treatment of future royalties from sale of the technology. "The advantage is obvious" says Larry W. Sumney, executive director of the Semiconductor Research Corp. (SRC), the research co-operative formed in 1982 by a dozen electronics companies. "The money would come from outside the industry."

Four million-bit chip. SRC is considering a limited partnership to raise money to develop a 4 million-bit, random-access computer memory - two generations beyond next year's 256,000-bit chip - at a cost of perhaps $100 million. (Business Week, 8 August 1983.)

European computer giants in research pact

Three of Europe's major computer companies have agreed to develop a joint research institute to undertake pre-competitive research into selected areas of information processing. The French firm Compagnie des Machines Bull, the British firm ICL and the West German firm Siemens intend to build the research institute at a neutral site in Southern Bavaria to commence operations at the beginning of 1984. Surprisingly, Olivetti, Europe's largest computer manufacturer, has not been included in the agreement and will be barred from the research institute for at least the first two years of its operation. The joint research institute will employ about 50 staff within two years, some seconded from the parent companies and some recruited directly by the institute. Research will be centred on knowledge processing, and the results of any research will be freely available to the participating companies.

The agreement between the three companies can be seen as a reaction to similar collaborative agreements in the United States and Japan, in which other major computer companies have agreed to share the huge costs of research into knowledge processing.

The research institute will be owned and costs will be shared, equally by the three companies. Each of the companies involved will continue to fund its own research in other areas, and the agreement between the three is strictly limited at present to research. There are, for example, no plans for joint production of equipment as a result of the joint research. ICL will continue to participate in the United Kingdom's Alvey research programme, and all three companies will continue to participate, whether separately or jointly, in the European Commission's Esprit strategic research programme in information technology. (Electronics Weekly, 7 September 1983.)

IBM talks with French

IBM and France's state-owned Compagnie Generale D'Electricité (CGE) have revealed that they are holding preliminary talks which could lead to joint manufacturing and marketing ventures in data processing, telecommunications and other high technology areas. IBM, whose subsidiary IBM-France already marks up the biggest profits and turnover in the French computer industry, could now look forward to extending its markets in France and elsewhere. But they fit into the pattern already set by the world's leading telecommunications and computer groups which are joining forces in readiness to devise the next generation of telephone switching systems in which data processing will play an increasing role.

IBM earlier this year called off an arrangement with Mitel for development of the Canadian firm's X-2000 PABX. Then the company bought a minority interest in California-based Rolm, one of the world's biggest PABX makers. CGE, which has recently acquired what amounts to a monopoly role in the manufacture of digital time division telephone exchanges in France, could hope to boost its sales in parts of the world where IBM is strongly installed. Through its subsidiary Cit-Alcatel, CGE is selling switching systems to 33 countries and controls 30 per cent of the international market. IBM and CGE executives stress that the talks now under way are only a starting point and are not fully-fledged negotiations.

CGE's CIT-Alcatel offshoot is looking for foreign partners in telecommunications ventures following the parent firm's exchange of assets with Thomson-Brandt, France's biggest electronics group. CIT-Alcatel has teamed up with Philips in mobile radio and has got a French government go-ahead to build electronic typewriters - with the possibility of moving on to full-scale office automation systems with Italy's Olivetti. The talks between IBM and CGE could mean a serious challenge to American Telephone and Telegraph Co., and Philips which have formed a joint telecommunications venture. It could also undermine the potential of an alliance between Olivetti and CGE. More serious still for French industry, it could leave the ailing, state-controlled Bull group, the biggest in France, in dangerous isolation. (Computer Weekly, 3 November 1983.)

Siemens expects to break 1Mbit RAM barrier by 1985

The 1Mbit dynamic RAM is on the way. Siemens expects its first design to be ready in mid-1985, with the first samples to be produced in the autumn of that year. According to Dr. Diederich Widman, who is responsible for developing the VLSI manufacturing processes at the Munich-Perlach site, the 1Mbit RAMs will be about 60 to $70mm^2$, a cell size of $40u^2$. As this chip will have minimum dimensions of 1μ, Siemens, in conjunction with Zeiss, has developed a very high resolution lens for use in the optical lithography process. This lens said Widman, will enable them to achieve submicron dimensions.

The company has already developed the process for 256K dynamic RAMs. Pilot production of these chips will begin at the end of this year. Mass production is expected to begin in 1985 at the Siemens plant in Austria. The 256K RAMs have a chip size of $45mm^2$, a cell area of $90\mu^2$, and an access time of 120-150ns.

Siemens has invested DM9m in the installation of a new clean area where manufacturing process for structure of 1μ and less will be developed. The facility uses the entire ceiling as a filter area, and the entire floor as an exhaust area. This eliminates the areas turbulence normally found in clean rooms. The air flow will be about 30 cm/sec, much higher than usual, and the filters used can filter particles down to 1μ. Siemens believe that this is the most advanced facility of its kind in Europe. (Electronics Weekly, 9 November 1983.)

SCS (Italy) expands Catania plant

Italian semiconductor manufacturer SGS will start work on a new production area capable of handling sub-micron designs at its site in Catania, Sicily next year. The company's Catania facility is the headquarters of its discrete and standard logic division. No final decision has yet been reached on what parts will be built in the sub-micron area, but they are likely to include CMOS, NMOS, silicon-gate MOS and power MOS devices. Division director Salvatore Castorina, said: "The investment in the building alone will be about $12m, then we will have to invest in equipment. Our objective in building the sub-micron module is to have a production area which should still be competitive in 1990. We don't know what we will make there yet, but the technologies available will not be obsolete five years from now." SGS' Catania factory will make its first CMOS wafers early next year on an existing production line. They will be the 4000 Series standard logic devices already in production at its site near Milan.

Catania is also responsible for development and manufacture of the devices for the world power market. Currently under development is the company's answer to Motorola's Smart Power components which incorporate both a power transistor and logic on a single chip. Although sampling is expected to start next year volume shipments of the device will not be available before 1985.

Despite continuing losses in its discrete semiconductor business SGS returned to profit after about 10 loss-making years in June. This year's bookings and billings are both substantially up on last year's comparable figures, with fourth-quarter billings forecast to increase 31 per cent to $155m on 1982's fourth-quarter result of $118m. Total billings for 1982 reached about $170m, of which about 77 per cent went into the international market. The company's United States business has grown fourfold since 1980 leaving it on course to open its first United States manufacturing plant in 1985. (Electronics Weekly, 9 November 1983.

Custom MOSICs in Europe

Eurosil Electronics GmbH is a new joint-venture company formed by partners AEG-Telefunken, United Technologies (UTC), and the Diehl Group. The new company has been formed to concentrate in the development, production and marketing of custom MOS circuits. The agreement calls for Eurosil Electronics to take over the present activities and assets of Diehl's Eurosil GmbH. Established in 1972, Diehl's Eurosil recently laid the technical foundation for a modern electronics components factory in Eching, near Munich. According to Peter L. Scott, executive vice president-electronics of UTC, "These facilities will enhance the capacity of Eurosil Electronics to accelerate its timetable for achieving a prominent position as a major supplier to European industry." Eurosil electronics will provide its customers with custom designed circuits and CAD software services. Scott reported that Eurosil Electronics will also design, develop and produce VLSI components and will recieve advanced VLSI technology from the United Technologies Microelectronics Center and Mostek, a wholly owned subsidiary of UTC. (Semiconductor International, August 1983.)

New Semi-Custom Design Center for Europe

Fairchild has established its European design center for semi-custom logic arrays in Shire Hall, Reading, England. The company is also carrying out the design of new items in some standard logic lines, especially its FAST series, in the same center. The center is able to handle three simultaneous customers' design teams, and has facilities for all of the necessary training and all stages of the semi-custom process through to the output of the mask data. Currently designs are implemented on the GTO750 bipolar gate array. Full CAD equipment is available at the center which is making further developments in the CAD package. A VAX 11/780 is employed with a Systems 164 array processor for the running of simulation and analysis programs. An Applicon AGS-895 system has been installed for mask layout and design.

Fairchild stated that many of the reasons for selecting Reading were geographical, but other important factors were a 25 per cent grant for the cost of capital equipment and their favourable experience with the creativity obtained from British engineers. At present, work on an array at Reading terminates when the mask data are produced, which then goes to the United States for mask making and metallization. However, Fairchild's new facility at Wasserburg, Germany, presently used for assembly and testing, will be equipped for wafer fabrication in the near future. Fairchild believes that the main limiting factor on the size of gate arrays employed in many applications will be the capacity for testing them. They are prepared to accept a penalty of up to about 20 per cent in the area of the silicon used in order to have scan testing capability for their product. (Reprinted with permission from Semiconductor International Magazine, June 1983, Copyright 1983 by Cahners Publishing Co., Des Plaines, IL.)

Honeywell-NEC

Honeywell, one of America's biggest and oldest computer companies, is teaming up with Japan's NEC (Nippon Electric) in its attempt to hold market share against IBM. Honeywell, which first supplied technology to NEC twenty years ago (NEC broke off the relationship in 1979), will market NEC's top-end mainframe in the United States. In addition, Honeywell will have the option to build the mainframe, and the two companies will undertake joint development and otherwise share technology. (Business Week, November 7, 1984; and Electronics News, October 24, 1983.)

AT & T is ordered to drop the Bell

American Telephone and Telegraph last week accepted the United States District Court's requirement that it give up the trading name "Bell" when it divests itself of its 22 operating companies in January 1984. The requirement is one of the conditions Judge Harold Greene made in July 1983 for accepting the terms of the settlement between AT & T and the

Justice Department. The deal ends a nine-year anti-trust suit against AT & T and allows the company to enter new computer-related telecommunications markets. American Bell will be renamed AT & T Information Systems.

Bell Laboratories and AT & T's foreign affiliates will be allowed to keep using the name, but apart from that the entitlement to use it will pass to the seven new regional companies that will take over the 22 local operating companies. The logo of a bell in a circle that AT & T has used since 1889 will be replaced by a blue globe with white grid lines.

AT & T will keep its long distance telecommunications services, which will operate under the name AT & T Communications, as well as the manufacture and sale of telephones and switching systems by its Western Electric subsidiary and its research activities at Bell Labs.

As well as the requirement to drop the Bell name, the conditions included allowing the operating companies to sell rights to AT & T patents. (Computer Weekly, 11 August 1983.)

Western Electric Co.

Western Electric Co. declared recently that it would enter the commercial market for semiconductor devices this fall. The announcement failed to generate concern among chipmakers because the American Telephone and Telegraph Co. subsidiary has never peddled its chips on the open market or had to scramble to get production costs low enough to match hotly competitive United States and Japanese producers. But most of Western's critics and future rivals are now taking a second harder look and are beginning to worry about competing with Bell's chipmaker. Not only does the dramatic bid have the strong backing of AT & T top management and the gobs of cash needed to compete in the open market but Western also is demonstrating that it is on a par with industry leaders in building some of the latest chips. The company already has the muscle of a high-volume producer and is churning out integrated circuits (ICs) for its equipment divisions at a $350 million annual clip. Only a dozen chipmakers in the world are larger.

Western has picked a momentous battleground for its first fight in the chip wars: the 256K memory chip. The AT & T subsidiary will greatly enhance its reputation by becoming the first United States producer to go into commercial production on the so-called 256K random access memory (RAM), a new generation of computer memory capable of storing more than 256,000 bits of digital data on a tiny silicon chip. The battle for this market is widely expected to be the bloodiest ever, because the chip will be the largest-seller in industry history. Sales will hit a spectacular $3.7 billion annually in 1989, says Dataquest Inc., a San Jose (Calif.) market researcher. (Business Week, 18 July 1983.)

Hitachi in Penang

Hitachi of Japan is moving ahead with plans to boost semiconductor production at its two Penang facilities this year. Production capacities at the plants are being raised through the installation of smaller high-speed assembly equipment. Output is being raised on all production lines except transistors. Hitachi Semiconductor (Malaysia) Sdn Bhd (HISEM) has manufactured transistors and other semiconductors in Penang for 11 years. The company owns Hitachi Semiconductor Technology (M) Sdn Bhd (HISET) which occupies part of the Penang site, and also Hitachi Semiconductor (Kedah) Sdn Bhd (HISAH), recently established in Kedah State. Assembly and testing is carried out in Penang while all research and development is undertaken by the parent company's seven laboratories in Japan.

Production director Katayama disclosed that plans for developing HISEM this year include increasing the plant's semiconductor production capacity by 20 per cent. However, transistor production capacity will remain at 60 million devices monthly, 50 per cent more than projected monthly production averages for the rest of this year.

As HISEM's factory floor space is fully occupied, production capacity increases are being achieved by installing smaller machinery and also using the new Hitachi plant in Kedah to boost the parent company's total production in Malaysia "Here at HISEM we must increase testing, as we are also testing HISAH's production as well," Katayama said. "Consequently we must start using new small-sized machines to save space. In Japan they are building assembly and test equipment which is smaller, thinner, lighter and shorter - this is the philosophy."

"Already we have thrown away some machines after they have been depreciated. We have thrown away a few hundred machines of all types so far," Katayama continued. "We are bringing in new wire bonders, smaller in size and also smaller die attach equipment. We are bringing them in because we need the space. Our new wire bonders are about 60 per cent of the old size, the die attach machinery is 80 per cent of the old size and the new testing equipment is 70 per cent of the old equipment size." About 70 per cent of HISEM's production is exported to Japan at present. Another 20 per cent is exported to Hong Kong. The balance is exported to the United States and Singapore. (Electronics Weekly, 7 September 1983.)

Toshiba plans $122m custom plant

Toshiba has given the go ahead to a $122m plant dedicated to custom and semi-custom integrated circuits. Freshly back from Japan, Toshiba's newly appointed general manager of the semiconductor division, Phil Pittman, said: "Semi-custom is where the whole industry not just Toshiba, is seeing huge growth". The new plant will be built about 260 miles north of Tokyo at Kitakami in Iwate prefecture. It will be able to manufacture five million custom and semi-custom parts a month. This will double Toshiba's present capacity. (Electronics Weekly, 7 September 1983.)

APPLICATIONS

Process control

For the past 20 years or so many plants have been operating semi-automatic process control systems. Plants use a control room or control panel from which pumps, valves, compressors, or other equipment in remote locations can be stopped and started. The great jump forward with microprocessors is that they allow you to stop or start this equipment in any sequence you like, with many different timings between steps. Typically, for £800 you can get a programmable logic controller (PLC) which can open and close 10 valves, stop and start 10 motors etc. in any sequence. Bigger systems require bigger PLC's and a bigger budget.

Computers are now used to control very large plants - thousands of valves, motors, and other equipment - and give complete management information on plant performance. These big systems are fine, provided you can get a huge budget. The present state-of-the-art however makes it very attractive to automate bit by bit, starting with the least critical portion, using it as learning experience. The concept of having one big computer running the entire plant was in vogue up until 1980 when the really low cost microprocessors came into their own. The current trend is towards decentralized control, where each section has a computer controlling its operation.

In a dairy, for example, you might have one microprocessor controlling a group of 3 pasteurizers, one controlling a cleaning in place (CIP) washing set, another controlling raw milk cooling and storage, and so on. This form of 'distributed control' has distinct advantages. Each block can act independently of the other. If one microprocessor fails for any reason, the rest can carry on independently.

In a typical existing plant, the engineer will install a microprocessor for each section, but the ultimate aim is to have the plant controlled from one room. Therefore, a management computer is used to control the various microprocessors. The microprocessors in turn provide information to the management machine so that the overall plant records such data as temperature, pressure, flows, tank levels for management use while in operation. The biggest hassle here is inter-communication between microprocessors and management computers of different manufacturers. In general, microprocessors and management computers of the same manufacture can communicate; there are well established systems for getting microprocessors and microcomputers (desk tops) of specific different makes to 'talk' to each other. However, mixing up all sorts of microprocessors normally leads to trouble later on.

Over the last 18 months, a number of Irish dairies, breweries and food manufacturers have installed microprocessors to control CIP systems. Briefly, these systems are used to wash milk tanks, pipes, pasteurizers and other equipment in the dairy. Washing might consist of a wash of water followed by a hot caustic wash followed by hot water rinse, and lastly a cold water rinse. Up to recently this 'program' was followed through typically by an electro-mechanical relay system with drum timers etc. The opening and closing of water, caustic, and steamheating valves and control of pumps all followed the program. These older systems are troublesome (high relay failure rate), inflexible (difficult to change duration, chemical concentration and temperature of washes) and provided no communication to other systems. The same applies to the old punched card program.

The new microprocessor systems cost between £800 and £2,000 - depending largely on the number of programs. Their advantages include:

- reliability
- repeatability
- ease with which operators can change programs
- recording. Some micro's can be tied into a printer to give a readout of each wash, its duration temperature etc. This is a better arrangement than the traditional recorder.

All microprocessor systems must be designed to cater for failure. What if the microprocessor blows up? One can't have dirty milk tanks, nor leave cream in tanks for days to go off because the emptying program doesn't work. So we have a back-up. Typically, this could be a mimic panel or VDU. This equipment allows each valve to be manually controlled in the event of failure. A must. Also a must is feedback from the system - that is, if a valve hasn't opened as instructed, a signal from a proximity switch says so, and the microprocessor stops the program and alarms. This is a great security and a great feature of the microprocessor. The biggest plus for a micro based system is the repeatability. Every day, each piece is washed at correct temperature with correct chemical for the right duration. Problems tend to be 95% mechanical, for example caustic dosing pump failure, wet limit switches, caking on level probes (especially in hard water areas) etc. The operators and dairy electrician usually learn how to use the system, change programs etc. in a day, given a standard microprocessor. Other process control applications now include batching, in-line blending, milk transfer and microprocessor control of an evaporator. It is important to have a local supplier to install the system, for you'll need to change it, expand it, or modify it somehow. That will cost a lot in time and money if there's no local back-up.

Ultimately, the larger dairies will be computer controlled - run by one man or maybe none. Such a plant is that of the Dutch Co-Op Coberco whose butter factory is the largest in Europe (only just bigger than Avonmore). It processes 700 million litres of milk a year, and the entire processing/cleaning section is controlled by one man. Labour is used for tanker unloading and tending the packaging machines. At weekends, the plant is unmanned, but if there's a problem, the computer rings the operator who is 'on call at home, to alert him. Other industries where computerized process control will take over soon include:

- Chemicals
- Milling
- Meat Processing
- Energy Systems
- Food Processing (all types)
- Plastics

The number one problem area is instrumentation, which has not progressed as much as the microprocessors which control it. This is especially so in the food industries where hygiene is a special requirement. Electronic instruments, especially, have a name for being fragile. However, they are improving in leaps and bounds. Pneumatic instruments are still useful: good quality air, and good maintenance is essential for long term reliable operation. The other flies in the ointment include faulty feedback switches (usually caused by water) or caking on probes which consequently give false signal. The simple cure for the latter is taking them out and giving them a wash on a regular basis. ...

... Finally, there is no point in automating a plant to ensure reliability and repeatability if you still leave the operator the facility to make a major error. Interlocking is one way out of this. It may be software interlocking so that while the computer is running, there's no danger of, say, a detergent valve opening and spraying into a full cheese vat. But if the computer fails? Then we're operating manually from the mimic panel or VDU. Some people don't believe it is worth the expense to have the interlock for this operation. I wouldn't agree at all with that view. Operating manually will not be normal so the operator will not be well versed with the routines, he can easily make a mistake. You must have a certain amount of hard wire interlocks for working in the manual mode. Then you end up with a totally safe system, no matter what happens. (Technology Ireland, June 1983. Article by Martin McCarthy.)

The economics of NC *

... For the purposes of this article let us assume that a manufacturing company has severe problems in meeting delivery dates and customer quality requirements. Management, by systematically going through a check list of problem areas, has defined the problem as being one of lack of capacity in the turning area of manufacturing. On the face of it, the solution to the company's problem is to buy new machines to replace old equipment. However, before that decision is made, it is imperative that certain basic questions be asked and answered honestly.

They are:

1. Are the existing machines being used effectively? If not, can anything be done to increase use/productivity to the levels required?

2. Are the new machines being bought as direct replacements for existing equipment? If so, there is a danger of perpetuating obsolescent production methods.

3. Is there sufficient visibility to determine whether the new equipment purchased is compatible with some new production being planned?

4. Will there be a continuing supply of sufficiently skilled people to meet the needs of the future?

5. Is new technology available which will reduce manufacturing costs? If so, will this reduction in costs be sufficient to yield a satisfactory return on investment on the basis of current prices, thus making it attractive to invest in new technology as opposed to conventional equipment? ...

... In general, NC equipment is at its most profitable in the following conditions:

- Where batch sizes are small to medium.

- Where complex shapes/contours have to be machined.

- Where many changes to design have to be made.

- Where accuracy and repeatability are very important. This aspect of NC machines greatly reduces inspection costs.

- Where expensive tooling by way of jigs and fixtures is required.

- Where shorter lead times are required. By virtue of the greater speed of NC machining it is possible to greatly reduce lead times. This has the added advantage of reducing both in process and finished goods inventories.

- Where skilled labour is in short supply.

These generalizations are very helpful in focussing attention on a particular piece of equipment, but there is only one way of determining the most economical way of producing a number of components. That is to evaluate their production costs for different machines and

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* By Patrick Connolly, Managing Director of Monksland Precision Engineering Company Ltd. of Athlone, Ireland. The company specializes in small to medium batches of high precision machined components.

plot the results. This analysis of manufacturing costs is very time consuming, but essential if proper decisions are to be reached. Where large investments are contemplated a very detailed financial analysis including a preliminary comparison with existing methods should be made to determine whether there is good reason to do the full scale analysis.

For the small company with limited accounting and management resources the financial analysis need not be so exhaustive. Essentially the analysis will involve comparisons of costs and savings between existing equipment and the proposed equipment or between alternative proposals. Suppose that the lack of capacity coupled with poor quality is in the turning area where there are two semi-automatic capstan lathes. Management investigations have revealed that the machines are fully utilized and because of their age nothing further can be done to improve performance in the area significantly. The decisions that now have to be made are:

- Does the company replace the capstans with more modern machines.

- Does the company purchase NC equipment.

To help with these decisions, an expenditure forecast should be made on a format as indicated in the table below.

Great care should be taken to list all the expense related to the purchase and installation of the equipment to the point where production can commence. The following items should be covered under capital expenditure:

1. The machines including transport and insurance.
2. Foundations.
3. Installation.
4. Special tooling or equipment such as tape preparation equipment or computer back up.
5. Grants.

There will also be some once-off expenditure:

- Pre-production costs - most of which is the cost of studies by management or consultants.
- Movements and re-arrangements.
- Training Costs.
- Other miscellaneous expenditure.
- Disposals.

Under annual expenses are listed the day-to-day expenses of running a machine shop. Whetner in-process inventory should be considered in this category is arguable and for the purposes of the remainder of the calculations we will omit it.

<u>Forecasting expenditure - how an NC lathe might compare with the Capstan lathes</u>

Description of equipment	Two capstan lathes	NC lathe	
Capital expenditure	£	£	Additional capital cost
Machines	30 000	60 000	30 000
Foundations	1 000	4 000	3 000
Installation	1 500	2 000	500
Special tooling	500	8 000	7 500
	33 000	74 000	41 000
Grants 35%	(11 500)	(25 900)	
TOTAL	21 450	48 100	26 650

Annual expenditure	£	£	Difference in annual expenditure
Direct labour	12 000	6 000	6 000
Overtime, bonus etc.	4 800	1 500	3 300
Indirect labour	6 000	10 000	(4 000)
Fringe benefits	3 000	1 800	1 200
Special tooling	1 500	350	1 150
Consumables	800	600	200
Scrap	6 000	3 400	2 600
Tool maintenance	900	900	
Equipment maintenance	300	1 000	(700)
In process inventory	4 500	3 000	1 500
Other expenditure	1 000	1 000	
			11 250

Once-off expenditure	£	£	Difference in annual expenditure
Pre-production costs	1 500	2 800	1 300
Training		5 000	(5 000)
Factory layout changes	1 000		1 000
Disposals			
Miscellaneous	350	1 500	(1 150)
			(3 850)

(Excerpted from an article in Technology Ireland, August 1983.)

Recipe calculation system improves raw material utilization in meat processing

Two computerized recipe calculation systems which provide meat processing companies with improved opportunities to optimize the raw materials used in processed meats have been launched in Sweden by AB Proman. They are aimed at small- and medium-sized meat processing firms, since big companies solve recipe formulation problems by employing large central computer systems. The small system, the PYL 1000, comprises a microcomputer, programmed with information about water, protein, fat, carbohydrate, salt, collagen content, binding ability, colour quality and the prices of 25 raw materials. By entering different quantities of raw materials and running a recipe calculation programme, the qualities of the finished product are obtained. Changing the composition of a recipe is accomplished by adding or deducting a desired quantity of a raw material.

The system also includes a printer, magnetic card reader and magnetic cards. Raw materials input can be easily changed in the calculator. Since information is also stored on magnetic cards, a reserve copy always exists. The bigger system, the PYL 2000, is a table-top computer with a terminal and printer. It can store a recipe "library" and calculate new recipes. In addition, it can simulate and optimize existing recipes and calculate the total raw materials necessary for an entire factory. The system also includes functions for manufacturing orders, general repricing, and routines for the most common administrative functions such as accounting, customer receivables, invoicing and word processing.

Centralized control of Stockholm's traffic-light network with new system

A new system which will automatically monitor and control the Stockholm traffic-light network has been ordered by the city's roads and works department from Ericsson Radio Systems AB and Dansk Signal Industry A/S. It will provide an alarm immediately a traffic-light fault occurs, indicate which traffic lights are involved and describe the nature of the breakdown. The system allows a controller in a central unit to reprogramme signals according to special traffic situations, which can be influenced by rush-hour bottlenecks, road works, demonstrations, etc. At present, the majority of Stockholm's traffic lights are pedestrian-controlled via push-buttons or detectors. Lights are co-ordinated from 30 regional centres, which programme them in accordance with traffic patterns. These regional centres will be connected to the central unit of the new system.

(Science and Technology, July 1983, published by SIP, The Swedish-International Press Bureau, Linnégatan 42, S-114 47 Stockholm.)

The chemical process industry's growing dependence on computers

The chemical industry is now emerging from one of the most severe and prolonged recessions that it has ever experienced. And at the same time, the industry is facing increasing competition from its Japanese and Middle Eastern counterparts. More than ever before, the industry faces the need to increase its overall operating efficiency and its productivity. Of course, the chemical industry is not alone in these needs. But it is different. Unlike labor-intensive manufacturing operations that can solicit productivity gains from its employees, the chemical industry is a capital- and energy-intensive business with relatively few employees. Thus the industry has little choice but to turn to the computer industry for the help it needs in streamlining its production facilities. An obvious way in which the industry can improve efficiency and productivity is with process control technology. Process control, of course, is not new. Whether performed by people or machines, chemical process control has always been needed. The careful monitoring and adjustment of process parameters such as pressure, temperature, and flow rates are necessary - both to assure a quality product and safe operation of the plant.

A leader in the development of automated process control systems for the chemical process industries is Foxboro. With its long history of designing and marketing sophisticated sensors and instrumentation for the process industries, it was a natural development for the company to expand its expertise into automated process control. The company has found its entry into the market a rewarding one. Foxboro says that today, total United States expenditure for process control equipment are running about $3 billion per year. And the company expects that to double within 10 years, an average annual compound growth rate of about 8 per cent. Users of the equipment are finding that it pays for itself in many ways. Automated controllers can more closely and accurately monitor the performance of a plant, thus maximizing yield and minimizing energy consumption. Further, in the case of batch processes, the use of automated controls can increase the turnaround time between batch runs. Some companies are taking process control a step further. August Systems, for example, has been a pioneer in the development of fault-tolerant systems - automated controllers that are virtually immune from the glitches that sometimes disable today's ordinary computer-based systems. Because such computers operate with nearly certain reliability, their application can be extended safely and effectively to monitoring and safety-shutdown systems. Fault-tolerant systems are naturally being adopted for process control where potentially hazardous materials are being handled. But chemical companies are finding the new systems beneficial even in the traditional applications of process control. The reason: their high reliability means fewer interruptions and plant shutdowns due to computer errors. And that translates into increased production, greater efficiency and enhanced personnel safety.

Perhaps a less obvious, but more fundamental application for today's computer equipment is the need for increasingly sophisticated laboratory equipment to support the chemical industry's research and development programs. Just this year alone, the chemical industry will spend more that $6.8 billion dollars on R&D, an 18.8 per cent increase over 1982. That increase is well above the average for industry as a whole, so it should come as little surprise that the chemical industry is making substantial investments in automated equipment to make its R&D as productive and efficient as it possibly can. In fact, Hewlett-Packard, one of the foremost makers of analytical instrumentation, says that more than $2 billion will be spent on instruments this year, up from less than $1 billion in 1973. Moreover, the company projects that sales of the instruments will continue to grow at about 16% per year for the next 10 years. One of the most important reasons that this segment of the industry is growing so rapidly is that today's instruments do so much more than analyze and measure. Modern instrumentation systems also collect, store, sort and recall the data for future manipulations, long after the initial analyses are completed. The systems are also capable of printing reports, complete with graphic representations of the data. In one respect, the analytical instrumentation systems being produced today are even a bit like process control systems. Left unattended, they will continue to do everything that's been asked of them - a real productivity booster. And last, but hardly least, the chemical industry is turning to computer-assisted design to obtain the necessary cost savings it needs to survive into the next decade. CAD, according to Computervision, is already a $3 billion business in the

United States. Growing at an 8 per cent per year clip, use of CAD should double over the next 10 years. Chemical and related industries account for about 10 per cent of the market today, but that segment is growing much more rapidly than the market as a whole 40 per cent per year.

One reason that the chemical process industries will step up its purchases of CAD equipment over the next few years is that, quite frankly, the industry and the technology got off to a slow start. Early in their development, CAD systems were confined to designing in two dimensions, and had limited storage capacity. Today, all that is changing. Hardware costs have come down and software is getting increasingly sophisticated. Already, entire chemical plants are being designed using the latest in CAD technology. In just a very short time, those plans will be transmitted to manufacturing plants that will automatically machine the parts designed using CAD - a process called computer-assisted manufacturing (CAM).

The benefits of CAD/CAM are multifold. Companies that are now installing these systems ultimately expect the technology to reduce the installed cost of a chemical plant by 2-3 per cent. For those companies limiting the use of the technology to initial design, total time spent designing a plant can be cut by half or more. Another benefit of the systems is better control over the design of the plant. It can be built to finer tolerances and its output and other characteristics can be more accurately predicted. All told, the chemical process industries are making tremendous use of the tools that the computer industry is putting at its disposal. The gains in energy efficiency and productivity that result are helping chemical companies stay profitable, despite difficult economic conditions and the growing competition from companies in Japan and the Middle East...(Excerpted from an article by Robert T. Martinott in Chemical Week, 14 September 1983.)

Computer takes guesswork out of factory planning

Production engineers who devise new methods for turning out goods normally rely on little more than guesswork to evaluate the effect of their innovations. Now a set of software techniques from an engineering consultancy gives planners a more effective way of assessing the contribution of new machinery. The factory planner keys into the computer system, called Foresight, a specification of what changes he is advocating. These can include the introduction of new kinds of machine tool, abetted with robots or other devices for transferring items between different machines for, say, cutting or drilling. The engineer would also give the computer details such as the kind of goods he hopes to make, the rate of production, the percentage of defects he is prepared to tolerate and how many workers are present and what they are doing. Armed with these facts, the hardware would assess what is likely to happen if the new factory mechanisms were in place. The computer system could even run through several weeks of simulated production to find out whether, for example, the new way of working is cheaper.

The software on which the system is based was developed by engineers at British Steel to plan changes in the way steelworks run. Ingersoll Engineers, a consultancy at Bourton Hall, near Rugby, has done a deal with the steel company to use the system as a planning tool. With the equipment, according to Brian Small, Ingersoll's joint managing director, the engineering firms that are his customers can work out more quickly the effects of advanced automated machinery. (New Scientist, 29 September 1983.)

Type on the cheap

Microcomputers could be about to make a new inroad into an industry dominated by large machinery. Linotype-Paul, maker of the casting machines on which generations of printers have set type into metal, has launched a photo-typesetter driven by a home-computer keyboard. The idea is to allow organizations such as large companies and local authorities to print their own material to professional standard. The cost: around £15,000. (New Scientist, 10 November 1983.)

Success of computer-linking of European ports

A pilot scheme of computer links between 24 ports in continental Europe and the British Ports Association, aimed at lowering costs, reducing the risk of pollution and increasing safety and efficiency, has been declared a major success. London, Copenhagen, Hamburg, Bremen, Rotterdam, Antwerp, Le Havre, Genoa, Piraeus, Naples and Venice are among the members of the European Port Data Processing Association (EVHA). The scheme comprises a data communications feasibility study, a dangerous substances study and a final network system study. When a ship sails from any EVHA port, information, including its name, destination, draft, a summary of any dangerous substances it may be carrying, its time of departure and estimated time of arrival is fed into the computer, which stores it until the port of destination make an inquiry. Ports are able to prepare themselves for the arrival of ships in a way that has never before been possible on a large scale. Time and money can be saved, and advance warning can mean safer handling of dangerous cargoes. The threat of pollution can be reduced, as can risk to dock workers. (Outlook on Science Policy, Vol. 5, No. 9, September 1983, published by Science Policy Foundation.)

Cargo-handling by computer

No matter how many tonnes of cargo a ship carries, when she puts to sea her voyage is also burdened with a vast amount of documentation, passenger lists, crew lists and wages accounts, bunker fuel intake and consumption, stores lists, cargo bookings and freight invoices - all these and other data and statistics have to be compiled, sorted, extrapolated and entered up for every voyage. This has traditionally been a tedious and time-consuming manual task but the picture, quite literally, is changing fast as more and more shipping lines are now going on-line with SHIPS, Shipping Industries Processing System. This is the name given by London computer services specialists Turnkey and Applied Computing Systems Ltd. to a flexible hardware and software package that can be tailored to meet the particular documentation needs of individual clients. ...

Moreline - Morflot International Liner Agency - which manages a large fleet of Russian ships including cruise liners, has invested some £400,000 in a SHIPS package comprising a DEC PDP11/70 computer in its United Kingdom HQ in London and a PDP1/44 in its Tilbury office. These "speak" to each other over leased phone lines and Moreline's office in Hull is also connected to the London computer via two terminals. The United Kingdom's system is linked, again through leased telephone lines, to computers in Hamburg and Leningrad. Moreline says that 80 per cent more bills of lading can now be handled without any increase in office staff.

For example, USSR/UK manifest data can now be automatically transmitted in 20 minutes direct to Tilbury where it enables the PDP11/44 to produce copies of the manifest for Customs and the Port of London Authority well in advance of a vessel's arrival; notification of arrival to consignees; invoices, delivery orders, and land haulage instructions. For vessels outward bound from the United Kingdom a single entry of bill of lading and freighting details to a VDU produces bill of lading, freighted and unfreighted cargo manifests, freight invoices, updated sales figures, nominal and voyage ledgers, cargo types, shippers, consignees and revenues as well as other statistical reports.

The latest software package by T&ACS covers container control, tracking the movements and location of containers in the United Kingdom and linked with their repair and maintenance plus storage and handling.

The use of the SHIPS system has been such a success that Moreline is now looking into computer exchange of manifest data to cover its services to the Mediterranean, East Africa, India and Pakistan, and the Far East. In fact, Moreline would like to extend the system into agents' offices in ports around the world, considering that this would be well worth while if only for the benefit of transmitting manifests by computer, particularly to more remote areas, instead of having to rely on couriers and air transport. ... (Electronics Weekly, 24 August 1983.)

Speech-recognition system fits in watch, responds to five one-word commands

Minimal power consumption and small size combine in a novel speech-recognition system now in development at Asulab AG in Neuchatel, Switzerland. These attributes, plus the low cost of the final chip, will make the system applicable in battery-powered consumer products like watches, clocks and toys, as well as remote-control units for home appliances and radio and TV sets. Sporting a 15-word vocabulary, the system currently under development for watches will recognize 10 spoken digits and five one-word commands. Its 1,500-bit memory is small enough for low-volume and inexpensive chip implementation, yet large enough to completely program a watch or, for that matter, other equipment around the house.

Unlike other systems, the Asulab chip uses virtually no peripheral devices. It comprises an analog preprocessor and a special microprocessor, both Asulab-designed. After preamplifying the acoustic signal from the external microphone, the preprocessor analyzes that signal within a 200-to-4,500-hertz range, breaking it down into seven channels by means of bandpass filters. Once the signal from each channel is rectified and averaged, its energy is extracted and digitized with a variable threshold that tracks the level of the input acoustic signal. Sampling every 10 milliseconds yields a data rate of 700 bits per second at the parallel outputs, implemented as a seven-line data bus. To keep power consumption low, all circuits used in signal analysis, such as the fourth-order bandpass filters and the energy extractors, are designed in low-power switched-capacitor technology. The bandpass filters are realized by cascading two second-order sections.

Further signal processing is done in the microprocessor. It eliminates redundancy in the voice signal and codes and compresses the 700-b/s data stream from the preprocessor by using run-length coding, popular in image processing. Then, in the recognition mode, the microprocessor goes through the correlation process according to a program stored in its 10-K read-only memory. This process entails comparing the characteristics of the incoming word with the sonogram of the word stored in the RAM. At a clock rate of 32 kilohertz, a common value for electronic watches, it takes only about 100 milliseconds to perform a correlation, this short time being a result of a well-defined instruction set. (Speech recognition systems already on the market also feature 100-ms correlation times, but at clock rates much higher than 32 kHz.) The microprocessor's sequencer handles system timing, and its arithmetic and logic unit performs functions like estimating the similarity of input and reference words.

Thus far the Swiss engineers have integrated the switched-capacitor filter banks, the level detectors for analog preprocessing, the ALU, the sequencer, and the RAM. The software and all critical parts of the hardware have been extensively tested. At this point, Asulab director von Willisen is reluctant to give information on chip prices. But he hints that, given the small silicon area and the relatively small vocabulary, the cost will be fairly low. (Electronics, 19 May 1983.)

Easier-to-service digital TV

ITT has invested £20 million over the past decade on the design of a television set that handles picture and sound signals in digital code instead of the conventional analogue waveform. For the public there will be no immediate advantage when the "Digivision" sets first come onto the market in 1984. They will cost the same as conventional analogue television sets, and the pictures will look the same. But the Digivision sets will contain fewer components to go wrong, and will be far easier to service when they do. Also, they will be easy to upgrade by fitting new chips as they become available, offering features not possible with analogue circuits. A digital television immediately decodes the incoming sound and picture signals and converts them into an 8-bit digital code. All-digital circuits, like those in a computer, handle the signal. The signal is converted back into an analogue waveform just before it is fed to the picture tube and loudspeakers. The set will have seven integrated circuits or chips which ITT makes in the Federal Republic of Germany. The seven chips replace 282 separate components, for instance transistors and resistors and cut by over 700 the number of solder connections. The sets will therefore be very easy to make. Computers will do the physical "tweaking" needed to adjust the picture, and to control quality. And if a set goes wrong later, a service engineer can bring the picture back to normal by plugging in a computer handset which re-adjusts the circuits in the same way.

But the most exciting aspect of Digivision is its future potential. The next generation of chips, which the company could fit in existing digital sets, will offer selective zoom, still pictures, and multi-standard operation. A frame store could freeze any moment of the action on screen, and display it as a still picture. The zoom control would allow the viewer to enlarge any area of the picture displayed. And because the signals inside the television are in digits, it is of no consequence to the circuits whether the input is the US standard 525-line or the European 625 lines. So a single set can cope with either standard. It is also relatively easy to double the number of lines displayed to improve definition, or to double the number of picture frames displayed every second to eliminate flicker. A viewer will also be able to check what's on another channel by inlaying a small picture of that channel in the corner of the main picture. Interference and ghost images caused by reflections of the received signal are more easily cancelled out in a digital television. (New Scientist.)

Computer translators say goodby to water goats

In an attempt to cut the £300 million it spends every year on translations, the EEC has launched a project to build an all-purpose, automatic, translating machine. Although the EEC already has a translation machine called Syrstran, at best it can manage to get only eight out of 10 words right. It can translate documents only in specific technical areas, and it cannot be revised with a better vocabulary or better grammar routines. The result of these shortcomings, according to Douglas Arnold of Essex University's language and linguistics department and one of the project's co-ordinators, is that Syrstran has a habit of translating hydraulic ram as "water goat", and out of sight, out of mind as "invisible idiot".

The EEC's new system, under development at 11 European universities, will not only be able to cope with the 42 European languages and variations, but will be part of other automated office aids such as electronic mail. The Eurotra system, which should be in service by 1986, will enable a typist to tap in a document in one language and a language expert to check the machine's translation on a second screen before printing it. Although Eurotra will not produce perfect translations - the complexities of syntax are just too great, says Douglas - it will allow the EEC to count out the people who do the first translations. Translators for some language combinations, such as Danish into Greek and Dutch into Greek, are particularly hard to find.

Working at a rate of around 10 seconds per sentence, the Eurotra system will run on a large computer to begin with, although Arnold says it would be possible eventually to put it on a microcomputer. (New Scientist, 15 December 1983.)

Metal stampings

A software-controlled laser system can effectively produce prototype metal stampings, according to TL Vanderwert, Data Card's Laserdyne Div. (Eden Prairie, MN). Prototype design changes can be accommodated with computer-controlled laser equipment simply by changing the tooling software, i.e., an NC program. In addition, laser machining makes it possible to produce a limited number of stampings while permanent dies are being fabricated. To be effective in prototyping, laser machining must be able to produce a finished product with characteristics equal to or better than die stamping parameters. Advantages include narrow curve capability and close tolerances, replacement of dies and tools with programs, easy parameter changes by altering the CNC memory, more efficient use of material, comparable equipment operating costs, and the ability to integrate laser machining into a total automated environment. Machine D, 10 June 1983, pp. 107-111. (Technology Update, 29 October 1983.)

Computers in fight against oil pollution

Computer simulations of the North-West European Continental Shelf tidal currents promise improved predictions for oil spill tracking.

Scicon, on behalf of the Department of Transport, the Department of Energy and the Offshore Pollution Liability Association Ltd. (an oil industry association which administers an agreement whereby offshore oil operators accept liability for pollution damage and the cost of remedial measures) has carried out tidal stream modelling with special reference to the Channel and Moray Firth regions. The databanks resulting from these simulations have been extensively validated, with reference to known data, and have been shown to reproduce accurately the observed current patterns. When used with Scicon's oil spill modelling program SCOOP, they provide valuable assistance in countering oil spills and locating coastlines most at risk from, for example, offshore oil operation.

Accuracy on information on currents has been a limiting factor in forecasting oil movements and the more detailed information produced using the results of Scicon's hydrodynamic modelling will give a considerable improvement over simulations using the hitherto sparse data available. Hydrodynamic modelling, used to generate tidal stream databanks, was carried out on one of the large mainframe computers at Scicon's Milton Keynes based bureau operation. Data on water depth, coastline definition and tide height required by hydrodynamic models was obtained from both British and French sources. Graphical techniques were used to speed the data input process. (Electronics Weekly, 7 September 1983.)

Computers trap polluters

When fish started dying in the River Frome, near Bath, United Kingdom, last July, no one knew why. But within hours of a sample of water arriving at the local water authority's laboratory, scientists knew the chemical responsible - trichloroethylene - and more importantly, the factory the pollution came from. The incident was a good illustration of the way in which new types of equipment, developed originally for medical laboratories, can help authorities trace and prevent pollution. The Wessex Water Authority, which covers parts of seven counties in southwest England, claims to have the most advanced equipment in Britain. The machine responsible for catching the trichloroethylene polluter was a mass spectrometer. It works by comparing characteristics of chemicals in the sample with more than 30,000 chemical "fingerprints" in its memory. It then prints out the name of the chemical. With old, manual methods, naming a chemical was possible only after a lot of repetitive work. "If we had worked on it for two months, we might have got somewhere", one scientist said.

Another weapon the authority laboratory has against pollution could provide the water analysis business with its biggest breakthrough since the work of Louis Pasteur. Gareth Jones, a scientific officer, saw an advertisement for a blood-testing machine and realized it could be adapted to spot bacteria in water. The machine consists of water baths for growing up to 112 samples of bacteria, and a computer which measures their growth by monitoring changes in their electrical conductivity. The results appear as a graph on a screen, and can spot seriously contaminated water in two to three hours. Even more interestingly, it is sometimes possible to identify a bacterium by the shape of its pattern of growth. But the scientists say they will need at least eight more months of development work before they can be sure. But they are confident that fewer people will get away with dumping nasty substances in the rivers. (New Scientist, 15 September 1983.)

Energy saver

R. Bristow, a British electrical engineer, found that a single chip microcomputer can substantially reduce the amount of energy consumed by electric motors. Just how much energy can be saved depends on many factors, including the size of the motor, its loading and how efficiently it normally operates. Bristow himself is cautious about making specific claims, but a reduction of 10-15 per cent is likely with relatively efficient motors. Officially known as the "Fairford System 3MC Module", this specially programmed microprocessor performs several functions formerly limited to much more complex and costly controllers for three-phase induction motors. In technical terms, the Fairford motor controller comprises a silicon chip containing the logic necessary to regulate the power applied to an induction motor according to the phase lag between the supply voltage and the current. By linking the power input of the motor to its load requirement in this way, energy can be saved. The Fairfold chip also provides for "soft start" (i.e. gradual start-up) of electric motors, detects loss of phase current, and eliminates starting in-rush currents.

The significance of this breakthrough is at least threefold. First, because it matches power input with load requirement much more accurately, it enables motors of smaller capacity to be used to perform the job now being done by motors of larger capacity. With large electrically-operated industrial machinery, this can add up to real savings in capital cost, and even with smaller motors, the savings will be substantial. Second, because it provides a number of forms of protection, including automatic shut-down in the case of overload, the Fairford motor controller will undoubtedly find use all over the world, it has special significance for developing countries. In recent years, although energy-intensive industries in the developed countries have achieved substantial savings in energy consumption through conservation and increased efficiency, Third World industries have not, for the most part, made nearly as much progress in this direction. Consequently, the motor controller offers them an opportunity for greater rationalization. Moreover, it has the advantage of being much less expensive than existing motor control systems: even produced in limited quantities for industrial use, it is only expected to cost around £30 (approx. $US 45).

Although the Fairford motor controller is small, can be made cheaply and looks simple, its development was no easy task. Bristow began working on it in 1979, collaborating with two computer software specialists at Plymouth Polytechnic and aided financially by the Intermediate Technology Development Group (ITDG), set up by E. F. Schumacher in the 1960s to help small industries in both industrialized and developing countries. Perfection of the device was to take seven man-years of hard work. When Bristow realized that his goal was within his grasp, he formed a small company, Fairford Electronics, to market the device. Sales promotion has just got under way in Britain and the company is now looking for partners in other countries. Understandably, Bristow is concerned that while needing to be large enough to serve growing markets in other countries, joint venture partners should not be huge conglomerates, or they may simply swallow up a small company like Fairford. At the same time, ITDG is working with Fairford in introducing the motor controller to developing countries.

Further information on the Fairford motor controller can be obtained from Brian Padgett at ITDG, 9 King Street, London WC2, United Kingdom, or from Ray Bristow at Fairford Electronics Ltd., Maynard House, 3 The Plains, Totnes, Devon TO9 5DR, United Kingdom. (Ward Morehouse, President of the Council on International and Public Affairs in New York.

Heating bills

Energy auditing is catching on almost everywhere. Although new homes are being built more energy-efficiently, old ones often need serious patching and padding. France's department of energy is subsidizing up to 80% of home energy audits there and in Denmark energy audits will soon be virtually compulsory for any house being sold. In America, all private utilities now offer energy audits virtually for free. Auditing a house can be done in various ways. Usually it's a pencil-and-paper affair with blanket recommendations, although in the United States some auditors use a large mainframe computer at their headquarters to do the analysis and Britain's Building Research Establishment is trying a similar approach.

The trouble has been that, typically, the householder does not act on the recommendations. Because he simply does not believe the projected savings or because he is unwilling to dish out money for longer-term savings. The CIRA (Computerised Instrumental Residential Audit) programme may change this. Its novelty is that it can be run on an inexpensive, portable microcomputer. This means that an auditor or surveyor who knows nothing about computers can measure up a home on the spot - with a lot of input from the home owner. The programme instructs the micro first to ask the surveyor and client a number of questions about the house: e.g. the type of fuel used for water and space heating, the direction that the house faces, the thickness and material of each wall, the number, size and condition of the windows, number of occupants at different times of day, and so on. Factors such as local weather patterns are already included in the programme. The computer then weighs up all the factors leading to energy wastage. A few minutes later the verdict is made; a print-out shows the recommendations for improvements. These take into account the cost of, e.g., roof insulation, the owner's budget and the period over which he wishes to recoup his expenses.

The detailed print-out also advises the client on which measures will save what percentage of his present bill. Listed, too, is the total amount needed to retrofit the house and the payback period for every measure taken.

The CIRA programme is accurate: fed with adequate information about a house, its estimates of how much energy that house will use compare well with its actual energy use. And since the client is so involved in the diagnosis of his house, the hope is he will be more inclined to take remedial steps. If so, the savings could be considerable. In America, buildings gobble up the energy equivalent of 14m barrels of oil a day. CIRA's developers say this could be halved if people followed their (and other auditors') advice. (The Economist, 17 September 1983.)

Clinic is calling on doctors

Doctors are to get a look at how computers could transform their surgeries by the year 2000. An exhibition called Clinic 2000 is to tour the United Kingdom to demonstrate how a computerized reception can cut down on administration work, allowing doctors more time with their patients, and how computers can aid clinical investigations. It will also demonstrate computer-aided diagnosis and online data banks containing information on different treatments and drugs. Doctors visiting the exhibition can try out any of the aids on show.

Over the next two years the exhibition will tour postgraduate centres, being updated as it goes. It is being run by a department of the pharmaceutical company Smith, Kline & French. The exhibition is purely for educational purposes. But it is based on a programme undergoing clinical evaluation at the Goven Health Centre in Glasgow. Smith, Kline & French has provided an educational service to the medical profession since the 1950s. It pioneered the use of colour close circuit television for medical purposes in the United Kingdom and later the development of videodisc aids. (Computer Weekly, 20 October 1983.)

From human hearts to microchips

People suffering from cardiovascular diseases can expect in future to benefit from some striking experiments now in progress at Stanford University in California. Scientists there have demonstrated the possibility of taking X-ray pictures which, free from the usual shadowing and interference caused by bones and other tissues, show in detail only the heart and blood vessels. And of doing so with less risk to the patient. ... The Stanford group, led by Dr. E. B. Hughes, has got around problems by using as an X-ray source a particle accelerator, a powerful electron synchrotron. A synchrotron can produce radiation in a range of wavelengths, from long wavelength infrared radiation to shortwave X-rays. Thus the wavelength of the radiation can be "tuned". ...

Moreover, synchrotron radiation is far brighter than conventional X-rays. This means that pictures can be built up line by line, each line being recorded in a fraction of a heartbeat, free from any blurring due to movement. Safety is also increased: lower doses of iodine can be administered into peripheral veins (eliminating the need for a catheter) and lower doses of X-ray radiation used. The Stanford team has successfully demonstrated the technique on animals, and is now creating a facility for human patients. Trials on human patients are expected to begin early next year. The snag, of course, is that synchrotrons are massive, expensive pieces of equipment. While, in theory, dedicated facilities could be created (at a cost of $10 m or more), the more feasible approach is probably to create angiographic facilities at the few centres that happen already to have suitable synchrotrons, and have patients travel to them. There is talk of creating facilities at Brookhaven in Long Island and at Hamburg in the FRG. In Britain, there is a machine near Warrington that could serve Manchester and Liverpool but there are as yet no plans for creating an angiographic facility there.

There are many other applications for the brilliant radiation of synchrotrons. Mostly these are research applications, ranging from studies of the surface behaviour of catalysts to the mechanisms of metal fatigue. But synchrotrons could also become tools for the manufacture of tomorrow's electronic chips.

Chip-makers developing the next generation of superfast computers need to print circuits with line definitions of a fraction of a micrometre (a millionth of a metre). Chip circuits are usually created by shining light through a mask on to a photosensitive coating on a silicon wafer. The trouble is that light - even ultraviolet light - has a relatively long wavelength, and this limits the definition of the lines it can draw. The powerful, shortwave X-rays produced by a synchrotron could produce much finer circuits. IBM thinks the synchrotron is a serious contender as the lithographic tool for the next generation of superfast microchips and a consortium of European companies is investigating the possibility, too, using a new synchrotron in West Berlin. Of course, what chip-makers need is a machine that can be used in the secure, clean controlled environment of their own manufacturing plants: a dedicated machine. Happily, that need not be so powerful as the machines needed for angiographs. Scaled-down synchrotrons, costing perhaps under $2 m each, are now being designed for the purpose. (The Economist, 17 September 1983.)

Computer muscle stimulation

Bio Medical Research of the Shannon Development Centre, Limerick, Ireland has developed a machine, which using a computer can help in muscle stimulation. This development, which so far has cost £1/2 m, promises to be of great benefit to paraplegics especially. The attachment is put on the skin in the same manner as the well-known Slendertone health and beauty aid. It feeds electric pulses to dead muscles or those which are not being used and causes reviving reactionary movements.

Bio Medical's main market is seen in the United States but strong interest can be seen coming from the Irish Athletic market. When Electronics Report spoke to Neil Cusack, former Dublin City Marathon winner, he said that he was very impressed with what the new development could achieve. Runners could be aided immensely in their warm-up and warm-down period and it could even be used to increase the speed of recovery after an injury. Bio-Medical Research Ltd., was established in 1975 as a subsidiary of Medical and Biological Instrumentation Ltd. (Electronics Report, Ireland, October 1983.)

U.S. patent office prepares to automate

Paperless operation by 1990 has become the goal of the United States Patent and Trademark Office, now that the hardware needed for the job is either on the verge of production, in the case of optical-disk storage, or uses technology already in hand, in the case of text and image processing. Those advances, in the view of John Bryant, the agency's administrator of automation, now make computerized storage of some 24 million pages of patent documentation feasible. The integration and correlation of character data with digital images also can be done, he says. But the necessary custom-tailored software, he adds, could cost up to $75 million, which is 22% of the $341.5 million budget for the eight-year project. The objective of his agency's automation, he asserts, is to enable patent examiners to guarantee the accuracy of patent decisions and to make them within 18 months. Now, decisions come in 30 months with something less than guaranteed accuracy because at any one time some 7% of the agency's files are missing.

Confronting Bryant's automation strategists when they started moving forward two years ago was the question of how best to convert a total of 4.5 million United States patents and 9 million foreign patents into machine-readable form. The answer: digitize the text of 2 million of the most recent United States patents and the pictures and diagrams of all 13.5 million. The immediate storage requirement is 60 billion bytes of character data and about 3 trillion bytes of digitized information: 37 million pictures compressed into 80-K bytes apiece.

Optical disks promise the density necessary for such an undertaking. With a 12-inch optical disk having a capacity of 1.6 billion bytes soon to be marketed by 3M Co. of Minneapolis, the patent office would need about 1,850 disks. Better yet, Bryant says, would be a disk capacity of 4 billion bytes, which would result in a very manageable 620 or so platters. That capacity advance should make Bryant's timetable. Scheduled for early 1984 is volume production of a 4-billion-byte model by Storage Technology Corp. of Louisville, Colorado.

For software, the agency will have to go beyond off-the-shelf programs. Current archival-based systems including IBM's Stairs, Battelle Memorial Institute's Basis, and General Electric Co.'s Gescan handle only character data. These firms could modify their software to incorporate digital image processing, but Bryant doubts whether any will agree to invest in what promises to be a one-shot market. So, seeking to avoid the cost of starting from scratch, Bryant has his hopes pinned on Chemical Abstract Services of Columbus, Ohio. It has spent $50 million developing software comparable to what the patent office needs. Although software is expected to pose the most serious obstacle to automation, Bryant predicts there will be hardware capable of performing some jobs that now can be accomplished only in software. For example, he sees the possibility of image data compression being implemented by a microprocessor-based system that is faster and less expensive than existing programs.

With its 18-month, guaranteed-integrity goal in mind, the patent office has specified the following performance requirements for the system:

- It must be fully available 99% of the time during the scheduled 11.5 on-line daily hours of operation and accommodate at least 90% of concurrent users in peak periods.

- Simple text and image searches should average less than 3 seconds, with 12 s at most for more complicated tasks. Additional pages should not be delayed more than 0.5 s after the initial display. These capabilities imply a local network running at 200 megabytes/s at least.

- Total recovery of a data base of 2 billion bytes should not require more than three hours. If a breakdown affects a file in use, recovery should take less than 10 minutes.

Still to be specified is the resolution of image displays. Going with 100 picture elements per inch versus 200 or 300 pixels/in. would make the system faster and cheaper, but it would sacrifice quality.

Putting together hardware and software configurations that meet those criteria will be the major task of the vendors that submit design proposals for the system later this year. The system contractor, the Mitre Corp. of McLean, Va., will issue recommendations by mid-1984. As Mitre conceives it, the modularly expandable architecture will be built around five subsystems, says William T. Bisignani, manager of the project (see "The patent office's five building blocks"). One of the more viable approaches, according to the company, would be to centralize the text storage but to localize the graphics storage.

With completion of subsystem installation and data-base conversion late next year, Bryant believes that computerization of all patents can be done between 1985 and 1987. During the next three years, final upgrades will be incorporated into the system to allow for truly paper-free operations. However, unless non-governmental users go to one of the 40 public patent depository libraries scattered across the United States, there will be no free access to the agency's data. The patent office plans to sell its search and retrieval services to private companies like Mead Data Central, the Dayton, Ohio, information bank. Mead, in turn, will charge customers dearly - about $100 per hour - to tap the voluminous patent files. (Electronics, 21 May 1983.)

The future of computers in education in the developing world (by Jamesine Friend *)

In some ways, the future of educational computing in the Third World will parallel what has happened in the United States. The first uses will be in administration and in the teaching of computer science at the university level, and only later will computer-assisted instruction (CAI) be used in other than small experimental projects. In other ways, the Third World is in the position of "leapfrogging": by taking advantage of technological changes that have occurred over the last 20-25 years, the developing world can enter into the field of computing at a more advanced level immediately. Not only hardware, but also software from the industrialized world can be used without going through a lengthy development process. Especially in administration and in computer science departments, ready-made software can be imported and put to use immediately. It is less clear that imported CAI programs can be used in the Third World, though, since the educational needs of developing countries differ from the needs of the countries in which such programs are now available. Before looking more closely at the possible applications of CAI in the developing world, we turn to a brief overview of the history of CAI in the United States.

Computers have been used in the United States for teaching for 20 years, providing individualized instruction that is both motivating and effective. The first educational programs were written for large mainframe computers which communicated with remote sites by means of telephone lines. One mainframe computer could serve many schools that were as far as several thousand miles from the computer center. Because of the high cost of telephone service, many schools began to acquire their own minicomputers. Although minicomputers serve fewer students, the lower cost of smaller computers plus the saving in telephone charges made them a viable alternative to central mainframe computers. The more recent microcomputer, with its even lower cost, has given new impetus to computer use in the field of education. There is hardly a school in the United States that cannot now afford at least one microcomputer.

Many of the educational programs developed for mainframe computers and minicomputers can provide students with daily lessons for months or even years. Some of the programs provide drill-and-practice exercises, which are meant to supplement a regular course of instruction. These programs derive their effectiveness from their ability to provide individualized instruction, offering each student the precise kind of practice needed to fully develop skills previously presented in the classroom. Another kind of program is the tutorial program which provides instruction as well as practice; tutorial programs are intended to provide complete instruction in a given subject, and are most often used by students who do not attend regular classes. One of the most attractive features of the tutorial programs is that students can study at their convenience, working at any time of day, and for any length of time.

A number of research studies have shown that both drill-and-practice programs and tutorial instruction can be very effective for many subjects and for a wide range of students. While drill-and-practice programs have been most common in elementary schools, tutorial programs have been used most often by high school or college students, or by adults who are not regular students. Drill-and-practice programs are characteristically developed r skill subjects such as arithmetic, grammar, spelling, and foreign languages. Tutorial programs have been used for a wider range of subjects: logic, computer programming, algebra, history, geography, statistics, physics, etc.

Several other forms of computerized instruction have also been used, although to a lesser extent. Intelligent computer-assisted instruction, which involves the application of artificial intelligence techniques, is a sophisticated development, promising programs that are more "knowledgeable" about both the subject matter and the individual student. "Artificial intelligence" refers to the capacity of the computer to simulate human intellectual and cognitive behaviour, which can include voice recognition and personalized responses. So far it has seen little application outside of a specialized, research environment, and much basic research is needed before intelligent computer-assisted learning replaces the more standard drill-and-practice or tutorial programs. Simulation programs are also very promising; in a few short, interactive sessions, these programs can provide students with experience equivalent to hours spent in the laboratory or field. Flight and driving simulators use a computer to control elaborate simulation equipment and provide training that would otherwise be more costly, more dangerous, and more time-consuming.

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* Jamesine Friend has worked in education for 20 years, with over ten years in the design and production of computer-assisted instruction. She was the Overseas Director of the Radio Mathematics Project in Nicaragua.

Dental and surgical patients have also been simulated by computer for use in training dentists and diagnosticians. These are elaborate constructs that simulate human reactions to drugs, blood loss, etc., in quite a realistic fashion. There are also simpler kinds of simulations which use a simple computer terminal to simulate experiments with rocket trajectories, chemical mixtures, life cycles of organisms, and so on. These simpler simulations are highly verbal, describing outcomes rather than providing realistic simulations, and although they do not provide the same kind of realism as the more complex simulations, they can be quite effective teaching devices.

Most of the kinds of programs mentioned above are implemented on mainframe computers or minicomputers. Some of them can be translated for use on microcomputers, although the smaller memory and storage space available in microcomputers precludes easy adaptation of the bigger programs.

Teaching programs for microcomputers are usually small efforts, aimed at providing game-like instructional activities to supplement teaching in specific topics. The programs are intended for occasional rather than daily use, and few guidelines exist to help teachers integrate the use of CAI programs into their planned curriculum. Only a knowledgeable and well-trained teacher can successfully select, from the miscellany of available small programs, a mixture that is well integrated with on-going instruction and well suited to the needs of individual students.

Not much research has yet been undertaken on the effectiveness of programs produced for microcomputers. However, one would expect greater variance in quality among the microcomputer programs than among programs for larger machines, primarily because small producers of microcomputer software are not subject to the kind of quality control that has existed in producing programs for mainframes and minicomputers. This works in two ways. On the one hand, some independent entrepreneurs have little interest beyond producing a marketable item which may have much immediate appeal but no enduring educational value. On the other hand, precisely because there is less bureaucratic encumbrance, some truly innovative and educationally knowledgeable people are producing excellent programs.

Although there are teaching programs that are remarkably effective, the decision to use a particular program must be based on its cost as well as its effectiveness. This is especially true for the developing countries that cannot afford to purchase expensive systems simply to improve the quality of instruction, much as they would like to. Since much of what is taught by educational computer programs could be taught by other means at lesser cost, no matter how good the computer programs may be, they might not be suitable for use in the developing world. This is not to say that all educational applications of computers are out of the question for poorer countries, but the decision to use them ultimately rests on their cost effectiveness, rather than simple effectiveness. It must also be considered that a program that is cost effective in the United States due to saving in labour costs may not be so in another country where teacher salaries are lower.

Even with cost in mind, there are several possible applications of computer-assisted instruction in the educational systems of developing countries. One of these is for remedial instruction, which has proven one of the most cost-effective applications of computers in United States schools. For any country that is now providing small-group instruction for students who are below grade-level, drill-and-practice by computer might, in fact, be quite cost effective. A potential problem with this application, however, is the development of suitable software. Programs that are designed for the United States are probably not suitable for most other countries. The content may not be appropriate; reading and social studies programs, for example, are specific to both language and culture. The style of instruction and format of programs may also be inappropriate; many of the programs now available for microcomputers are more concerned with motivation than with teaching, which may be neither acceptable nor appropriate in other countries.

Another cost-effective use of computers in education is in classrooms with low student/teacher ratios. This most often occurs in university classes on such advanced technical subjects as topology, thermodynamics, multivariate analysis, and econometrics. In some countries, there may be very few students for even less advanced topics, such as probability theory, differential equations, and organic chemistry. The cost of providing a qualified instructor for only a few students may well be higher than the cost of providing tutorial instruction via computer, especially if the programs can be used, and the development cost shared, by several countries.

A third, and even more promising, possibility is to prepare instructional programs that teach computer literacy and programming. There will be an ever-increasing demand in the Third World for instruction about computers themselves, and there are now few qualified instructors. Several successful experiments have shown that students can learn programming from instructional programs, even in the absence of a teacher. Here again, there may be only a few students in any one location (at least in the immediate future), so the cost savings would thus derive from sharing development costs.

To sum up, many of the common educational applications of computers in the industrialized world today will be in wide use in the Third World in the near future. Particularly likely to be transferred are microcomputers for drill-and-practice and for remedial instruction, and specialized technical courses by computer for advanced education.

Cost effectiveness is an issue that needs careful review, with local teacher salaries factored into hardware and software purchasing decisions. As more evaluations of programs and software become available, it will be easier for decision-makers to have a basis on which to judge and compare the merits and relevancy of various systems to their unique situations.

It is hoped that the United States experience with CAI over the last 20 years will be of value to developing countries, and that this experience may help such countries to avoid some of the start-up errors that so often go hand-in-hand with the introduction of any new technology. (Reprinted with permission by Development Communication Report *.)

SOFTWARE AND COMPUTER EDUCATION

Software rentals

For personal computer buffs, some of the ads in magazines are irresistible. "Feel like a kid in a candy store," says one, offering rental of software programs at one-fifth their purchase price. Another beckons with: "Try before you buy.... Eliminate the risk - Rent first." Such are the pitches of more than a half dozen rental companies, most of them formed in recent months. But attractive as the ads might seem to consumers, the offers make software publishers see red. Their personal computer programs are easily copied, and the publishers say the rental business amounts to piracy. One market research consultant, Jean L. Yates estimates that piracy and the already troublesome informal copying of personal computer programs could drain as much as $500 million in annual sales from software companies.

With that much to lose, the industry is looking for protection. But so far lawyers have raised as many questions about software ownership as they have answered. Now, however, what is believed to be the first United States suit on the rental issue may begin to define the law. Last month MicroPro International Corp., a major San Rafael (Calif.) software producer, slapped a piracy suit on one of the most aggressive advertisers, United Computer Corp. MicroPro, the developer of WordStar, a word processing program that has 45 per cent of the world market, is a strong standard-bearer for the industry; United, based in Culver City, Calif., vows to mount a tough defense of the rental business. MicroPro's suit, in federal court in San Francisco, charges that United is infringing its copyright and violating its licensing agreement. "A substantial number of defendants' rental customers have copied and are continuing to copy (MicroPro's software) without authorization," the suit alleges, adding that "the commercial success of defendants' software rental business is predicated upon the unlawful copying" of software...

Chief among the thorny legal questions is whether the software industry's licensing system, developed by International Business Machines Corp. and used by most publishers, is valid. The license, packaged in each piece of software, declares that the buyer of software

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* Development Communication Report, published quarterly by the Clearinghouse on Development Communication, has a circulation of over 5,000. The newsletter is available free of charge to readers in the developing world, and at a charge of $US 10 per year to readers in the industrialized countries.

A center for materials and information on important applications of communication technology to development problems, the Clearinghouse is operated by the Academy for Educational Development, a nonprofit planning organization, and supported by the Bureau for Science and Technology of the United States Agency for International Development as part of its program in educational technology and development communication.

is purchasing only the right to use it. Ownership, it is claimed, remains with the publisher, and the user cannot legally give or sell the program to anyone else. Because United is not an authorized MicroPro dealer the publisher views it as an end user. (Business Week, 1 August 1983.)

FT makes its first move into software

The Financial Times moved into the software business last week with the launch of a financial modelling package for 16-bit micros. The package, called FT Moneywise, was developed by Moneywise Software Limited (MSL), a small independent company set up about a year ago. MSL took the package to the FT because it decided the average reader was the type of user it wished to reach. The two companies have established a joint marketing agreement. The FT intends to launch other packages and Simon Bisson, of MSL, said: "We will be taking more products to the FT including enhancements to FT Moneywise." He emphasized that although the FT was endorsing the product, it was in no sense badge engineering.

FT Moneywise has been recognized by the National Computing Centre, which has awarded MSL £350,000 through the Department of Trade and Industry's software products scheme grant.

The Financial Times claims that FT Moneywise is 10 times faster than competitive products. It will initially be available on the Sirius and the IBM-PC, and there are plans to adapt it to other micros. It costs £395 plus VAT. Last month the FT announced a tie-up with ITT to establish an electronic business news service, International Financial Intelligence. (Computer Weekly, 24 November 1983.)

Chinese software fills gap

China has developed its own computer software for design and analysis of offshore structures. The system is called DASOS-JIGFEX-Design and Analysis System for Offshore Structures based on the China-developed general-purpose structural analysis programme, JIGFEX. DASOS-JIGFEX is the result of co-operation between the Dalian Institute of Technology, the Scientific Research Institute of Oil Exploitation and Development and the Design and Research Institute of the Bohai Oil Company, headed by Professor Zhong Wanxie, of the Dalian Institute. It still fills gaps in China's computer software, and will be especially useful in designing offshore platforms.

Zhong Wanxie said: "Platforms account for 50 per cent of the cost of offshore development but with the help of this machine, China can save large amounts of foreign exchange in the joint development of offshore oil with foreign companies." The new software increases China's competitiveness in bidding on offshore oil development contracts at home and abroad. He added: "Our tentative enquiries to buy or lease computer programs from foreign companies were turned down - they even refused to talk to us so we decided to develop our own system." (Electronics Weekly, 7 September 1983.)

"User-defined" software

Mr. Nettig, owner of Photo-Nettig (Austria), a retail chain dealing with films, cameras and other photographic equipment, developed an EDP model for the retail business. With the basic concept Mr. Nettig went to IBM and had his model tested for suitability in a concrete situation. As a result Mr. Nettig was invited to present his model to a forum of data processing specialists in Brussels in September this year. Interested retailers from abroad are already applying for the Nettig-IBM model to reorganize their business. The advantage for Photo-Nettig is clear: his pact with IBM is based on especially favourable conditions and his organization has gained a competitive edge over others thanks to IBM know-how. Also, commission fees will be paid to Nettig as the original inventor of the EDP model. One of the biggest photo retailers in Mexico has decided to install the new system. Firms in the FRG are also negotiating for the system. The system supplies important sales information every hour. Special sale and discount offers can directly be fed into the cash registers of all branches so that customers pay the same price for a specific product. (Excerpted from Kurier, 14 October 1983.)

Researchers cash in on artificial intelligence

Academics at the universities of Bath and Cambridge stand to gain financially from a venture that will sell advanced computer systems to the United States. Metacompco, a software company in Bristol, aims within the next year to sell 1000 software packages based on the principles of artificial intelligence, the general aim of which is to make computers operate in a way similar to the human brain. The software is written in a form of LISP, an advanced processing language, that researchers at Bath and Cambridge developed. Under a complicated arrangement, royalties from each sale will go to the academics who have had a share in devising the language. Further payments will go to researchers at Cambridge who developed a set of basic software principles called TRIPOS. This forms what is called the operating system of the machine. The software should prove attractive to researchers in artificial intelligence in academic institutions. Other customers could be doctors who want to construct "intelligent" data bases to help them diagnose diseases. Because of the way LISP is structured, it is useful in applications in which a computer has to draw upon a store of established information, in much the same way as the human intellect taps the vast array of details locked away in the brain. Such applications include making sense of ordinary speech, a task beyond most of today's computers. These machines require that data are presented to them in special formats that bear only a passing resemblance to English...(New Scientist, 10 November 1983.)

Why fifth-generation languages?

Declarative languages such as Prolog and Lisp allow a programmer to define a desired result without concerning himself about the detailed instructions of how it is to be computed. Unlike conventional languages such as Fortran and Pascal, they are well-suited to parallel-processing machines because program evaluations can be run in any order without regard to sequence. Aside from the performance advantages of parallel processing, declarative languages offer a solution to the software crisis. They are shorter and more concise, more powerful and understandable than present-day languages, say their proponents. Furthermore, programs can be first written for clarity, then greatly speeded up by program transformation, a task that can be mechanized. Prolog is best known in Europe as the language Japan chose for its fifth-generation computer project. It is derived from formal deductive logic, the groundwork for which was first laid by Aristotle with his syllogisms. In a more modern guise, such deductive logic is the basis of set theory.

But there is another class of declarative languages of which Lisp and Imperial College's Hope are examples. These languages comprise sets of equations by means of which a required function can be defined in terms of simpler, more primitive functions. The idea is to decompose the original statement into simpler tasks that can be easily executed in parallel by the computer. To determine factorial n, for example, all its product terms (n, n - 1, n - 2 ...1) are first generated, then product pairs are successively multiplied until the expression has been reduced to a single term. Any such reduction process can be expressed as a tree network, each node of which represents a computation. In Alice, there is a data packet for every node in this network.

That is the way it is supposed to work. However, there are many problems that are still to be overcome. One is the need for suitable hardware, because these languages run slowly on a conventional machine. Another problem is how to interface such languages - which have no sense of time and sequence - with a real world dominated by both. (Kevin Smith in Electronics, 24 February 1983.)

IBM Research Lab is working on development of a new computer language that would not require the programmer to detail every instruction in a program. J. Backus, a codeveloper of FORTRAN, says that a new kind of language framework is needed, which is very logical and carefully constructed according to well-defined rules. E. Soloway of Yale University is studying how beginners actually write programs, in order to determine how languages should be written to avoid common mistakes. Soloway says that algebra-like programming will be extremely difficult for the average person. Backus hopes to develop sophisticated programs that the user can combine at will. Such a language could be ready within a few years. Soloway's language is 5-10 years in the future. About a dozen errors that novice programmers make repeatedly are being used to determine the thought patterns that people bring to a problem. Soloway feels that users should be able to see the step-by-step execution of a program, whereas a functional language would hide the steps and make it more difficult for users to understand what is going on. S. Papert, creator of LOGO (a programming language for children), fears that some of the habits being created today may not be good in the long term, as new technologies and languages are developed. (Technology Update, 15 October 1983.)

Inmos sets its heart on Occam

Inmos, the state-backed chip maker whose future has been the subject of recent speculation and controversy, is pushing ahead with plans to sell its programming language Occam. An evaluation kit for the language has been bought by several hundred software development organizations round the world since its release last December. Now Occam moves from the experimental stage towards the marketplace with a set of tools to be called the Occam Programming System, providing support for real time systems designers. Occam was the brainchild of Professor Tony Hoare, director of research at Oxford University, and Inmos's David May. It is based on the principle of concurrent rather than sequential operations which Inmos says is vital for the fifth generation of computers. The language has been exciting a lot of interest in Japan. The arrival of the toolkit could help to bring Occam from the academic world into the commercial world. (Computer Weekly, 28 July 1983.)

A fundamental language

Programming languages are a major obstacle to the use of computers in Third World countries. Even the so-called "high" programming languages like BASIC, which are closer to everday language, present difficulties in that they are - to varying degrees - symbols based on European tongues. Programming languages are therefore twice removed from the Third World user.

The Japanese have come up with a solution - a computer programming language translatable into any world language. Called AFL (A Fundamental Language). It is a symbolic system with uncommitted symbols that can be assigned any values in any language. The programmer types his instructions in his mother tongue. The information is then handled by a translating and editing unit which processes simple sentences and prepares them for the computer. It is higher than the highest languages in use, since it does not require the user to programme the computer directly. Data may be entered in any shape or form.

Not only is AFL a translatable language, it reduces the need for training programmers, Matsuhita, which is marketing AFL in Japan, plans to make it available in other languages before the end of 1983. Arabic and Korean software is already in the pipeline. (South, May 1983.)

Wang picks its words

Wang Laboratories has picked up the world-wide electronic publishing rights to some major reference books through a merger with Dictronix. The Concise Oxford English Dictionary and Roget's Thesaurus are among the standard reference texts which will now be linked in with Wang's office automation software. (Computer Weekly, 13 October 1983.)

Macmillan links with Sinclair over software for children

Publisher Macmillan moved from the era of Kipling and Henry James to that of the ZX81 and Spectrum recently. And 89-year-old former Prime Minister Harold Macmillan made an appearance to bless the new alliance with Sinclair Research. The occasion was the launch of a new range of software for five to 12-year-olds by Macmillan and Sinclair. The first programs of the series went on show at the Schools Computer Fair at a London hotel. Opening the show, Roger Watson, chairman of the Education Publishers Council, urged the government to give every secondary school £400-£500 to spend on software. One of the main suppliers of computer suppliers to schools, Research Machines of Oxford, has said it will give £1,800 worth of programs to any school that buys its RML chain network system. Meanwhile, its rival, Acorn of Cambridge, the BBC micro maker, has strengthened its expertise by taking over ICL's schools division. The team of six was set up to produce books on computers in society, but has since branched into writing software for the classroom. It is to be integrated into Acorn Computers Education Services. (Computer Weekly, 17 November 1983.)

CAD may not last as single market

Computer aided design is on the way out as a single market. The needs of CAD/CAM users are changing, says United States CAD giant Computervision, and different market sectors are demanding different products. "We serve a series of industries," says Computervision president James Berrett, "and used to offer machines with generic capabilities. As a supplier we now see industry-specific requirements developing. This will continue to drive generic standardization out as there is more specialization." CAD/CAM systems must be able to manage design information too, adds Berrett. It is not enough just to have the core capability of creating design and manufacturing information. The ability to control the information will grow in significiance. To meet the requirements of the diverging applications, Computervision is hiring industry specialists to tailor products to meet the particular needs. For example, aerospace now wanted something completely different from the automotive industry, Berrett added. "This is not a mature industry, so we must stay abreast of its needs." Over 1,000 of Computervisions's 5,000 staff are involved in research and development, and the company devotes between 12 and 13 per cent of its turnover to R & D.

The company has given $25 million in CAD/CAM equipment to universities and colleges in the last five years, so that people will come out with the right training. In the United Kingdom, Computervision has very close ties with Warwick University, which has a CAD/CAM course. (Computer Weekly, 20 October 1983.)

New concepts in CAD/CAM - an analysis of trends

CAD/CAM is clearly one of the most dynamic growth areas of the computing industry. But it is surprising how the different manufacturers and software suppliers see the trends moving in different directions. CAD/CAM seems to be moving towards networks, towards micros, towards host systems and towards turnkey systems depending solely on the products of the supplier concerned. Two things that are certain are that the industry is largely software driven, and that integration as a concept is just beginning (though still on its own CAD drawing board).

Norsk Data, however, takes the integrated approach one step further. Phil Nadin, marketing manager explained: "Having formulated the integrated approach to CAD/CAM technology, Norsk Data is looking to develop further growth areas, particularly in the mechanical, electronics and civil-structural engineering markets. "Long-term goals include further investigation into the field of artificial intelligence as it relates to the CAD/CAM market by refining the concept of the 'expert system'. "Building design rules and high engineering principles directly into the software program itself would give the draughtsman access to knowledge associated with senior engineers, improving project efficiency by raising the skill level of all professional designers and development engineers. "In short," he continued "Norsk Data approaches the CAD/CAM market with what amounts to a strategic planning concept for manufacturing concerns, rather than a specific range of dedicated products. Integrated software tools coupled with powerful machines will prove to be the way ahead for design activities in the future."

Pafec is one of the recognized software leaders in the CAD/CAM area. Ian McKenzie, Pafec CAD manager, told us that he is "about to announce new products in the areas of computer-aided numerical control and three-dimensional wire frame modelling. Later next year we shall also be releasing products specifically tailored for the architectural and reinforced concrete design areas."

In the meantime, McKenzie feels that CAD/CAM buyers do not always make sufficient demands on the would-be supplier. "Many companies," he explained, "still present the CAD/CAM supplier with a checklist - and are satisfied if he is merely able to tick off an item such as finite element analysis. "It isn't always realized that this is an extremely complex subject. Just because the salesman claims his product can do it, doesn't mean it can support or is even properly interfaced to the draughting and design functions. "It is only slowly that the buyers are beginning to appreciate the full complexities in CAD/CAM requirements, and the differences between different types of three-dimensional modelling; between wire frame modelling, solid modelling, and surface modelling." The real solution he feels, may rely on "attending a training course, or insisting on a trial rental from one of the suppliers".

Harris Systems is one of a large number of hardware suppliers that support Pafec software. Jonathan Long, Harris marketing specialist, sees a "CAD/CAM market trend away from turnkey systems to larger, more flexible supermini host based systems with low-cost workstations. This trend is being driven by disappointing performance from the heavily loaded turnkey system, a growing need for a large and integrated database, and the need to share the CPU with non-CAD/CAM applications."

Another supermini supplier is Digital Equipment, which is never backward in its claims. "We estimate", said marketing specialist Bob Grindley, "that sales of DEC computers bought to run CAD/CAM software rank us as the number two supplier for CAD/CAM systems in the world - but if you add to this the number of DEC computer components included in turnkey systems, we are undoubtedly the clear market leader." Digital Equipment has never considered itself a major applications software supplier, preferring instead to enter joint marketing agreements with the leading third party specialists. "But, said Grindley, "DEC will continue to produce the generic tools that aid integration and where appropriate, we will market relevant application software. In short, Digital Equipment will provide the environment for systems builders to design integrated CAD/CAM systems. "The pressing priority for all CAD/CAM users must be the integration of CAD/CAM with the rest of the manufacturing process. The benefits from this are likely to yield savings that far outweigh the gains that can be achieved by automating any of the functions individually." Ferranti

Cetec is one of the companies with which Digital has a marketing agreement. Keith Nichols, product marketing manager, feels that theory is far outstripping practice. "The CAD/CAM marketplace," he explained, "is being driven by the market analysts who are setting expectations far in advance of current technology. For example, we have recently seen the CAD/CAM concept being taken rapidly through CAE (computer aided-engineering) and on towards CIM (computer integrated manufacture), which provides a framework for product design right through to factory automation." Nichols does not deny the desirability of these concepts, or even that they will eventually come. But he fears that "in their desire to keep pace with these market expectations, some vendors have attempted to expand their system capabilities at the expense of diluting their support services".

Finally, we must give some mention to the microcomputer market. So far, it effectively covers CAD only - but who knows in the future? Mike Bayfield, founding director of Interactive Graphics, believes there are many companies which need CAD/CAM facilities but cannot afford the large systems necessary. "Many of the current micro-based CAD applications suffer from performance limitations, since hardware that may be sufficient for business applications is not adequate for the number-crunching requirements of effective CAD work. "At present, the market is waiting for the arrival of 32-bit micros with suitable working software and when this happens there will be a stampede to move the proven CAD software from the powerful minis and mainframes down to the new micro systems. "In the meantime," he continued, "Interactive Graphics is providing an interim solution with its own bit-slice processor coupled to a CP/M microcomputer." This graphics processor was designed so that CAD software developed during the last 10 years or so by British Rail could be moved straight on to it without change. "Overall, it has provided mature CAD software with the required level of performance, but on a system that is compatible with the vast CP/M applications library - and all of this for a cost of little over £17,000 on a hard disc micro."

Hytech Consultants is also part of the micro market. We asked Ron Lee, managing director, if he thought that cheap micro CAD systems such as Interactive Graphics' Brightpad and his own Micro-Designer might not lead to mass unemployment among draughtsmen. "No," he replied, "because there is already a shortage of good design draughtsmen even in today's recession. Our experience is that companies use CAD systems to improve the service offered and the quality of work rather than to cut down on the number of draughtsmen." So we levelled the suggestion that a CAD system can only be as good as the programmer, a discipline that is surely much different from that of the draughtsman.

"This assumes that there is a reduction in the level of skill necessary to use a CAD/CAM system. It also assumes that a programmer is less of a craftsman than a design engineer. Both assumptions are wrong. A computer system is unable to provide any design input, it is simply an aid. "The designer's knowledge, flair and skills are still required - but he also needs to learn the new techniques of designing with a computer for an assistant." (Reprint with kind permission of an article in Computer Weekly, 1 December 1983.)

CAD/CAM takes over the factory floor

Just as manufacturers have come to realize that word processing is only a part, albeit an important part, of the overall concept of the automated office, so are they now realizing that CAD/CAM is but a part of the automated factory. Indeed, some manufacturers are now taking the concept further by claiming that the automated manufacturing process includes both the automated office and the automated factory. The move towards this new integrated approach started in the early 1960s with computerized numerical control machines.

Dennis Papworth, Data General senior marketing specialist for CAD/CAM and industrial automation, explained the development. "In those days," he said, "automation consisted of a lathe that might have a punch tape controller. A programmer would write a system to control the lathe - a method that, in modern terms, was arduous, difficult, lengthy and expensive. The breakthrough came with the arrival of minicomputers at a much lower cost than the traditional mainframe. "With high level languages like Fortran it became easier for companies to automate the manufacturing environment - process control, machinery control, and so on. At this stage the two leading lights in the minicomputer world were DEC and Data General. "From then on," he continued, "we have seen a steady process of evolution. More and better software is becoming available on cheaper machines. Where only the British Aerospace and ICIs of the world could afford the £1 million-plus necessary for mainframe CAD/CAM (and still do, of course), now even the smaller company can afford CAD/CAM on £10,000 micros... In the meantime, other manufacturers are equally active, and all are beginning to pursue the automated factory concept.

A few weeks ago James Berret, president and chief executive of market leader Computervision, visited the United Kingdom to explain his company's recent moves in the market. "During the past several months," he announced, "we have made a number of agreements, associations and acquisitions, including that of Cambridge Interactive Systems from your country and Grado of the FRG, as well as the Organization for Industrial Research from Massachusetts. "We have also signed an important technology-sharing agreement with Sun Microsystems of California," and last, but not least, "a major contract with IBM."

He went on to explain the significance of these acquisitions. And the picture he drew was one of a growing realization that CAD/CAM, Computervision's own speciality can no longer be viewed in isolation from the rest of the factory.

"CAD/CAM systems," he explained, "were originally conceived to make the engineer's job easier ... that vision has been realized." Now, he continued, "our customers have told us that they want to give their entire engineering staff access to an extended range of CAD/CAM-related capabilities. For example (the engineer) may want access from his terminal, through a communication network, to manufacturing cost data so that he can select the most cost-effective part or material for a particular job. Or he might want to use some office automation capabilities such as word processing to prepare specifications or reports on his work. In many cases, his activities will generate conceptual design information which will be used at a later stage in the product design and manufacturing process. For example, an electronics engineer might use his engineering workstation to complete a logic design, then pass that information through a communications network to a CDS 4000 system where the printed circuit board layout will be completed."

Hence the agreements and acquisitions - with Sun Microsystems for the networking capabilities; and CIS and Grado to produce new software for the new concept. And to bind it all together into the automated factory is IBM. "By integrating selected IBM hardware and software into a complete Computervision systems solution, we will be able to provide not only the capability to create new engineering and manufacturing information, but to manage and control that information as well."

Chasing the same concept, but from a different starting point, is Hewlett-Packard. HP already has the necessary hardware and communications capabilities. "Now," explained Mathew Wallis, third party marketing manager, "HP is actively seeking the best of the market's CAD/CAM software to go on to our MPN." MPN, it must be explained, is the HP Manufacturer's Productivity Network, a vast and ambitious project that aims to integrate four separate manufacturing areas of administration, CAE, factory and plant automation, and operational planning and control systems. "To achieve this," continued Wallis, "we need a networking approach where different users can share common peripherals, like plotters and large discs. We've chosen an Ethernet network, which is working now, but are slowly working towards the ISO-recognized IEEE 802.3 standard. This is an Ethernet compatible baseband standard that should be available by the end of 1984." At the heart of this new approach is the proprietary Focus 32-bit chip. This has enabled HP to develop its primary CAD/CAM workstation, the HP9000; in concept a supermini, in size virtually a desk-top micro.

One third party software developer commented that he could get "about half a Vax from the 9000". Below this is a 68000-based microcomputer that is virtually used as an entry-level device into the MPN. With this hardware "our strategy", continued Wallis, "is to use third party software as much as possible. We accept that industry standards already exist, and we want to ensure that those standards are available to our own users. "Today, we have to accept that software very much drives the selection of hardware. You cannot simply market boxes any more. People don't buy boxes - they buy solutions. Our aim is to provide those solutions in an integrated and automated manufacturing environment." (Reprint from an article in Computer Weekly, 1 December 1983.)

CAD cuts airport design time

The application of CAD techniques to the design of Heathrow's fourth terminal cut the time taken to do the job by a year, according to Ken Gilham, of Scott, Brownrigg and Turner, the architect on the project.

The application of CAD techniques to the project began in 1979. During design work, about 1,500 drawings were produced in 13,000 workstation hours. Gilham said: "Using CAD techniques doesn't affect the conception or the design. But it does help enormously with the speed of response in terms of producing drawings." But he added: "The techniques do aid design by giving a more powerful tool to the designer. They make it easier and faster to make alterations on a drawing." It is not possible to assess at the moment how much money has been saved by using CAD techniques. "The cost of each stage of the project is being closely monitored and when it is finished we shall go back and try to estimate what the costs would have been without the use of CAD," explained Gilham.

He suggested that the success of CAD techniques on the Terminal 4 project will mean building sites are computerized before long. "Instead of generating all drawings in the architects' offices a disc will be sent to the site and the drawings produced there." (Computer Weekly, 28 July 1983.)

CAD for building industry

A team of researchers at Sydney University claims to have reduced the price of computer aided design (CAD) with a new system developed for the building industry. The university's Department of Architectural Science said the system would reduce the cost of installing a computer to carry out architectural drafting by more than two thirds.

The Interactive Computer Aided Drafting System was designed by Associated Professor John Gero, director of computer applications research unit in the Department of Architectural Science, and Andrej Sambura, a research fellow in the department. The university has been approached by two Australian companies interested in manufacturing the system and one United States company interested in marketing it.

The system was designed with Australian building codes and conversions in mind, but its designers claimed it can easily be modified for overseas codes. The two designers said they had been able to slash the cost of CAD by developing a system specifically for the building industry. (Electronics Weekly, 5 October 1983.)

CAE

The computer-aided-engineering (CAE) market, will explode to $60 million in 1983 vs $19 million in 1982, up 65 per cent/year to 1987, according to Dataquest. Much of this explosive growth is due to the great demand for design automation capabilities in electronics, particularly ICs and PC-boards. Engineering workstations give electronics design engineers desktop access to powerful software tools that automate the tedious and error-prone process of designing the complex chips and systems used in modern electronic products. The advent of 16- and 32-bit microprocessor-based desktop computers has given designers access to the mainframe and minicomputer-based software tools on an individual basis. Xerox, one of several big firms rushing to compete in this market, offers electronics design twists to more general purpose workstations, while Hewlett-Packard has introduced its 32-bit HP 9000 microprocessor and plans 3rd party electronic design automation software for it, and Digital Equipment is licensing many electronic design software tools, including packages from Phoenix, Silvar-Lisco, NCA, and CGIS. Offsetting the tremendous optimism based on CAE's growth potential is the propensity for chaos in the end-user market. Once the market settles down or shakes out, there will be several long term effects on the electronics industry, e.g., changed relationships between IC vendors and customers that will have workstation design power to produce or specify proprietary IC designs; and the reduced time needed to bring an IC design through developmental phase to the market. Elec.Busns. 9/83, pp.90-101. (Technology Update, 17 September 1983.)

Computer aided engineering station

Computer-aided engineering system is said to be the first commercially available system that allows an engineer to create a logic design and continue the design process through to the creation of VLSI circuits. Called SCALDstar, the design station features two high-resolution graphic CRT displays: a colour display for presenting the design topologically, and a monochrome display for use in logic design. Once a schematic has been entered, a set of computer programs perform verification procedures throughout the design process. The programs include a compiler, timing verifier, simulator and post-processor. These software tools allow the user to simulate a design and perform worst-case timing analysis before the cells in the topological design are created. As design rule checker tests the layout against the process design rules, providing immediate feedback to the designer and catching errors before they proliferate throughout a chip. Circuit connectivity is extracted from the layout and the logic diagram and then compared to insure that the design is correctly implemented in silicon. Typical price for the system is $70,000. Valid Logic Systems, Inc., Sunnyvale, Calif. (Semiconductor International, August 1983.)

UKCCD sponsors training course on IT training centres

The UK Council for Computing Development (UKCCD) is a professional, non-profit making organization, with the objective to foster, co-ordinate and direct support by the UK for developing countries in the development of their own computing capability. It will organize a course on the 'Establishment and Managements of Information Technology Training Centres' at the Polytechnic of Central London from 4 June to 20 July 1984. The course is aimed at directors or senior executives in existing or proposed public or private computer training institutes in developing countries. Further enquiries should be addressed to Professor Y. Paker, The Polytechnic of Central London, 115 New Cavendish Street, London W1, England.

Dawn of the microchip university

Entrepreneurs in California are preparing for the arrival of the world's first electronic university. A company called TeleLearning Systems is introducing a telecommunications system to owners of personal computers. Initially, it will provide 170 courses, available 24 hours a day, through an electronic "mailbox" that will link professors and students. TeleLearning executives hope to interest people who do not have the time or ability to attend traditional courses at technical schools or universities. Any owner of a computer can buy from TeleLearning a "knowledge package", consisting of the software, telecommunications hardware (a modem) and a course catalogue. The cost: between $100 and $230. Courses cost a further $35-$150, depending on the course and the instructor.

The software allows easy communication with TeleLearning's host computers, which in turn will automatically file lessons, including graphics, in the student's computer. At the other end, a student's work will be stored at TeleLearning's electronic mailboxes until the instructor gets to it. At certain times, both student and instructor can communicate directly. According to Ron Gordon, TeleLearning's chairman and ex-head of Atari, a maker of video games and small computers, TeleLearning is negotiating with universities to win official recognition for courses taught by their faculty through TeleLearning's system. TeleLearning's executives plan to market the package at electronics and department stores and are drafting an international marketing plan to sell it abroad. The package will operate on most personal computers, and courses are being written in several languages. TeleLearning has won fans in Washington: the United States government's secretary of education endorsed the concept last week. (New Scientist, 22 September 1983.)

Computer crooks

Microcomputers just had to produce some new crimes. An increasing number of companies, especially in the United States, are opening their offices in the morning to find someone has violated the office computer overnight. A "hacker" sitting at home has dialled into the corporate databank and has either stolen information or has left the digital equivalent of his calling card. It recently happened in Britain in a very public way, when people wheedled their way into British Telecom's Prestel system and left messages - clean ones, fortunately. Another criminal side effect of the computer boom is the theft of software. Someone buys a software package for a few hundred pounds - same number but different currency if you are in the United States - and passes copies on to friends with compatible computers.

Both these difficulties are more a symptom of sloppy practice in the computer business than growing criminality. It isn't difficult to prevent data theft, you just have to be a little bit clever. You can even protect software from the pirates, thanks to the arcane art of cryptology... (New Scientist, 20 October 1983.)

British firms move against software pirates

British computer companies are banding together to produce a foolproof method of preventing the pirating of software for personal computers. Twenty firms met at the National Physical Laboratory (NPL) in Teddington, West London, to discuss building a prototype device for coding programs that will be unbreakable. NPL and the British Technology Group plan to pay about £50,000 towards the cost of research, and they expect some 10 commercial firms to contribute another £5,000 each as a subscription to the scheme. NPL already runs two similar "clubs": the Key Club for data encryption and the Speech Club, which researches into making computers understand the voice of human beings.

Brian Wichmann, the project leader, said that firms were reluctant to produce software for personal computers because of the risk of their programs being stolen. Wichmann said: "Over the next two or three years, with the arrival of 32-bit micro-processors like the Motorola 68,000, it will be possible to run the sort of complex software on personal computers previously only available on mainframes. Many companies feel they cannot produce that software without proper protection," he adds. The NPL intends to produce a box which will plug into the back of a personal computer. Programs will be encoded before they are sold, using a system called public key cryptography. The box will contain the key to the code.

A British company called Open Security Systems has already produced a similar device, although Wichmann says NPL plans to produce a cheaper, simpler deciphering machine costing around £100 each. The specifications of the machine have not been settled. "Those who came to the meeting are now deciding exactly what they want," said Wichmann. But the device will not be used to protect computer games - it would be too expensive. Instead the aim is to use it for much larger computers containing more than £1,000-worth of business software. (New Scientist, 6 October 1983.)

ROBOTICS

New Developments in Manufacturing Technology

Four principal technologically based systems are being implemented worldwide in manufacturing operations. They are discussed below.

Robots

A new generation of small and relatively inexpensive robots is in use today. The biggest users are major mass producers like automobile companies or machine tool companies. In the United States, only 4,000 robots are in use today, compared to Japan, where some 14,000 are in use. The range of tasks the robots perform is wide - and applicable across the spectrum of manufacturing. A single robot can typically be fitted with a variety of heads to enable it to pick up, reposition, lubricate, drill, weld or paint. Such multi-purpose robots illustrate a key characteristic of the present trend of automation, which separates it distinctly from earlier attempts: flexibility. In place of the very expensive, rigidly specific machines of the past, manufacturers can now purchase a range of options. Thanks primarily to microprocessors, automation payback is now no longer a question of single-product production volume as it is of function throughput - and with multiple-function capacities, the opportunities for using such machines are markedly increased. It is no longer necessary to justify machines in terms of a single product or even a single process. With decreasing microprocessor costs, such economies, accuracy and volume as were once the domain of large scale manufacturers become accessible to the smallest batch producer and custom shop.

Integrated Flexible Systems

Many robots today are working side by side with human labourers, eliminating human participation in the hazardous, unpleasant, highly routinized or particularly difficult jobs. Such integration is a first step, but it limits production to human capacities. The sequence of manufacturing processes is limited by human abilities, especially speed. Clearly major productivity increases require going beyond human speeds, accuracies and staminas. Programmable controllers can oversee several machines, providing substantial benefits. Texas Instruments cites a 33% increase in productivity, dollar savings in production, and improved accuracy in thermostat calibrations, for instance. The next step beyond individual robots is the integrated manufacturing system, combining automated manufacturing processes with automated materials-handling and process monitoring. Here too, as with robots, the key to the future is flexibility. To be feasible for most of United States industry, such systems must deal with frequent shifts from one product to another.

In both robots and integrated systems, the key to efficiency is careful coordination - of materials, machine utilization, sequencing, inventory removal, and the like - to insure maximum machine utilization.

Automated, computer-monitored job-shop systems are already in place today. They typically consist of a group of general machine tools, integrated with materials handling systems to perform a sequence of operations on a number of different products under computer direction.

CHART 1

Generally Accepted Fundamental Assumptions

Old Style Technology:	CAD/CAM Environment
Economy of Scale	Economy of Scope
Experience Curve	Truncated (or expanded) Product Life Cycle
Task Specialization	Multi-Mission Firms
Work as a Social Activity	Unmanned Systems
Separate Variable Costs	Joint Costs
Standardization	Variety
Flexibility and Variety are Expensive	Flexibility and Variety Create Profits
Desirable Operating System Characteristics	
Centralization	Decentralization
Large Plants	Disaggregated Capacity
Balanced Lines	Flexibility
Smooth Flows Ability	Surge and Turn-around
Standard Product Design	Many Custom Products
Low Rate of Change, Innovation and Responsiveness	
High Stability	
Inventory as a Decoupler Demand	Production Tied to
Focus as an Organizing Concept Repeated	Functional Range for Reorganization
Job Enrichment and Enlargement Rewards	Reponsibility Tied to
Batch Systems	Flow Systems

- Ingersoll Rand installed the first computerized integrated system in 1970 - over a decade ago. Palletized parts are automatically shuttled to the correct tool, loaded, processed and returned to the materials-handling conveyor after processing. The system manufactures some 150 different parts in batches of two to ten pieces. The system reduces parts costs by an average of 45% compared with conventional machine shop operations.

- Caterpillar Tractor purchased its system in 1971. The system machines housings for two families of automatic transmissions, producing the finished, assembled case and cover from rough castings. After the rough castings are manually loaded, the system recognizes the part, delivers it to the machine, and handles the remaining machining, inspection, transportation and other operations. In addition, the computer performs an elaborate array of scheduling, prioritizing, reporting and auditing functions.

- Deere and Company ordered a robot-tended flexible machining system in 1980. This system, designed to produce a variety of parts - many of which have not yet been designed - will cost over $2,000,000 as a turnkey project.

- The first General Motors flexible machining system was installed at the Chevrolet Gear and Axle plant in Hamtramck, Michigan, early in 1982. This line will machine a variety of short cycle parts in small batches (but totalling over 100,000 pieces per year in demand). The flexible machining center offers the potential for substantial cost savings in retooling to meet product design changes, and constitutes a very visible move away from traditional "hard-tooled" transfer lines.

CAD/CAM

Computer-Assisted Design with Computer-Aided Manufacture (CAD/CAM) is another step beyond the integrated manufacturing system. Coupling the computer into the design process offers substantial increases in productivity at each step in the process. For instance, a designer can draw a design on a monitor screen with a light pen. The computer will automatically generate different views, rotate the image or reverse it on command. Lettering can be added, the drawing scale changed, or other modifications easily made at the keyboard. Once a satisfactory monitor image has been produced, "hard copy" can be automatically generated by the computer. In addition, the computer can be instructed to produce a tape that will guide numerically-controlled production machinery.

Computer-assisted design can be used for revisions of existing work, too. It is estimated that some 80% of drafting work consists of modifying existing designs. CAD data bases can store large numbers of standard designs to be retrieved and modified. Computer-generated drawings reduce repetitious drafting, as well as increasing drafting productivity.

Beyond such economies, CAD/CAM can also integrate other sorts of data - materials constraints, stress and load factors, engineering formulae and the like - to be evaluated automatically in the course of a design. Thus routine constraints can be automatically attended to, flaws or inadequacies automatically detected, and adjustments made at early design stages with substantial consequent savings. In addition, such systems permit human designers to concentrate on creativity and aesthetics, confident that the underlying parameters have been taken into account. All of these capacities are in use today.

- St. Gobain designs elaborate perfume and liquor bottles by means of CAD. Precise volume capacity is attained, along with elegant design. Design productivity has increased sevenfold, while the needed turnaround time from design to manufacture has decreased.

- GM used CAD to downsize the Cadillac Seville, producing a shorter, lighter, more fuel-efficient car. In 1978, CAD cut the X-body car design process by a year, according to GM estimates.

- Boeing used CAD to design two new planes, the 757 and the 767, simultaneously - a feat made possible by productivity increases due to the new systems. Moreover, by enabling the company to incorporate engineering data more readily into the design process, costly design flaws could be identified and eliminated before manufacturing began.

Computer-Integrated Manufacturing

Computer-integrated systems sequence and optimize a number of production processes, achieving order-of-magnitude improvements in equipment utilization and capital productivity by cutting down on queueing time, waiting time, machine downtime (through more predictable maintenance and operation) and elimination of in-process inventory. The significance of computer integration for process improvement can be estimated by the typical traditional machine-usage times: of time in the shop, a part spends typically only 5% on a machine, and less than 30% of this (1.5% of the total time in shop) is incut time. Elimination of substantial portions of the 95% moving and waiting time promises fuller utilization of machine capacities as well as substantial reductions of in-shop time and thus inventory in process. In one major integrated facility, operating now at Messerschmitt-Bolkow-Blohm in Augsburg, FRG, incut time has increased to 75% or better. Production lead time for the Tornado fighter plane is 18 months. In comparison with 30 months for planes produced by more conventional means. The system, which cost more than $50 million, reduced the number of required NC machines by 44%, required personnel by 44%, required floor space by 30%, part flow time by 25% and investment costs by 9%.

Unmanned machines at Niigata Converter's Kamo Works, Niigata, Japan, have proven, on average, nine times more productive than the conventional machines they replaced, with incut time ranging around 50% and often going as high as 75%.

Integrated systems at John Deere were cited as the sources for improvements in manufacturing efficiency that boosted Deere's net 28% despite foreign currency losses and a sales decline of 0.8% for the quarter ending October 31, 1981. Deere's efforts include computerizing engineering, planning and analytical methods for tooling, part and process sequencing and automated machining and assembly.

In each system, computer controls and programmable, "smart" machines offer the advantages of specialized, automated processes and the flexibility of easily changeable specifications. The most important characteristics of these sophisticated, computer-based manufacturing systems include:

- Extreme flexibility of product design and product mix The new machines perform a variety of tasks equally well, so that traditional logic of batch size versus inventory costs, for instance, will no longer be meaningful. New systems will process an almost unlimited variety of specific product designs within a reasonable family of design options, including alternative materials.

- Rapid responsiveness to changes in demands, in product mix and design, output rates and equipment scheduling.

- Greater control, accuracy and repeatability of process operations, leading to better quality products and much more reliable manufacturing operations.

- Reduced waste, lower training and change-over costs, and lower, more predictable maintenance costs.

- Greater predictability in all phases of manufacturing operations and vastly increased amounts of information. This will lead to more intensive management and control of the system.

- Faster throughput due to better utilization of all machines, less in-process inventory, fewer stoppages for missing parts or materials or machine breakdowns, and the use of higher speeds and a variety of exotic new processing techniques made possible (and economically feasible) by the sensory and control capabilities of the smart machines and the information management abilities of the new CAM software.

- Distributed processing capability made possible and economical by the encoding of process information in easily replicable software instead of hardware. (Excerpted from an article by M. Jelinek and J.D. Golliar in Columbia Journal of World Business, Spring 1983.)

The following survey on government policies in OECD countries concerning the use of industrial robots is reprinted from a recent OECD report "Industrial Robots: Their Role in Manufacturing Industry".

Government measures

Many national governments have adopted measures designed to facilitate the use of industrial robots and other forms of flexible automation, to stimulate domestic production of the equipment and to promote research and development. The United Kingdom has instituted a CAD/CAM awareness programme and is expected to spend £4 million in 1983-84 on support for robotics. The Netherlands has introduced investment incentives in the form of low-interest loans for companies investing in flexible automation applications. Japan has had a special depreciation programme, which allowed 10 per cent of the purchase price of high-performance robots in first-year depreciation in addition to the normal depreciation allowance. France also gives financial support to companies investing in robots, while the United States Defence Department has an integrated Computer-Aided Manufacturing project to encourage its suppliers to upgrade their manufacturing systems through introduction of robots and other automated machinery.

One of the most successful initiatives has been taken in Japan where, encouraged by the Ministry of International Trade and Industry (MITI), the Japan Robot Leasing Company was set up in April 1980. It is a consortium of 66 firms, including industrial robot manufacturers, whose robots are mainly leased to small and medium-sized companies In its first year of operation, 150 units worth 1.15 billion yen were leased.

While the bulk of government support is aimed at stimulating the use of new manufacturing technology, there is help available to the supply side of the industry in a number of countries. The emphasis here is on R&D. In France, a special agency was set up in 1980 - the Institut de Recherche d'Informatique et d'Automatique - to undertake research in information technology and automation, with special attention being given to robotics, while another body, the Advanced Automatisation and Robotics Group was set up by several research institutes the same year. In the United Kingdom, the Science Research Council has launched a £2.5 million research programme on industrial robotics, while Germany and Norway also give support to research projects in the field of CAD/CAM and industrial robots.

In Sweden, Kr.260 million has been allocated to R&D on robotics and CAD/CAM for the period 1980/81-1984/85, while Japan's MITI has drawn up a major national research programme, which includes an allocation of 15 to 20 billion yen for a seven or eight year project starting in April 1983 aimed at the development of remote-control robots for dangerous tasks.

HKPC Mission to study Industrial Robot Technology in Japan

Japanese industry has been actively applying industrial robots in various aspects of production to increase productibility, reduce labour costs, improve working conditions and material savings. Current forecasts indicate that the sales of industrial robots will amount to an estimated US$ 1.3 billion (HK$ 9 billion) annually by 1985. To study and observe this fast developing technology, the Hong Kong Productivity Centre, in cooperation with Asian Productivity Organization, organized a mission to Japan between August 28 and September 10, 1983. The programme of the 2-week mission included plant visits to observe the applications and development of industrial robots in Japanese manufacturing industries.

One of the programme highlights was a visit to the 1983 International Industrial Robot Exhibition in Tokyo. Mission members were able to view the latest developments in robotic technology in some 300 exhibition booths. These include human manipulators, playback robots of fixed or variable sequence, memory playback robots, NC robots, intelligent robots, robot processing and application systems. (AEU, July 1983.)

Expert systems are in danger of being expert

The dangers of viewing expert systems as really "expert", rather than as a helping tool, was put time and again by speakers. "We are in trouble because of the terminology selected for this field; it was not done for clarity, but to get research and development money", said Kristian Nygaard, from Oslo University. Many of the claims for expert systems, or artificial intelligence, have been widely exaggerated. In spite of this, he said, expert systems will be produced and used on a growing scale.

The United States, for example, has "exactly 200 people" who are qualified to develop expert systems. The result, Nygaard said, is that there will be a large number of extremely lousy expert systems.

Reinforcing Nygaard's comments, Niels Bjorn-Andersen, of the University of Copenhagen, said that concepts of artificial intelligence will "enforce a logic route on an ambiguous world", and in so doing ignore what cannot be defined. Factual and value premises, which help reshape our attitudes, cannot be differentiated or evolved in artificial intelligence; the resulting danger is of a one-dimensional thought process. Most expert systems to date have been designed with a consensus of knowledge. "How accurate", asked Les Gasser, professor of computer science at UCLA, "is that consensus? How, for instance, do we assess the legitimacy of one body of knowledge over another?" Gasser cited as an example traditional medical practices as opposed to the holistic approach, which aims to treat the whole person rather than just the symptoms. (Computer Weekly, 29 September 1983.)

France mobilizes robotics research

For a tiny company in the French provinces, Toulouse's Midi-Robots has landed itself a key role. Backed by some advanced local laboratories, it will act as intermediary between robotics research centres and France's main robot manufactures, Renault, Matra and the Compagnie Générale d'Electricité (CGE). Midi-Robots was set up this year. The main shareholder is the CNRS (Centre National de la Recherche Scientifique), the state research giant. But Matra, CGE and Renault also have shares, as does Onera, the National Aerospace Research Office, and a number of regional development bodies. As well as providing a ready-made market for Midi-Robots' services, this hotch-potch has already given the company a privileged access to the research laboratories around Toulouse. ...

It is this sort of product and research-industry interchange that Midi-Robots will try to develop in the future. "Initially we will specialise in perception and intelligent systems", says Eric Daclin, managing director of Midi-Robots. The company will also try to make sure it fits in closely with the industrial infrastructure of the region and the country as a whole. Midi-Robots will keep its fingers on the pulse of local industry and local research. The firm will usually farm out production elsewhere, either to its shareholders or to other companies. "We'd rather follow the example of Sinclair and Timex", says Daclin. "Our idea is to develop an innovative product and then sell to the highest bidder." Despite the state's role in financing, the company will make profits on its own.

Yet another role will be to help local industry to automate. Midi-Robots already has responsibility for further applications of the gate-array image-processor. But it also has in mind a production-planning system based on a microcomputer "user-friendly" enough not to deter the relatively innumerate small company. "We don't want to replace one unskilled workman with three engineers", says Daclin. (New Scientist, 13 October 1983.)

France wants co-operative Euro robot

France has called for European co-operation in developing robots as part of a three year programme aimed at modernising the country's production and revitalising its machine tool industry. At present France lags behind world leaders Japan, as well as the United States, the FRG, Sweden and the United Kingdom in robot production, and the French government hopes that offering subsidies to firms that want to automate their factories, will help it catch up. (Computer Weekly, 13 November 1983.)

Robots sharpen up their vision

Robots that can "see" the object they are working on no longer need special lighting thanks to new developments in vision systems. Early vision-guided robots, such as NEL's Nelson 2, needed a very strong contrast between the object they were supposed to pick up, and its background. But such conditions are often impossible to maintain in the real world of industry. But at two recent exhibitions of robotics in the United States - Robotic vision and sensory controls, in Cambridge, Massachussetts; and the automated factory of the future exhibition in Detroit - the capabilities of the new generation became apparent.

Robot makers are taking two approaches to building machines that can "see" in a real industrial environment. One is to build machines that look for localised changes in contrast, and use these to find the "edges" of objects, regardless of their overall illumination or brightness. The other involves very intense illumination from a laser "stripe" of light, which looks for the spot of light where the beam hits a solid surface. This method relies on a degree of diffuse reflection by the surface; in theory it would not work on perfectly absorbing, or perfectly reflecting materials. But you do not find such perfect surfaces in the real manufacturing environment.

General Motors has been a pioneer in using "light stripes" to distinguish objects such as castings from the background of a conveyor belt with which they have little intrinsic contrast. The principle is to illuminate the object with two beams of light at an angle to the vertical, and to focus a line-scan camera on the line where the beams converge. Usually, this will be on the conveyor belt itself, so that any object passing under the scanner forces the beams to diverge and is seen as a dark silhouette on a bright background. At General Motors of Canada's foundry at St. Catherine's, Ontario, a variation of this "consight" principle has been working for more than two years. It guides two Cincinnati Milacron T3 hydraulic robots to pick up rear-axle bell-housing castings that are positioned at random on a conveyor belt. The castings, bell mouth down, pass under light beams which converge at the height of the "boss" into which the robot's expanding gripper will be inserted; the vision system tells the robots where to pick them up and place them. The robots handle 1080 castings an hour between them, each weighing up to 25 kg, and the whole plant works continuously, with five shifts of casting and one shift of maintenance. Although the machine was installed by General Motors' central labs, the foundry's plant engineers now maintain, and have modified, the system. It is now capable of dealing with different patterns of casting on different shifts. ...

Another system uses light from several fixed lasers, and a fixed camera, to identify the exact position in three-dimensional space of the two ends of the seam between a car's roof and door pillar. Traditionally, factory workers have smoothed the seam with lead-based soft solder. Now an automated silicon bronze welding process can eliminate this health hazard. Without vision, positional variations due to tolerances on the pressings would have made automation impossible.

Following weld seams is an area in which several European companies will be competing next year. Oxford University's engineering department has built a very compact vision head, in which a light stripe from a laser diode follows seams on pressed steel assemblies during welding. Optische Industrie de Oude, of Delft, Netherlands, will offer a robot based on similar principles but with a rotating mirror producing the beam. ASEA OF Sweden has developed both a simple "start and end point finding" vision system for welding, and a grey-level processing system to guide robots in automated assembly plants.

Picking parts from a jumbled pile in a bin has been one of the tasks that the University of Rhode Island's robotics group set itself to master. It has demonstrated a vision-guided robot which can select the best "grasping point" in an image and "feel" for a part in a pile, trying again if obstructed. The algorithm is being exploited commercially by Object Recognition Systems of Princeton, which has developed a robot that can pick up bolts from a jumbled pile under ordinary office lights. (New Scientist, 15 December 1983.)

Robots increase BL production

With an investment programme of 850 million DM, the British automobile enterprise Austin Rover, which is part of the British Leyland conglomerate, wishes to find its technological-economic place at the world leadership. In the Cowley plant, where the "Maestro" is being built, 116 robots are being installed, and the production rate per employee per year is to rise to 18 per 1984. In 1979 this rate amounted to six, and in 1982 to 14. Productivity will thus achieve Japanese rates, where the quota is about 20. Without strong government support, the enterprise surely would have vanished from the market. Cooperation with Honda yielded new know-how. The mini car Metro became "the first competitive product", according to Harold Musgrove, chairman of the board and director of Austin Rover. However, technology is expensive, as Musgrove well knows. The current principal requirement is supposed to be the large research and development expenditure for small enterprises. With the Maestro, a mass-produced automobile is now receiving plastic bumpers, which can be lacquered together with the body. When the lacquer is turned in, the plastic heats to 135° C. (Duesseldorf VDI NACHRICHTEN, 22 July 83, translation from German.)

The legend automates

Britain's Jaguar Cars is looking to Japan for an automated helping hand. It has signed a three-year collaboration agreement with Dainichi Kiko, Japan's third largest producer of industrial robots, and Dainichi Sykes Robotics, a British firm which uses Dainichi robots in advanced manufacturing systems of its own design. The three hope not just to revamp Jaguar's plants but also to find ways for other engineering firms to benefit from automating small production runs. Jaguar is not the first British motor company to buy robots abroad. Ford has got them from FRG's Kuka and from Cincinnati Milacron of America; Land Rover from the Swedish firm Asca; Austin Rover from Unimation in America. Britain now has nearly 1,500 robots according to the British Robot Association, about a third of them in the motor industry. This puts Britain in fifth place, behind Japan (which has 15,000 working robots), America, the FRG and Sweden.

The Jaguar deal is interesting for three reasons: Jaguar, part of state-owned BL Cars, is a low-volume producer. Even if i fulfills its ambitions to double production from this year's 28,000 cars by the late 1980s, it will still be dinky when measured against Austin Rover (450,000 cars a year) or Ford of Britain (300,000 cars a year). Jaguar workers have already boosted output from 1.2 cars per employee in 1981 to 3.5 today. Now only new capital investment can raise productivity dramatically. (The Economist, 29 October, 1983.)

Swedish Robot for Cast Parts

In the foundry of the Volvo Komponenter AB in Arvika the cleanup of heavy castings is taken over by an integrated manufacturing cell which is equipped with four tools. An industrial robot is the center of this installation which has been developed and is being supplied by the ASEA. With its 450 employees the foundry in Arvika produces annually about 25,000 tons of automotive parts for the most part consisting of graphite-shot castings. It is becoming increasingly difficult to find personnel for the stressful and unhealthy work of casting cleanup. For this reason there has been installed in Arvika an industrial robot having a carrying capability of 60 kg and a positioning accuracy of ±0.4 mm. In rework of transmission housings the riser is first separated from the ingot; this is accomplished when the robot presses a hydraulically driven separating disk against the casting. Having been reduced now to a weight of 55 kg the part is then lifted by the robot and successively applied with high precision to the fixed tools. The outer edges of the transmission housing are polished and the interior metal shavings removed by means of a compressed air hammer and a rotating file. The entire cleaning program lasts 9 minutes as compared with 12 minutes for cleaning by hand. The time saving is thus 25 per cent and at the same time one obtains higher and more uniform quality. The manufacturing cell is supplemented by a manipulating and storing facility developed in Saffle by MHT System; this storing and manipulating facility is capable of simultaneously taking up 96 parts and delivering them automatically to the robot. This permits unmanned nighttime operation. (Wuerzburg ELEKTROTECHNIK, 18 March 1983, translation from German.)

Wafer fabrication turns to robot power

A wafer fabrication facility in which not a single human being will be required on the production floor for all the processes from diffusion through to probe and test, is being constructed by Mitsubishi Electric. The fab is basically designed to run the company's 256K DRAM. However, it will start by running 64-K DRAMs in the humanless plant in July 1984, and expects to have production of the device up to five million a month levels by 1984's third quarter. Mitsubishi's present 64K fab is turning out 64Ks at a rate of 2.5 million units a month. The person-count for the processes from diffusion to test is 500 people. ...

Hitachi is heading in the same direction. "We have an integrated photolith line, an integrated assembly line, and an integrated packaging and bonding line," said a spokesman. "We have plans to combine all three together." When would Hitachi have a humanless fab? "We'll certainly be heading that way by the end of 1984." (Computer Weekly)

Underwater robots

Oil companies are hoping to take robots underwater. Offshore oil and gas exploration is moving into waters too deep and, often, too cold for divers. Even in today's oil fields sending a man down, say, to repair pipes on the seabed is both dangerous and expensive. A variety of researchers are trying to create machines that can take over the divers' job. Today's underwater robots are relatively primitive. Called "remotely-operated vehicles" (rovs), they are relatively expensive - costing £410,000-800,000 to buy or £1,000-10,000 a day to rent with their operating team. They are also cumbersome. The rovs must be operated from the surface via an umbilical cord, and their grippers and sensors are not capable even of many simple tasks. ...

Eliminating the umbilical cord is the single biggest prize. That would get rid of the major cause of problems with rovs at present: snarled cords. It would allow rovs to work where today's machines cannot: e.g., under Arctic ice. And free-swimming rovs could use smaller engines and less power without all that cord to drag around. But creating a free-swimming rov is tricky. Researchers reckon it will be at least 10 years before such machines swim into commercial use. The two big challenges are communication and power. Radio waves do not travel well through sea water. Sound waves can be used to carry signals instead, but even sound waves become distorted when travelling from the surface to great depths. Equally important, a rov without an umbilical cord to provide its power needs a prohibitively large battery pack to get from the surface to the worksite and back. Researchers at both Scotland's Heriot Watt University and America's Woods Hole Oceanographic Institute have developed a partial solution. They have built prototype rovs in two parts: a "master" rov still tied to a surface mother ship by an umbilical cord and a free-swimming "slave". Power from the umbilical cord takes both master and slave to the worksite and back, and can be used to recharge the slave underwater. So long as the master rov is kept close to the slave, it can communicate with it via sound waves without fear of distortion.

Unfortunately, eliminating just one link of the umbilical cord does not confer many advantages. Although the two-part rov might be able to send its slave into tight spots that a tethered machine could not negotiate, it still cannot work, e.g., under Arctic ice. More important, the slave's capabilities are severely limited by the inability of sound waves to transmit as much data as can a coaxial (let alone a fibre-optic) cable. Using sound waves means cutting back on either the amount of communication used to guide the rov or the amount used to operate its grippers and sensors and take feedback from them. In future researchers hope to be able to provide rovs with enough "intelligence" to navigate on their own - and so allow communications channels to be kept open for directing actual work. Researchers at both Woods Hole and Heriot Watt have taught their prototype rovs to decide whether the sonar signals they receive represent an obstacle or the object of their mission. But rovs need to be smarter still to navigate on their own. Although today's computer software and hardware cannot provide the brains needed, both are improving fast. Together with advances in battery technology - like light, compact lithium batteries which could replace today's bulky packs - that should make a free-swimming rov possible within a decade or so. .. (The Economist)

Robotics in brief

Heath's Hero-I robot has been endowed with a sense of smell by PH Stakem, Interface Technology (College Park, MD). Mechanical 'sniffers' exist for very specific aerosols and gases, and the home smoke detector uses an ionization chamber to detect products of combustion. Despite the availability of this technology, however, Heath's ET-18 Hero-I robot has yet to offer this capability. A Sears 439-57301 smoke detector was added to the ET-18 circuitry. A simple program tests the least significant bit (LSB) of the experiment board address to see if the detector is activated. When enough smoke trips the 12V relay unit the robot can take appropriate actions, e.g., announcing 'fire' repeatedly. (Robot Age 8/83 p.20, 21.)

Camel Robot (Italy) has developed a simple, rigid robot for hot forging applications. Due to positive gripping of components, the microcomputer controlled robot can achieve 85% efficiency, vs 45% for a mechanical transfer system. Camel simplifies robot controls by using cartesian coordinates in its NC controls, thereby simplifying linear movements. Italian Teksid (Torino) uses 12 Camel robots in a connecting rod forging line to handle parts weighing up to 100 kg. (Ir Age Int 7/83 p8mp5+.)

A drive mechanism for a motorized paraplegic ambulator has been patented by JP Wier and RA Garrett. US Pat 4,258,815 describes an ambulator drive mechanism of medium size, with a low center of gravity and maximum maneuverability that supports a paraplegic in a standing position. The mechanism's unique design enables easy movement along any of 3 axes of motion. The drive consists of 4 wheels mounted at each corner of the platform and pivoted to rotate around a generally vertical axis. As the result of an 18 deg inclination of the wheels, only 1 or 2 of the outermost rollers contact the ground at any one time, offering optimum maneuverability. The direction of platform movement depends on the combination clockwise and counterclockwise rotation of the 4 wheel assemblies. (Robot Age 8/83 p.23, 25.)

Meidensha Electric Mfg (Japan) has commercialized an overhead robot system to carry invalids from their beds to the bathroom and elsewhere around their homes. Elderly or handicapped persons can raise or lower themselves by pushing buttons. Forward or backward movements are accomplished by blowing or sucking a tube. The system was successful in trials at 5 homes, and will be introduced throughout Japan by end-1983. (Jpn Econ J 8/23/83 p.9.) (Technology Update, 17 September 1983.)

Kobe Steel (Japan) will introduce an industrial robot to clean and remove surface flaws from red-hot steel slabs. The unit could save Y30 mil/yr in slabmaking costs vs the conventional manual process. Japan makes widespread use of robots in secondary steel processing jobs, but for basic production applications robotization has proceeded more slowly since slabs and ingots are heavy and very hot. (Jpn Econ J 9/6/83 p.8.)

Hitachi has developed 6 types of remote control inspection and repair robots to operate in radioactive areas in nuclear power plants. Power Reactor & Nuclear Fuel Development, a govt organization, also participated. Hitachi will use the robots to repair its idle spent nuclear fuel dissolution tub facility. Each unit has a periscope and TV camera to monitor its surroundings, and a hand to polish walls before inspection. They use dye infiltration and internal flaw ultrasonic wave tests to check their completed work. (Jpn Econ J 9/6/83 p.8.)

American EMB and parent Elastogram Maschinenbau will demonstrate a rotary table and robot to perform external mold release, insert placement and parts removal. The unit, which can be used to produce low pressure foam parts or RIM parts such as steering wheels, is centered around the rotary table. Each table segment is individually mounted on bearing wheels to accommodate unevenness of the plant floor. The rotary table is driven by a dc drive, which allows the molds to be positioned in front of the robot or mix head with an accuracy of +/-1 mm. Each part and all processing parameters, including robot action, are automatically adjusted. EMB also has a new high pressure PU machine and mix heads. (Plast Tech 8/83 p.17.) (Technology Update, 8 October 1983.)

The most common pitfalls in incorporating robots on the factory floor can be avoided by 5 application analysis steps, according to DB Ewaldz, Ingersoll Engineers (Rockford, IL). Most robot installation failures are the result of an inadequate selection and preplanning for the application. Frequently, all installation planning is done after the robot has been purchased and is standing on the factory floor. Robot installation success is more likely if 5 suggestions are followed: know the manufacturing operations in detail, including cost concentrations, output constraints and product and process-cost distributions; take advantage of key opportunities to increase output and reduce cost indicated by a close evaluation of the manufacturing operation; optimize operations by simplifying the task elements and upgrading the reliability of the method; examine the impact of the new work-center capacity on other areas of the factory; and build a 90-d inventory before starting up the robotized work center. (Tooling P 10/83 p.74.) (Technology Update, 29 October 1983.)

A flexible manufacturing system designed to forge steam turbine blades for electric generators will be used at Westinghouse's Turbine Components Plant (Winston-Salem, NC). This $5 mil, robot-manned forging system will require no human assistance either in operation or set up and will run on an advanced rule-based language being developed by Carnegie-Mellon U. The cell will consist of a team of computer-controlled machines supervised by a master computer; it will include a parts identification station based on an Automatix machine vision system; 2 Versatran material handling robots; a rotary hearth furnace; a GMF swaging machine; a cropper/stamper; and an optical gauging station also based on an Automatix machine vision system. Westinghouse undertook forging sale project, starting 4 yrs ago, mainly to gain experience in the development and operation of such systems. (High Tech 6/83 p.20-22, TU 3/9/83.) (Technology Update, 3 September 1983.)

Dainichi Kiko (Japan) is offering a service robot for restaurants that takes orders, clears dishes and converses with customers. The Robo Robo Mark I is operated by remote control and moves about on a small cart. It has an infrared detector to prevent collisions and can perform 8 movements, including extending its torso and bowing its head. Jpn Econ J 11/1/83 p. 10. (Technology Update, 19 November 1983.)

A robot watchdog system Roverbot, could effectively ensure the safety of workers and equipment, according to J.W. Blankenship, D.N. Strickland and K. Kittiampan, W. Virginia University. If Roverbot sensed that the position of the workstation robot didn't match the indicated controller position, the watchdog would signal for a total power cutoff and the equipment would be shut down for repair before expensive machinery could be damaged. If a person or object intruded into the workstation, Roverbot would have 3 options, depending on data fed into it: ring a warning buzzer, slow down the robot or stop all action at the workstation. Machine D 9/8/83 p. 16.

Oak Ridge National Lab. (Oak Ridge, TN) is developing a remote manipulator to work in environments inaccessible to humans. The manipulator will comprise a transporter vehicle, a small hoist, robot-like manipulator arms and a control system. The control system will include closed circuit TV and force feedback sensors to aid the operator in directing the manipulator as it works. The lab, operated for DOE by Union Carbide's Nuclear division, is developing the manipulator for maintenance tasks in nuclear reactors and fuel processing systems, but the equipment would be useful in any environment too toxic or hazardous for humans to enter. Am Mtl Mkt 10/24/83 p. 7. (Technology Update, 26 November 1983)

A guide to plastics processing robots, including current applications, is presented by K. Susnjara of Thermwood. Nonservo robots are usually small and powered by air. Larger, hydraulically powered nonservo robots do an excellent job in tending molding machines, even when the parts to be handled are large. Nonservo robots are programmed by setting the stops at the ends of the various axes (movements). Reprogramming takes little time, and can be done during changeover from one product to another. Servo/point-to-point robots, generally larger than nonservo robots, can stop at any point within their reach. Since they are larger than nonservo robots, they can generally lift substantial weights and transfer them over long distances. The continuous-path lead-through-teach robots, all servo-controlled, differ from servo/point-to-point robots, which record only points in space, by recording entire paths. The arm of a robot is balanced so it can be moved physically by the programmer during programming. The control system is programmed by manually moving the arm through all of the motions it will make in operation. Traditionally used in spray painting, these robots are moving into material handling because they are easy to program and are now cost-competitive with servo/point-to-point robots. Plast Eng 7/83 pp. 19-24.

Robot-controlled high-speed plasma-arc removal of rigging on engine-block castings is being developed at the University of Rhode Island's Robotic Research Center. Even though plasma-arc cutting is recognized as a faster removal process vs. other processes in use, an undesirable side effect of the process is the deep layer of chilled white iron with a hardness of about 450 Brinell on the kerf surfaces. A suitable combination of process variables, e.g., cutting speed, current, electrode stand-off and plasma-gas flow rate, can reduce the chilled-iron layer to 0.003-0.005" thick, which can be removed simply by undercutting the layer in a rough-machining pass. Process drawback yet to be satisfactorily resolved include: slower cutting speeds vs. cutting wrought ferrous materials; slag build up underneath cut surfaces; the inability to use water injection in the plasmas to improve kerf surfaces; process variations due to compositional and thickness differences; the 5 s needed for the plasma arc to re-establish itself for every new cut; and difficulties in applying robot controls to casting variations. Matrl Eng 11/83 p. 9.

A cog-wheel driven cart for robotic transport controlled by an Apple II computer has been developed by J.R. Grote (Redwood City, CA). The cog-wheel drive eliminates slippage and achieves accuracy in the fore-aft direction. The cart is driven by a DC gearmotor. Vehicle position is monitored by an on-board rotary position encoder. Control and interface electronics and power supplies are off the vehicle. The cart runs on a cog-track system made of parallel automobile engine timing belts glued on aluminum strips. Power for the drive motor is provided by trailing wires or by a power track with brushes on the vehicle. Article discusses in detail the robot operating system, the mechanical and electronic hardware, and software. A possible application is for low-resolution tasks such as picking up printed circuit boards and carrying them from place to place. Robot Age 10/83 pp. 20-29. (Technology Update, 3 December 1983.)

COUNTRY REPORTS

Austria makes its SC entry

AMI's Graz facility was opened in October 1983. The unlikely marriage between Austria's largest industrial conglomerate and the Silicon Valley-based custom and semicustom IC company was first announced two years ago. A joint company, Austrian Microsystems International (AMI), was formed, and while the United States company supplied the technical know-how, Voest Alpine went about raising the money to construct a manufacturing facility. Those two years ago, both parties announced the facility would be ready by autumn 1983, and their optimism was rewarded.

The strategies which brought Voest Alpine and American Microsystems together do differ. The Austrians are extremely keen to embrace new technology; the United States company wanted a European facility to stiffen its attack on the Continent's custom IC market. The explosive growth in this sector made it all the more imperative a base was found. Once the Austrian deal was struck - and there is little doubt the Austrian government has been generous in its financial commitment to the project - American Microsystems assigned its vice-president, technology Dr. Lee Seely to oversee the facility construction. ...

As Dr. Seely points out, development cycles are going to be crucial in winning the custom semiconductor battle. The faster a product can be guided from design to finished devices, the more customers are going to be beating a path to the door. With its own facility in Europe, AMI is going to shrink that time considerably - especially when it is allied to its new computer-aided design tool known to Sceptre. Sceptre allows a customer to do his own design and, according to AMI's Alan Watts, the tool has been received very favourably since its launch earlier this year. Computers play a major part in all aspects of the custom and semi-custom business, not the least of which is in the production process. ... AMI has not stinted on the production equipment now being installed. Electron beam techniques will be used, and $1.5m has been shelled out on this piece of equipment alone. ...

The computers will cut down on the paper data usually wafting about semiconductor plants. Data fed into the computer will be used to identify each wafer boat entering the Graz furnaces, using nearby video display units. At present there are five diffusion furnaces, and room for two more. A wafer stepper machine, the Perkin Elmer SRA 100, arrived only three days before the official opening.

Packaging is another area AMI, like the rest of the semiconductor industry, has concentrated on, and again latest techniques are used. Some $4m of the $50m invested thus far has been splashed on test equipment, an area still neglected by some in the semiconductor industry. The Graz facility has a Fairchild Sentry VII logic tester, a Xincom memory tester and a LTX linear tester.

Despite all this state-of-the-art equipment, almost as impressive are the utilities in the basement of the plant. Huge air-conditioning plants blast pure air into the clean rooms, and tanks break down the chemical wastage. Austria wants the technology, it does not want any pollution, and AMI is ensuring there will be no cause for complaint.

Dr. Seely says the full range of AMI processes will be phased into the Graz facility. Initially the company is running its four micron NMOS and five micron CMOS processes, but by next year the three micron NMOS and CMOS processes will be up and running. Seely is also enthusiastic about AMI's switched capacitor filter techniques. These combine digital and analogue circuitry on one circuit. According to Seely, the performance of these circuits has been impressive. "We have designed such things as operational amplifiers with 10MHz bandwidth and 120dB gain, comparators with one millivolt accuracy, 12-bit A/D converts with a conversion time of 100 milliseconds, D/A convertors with 12-bit resolution and filters with up to nine poles with a 25KHz bandpass."

The plan is to invest another $50m in the facility before it is completely equipped. At present there are 250 employees, and this should increase to 500 by the end of 1984. Present capacity is 1,000 wafers a week; the eventual output will be 5,000 wafers a week. All the equipment is capable of handling five inch wafers.

The Graz facility joins two other plants American Microsystems has set up around the world. A similar joint venture has been set up with the Ashahi company in Japan, and there is a facility in Korea. (Electronics Weekly, 9 November 1983.)

Siemens IC plant in Austria to produce 256K

The Siemens plant in Villach, Austria, opened in late 1980, is one of the most modern manufacturing plants for ICs in Europe. At present, more than 1 million 16K chips/month leave the plant. a new production line for the 256K chip developed in Siemens' Munich labs, will be completed in 1984. The number of employees will be increased from at present 800 to 1,000. Research amounting to an equivalent of AS 50 million in 1982/1983 concentrated on semi-custom chips (CMOS as well as bipolar).

Computer science to be introduced in Austrian secondary schools

The Austrian Minister for Education announced recently that he plans to include EDP in the curriculum of secondary schools and later, once enough teachers were available, also in primary schools. Computer science will become a mandatory subject for students wishing to pass the Matura (baccalaureate).

Australia: Computer order to boost spin-off jobs

The major computer purchase by the Department of Social Security will create more than 350 jobs in "sunrise" industries in Australia. The department's $A100m computer re-equipment programme announced recently will result in at least $A18m worth of work in Australia. Defence Support Minister Brian Howe, who is responsible for the Australian offsets programme, said the local computer industry would benefit greatly from the projects. ... "An estimated 140 people will be employed as a direct result of the offset work, according to the companies concerned", he said. "Combined with the jobs to be provided by subcontractors, at least 350 jobs will be created in the Australian computer industry."

Howe said the computer work represented a major development in the advancement of Australian technology. "The job opportunities provided by the offsets work demonstrate the Government's commitment to supporting 'sunrise' industries which show promise in creating employment in areas of increasing market potential", he said. (Electronics Weekly, 7 September 1983.)

IBM plans a $100m high-tech boost for Australia

Australia's high-technology industry will receive a $A100m boost over the next five years from the American computer giant IBM, which plans to manufacture its Personal Computers at its Wangaratta plant in northern Victoria. IBM Australia Ltd. and the Victorian State Government said the company planned to produce its Personal Computer (PC) range for Australia, New Zealand and South East Asia at its Wangaratta plant.

Further initiatives include:

(1) The establishment of a Software Development Support Centre in Sydney designed specifically to acquire software products from local industry opening up extensive international markets to Australian software companies.

(2) IBM's plan to produce in Australia software and documentation for the IBM Personal Computer.

(3) Expanded procurement from Australian industry to include assemblies and components for Wangaratta's Personal Computer production and other IBM products.

Software

... One upshot of IBM Australia Ltd.'s announcement will be that State and Federal Governments are likely to treat IBM bids more favourably when calling tenders for computer equipment. However, of more immediate consequence, is IBM's commitment to purchase an estimated $A27m worth of computer components from Australian manufacturers over the next five years. In addition, the company said it was actively pursuing opportunities for local procurement of parts for its other product lines. The Minister for Defence Support Brian Howe, who is responsible for the offset programme, welcomed the IBM announcement. He said IBM's decision to manufacture its PC central processor unit in Australia would be a significant development for the capabilities of the Australian computer industry. (Electronics Weekly, 2 November 1983.)

Belgium puts £6m in office

The Belgian Government has announced that it will spend 500 million francs (£6 million) on office automation this year and double this annually from 1984 to 1986.

Announcing the new move, the Government's Ministerial Committee For Economic and Social Co-ordination said: "Our objective is to enable Belgium to set up an industry with the capability to manufacture complete office automation systems which involve a maximum number of components, products and sub-systems with high added value and of Belgian origin."

The Government was also concerned about guaranteeing its own sources of supply from Belgian industry because the Civil Service was a big customer for these systems. (Computer Weekly, 15 September 1983.)

Canada

Total of Alberta schools using microcomputers has reached 857, or 63.4%, as the result of the influence of Alberta's Task Force on Computers in Schools. The Task Force expects all graduating students and teachers to be computer-literate in 5 years, and has made 48 recommendations to achieve this. Major ideas include: giving all students access to computer learning by 1985, requiring graduating teachers to take computer courses, testing all courseware prior to recommending it, developing network standards, and establishing model high-tech schools. To formulate these recommendations, the Task Force toured schools in Minnesota, Texas and California. (Technology Update, 22 October 1983.)

Electronic projects receive priority in China

The State Planning and Economic Commissions have called for work to ensure that in 10 to 15 years, all of China's major electronic products reach standards comparable to those attained by industrially developed nations in the late 1970s or early 1980s. For, if China is to modernize, its electronics industry must move 5 to 10 years ahead of other branches of the national economy to provide them with advanced equipment. A total of 550 technical renovation projects in the electronics industry will receive priority in allocation of funds, materials and labour. They fall into 30 categories, including developing large integrated circuits, and were chosen for their importance in China's construction, or their export potential. Most are scheduled for completion within the Sixth Five-Year Plan period (1981-85). (Outlook on Science Policy, October 1983.)

Sinclair signs an assembly deal with China

Sinclair Research, which sells home computers in the United States and Japan, is on the doorstep of another potentially huge market - China. The company has agreed to ship components for assembly by the Chinese into its ZX81 and Spectrum home computers. A factory for the assembly of home computers has been built in Canton, and Sinclair says that large quantities of computer components will be shipped if the initial venture is successful.

Sinclair has signed agreements with the South China Computer Company and the China Electronics Import and Export Corporation. Chinese engineers will visit the United States soon for first-hand experience of Sinclair's assembly techniques. Sinclair's United Kingdom distributor Prism has won a contract to stage exhibitions in Peking to help United Kingdom machines push into the Chinese market.

The Sinclair deal is likely to be followed by many others between western companies and China. Already, factories in China make micros modelled on United States and Japanese imports, and Commodore has some of its components made there. China's aim is to build its own computer industry to serve its home market, and later perhaps to export. Demand for consumer electronics products has rocketed in the last two years. ... The Chinese market looks especially ripe for the Japanese, because both written languages require a great many characters. Fujitsu has already sold mainframes to China, and Hitachi has produced a range of computers that can handle an input of up to 3,000 characters. (Computer Weekly, 15 September 1983.)

Chinese computer from HP

Hewlett Packard company has announced the introduction of a revolutionary and innovative Chinese character computer system which is said to be composed of any HP 3000, HP 1000 and HP 250 computer model plus an advanced state-of-the-art terminal printer and printer controller. These terminal and printer devices are products available through HP Far East Limited. The new HP Chinese character system is claimed to be a cost-effective solution to satisfy Chinese data processing equipment where the Chinese language is spoken. By design, the new computer does not need modification to current software. It also permits Chinese character printing and display capabilities to be added to all installed HP computer systems in the HP 3000, HP 1000 and HP 250 families. (Electronics Weekly, 7 September 1983.)

China plans big polytechnic project

China will set up 17 polytechnics under a United States $206m Polytechnic and Television University Project. The polytechnics will replace existing technical institutions which lacked well-trained staff, facilities, and equipment. The new institutions will offer a broad range of specialized subjects in engineering, science, business management, economics, social sciences, and humanities, all emphasising practical rather than theoretical work.

Once established in major urban centres, the new polytechnics will serve about 45,000 students, a six-fold increase in enrolment. New facilities, including libraries, laboratories, and classrooms will be built to cope with this increase. To help the students gain "hands-on" experience, laboratory equipment and computers will be made available for group instruction. Audio-visual and language laboratory equipment, as well as instruments and reference texts will also be provided. The curricula of the polytechnics will be adapted to local industries through frequent contacts and close co-ordination. To improve management of the institutions, short-term foreign and local training for administration will be included in a staff development programme.

The second major goal of the project is to update and expand the 'television university' system, strengthening the central university in Peking, and establishing 28 production centres, and 85 study centres in the provinces. Improvements in facilities will enable enrolment in 'television universities' to triple to 1.3 million by 1990 and two million by the year 2000. Under the project, the system will reduce its reliance on TV broadcasts and instead produce more courses using media such as video and audio-cassettes and printed materials.

Nine UHF transmission stations will be established in the cities where production capacity for broadcast quality programmes is provided. The stations will be used exclusively for broadcasting television university programmes, mainly to enrolled students, but they will have a potential audience of five million.

European super centre by 1984

A European supercomputer centre in France for scientific calculations has been proposed by the French Government, which proposes to put up 40% of the budget. Premier Pierre Mauroy has promised full support by France for the centre to be built at Toulouse for industry and research workers from all over Europe. The centre, whose original impetus comes from scientists in South-west France, will be equipped with a supercomputer with easy long distance access, training facilities for scientific data processing users, and well-stocked data banks.

Although the target date - to get the centre operational by the end of 1984 - might seem optimistic, France will submit detailed plans to the European Council of Ministers early next year. France succeeds Greece in January in the chair of the European Community.

The French Government is prepared to put up 40% of the total budget right away - in the hope that its European partners will provide the other 60% - to avoid any delay in getting the scheme off the ground. The French choice of Toulouse as the site for the scientific calculating project is dictated in part by its closeness to Spain and Portugal, which are waiting to join the Common Market.

Observers in the French data processing industry say the Toulouse project could face the shortage of top-rate specialists which has hampered a venture by Cray Research at Ecole Polytechnique, the elite establishment which turns out France's top managers and technical brains. ... (Computer Weekly, 1 December 1983.)

ECC's Esprit

The European Parliament last week made key decisions to assure both the political and financial future of the European IT research project, Esprit. The budget and staffing levels for Esprit, Europe's £950 million response to the Japanese fifth generation challenge, were agreed, and now go before Europe's finance ministers for rubber stamping. Last weeks's agreement ends a long period of uncertainty about the financial viability of the project. (Computer Weekly, 27 October 1983.) In the meantime, the Council of Research Ministers slashed £60 million off the proposed £950 million. A final decision, which was to have been taken at the European summit in Athens in December, was postponed. (Note by the editor.)

Finland steps into IC market

Finland is now marketing integrated circuits from Micronas, and another company, Vaisala, may soon be selling ICs made in its own wafer fab near Helsinki. Micronas, backed by Nokia, Salora, Outokumpou and Aspo, has prototyped or shipped a dozen gate array designs to Finnish customers. It also has three standard circuits on the market based on Nokia designs. Next year it will market two Micronas-designed standard circuits for radiotelephone applications.

Vaisala, one of the world's top manufacturers of meterological sensors, stunned Finnish electronics circles when it announced, in late 1981, that it had a CMOS semiconductor lined up and running near Helsinki. The CMOS metal gate 7 micron line, which uses three-inch wafers, contact printing, ion implantation and wet etch, was set up in total secrecy. One of the two people responsible for developing the process, Doctor Timo Salo, told Electronics Weekly: "None of the people involved had at any time worked in a commercial semiconductor plant". Vaisala insists it is not in the IC business. It is, however, making more ICs than its sensor production. Sensor manager Christian Carlsson said: "The circuits we have contain some potential technology for measuring capacitances, and we would sell them as solutions to capacitance measurements problems." The preferred marketing route would be "on an OEM basis", said Carlsson.

Vaisala also makes SAW (Surface Acoustic Waves) devices, and has used its fab as a silicon foundry for multi-chip projects (several circuits on one 10mm x 10mm die) for educational institutions.

Micronas uses the wafer fab facilities of its West Coast associate company Micropower in which Nokia has an 11 per cent share holding. It has a design centre near Helsinki with 14 design engineers, a Calma, and a back-end processing facility. ... (Electronics Weekly, 12 October 1983.)

Federal Republic of Germany

Siemens AG, Erlangen, Federal Republic of Germany has founded a company, Mantec GmbH Fürth, specializing in robot manufacture. Mantec has developed its own robot prototypes but makes also control systems for other robot manufacturers. The total number of robots in use in the Federal Republic of Germany - mainly in machine tool, car and electrical industry as well as processing of metal, wood and synthetics - amounts to 3,500 at present. (Süddeutsche Zeitung, 27 October 1983.)

The Federal Republic of Germany is about to take the lead in the race to build even more powerful microchips. In January the giant electrical and electronics company Siemens plans to open a purpose-built laboratory which, the company hopes, will develop a 1-megabyte RAM before the end of 1985. Siemens is investing more than £5 million in the plant, which is now nearing completion at the company's research and development complex in Perlbach, outside Munich. It has spent nearly half the money on an air-conditioning system, and on other measures to ensure a dust-free environment for the study of such chips. In collaboration with the Zeiss optical firm, the company has developed a new lens to etch photographically the very fine patterns necessary on the silicon. (The distance between some of the components etched on the megabyte RAM will be less than 1 micrometre.) By the time the first samples of the megabyte chip are ready, Siemens expects to be mass-producing 256K RAM. When the process moves from the pilot plant to the factory in mid-1985, Siemens will be the only maker of such chips in Europe. *) (New Scientist, 10 November 1983.)

* See also news items under "Austria" heading.

French technology faces its most sweeping re-organization

The most sweeping re-organization of France's high technology industry since World War II has entered its final planning stages in board rooms and government offices: the outcome is likely to be a massive concentration of muscle in electronics, information technology and energy, the sectors on which the competitiveness of the French economy depends. New battle lines are being drawn between the two most powerful firms in these key industries, Brandt and Compagnie Générale d'Electricité (CGE), both of which came under state ownership 18 months ago.

Thomson's activities in information technology, office automation and telecommunications seem on the verge of falling into CGE's lap. Thomson is expected to take over CGE's military equipment division and to concentrate on electrical and electronics consumer products ranging from kitchen cookers to videotape recorders. CGE's assumption of command over leading edge technology reflects its outstanding performance as the only nationalized firm which reported a profit last year. Its 190,000 workers, whose jobs range from building nuclear generators to selling digital time division telephone exchanges, earned the group 638 million francs (£53 million) in 1982. Thomson, with a staff of 129,000, lost 2.2 billion francs (183 million).

France cannot afford to pour huge subsidies into loss-making business activities which are being conducted on a grand scale by nationalized industry, particularly at Thomson. Industrial observers say the French telecommunications industry will have to shed 22,000 surplus workers over the next year following the shrinkage of orders for the successful E10 telephone exchanges built by CGE's subsidiary CIT-Alcatel and the failure of Thomson's MT 20 and 25 exchanges to make any sizeable dent in the world market. French Telecom and Thomson recently flew a group of French pressmen to Chile to show their switching system operating in Santiago - one of the few world capitals where it is functioning without serious technical problems.

A report by the National Statistical Institute (NSI) published last week says: "Staffing in the public sector is shrinking just as fast as in private industry." Until nationalization, investment in the public sector was more sustained than in private firms, the institute recalls. But in 1982 investment dropped by 8% in State-run businesses and 7% in the private sector. Although Thomson's problems did not all begin under socialism, those of its biggest subsidiary Thomson-CSF which embraces the military and computer markets, are newcomers. Thomson-CSF registered the first losses in its history in 1981.

In the framework of efforts to establish a viable computer industry in France, Thomson's minicomputer division was handed over to Bull, in which the State holds 80% of the equity and Honeywell the remaining 20%. However, the group retained its military computer activities. These are not scheduled to be transferred to CGE which is negotiating with Olivetti in order to acquire the 35% stake in the Italian firm previously held by French glassmaker Saint Gobain. In the redistribution of responsibilities now under way CGE can be confident of developing France's nascent office automation industry in co-operation with Olivetti ....

It is still unclear what roles will be reserved for computer maker Bull and Matra, a leading electronics firm in which the State has a 51% stake, following a carve-up of high-technology activities between Thomson and CGE. Thomson has been promised that it will retain is leading role in developing electronic components. But it is not yet able to supply French industry on a big scale. (Computer Weekly, 15 September 1983.)

Television campaign in France

France's government-run information technology agency is to follow the example of the BBC in launching a series of television programmes designed to encourage French viewers to give the computer an active role in their everday lives. ... In the wake of the television campaign, the French Government plans to set up 1,000 computer centres with backing from both the private and public sectors all over the country. These will be open to professional and hobby users. Each will have 500,000 francs (£40,000) worth of equipment installed. ... (Computer Weekly, 13 October 1983.)

Greece leapfrogs into information technology

Greece is about to embark on a venture to set up a microelectronics design centre and establish its own software industry, with the aid of Greek specialists now working in North America and Western Europe. The design centre will be one of the key elements of a five-year plan to develop high technology industries, recently approved by parliament. It will get under way in 1984. ...

The country's leaders consider that the shortcomings of its economy make it vital for industry to leapfrog into advanced information technology. A start has been made with the creation of a research institute associated with the Institute of Information Technology at the University of Crete. The institute will work on office automation and other projects as a partner in Esprit, the Common Market's effort to make up the gap between Europe's computer industry and the industries of the United States and Japan.

"We have the brains to do this," says Minister of Technology George Lianis. "We have the people - here and abroad - and the capability to develop our own software industry and move into microelectronics manufacture. ... Earlier this year he made a tour of the United States and Canada to address meeting of expatriate Greek engineers, many of whom expressed enthusiasm to return and join in the national effort to endow the country with an information technology industry. Lianis has also established contacts with Greek experts in Britain and France. At the beginning of this summer these specialists from the Diaspora gathered in Athens to take a hard look at what was feasible. This seminar was the genesis of the Design Centre, which will be located in the capital and associated with the National Centre of Physical Sciences, Democritos.

Between $2 million and $2 1/2 million are being allotted to this project. Greece has asked the Common Market for cash support to the tune of seven or eight million ECU. "At this stage we are not planning to build a chip factory of our own", says Lianis. "We want to start with a small VLSI unit for research and possibly for small-scale custom production. We intend to give special priority to CAD/CAM design and testing and to systems architecture."

The Design Centre will have the task of keeping up to date with the state of the art and finding niches in which to develop subsystems. Design will begin at university level and the centre will co-ordinate multipurprose chip design. "The centre will have ample resources in computer power", says Katsafouros. "these will be located either in the centre itself or at a silicon foundry abroad, where wafer processing takes place. This means that the design engineers can simulate what they are going to produce on a chip, as well as simulating the logic at circuit level."

Lianis stresses that high quality telecommunications are essential for gathering information on multi-purpose chips and communicating with facilities overseas. "This is one of the reasons why we are renovating our telecomms network and moving from an electromechanical to a digital system", he explains. ... To help remedy Greece's lack of experience in semiconductors, special courses are being introduced into university programmes. Katsafouros says: "since students need hands-on access to circuits, we are building a fully fledged laboratory facility for this purpose at the Democritos research centre. Fundings totalling £300,000 have been allocated for this task."

The Greeks consider that, at the crossroads between Europe and the Near East, they are ideally situated - both politically and geographically - to export the products of their future microelectronics industry. (Computer Weekly, 15 September 1983.)

Hungary

Hungary wants to increase its tiny share of Britain's £550m software market. Ten Hungarian software houses have just put on a London exhibition, the industry's first in the west, to whet British appetites for products that run from video games to a sophisticated logical programming language. ... The Hungarian software effort is still small. Until now, the main western markets have been the German-speaking countries and France. Most sales go through the foreign trade company, Metrimpex, and annual sales to the west are running at a mere $5m. The Hungarians would like to co-operate with British firms. ICL has already used a Hungarian firm, Szamalk, to develop a system that provides quick analysis of the data on lorry drivers' performance put out by "spy-in-the-cab" tachographs. Trade also goes the other way. ICL's hardware sales to Hungary are rising.

In at least one respect the Hungarians are in the vanguard of software design. They were quick to spot the potential for Prolog, a logical programming computer language. Between 1979 and 1982, the Institute for Co-ordination of Computer Techniques in Budapest developed its own version, called M-Prolog, which can be used on computers built by IBM, Siemens and Digital Equipment Corporation. The system has already been successfully marketed in Japan, which is using Prolog in its fifth generation computing project. (The Economist, 19 November 1983.)

India

The Indian Government is continuing its program of promoting the production of integrated circuits. It is requiring that the foreign collaborator selected to manufacture electronic private automatic branch telephone exchanges provide knowhow to the public-sector Semiconductor Complex, Ltd. for the manufacture of large scale integrated (LSI) circuits. In addition, the Government proposes to spend US$213 million by 1992 on microelectronics research and development. (Electronics News, 19 September 1983.)

SFT system makes its Indian debut

The Store and Forward Telegraph System (SFT-System) developed by the Electronics Corporation of India Ltd., in close collaboration with the Tamil Nadu Telecommunication Circle, has been introduced for the first time in India. The entire system is based on modern microprocessor and VLSI technology. Telegraph offices connected to the system network operate directly into an exceptional fast microprocessor-controlled memory in the system which analyses and retransmits the message. Printing it at the receiver station takes a few minutes with perfectly reshaped signals. If any line connected to the system is interrupted, the system stores the message in its memory and forwards it immediately after the line is restored with the same speed and accuracy.

Facilities are provided in the SFT-System for supervisory position (with a video picture tube) to correct occasional human errors in messages received from connected telegraph offices. An elaborate journal prints out for the supervisor and the management, full details of every message (but without the text) such as time received, time cleared and reference numbers, so that any complaint on any message can be immediately investigated. The whole message, with its full text, is also retained in a magnetic memory for a specific time for retransmission and recheck, if required. The through transmission path in the system is totally solid state with no moving parts to ensure highest reliability. All magnetic recorders are only in parallel by-pass paths. (Electronics Weekly, 9 November 1983.)

Irish industrialists are introduced to chip design

An intensive five day workshop in microprocessor design and applications for industrialists has been started by a team of Physics lecturers at University College Galway (UCG). The team has held three workshops so far. The major emphasis of the course is hands-on laboratory experience sessions in a specially equipped workshop. This accounts for over half the programs. Numbers are restricted from 10 to 12 per workshop, to enable individual tuition to be provided. And as a result, several engineers with "zero experience of microprocessor design work" have been able to write software to control a traffic light sequence, incorporate a special interrupt provision within it, debug the program, test it on specially built hardware, and, finally, transfer the program to a minimum cost prototype board and have it execute as a stand alone controller.

The course organizers - drawn from the Applied Physics and Electronics Group within UCG's Dept. of Physics - say that the following are the minimum course areas:

- Basic design awareness;
- Design aids;
- I/O interfacing;
- Demonstration of various lab development aids;
- Provision of full course notes and other practical documentation.

Also, it is possible to buy - at cost - the special development board used in the course afterwards. For continued development of software after the course, then, all that is needed is a CRT monitor or an ordinary VHF TV set. (Technology Ireland, June 1983.)

Signing of agreement between the Ivory Coast and IBI

A Final Protocol Agreement for the implementation of a Project concerning an Administrative Data Bank System was signed in Rome, on 19 September 1983, between the Government of the Ivory Coast, represented by the Secretary-General for Informatics, Mr. J.M. Akeboué and IBI, represented by the Director-General, Professor F.A. Bernasconi, and in the presence of Mr. A. Hoba, Directeur du Cabinet of the Ivory Coast Minister of State II.

The detailed plan for the implementation of the Project, which forms part of the above-mentioned Agreement, was prepared jointly with the Experts of the Ivory Coast, during a technical mission carried out by IBI, following negotiations and the signing in Abidjan, on

5 November 1982, of a preliminary agreement between the Government of the Ivory Coast and IBI. The Project is aimed at creating a full text data bank memorizing all the administrative documents concerning the public services of the State, semi-public services and local governments' services, based on the results of the work for the collection, classification and reorganization of the existing documentation, carried out by the General Secretariat for Administrative Reform (Civil Service). (IBI Newsletter 12.)

Toshiba Japan to fund UK fellowship

Toshiba has established a fellowship program in which two British research workers will be selected to work in the Toshiba research center at Kawasaki. The two individuals will be paid approximately $40,000 per year and the fellowship term could be two years.

The fellowships offer the two people the opportunity to use facilities which are not available in the United Kingdom. These facilities include a super cleanroom claimed to be the cleanest in the world with less than 10 dust particles (each less than 0.1 um in diameter) per cubic foot of air. The Kawasaki Center is working on projects such as electron beam lithography directly onto the silicon wafer with a resolution of 0.2 um, the development of silicon nitride ceramics strong enough to be used in car engines, and the growing of gallium arsenide and sapphire crystals.

Toshiba is centering all of its activities in the area of VLSI technology. Current results of these efforts are a 500 gate gallium arsenide array, a 20,000 gate triple metal layer CMOS array, a silicon-on-sapphire 16-bit microprocessor, a CCD solid state sensor with 500 x 400 picture elements with an on-chip colour filter, and three dimensional integrated circuits. (Semiconductor International, September 1983.)

Fifth-generation computer program advances in Japan

Japan's national program to develop new computer architectures and software for a generation of machines with artificial-intelligence functions and so-called natural man-machine interfaces has made significant progress in its initial stage, according to Tohru Moto-oka, the Tokyo University professor of electrical engineering who chairs the project's main committee. Last June, a new organization called the Institute for New Generation Computer Technology was formed, and a laboratory in Tokyo was staffed by eight Japanese computer companies, mostly with software designers to be paid by the government for three years. So far, says Moto-oka, the hardware design of what is called an inference machine has been almost completed and is expected to be built with conventional components by the end of the year. If successful, it will be replaced with a very large-scale integrated version.

The design of a prototype relational data-base machine is also nearly completed and is expected to be operational in 1984. Current designs are based on Prolog, a language developed in France that is especially useful for mathematical computations. Now in the first of three stages, the 10-year program has some $42 million allocated for its first three years with $10 million earmarked for 1983. (Electronics, 19 May 1983.)

Nepal

An American private investor has set up a company, Data International, in Kathmandu which has already started operation in computer software production. The company, advertising in the local newspapers for new graduates with math and/or computer training, found many applicants with suitable background and intends to export computer software. (Reported by UNIDO's Senior Industrial Development Field Adviser in Bangkok.)

Puerto Rico

Silicon Valley-based Quantum is building a facility to produce eight-inch Winchester disk drives. The company is investing $1.3 million in machinery and equipment, and it is leasing a 21,500 square foot plant from the Puerto Rican Economic Development Administration. Quantum will lay off no Silicon Valley production workers as a result of the move. A company spokesman said: "Our strategy is to maintain a steady workforce here in the (Santa Clara) Valley, and as products reach high volume and mature, move production offshore." Eventually, Quantum will move its 5 1/4-inch Winchester disk drive production offshore, too, when "the product line matures and reaches full production". (Electronics News, 18 July 1983.)

Sri Lanka promotes "Export Village" concept

... The concept of the Export Village has been the topic of recent discussion. Sri Lankan Trade Minister, Lalith Athulathmudali, has been particularly active in promoting the concept. Given the enormous growth potential of the industries related to the new communication technology, the concept of the Export Village - which focuses on production and export of electronic components - is of great relevance. A Third World "Silicon Valley" would be a tremendous boost to development efforts. The achievement of this would depend rather heavily on firms from developed countries investing in export factories in the Third World, drawing on local, trained manpower. ...

Sri Lanka is an example of a country which is gearing itself towards making use of this opportunity. It is in the process of establishing the Arthur Clarke Centre for the Study of Modern Technologies at the University of Moratuwa. It is also providing enormous incentives to foreign investors to set up export-oriented electronics industries in Sri Lanka. These two measures should interact and create the right technological environment in which the new technology could best be exploited, from the communication as well as the commercial point of view. (Excerpted from an article in Development Forum, October 1983 by Narn J. Chitty, Counsellor at the Embassy of Sri Lanka in Washington DC.)

Singapore

A shift from labour-intensive industries to high-technology, knowledge-intensive industries is taking place. The government began reorganizing the country's industrial structure in 1979. It followed a National Wages Council recommendation to promote industrial advancement through wage increases. Computer-related equipment, aviation and industrial electronics, precision tools and aircraft repair are being emphasized. Foreign capital investments are playing an increasingly important role in Singapore's economy. Foreign high-tech firms are being offered a 40% income tax exemption for 5-10 yrs for investing in the country. Japan has established a strong foothold in the electronics field. It ranks 3rd in private sector investments behind the United States and Western Europe. Sord Computer System began producing microcomputers in Singapore in 4/82. The Singapore government is giving priority to developing software programs, hoping to export them in the future. The country currently has 1,200 computer programmers and systems analysts, but will need 5,800-7,800 computer experts by 1990. Specialists are being trained at 4 major institutes. (Technology Update, 1 October 1983.)

Singapore is rapidly becoming the disk-drive headquarters of Asia. Two more California manufactures, Maxtor and Computer Memories, have announced that they will open Singapore plants to supplement domestic production. According to industry analysts, Singapore has an edge on Hong Kong and South Korea in disk drives because the latter, while strong in electronic components, are relatively weak in precision metal and mechanical parts and the machining industry." (Global Electronics Information Newsletter, August 1983.)

South Korea

When Fairchild Semiconductor announced plans to close its optoelectronics division earlier this year, it arranged to sell its assembly equipment to General Instruments. The machinery is being shipped from Fairchild's Seoul, South Korea facility to GI's plant in Kuala Lumpur, Malaysia. Canadian telecommunications manufacturer Northern Telecom will work with the Daewoo Group to set up semiconductor manufacturing facilities in Korea. The announcement said that the facility will serve the Korean market, which probably means that it will supply linear integrated circuits to manufacturers of consumer electronics equipment for export. Timex, which has diversified in recent years from watches to home computers, has announced plans to assemble computers near Seoul. With the lure of $3 billion in orders for manufacturers into sharing some of their most advanced telecommunications technology. Among the foreign companies which have set up joint ventures with Korean industrial groups are ITT, AT&T, Northern Telecom, and L.M. Ericsson. These ventures are being organized to serve the entire Asian market, not just South Korea. (Global Electronics Information Newsletter, August 1983.)

Five-year national programme for microelectronics in Sweden

Guidelines for a five-year national programme for research, industrial development and training in the sphere of microelectronics in Sweden has been presented in a bill by the government. Estimated to cost Kr. 714 million ($95,000,000) over the period, the programme would be financed by contributions from the government and industry. In a first stage, the government will allocate Kr. 44 million for the 1983/84 fiscal year. The programme has been proposed by STU, the Board for Technical Development, as part of a broader scheme for integrated information technology.

The microelectronics programme will include fundamental research in the field of semiconductors and goal-oriented research in electronics and optics with a view to accumulating knowledge about new manufacturing processes and component technology likely to be of decisive importance for future system development, such as opto-electronic components and integrated circuits based on materials other than silicon. The part of the programme which concerns industrial development aims at building up the design capability among a broader circle of users of electronic components and the productive capacity among the leading component manufacturers which is required over the next 15 years. A total of eight projects have been suggested. The training programme covers equipment for instruction in microelectronics at university level and also funds for dissemination of know-how to small - and medium-sized companies and for extension courses for teachers and designers. Of the total of Kr. 714 million for the five-year period, the government will contribute Kr. 549 million and industry Kr. 165 million.

"Seeing" robot system introduced by ASEA

Industrial robots with an integrated vision system are now being introduced by ASEA, the Swedish-based manufacturer of electric and electronic equipment. The system, which is totally integrated in the robot, is designed to work in industrial environments. It identifies the workpiece, visually inspects it and determines its position and orientation using the same programming language and unit as the robot. The robot can easily and quickly be programmed by shopfloor operators. Another advantage is that complicated installation problems can be solved with minimum costs for planning and peripheral equipment. Moreover, in batch production, set-up times are substantially reduced.

The ASEA robot vision system comprises four main parts: the robot; a camera - up to four different cameras of the CCD (charge coupled device) type may be used, with external synchronization generated by image processing; an electronic part with memory and TV monitor integrated in the robot controller; and a programming unit. The gray scale technique is used for image processing, which is suitable, unlike binary systems, for normal industrial environments without any special auxiliary lighting. This technique enables the equipment to register small differences in contrast. The system is also capable of identifying varying forms on the surface of an object. The image processing system is extremely compact and, with the exception of the cameras, is housed in the robot control cabinet. Programming is done according to a memorizing procedure. First, the object involved is placed beneath the camera. The system then processes the image and presents its contours on the TV monitor. Thereafter, the system is "trained" a number of times in order to collect statistical data and to check if it really can recognize the object. Defining of the robot's grip point is also included in the programming mode. The main applications of the ASEA robot vision system will be in materials handling, simple assembly and integrated operations. The system is already in operation at ASEA Control, a division manufacturing low-voltage switchgear and control gear.

Flexible portal-type robot for materials handling and machine tending

Stockholm - A new portal-type robot for materials handling and machine tending, as well as automatic assembly, glueing, inspection, cutting and so on, has been developed by Electroline AB, Solna, outside Stockholm. Called the EP20, it can quickly handle components with weights up to 20 kilograms and, at slower speeds, even heavier loads. Of modular design, it can be tailor-made to suit the customer's working area, repeatability requirements and handling weights.

In its standard configuration, the robot is driven by three electrical servo DC motors for positioning with quick movements and high repeatability, while the control system can be expanded to encompass the positioning of eight electrical axes. Programming is made by a "teach-in" with a separate programming unit that has control buttons for function instructions.

The EP 20 is designed to work directly with production machines, transporters, carriers, etc., and clients can order the wrist in one, two or three axes design with electric or two-way pneumatic positioning. The gripper is specially designed for each application with single or double gripper or vacuum, magnetic or mechanical gripper. Maximum gripper speed is about 1.5 metres per second. Standard working volume is 1.5x1.5x3.0 metres.

In a typical application, the EP20 picks shafts from a transporter and delivers them to a lathe. Parts being produced are taken up by the double gripper and positioned in a fixture for inspection. If passed, they are placed on a pallet for accepted parts, if rejected, on a pallet for faulty parts. Pallets are subsequently removed on an automatic carrier. (The above three news items are reprinted from Science and Technology, November, 1983. SIP The Swedish-International Press Bureau, Linnégatan 42, S-114 47 Stoc .olm, Sweden.)

Spain looks to a future in semiconductors/ICs

The Spanish Ministry of Industry is considering a proposal to establish the country in the semiconductor/ICs producing market. A report presented to the Direccion General de Electronica e Informatica in June lays out a possible strategy for the development of a Spanish microelectronics industry. It is based on the formation of a company with two wafer processing centers and a third center for device design. Total cost is anticipated at $31 million. The report emphasized the importance of Spain establishing a base for a microelectronics industry in the next few years. If the Ministry of Industry decides to follow the program, the first facility will be a large processing center dedicated to the production of standard circuits and discrete power semiconductor devices. This center, ultimately, will be able to offer a complete product line. The facility would be able to produce about 3200 5-in. wafers per month. This projects to about 2300 good dies per wafer, which, after all processing and testing, would yield about 1275 circuits. Eventually, the facility would be able to produce about 100 million devices per year in 5 m CMOS and bipolar technologies. Of the three development approaches offered in the report, the medium cost one seems to have the best chance of success. This involves the acquisition of one or two companies together with the necessary technological information related to masking and processing. The acquisition is priced at about $5 million with $20 million for the plant.

The study foresees the establishment of a distributor network, both in Spain and in other countries, which would in about five years, bring sales, of about "22 million in standard linear circuits, $29 million in CMOS devices and $11.4 million in discrete power products. In the second phase, the report projects the formation of a design center for 2 um and 3 um CMOS products. The center would have to design and sell a minimum of 142 custom and semi-custom designs in a five-year period to become viable. The investment, including equipment and software for the center, is estimated to be about $1.8 million without the cost of the building. The center is expected to take a loss for the first two years, break even in the third, and become profitable during the next two years. A smaller facility dedicated to the fabrication of existing devices also is a possibility. This plant would have the capacity to produce circuits within about two weeks. About $4 million dollars is the anticipated cost of this unit. According to the report, the second facility would begin operation about nine months after the main plant goes into operation. During this period, the products designated for the second center would be manufactured elsewhere. (Semiconductor International, September 1983.)

Semiconductor manufacturing in Thailand *

Far better known for the dazzling colors of its raw silk than high technology, the Kingdom of Thailand is nonetheless home to a modest U.S. semiconductor assembly and test effort. With an area about the size of New York and California, combined, Thailand did not aggressively pursue foreign electronics companies like its neighbors Malaysia and Singapore. American electronics firms in Thailand can be counted on one hand: National Semiconductor is the largest. Next in size is Signetics Thailand followed by Honeywell Synertek (Thai) Co. Ltd. Minicomputer manufacturer Data General also operates a facility in Bangkok to provide parts for its own products.

Unlike the Philippines, where metropolitan Manila's "Silicon Superhighway" pivots around some 20 local and U.S. assembly facilities, the four U.S. company-owned plants in Thailand are situated in geographically different areas.

The attractions for locating in Thailand include a vast labor pool, low wages, large amounts of land and well-developed air and rail transportation systems. Other American companies reportedly were involved in negotiations with the Thai government in the past with a view toward locating an assembly site within metropolitan Bangkok. ...

The Thai people cling steadfastly to their language, and English is not common except in the tourist areas of Bangkok and Chiangmai in the North. "Only a very small number of our

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* By Ron Iscoff, West Coast Editor, Semiconductor International.

workers speak English," declares Lou Kish, managing director for Honeywell Synertek (Thai). "Even a figure like 10 per cent would be optimistic," Kish adds. "That means everything has to be translated into Thai, which is 'an inconvenience factor,' but it's not significant." Kish, who formerly worked in another Asian country, rates the Thais superior "Because of the quality levels they are willing to strive for and are able to attain. That's why I feel there's an advantage in being here." Kish reports that some difficulty upfront is commonplace. "Early on, National Semiconductor had labor catastrophes when they started here. Everybody knew about that; Signetics had its problems, also. "Traditionally," Kish continues, "it would seem that a lot of American companies had 'teething problems' when they started here. But once you get over them, it's a hell of a nice place to operate. The responsiveness is fantastic, and the skill level is high." The Synertek plant, which has about 40,000 ft^2 and 500 employees near Bangkok, acts as a sub-contractor to the company's larger offshore plant in Singapore. Wafers for assembly are sent from Synertek in both California and Singapore for assembly and packaging in the Thai plant, and then returned to Singapore for final test.

Honeywell Synertek is assembling and packaging only 24-, 28- and 40-pin plastic devices; ceramic and hermetic parts are handled in Singapore.

The company has a line of K&S model 479 and 1419 wire bonders and intends to replace the 1419 bonders with the automatic model 1482. "The mechanically-aided 479s still have a place in the semiconductor industry, but they're rapidly falling behind," he says. "We're going to see if we can't find some way to eliminate them from the environment." Kish explains that Honeywell Synertek (Thai) "is trying to develop an operation that has truly superior performance characteristics and uses a good selection of equipment and skills to turn it into a volume generator that will satisfy Synertek's needs." Additionally, Kish says he wants to minimize in-process inspection as much as possible and convert inspectors into producers. "It would be a distraction at this time to move other functions out here, such as customer service and that sort of thing, which are part of Singapore's charter." The Thai workers have a very low turnover rate despite the factory being "far enough from Bangkok that most young people don't really want to live out here," Kish remarks. Honeywell Synertek runs a special bus service from Bangkok for employees, because regular bus service to Pathumthani province is inconvenient. Kish notes that the government is putting up flats near the factory.

Data General, the only captive semiconductor maker in Thailand, operates from a 34,000 ft^2 facility. In addition to integrated circuits, the Data General plant assembles cables and produces printed circuit boards and system assemblies. National Semiconductor, the largest device maker in the country, is reported to produce chiefly low pin-count plastic devices in Thailand. Signetics Thailand Co., Ltd., is located in the Bangkhen suburb of Bangkok, about 25 miles from Synertek. A subsidiary of U.S. Philips, Signetics recently closed its Manila assembly plant and enlarged offshore locations here and in Seoul, Korea. Sig-Thai has expanded to about 2400 workers, an increase of 200-300, since the Manila plant was closed. Seoul has added about 150, according to Robert B. Mollerstuen, Signetics' senior vice president for manufacturing operations. Mollerstuen, based at Signetics headquarters in Sunnyvale, Calif., is a frequent visitor to the company's offshore plants. The Sig-Thai facility produces plastic, hermetic and ceramics, while the Signetics facility in Korea handles plastic only. In addition to assembly, both Sig-Thai and the company's Korean facilities perform final test on 90 per cent of the products assembled in Asia. A portion of the assembled and tested product from Korea is sent directly to customers, while the devices finished in Bangkok are returned to Signetics, Sunnyvale for distribution. Mollerstuen notes that cycle time is now a key issue, and Signetics is running a 10-day cycle for plastic. "We're going to put on a concentrated effort to reduce that time to 7 days," he reports.

Part of the time reduction will be equipment driven. Signetics plants, including Sig-Thai, now have Philips wire bonders, known as Phicom units as well as a mixture of Kulicke & Soffa units. The Phicom bonders have a throughput comparable to the K&S 1482, 1100-1200 units/h on 14 lead devices. Recently Sig-Thai took delivery of Shinkawa's aluminium bonders for use on the plant's hermetic line. Mollerstuen says vendor service in the area is exceptionally good. "Kulicke & Soffa has a full service network out here; Shinkawa is outstanding in their service; in the handler area, MCT has representation and an office in Singapore that serves the whole area. We've also got an IBM computer with service out of IBM, Thailand. "That's a lot different than it was when I first came to Asia nearly 15 years ago. It was a different story then. K&S or any of the vendors would send a rep over once every six months. We'd have a board go bad in a tester and the unit would be down while we sent it back to wherever. But those days are pretty well gone. If a part is not available in Thailand or Hong Kong, we can have it flown up from Singapore in a very short time."

Asked to compare Thailand with other Asian sites, Bruce A. Stromstad, managing director of Signetics Thailand notes the country has more import/export restrictions than Hong Kong or Singapore. "Customs controls are considerably tighter and Thailand is not a free port in terms of equipment as are both Hong Kong and Singapore." As a result of the controls, Stromstad says, "We just have to build a little time into our schedules. It's never been a major problem." Stromstad is the only American at Sig-Thai; however, the production manager is Chinese and both the quality manager and engineering manager are Korean. The financial staff is composed of Thais. The company uses local engineers for process development work, sustaining engineering, installation and training. We haven't found a problem in recruiting them," adds Stromstad, "and the ones we have recruited are quite good."

Sig-Thai does all of its equipment maintenance, including bonder repair. "When we buy a new piece of equipment, we will typically do the training on it either at the vendor's facility or bring in a field engineer from the vendor to train our local staff. "For example," Stromstad remarks, "right now we have two people in Japan undergoing training on some new equipment we will be receiving in a week or two. Our people will in turn pass that training onto our local staff."

What about the future of offshore assembly?

"I think it has an ongoing future," Mollerstuen replies. "As the industry grows, and you assume that in good times the industry will double every five years, then the number of devices required will continue to increase. "Additionally, I wouldn't know how to replace my Korean plant or this plant. If we were to try and recruit the kind of background and experience necessary to run this plant in the U.S., we would have a very difficult time. Where does an engineer in the U.S. learn assembly experience today?" Mollerstuen asks rhetorically. As we go to the fully automated line, then we will have more opportunity for more stateside assembly; but it will require some unique discipline." "To me, increased demand for integrated circuits means the offshore plants have an ongoing role to play." (Reprinted with permission from Semiconductor International Magazine, September 1983. Copyright 1983 by Calmers Publishing Co., Des Plaines, Illinois, USA.)

Britain gambles on super chips

Inmos,* Britain's government-backed semiconductor company, has unveiled its "transputer", a 32-bit microprocessor. But the firm faces stiff competition from nearly every big semiconductor and computer company. Motorola, Intel, Digital Equipment and Bell Labs are preparing 32-bit processor chips, while National Semiconductor and Inmos expects that when its device comes out at the beginning of 1985 it will be in the middle of a clutch of new 32-bit chips. The largest available microprocessors for computers and related equipment handle data in chunks of 16 bits. The new breed of 32-bit processors will allow engineers to build computers better suited to handling graphics, and understanding the human voice. Because 32-bit processors can cope with more complicated programs they are useful in systems where several people share a processor, or in computers that do several things at once. Inmos is pinning its hopes of commercial success on the fact that the transputer has a number of novel design ideas. First of all, unlike other processors, the transputer has its own memory - 4 Kbytes of static RAM (random-access memory). Information can be shuttled between this memory and the processor quickly enough to enable the transputer to carry out 10 million program instructions per second.

According to Inmos, the processor's memory would be used as a temporary store in a computer, holding data from higher-capacity memory chips wired up to the transputer. The transputer can call on four million bytes in this way. The transputer's speed is also due to its small size. At 45 square millimetres, it is considerably smaller than existing processors, few of which are under 100 mm^2.

Inmos has aimed the transputer at computers that use artificial intelligence techniques, particularly parallel processing, in which different processors carry out several steps simultaneously. Transputers are equipped with communications together in groups of four. Each transputer can carry out separate parts of a program at the same time. The device will cost around £5 million to develop, according to Inmos' managing director, Iann Barron. This compares with the $100 million that Hewlett-Packard spent on producing its 32-bit processor. So far Inmos has yet to make a full specification transputer - the prototype works half as quickly.

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* INMOS was launched in 1978, when the British government put up £25m. That has since become £65m cash plus £35m of loan guarantees. The company is now 75% owned by the British government with most of the rest belonging to two of its founders, Mr. Iann Barron, and Mr. Richard Petritz, the managing director. It has a factory and development centre in Colorado, U.S.A., an R&D centre in Bristol and a high-tech new factory in South Wales.

Companies such as Intel and Motorola which already make smaller size processors are experienced at providing the computer development systems and back-up that customers need to program their processors. Although Inmos does not have the same support, Barron believes his competitors are too wedded to their existing products, and will not be able to move as fast as Inmos. The transputer is the first of a family of processors that Inmos plans to make. The company is also developing a 16-bit version of the transputer, a processor designed to control magnetic disks and a graphics processor that will drive computer displays. So far Inmos, which has 50 scientists and engineers at work at its headquarters in Bristol, has contented itself with making 16K and 64K memory chips. Only the 16K chips have had much success in the competitive microelectronics market. (New Scientist, 10 November 1983.)

And more on INMOS

INMOS International PLC, the government-backed British semiconductor manufacturer, last week gave a description of a new type of microprocessor which, it claims, will become a building block for "fifth generation" computers.

The device, to be known as the transputer, was originated by Mr. Iann Barron, a director of Inmos.

...The transputer will operate with a reduced instruction set optimized for execution of high-level languages. The impressive specification has been achieved partly by increased communication speeds possible when memory and processor are combined on the same chip. But the feature that is likely to secure a long-term future for the transputer is that it is designed for integration into arrays of many transputers operating concurrently. The transputer will be able to interface with existing industry standard devices and, most importantly, with other transputers, via special "Inmos links". These links will allow an array of transputers to operate as an "intelligent community". Inmos has developed a special language for use with the transputer which reflects this feature. The language, called Occam, allows problems to be broken down into separately-running subunits so that the processing speeds likely to be needed in so-called intelligent machines can be achieved.... (Excerpted from Nature, vol. 306, 10 November 1983.)

UK must make chips - Sinclair

Britain must have its own chip making industry if it wants to take part in the next industrial revolution based on fifth generation computers. So says Sir Clive Sinclair, the man who has sold more computers than anyone else in the world. "Not to have a semiconductor industry would be like not having had any metal founding capacity during the first industrial revolution. It would be like Birmingham having been in Japan," Sinclair commented.

At the same time Sinclair slammed the government's Alvey programme for research into the next generation of computing. He said he would not invest in Alvey because he was not prepared to put up 50% of the money for research and then give away the results. "If 100% of the money for projects was an offer I might take a view that some of the work could be done on our premises, but I don't see ourselves as the sort of place where this research should be done," he said. Rather than the Alvey programme, the government should set up a central research facility to do fifth generation work. The government should bring everyone together for a crash programme," said Sinclair.

Sinclair said Inmos must be kept British. But he has no intention to buy any of it if the government goes ahead with plans to sell. "Inmos is a bit too big for me. It is not our business to invest in that kind of industry," he said. He went on: "Very soon the only way to have a leading edge product will be to design the silicon from scratch. If we don't make chips we've had it. I think I'll emigrate," he added.

According to Sinclair, the British semiconductor industry should be based around the chip makers Plessey, Ferranti and Inmos. "The bits of the semiconductor industry we've got is where we start. We need a national sense of humour to hammer out a massive silicon foundry among those people." Sinclair is planning to get into new areas of research. His new £2 million centre, Metalab, will open in the autumn. Projects at the centre will be those that do not fit in with current research or those which represent a high risk because it is not clear how long it will take to get a product to the market. (Computer Weekly, 4 August 1983.)

More cash for Britain's IT campaign

The government is putting up £250,000 to keep last year's information technology awareness campaign going for another 18 months. But industry people close to the IT82 campaign say the amount is far too little, and they point out that it is coming nine months after the end of last year's programme. During those nine months the government has relied on the IT82 committees to carry on last year's work on a voluntary basis. The money will pay the salaries and expenses of 10 regional co-ordinators. They will work closely with local Department of Trade and Industry offices and with the regional committees. The jobs will be full-time but last for only 18 months. The government has also bought two more caravans to mount mobile exhibitions on information technology. One will show an automated office and the other will concentrate on computing in retailing. These will join the six from last year and tour the country. They will be run by the National Computing Centre.

"The funding is not enough," said Alan Benjamin, director of IT82 and a full-time director of software house CAP. "A regional co-ordinator won't be able to do much with £25,000." But, he added: "They will be important in keeping local events going. And their close contact with the Department of Trade and Industry will mean the department's aims will get through to the committees immediately."

The department said there had been a lot of goodwill from committee members. People had given up their time, and companies had provided exhibition space and meeting rooms for free. The department added that the emphasis would now be on information technology awareness among business people, rather than the general public. Dennis Blackwell, chairman of a British Computer Society information technology working party, welcomed the plan, but said it should have been announced a year ago. "It's a very good idea to keep the momentum going and it's better late than never," he said. "But I doubt whether the amount's much use." Benjamin added that IT82 had been a success. Surveys showed that public awareness of information technology rose from 17 to 62% during the year, while over 80% of business people had called for more government backing for demonstrations and education. Over 630,000 people had visited the mobile exhibitions. (Computer Weekly, 29 September 1983.).

UK: Unemployed teenagers trained in IT centres

Britain's hugely-successful information-technology centres, which are being set up all over the country to train unemployed teenagers in the skills of IT, may soon be able to reinvest the profits from their commercial ventures in new equipment and business expansion. An announcement from the Treasury is expected later this summer. The new deal for IT centres follows intense pressure from the Manpower Services Commission (MSC), which funds the centres. IT centres are springing up at an extraordinary rate. The first opened in Notting Dale, West London in 1980. Today there are some 50 centres, few of which are more than a year old. Another 100 will open for business by the end of the year. At the heart of the scheme is the idea that young people should learn up-to-date-techniques in an atmosphere that resembles ordinary employment. Thus the MSC encourages each centre to sell goods and services to local industries. The centres are responding to the challenge. According to the commission, about 70 per cent are involved in some kind of commercial activity, for example typing out letters on a word processor or making rudimentary electronic goods.

The problem, however, is that under Treasury rules any cash that the centres make through such enterprises must be offset against operating costs, which are paid by the MSC. So the money the centres earn is effectively returned to the coffers of central government. And that reduces the incentive to become involved in business ventures. As information technology centres are so new there is plenty of opportunity to skirt round the rule. One centre in north-east England operates what it privately calls a "slush fund" that puts cash earned in business ventures into purchases of new equipment.

But most centres would like the government to approve the idea that the money can be put to whatever use each centre chooses. The cash would be spent without a reduction in the grant that each centre obtains from the MSC. A workshop training 30 people receives about £150,000 per year from the MSC with a further grant of £75,000 over three years from the Department of Trade and Industry. The MSC alone expects to spend some £20 million on information-technology centres this financial year.

- The MSC wants to widen the scope of IT centres by using them to train unemployed adults. In one plan under discussion, four pilot schemes would start over the next few months at centres in Telford, Leicester, Portsmouth and Southwark in South London. The centres would provide courses ranging between three months and a year in specific subjects such as computer maintenance or the design of printed-circuit boards. Each centre would cater for about 50 adults per year in addition to its teenage trainees. (New Scientist, 21 July 1983.)

Greater London Council puts technology in reach of jobless

Unemployed Londoners are being brought together with academics to create jobs by exploiting bright ideas. The Greater London Council is putting £4 million into setting up what it calls technology networks to make expertise and equipment at London polytechnics and universities available to "ordinary people". The project, announced today, is backed by two polytechnics plus researchers at St. Thomas' Hospital, Imperial College and City University.

The four technology networks, formed by the GLC's Greater London Enterprise Board, will have shop-like centres where people can go to discuss their own ideas or set up their own businesses using ideas from the centre. Workshops and second-hand equipment will be available to get ideas to the prototype stage. Network centre staff and academics will provide technical advice. Existing businesses will also be able to draw on the pool of ideas. Royalties will be re-invested in the networks.

"Enthusiasm among researchers and community groups is such that ideas for the product bank are already piling up, ready to go into production as soon as the networks open," said Dr. Michael Cooley, director of the Greater London Enterprise Board's technology division. These ideas include a robot arm, medical expert systems, energy monitoring products and a controlled entry system for flats and old people's housing. "The response of London's research institutions and their staff to the networks in the preliminary stages has shown the great enthusiasm they have for making their work more relevant to ordinary people," Cooley said. One in eight of London's workforce is unemployed and there are 33 million square feet of idle factory space in the capital. (Computer Weekly, 1 December 1983.)

Computer link for Jobcentres

Southeast region Jobcentres will be electronically linked with virtually every other Jobcentre in the country. The tie-up is the final step of a five-year project mounted by the Manpower Services Commission and developed in conjunction with Perkin-Elmer to improve the efficiency and effectiveness of the MSC's employment service. "The new computer-based system can transmit quickly details of vacancies to other Jobcentres in the network, and ensures that the widest possible choice of the jobs that are available are promptly made known to every job seeker," says John Taylor, head of the MSC's employment service Computer Development Branch. "This improves our standard of service to potential employees and employers alike, while helping to contain our administrative costs." Tests of the MSC's new Vacancy Circulation and Statistics (VACS) system have shown that it gets news of a job opening around all interested offices 1 1/2 days faster, on average, than ordinary post or telephones. (Electronics Weekly, 7 September 1983.)

Disabled projects aim to create 80 jobs

The first of a series of London projects to provide jobs for disabled people in the computer services industry was officially opened on Monday by industry minister John Butcher. The aim of the scheme is to create 80 jobs in the next two years by training disabled people to operate computer bureaux for local businesses, offering printing, word processing and book-keeping. Already seven disabled people are being trained for the first project in the London Borough of Lewisham with more projects to follow later this year in Charlton, Hammersmith and Islington.

"This is the first project of its kind in the UK," says Brian Upright, manager of the Lewisham project. The scheme is called Outset, and the Lewisham project has received initial finance of £100,000 from four sources: the Manpower Services Commission, which is paying for the training, the Department of Industry, the London Borough of Lewisham and Citibank. But Upright says that the scheme will eventually be self-financing, apart from disabled facilities such as toilets which will be provided by the borough. "We hope to break even as a bureau after the first year," he says. The bureau service is based on a DEC PDP-11, which will be linked to the project at Charlton. Each of the staff will have a terminal for program development.

The computer industry has provided more opportunities for handicapped people than most. There are now 200 blind or partially blind programers and analysts, according to the Royal National Institute for the Blind (RNIB). The RNIB is this week launching an electronic office product for use by blind people. The advent of word processors has kept blind people out of office jobs, but the new product, developed with the help of a Department of Industry grant, is equipped with mechanical aids to help the blind operate them. (Computer Weekly, 3 November 1983.)

UK government funds CAD/CAM study

Under a revamped CAD/CAM awareness scheme, the Department of Trade and Industry will provide half the cost up to £50,000 for firms to hire consultants to plan the introduction of new machines and production methods. This is one part of the enhanced CAD/CAM awareness project announced by Kenneth Baker, the Industry Minister. The allocation of the £10 million which the changes will cost was announced in the March Budget. Until now the amount available for consultancy under the awareness scheme was limited to £2,000 for feasibility studies. This figure has now been increased to £3,000. Provision of money for planning how to introduce CAD/CAM is a new facility, and should counter criticisms that the awareness scheme did not help firms to implement recommendations from feasibility studies.

Baker also announced that the scope of the project will be extended so that any company with a significant design problem is eligible. This will include companies involved in the mechanical, electrical and electronics sectors, or which manufacture discrete products in other sectors which call for significant engineering design, or provide direct support services to these manufacturing sectors. The DoTI has commissioned a self-teaching programme to show industrialists how to apply CAD/CAM techniques. The programme will cost £500,000 to produce, but this will cover the first 1,000 copies of the programme. (Computer Weekly, 4 August 1983.)

UK - Northern Ireland

Ever since 1968, when the 'Low Cost Automation Centre' was established at Queens University, Belfast, developments in technology have been monitored and translated into practical programmes and services by its Director Eric Beatty and his staff, to help industrial progress. Originally set up to focus on the 'do it yourself' approach to production automation favoured then by small companies, the Centre has progressively extended its resources and abilities.

Microprocessor systems, programmed logic controllers and robotic equipment share the new laboratory and office space with the Centre's nine full time staff. Eric Beatty explains that low cost automation is still important but the range of services dictates that 'Automation Centre' is a more appropriate title for today. Work is 'primarily associated with the application of new technology to the mechanization and automation of manufacturing processes'.

Director Eric Beatty is from Derry, and spent several years in manufacturing industry before joining the Centre when it was set up. He points out that the Centre 'derives all its income from outside the University', with most of the finance generated directly by work for industry. The advisory and information on automation service receives support from the Industrial Development Board. Eric Beatty has a particular concern for our small companies - 'they need awareness and training in specialist technology topics that can be profitably exploited in the short term'. He sees robotic equipment increasing in importance and notes the trend from 'circuits to systems' in electronics. The relevance of electronic engineering is clear from the training course programme, with almost half of the topics involving microprocessors, computers or information technology.

The Automation Centre is a key contributor to technology-based industrial innovation, progress and survival for Northern Ireland.

Another new scheme to help industry is the Advisory Service to Industry, now set up and ready to roll. It will be operated through the ASI Co-Ordinating Unit at the Northern Ireland Automation Centre. Its location underlines the status of the Centre, but this IDB initiative has its own staffing structure and operation permit. ASI Project Officer is Rodney Hamill, who has both process control and electronics industrial experience. The outstanding feature of the service is 100% grant aid for consultancy projects (up to 5 man-days work for larger organizations). There is an emphasis on production efficiency and aspects of design and product enhancement are also eligible as topics for advisory projects. Electronics manufacturers can benefit in areas such as automated assembly, automatic testing and product improvement. Already, companies and consultants are showing interest in the scheme. (Electronics Report, October 1983.)

US high technology

State governments have become key but inconspicuous players in the promotion of high-technology industries. In an intense competition to attract high-technology investment 27 state governors have appointed boards and commissions to upgrade local research universities, build science parks and conjure up venture capital for private or academic entrepreneurs who can turn scientific ideas into marketable products.

Science councils at state government level appear to have become essential for states that want to attract high-technology industries. Earlier this year, 27 states competed to persuade the new $50 million Microelectronics and Computer Corporation (MCC) * to make its home in their state. According to MCC chief executive Admiral Bobby Inman, the decision went to Austin, Texas, because a state board mobilized political, financial and academic leaders and put together a package of inducements MCC could not refuse.

As part of the package, the state will sink large sums in the University of Texas at Austin to build up its strength in computer science. There will be $15 million over three years for endowed chairs and additional professorships and $750,000 a year for 10 years in grants for computer science graduate students. The state is offering MCC a new building on university-owned land at a minimal rent, low fixed-interest home loans for MCC staff and a job-finding service for their spouses. Texas is only an inch ahead of other states working aggressively to increase their stake in high-technology. New York, which first set up a science and technology council in the 1960s, is spending heavily to implement a high-technology master plan, devised by the Battelle Laboratories (Columbus), that will boost the state's existing strengths in electronics, information science, medicine and biological products.

Under one programme, the state is supporting university and non-profit laboratories whose work can be rapidly commercialized. The State University of New York (SUNY) at Stony Brook, for example, is receiving money to find industrial collaborators for its work on the production of monoclonal antibodies. Meanwhile, a state-funded corporation for innovation development gives start-up capital to small high-technology ventures. A typical recent investment was $ 100,000 for Laboratory Microsystems, a Troy company that applies microcomputers to laboratory instruments. At the centre of New York's plan is the designation of "centres of advanced technology" to nurture links between universities and companies. Advised by the National Academy of Science, the state has already spent nearly $ 2 million on four centres at local universities: Cornell (biotechnology), Rochester (optics), SUNY (medical diagnosis) and the Polytechnic Institute of New York (telecommunications).

In Massachusetts, where new high-technology industries have helped to arrest two decades of decline in conventional industries, a state technology park corporation in raising funds for a network of facilities that can be used by universities and private industry to train students and employees. The first facility, a $40 million microelectronics centre, will receive half its money from the state and half from a consortium of private companies and universities. Like New York, Massachusetts has established a technology development corporation which tracks down venture capital for new companies or invests its own money in young companies. Last year, the corporation invested $ 150,000 in Aspen-Technology, a computer software company formed by members of the faculty at the Massachusetts Institute of Technology.

North Carolina, runner-up in the competition for MCC, has recently improved co-ordination between its already strong research universities and high-technology companies. By setting up a microelectronics centre and a biotechnology centre, the state plans to harness existing research resources so they are better able to compete for federal grants and private investment.

Later, however, there have been signs that this kind of competitive bidding is falling from favour. A forthcoming report by the National Governors Association points out that no state can capture more than a small share of high technology firms. Future efforts, it says, should concentrate on supporting local research institutions and nudging existing industries in the direction of new technologies. (Nature, vol.305, 1 September 1983.)

USA: Trust laws fall for new technology

President Reagan has made another cut at the laws, American companies claim are keeping them behind their Japanese and European counterparts in the scramble for high technology's profits. Reagan last week introduced moves to change laws dating from the turn of the century that were designed to keep the "robber barons" - mostly big oil and railway companies - from conspiring to fix prices and divide markets in restraint of free trade. These

* See also next news item.

"anti-trust" laws now discourage electronics, computer, drug and other technologically-driven companies from pooling their resources. "The result is a reluctance by American companies to follow paths that involve spending large sums on R&D especially in fields such as semiconductors where there is an active international market.

One enterprise has recently decided to run such a risk. Microelectronics and Computer Technology Corporation (MCC) is an affiliation of several medium-sized electronics firms. Its boss is Admiral Bobby Inman, formerly the deputy director of the government's super-secret electronic surveillance organization, the National Security Agency. MCC's aim is to dominate the world market in computers and their components, much as Japan hopes to do with its Institute for New Generation Computer Technology (ICOT).

ICOT has pooled talent and resources from several companies, something Inman hopes he can do as well. Last December, the US Justice Department gave Inman an amber light, letting him know that at least for now his consortium is legal. Once MCC starts selling products, however, the departments will take another look. (New Scientist, 22 September 1983.)

USA: Microlectronics education supported by semi-conductor industry

...The Microelectronics Laboratory of the University of Arizona was established in 1966 with just $80,000 from the National Science Foundation (NSF) and the University. Since then, the semiconductor industry has helped to maintain the Laboratory with equipment, research contracts, teaching help and grants. Industry support has come from local companies that include Motorola, IBM-Tuscon, Hughes, Burr-Brown, GTE and Roger....

...According to Roy Mattson, head of the electrical and computer engineering department, "To create a similar laboratory today with the same capability and equipment would cost at least $ 6 million. While this Laboratory has received relatively little state support, it is very nearly self-sufficient and is a high-quality operation"...

Its director believes that the University of Arizona has come up with a unique curriculum that produces an engineer who knows both the electronics of the device and the wafer fabrication process involved. "Today, the whole process from design to finished ICs is so interactive that it is extremely important to provide foundations in circuit design that relate to wafer processing," he says....

Among the many projects currently in progress at the University's Microelectronics Laboratory are research in tungsten and cold-wall tungsten LPCVD reactors, which may lead to a spin-off industry; a CMOS capability with which they would like to produce the first university-made microprocessor, and leading research in ISFETs, ion-sensitive field effect transistors. In addition, a graduate program in electronic package engineering, designed to involve both industry and other departments at the University, will soon be started. (Excerpted from an article in Semiconductor International, July 1983.)

Zimbabwe hit by personnel shortage

The Zimbabwe Government is having difficulties getting qualified and experienced computer personnel, the Deputy Minister of Economic Planning and Development, Chimbidzayi Sanyangare, has revealed. Opening a three-day computer appreciation course for senior Government officials in Harare recently, he said: "This situation is getting worse rather than better on account of the unprecedented increase in computers in the public and private sectors." The computers the Government acquired had to be used fully before other computer projects could be embarked on. This entailed the "involvement and commitment by all senior people in Government, to ensure that the tools on which a lot of money has been spent do not become mere white elephants".

The country lacked locally trained staff able to use computers and until personnel were available, little progress would be made in realizing the full potential of computers. "There is therefore little doubt that accelerated computerization is the most rational response to the demand for better management of data, its flow, manipulation and retrieval. Without accurate data we cannot make sound decisions for the development of our country and people." Some Government officials were not aware of the importance of information and of the extent to which they depended on information in making decisions.

The course was launched by the Ministry of Manpower Planning and Development and the Public Service Commission throught the Scientific Computer Centre. Two similar courses are to be held in the near future. (Electronics Weekly, 17 August 1983.)

GOVERNMENT POLICIES

In this new section, the Microelectronics Monitor intends to introduce in each issue one or two countries as examples of successfully implemented national policies in promoting new technologies.

In this issue we look at the Republic of Ireland, which for centuries had been mainly agriculture-based and then became a centre for subsidiaries of foreign-based heavy industries by offering favourable tax rates and depreciation allowance as well as cheap labour. As some of the older industries are failing and redundancies increase, Ireland is making every effort to become a major electronic manufacturing centre. The Irish Development Agency (IDA) decided ten years ago to concentrate on creating an electronics industry because it is clean, fast-growing, labour-intensive and needs low capital investment. The growth of the industry has been quite impressive: in 1972, 30 companies employed 5,000 people and exports totalled £28 million. Now, in 1983, 250 companies employ 22,000 and 1983 exports are expected to be £1.2 billion. Limerick-Shannon and recently Cork have become the main electronics industry centres supported by the national microelectronics application centre at Limerick and the national microelectronics research centre at University College, Cork. In Cork it has taken time to build up the necessary infrastructure. The IDA has had to buy land for new industrial estates, telecommunications and other services have needed improvement. More importantly, Cork University boosted its educational efforts and is now turning out a good supply of highly trained technical personnel. This may provide an incentive for foreign electronics companies to set up manufacturing subsidiaries.

As a further step, the government is planning a national electronic software centre in Dublin. The new centre will be established by the Industrial Development Authority at its new enterprise centre in Pearse Street, Dublin and will cost IR£1m, of which £400,000 will be in equity and the balance by way of grants for buildings and equipment. The centre will become operational by the end of this year and is expected to be self-financing within four years.

The minister, John Bruton, said it will have its own board of directors, membership of which will include representatives from Irish and international businesses, educational and technical institutions in Ireland and appropriate public sector members. A managing director with widespread experience in the computer software industry will be appointed before the end of the year and about 14 people will be employed in the initial stages, professional software personnel with at least three to four years' experience. Bruton said the aim of the centre was to increase the number of workers in the software side of the electronics industry in Ireland from its current level of 2,500 to 7,500 and possibly to 10,000 by the end of the decade. The new centre was decided upon after major research carried out internationally by the IDA, to ascertain the strategy Ireland needed for developing a software industry. It is based in concept on similar centres in European and the IDA has had close co-operation from the Irish national board for science and technology, another state body, in the establishment.

The activities of the new centre will include software development in co-operation with existing software and hardware companies. Software contract work will also be sought for the development of programmes for EEC and other international bodies. Advanced training in techniques at present not available in Ireland will also be provided to increase the technical capabilities of existing companies and technical assistance will also be available to Irish companies in the software export field by advising them on documentation needs. The country's minister for industry says it will provide a "total infrastructure" for the electronics and computer industry in the Irish Republic. (compiled from articles in: New Scientist, 20 October 1983; Electronics Weekly, 26 October 1983; and Electronics Report [Ireland], October 1983.)

India: debate on national communications policy

As part of the World Communication Year, as declared by the United Nations, it is proposed to initiate a debate on the national communication policy at the end of 1983. A number of technical and general seminars, besides other activities in diverse fields, in the earlier part of the year are expected to provide "talking points" for the debate. Outlining the various areas in which the Government was trying to initiate action during 1983 Mr. T. V. Srirangan, wireless adviser to the Government, told reporters that while methods to improve the existing communication network would be an important part of the year's activities, other projects had either been initiated or were to be organized shortly. He emphasized the need to generate awareness about the spectrum of activities covered by communications, like various types of media, defence and links with space.

One of the programmes included extension by the Posts and Telegraphs Department of the communication facilities to all parts of the country during the decade to enable a telephone to be available within 5 km of any inhabitation. Also, 300 long-distance telephones would be provided in selected areas in the north at a cost of Rs 154 crores. The facility would gradually be extended to other centres. The Railway Ministry had undertaken a survey on the Delhi-Ballarshah and Bombay-Nagpur section of Central Railway to explore the possibility of introducing on a wide-scale telephone link between trains and railway stations. Also during 1983, the communications systems in the Andhra-Orissa-Tamil Nadu cyclone prone coastal areas would be improved by the P and T Department so that wireless, telegraph and telephone links could help give timely cyclone warnings.

To symbolize the importance of communications the International Telecommunications Union had invited the Heads of State of all Governments to join a Committee of Honour and 65 Heads of State, including the President, Mr. Zail Singh, had accepted the invitation, according to Mr. Srirangan. (Statesman, July 1983.)

LEGISLATION AND STANDARDS

WIPO decides to have no special treaty on software protection for the time being

The Second Session of the Committee of Experts on the legal protection of computer software convened by the World Intellectual Property Organization (WIPO) within the Paris Union for the Protection of Industrial Property, was held in Geneva from 13 to 17 June, 1983. IBI was represented by Mr. Thomas Ennison Jr., legal adviser to the Director-General.

The first session of the Committee was held in 1979 soon after the publication of the WIPO model provisions on legal protection of computer software in 1978. Recommendations were made at that time for further study of the desirability and feasibility of a treaty for the protection of computer software and/or the adaption of one or more existing treaties. Accordingly, the International Bureau of WIPO conducted a survey on the issue and based on the results thereof, prepared a draft treaty. This second session of the Committee was consequently convened to consider once more the issue of the appropriate form of legal protection for computer software, in the light of this work done by the International Bureau; and its conclusions therefore represent the latest in the thinking of the international community on this subject.

The Committee took the important decision that it was premature to take a stand on the question of the best form of international arrangement for the legal protection of computer software. It therefore recommended that considerations for the conclusion of a special treaty as presented should not be pursued, for the time being. It noted that as a result of the application of the principle of national treatment, the increasing trend at the national level in a number of countries of granting protection under copyright law to computer software was likely to have the salutary consequence of satisfying to a considerable extent as between those countries, the need for international protection by means of the international copyright conventions.

In the meantime, the next stage of the work in this field will be focused on a WIPO/UNESCO joint study on the protection available for computer software under copyright laws and treaties, to be followed by a meeting of governmental experts. It was recommended that the results of the present committee should be brought to the attention of the future WIPO/UNESCO joint Committee of Governmental Experts, together with supplementary observations to be invited from governments and interested international organizations, particularly on the question as to whether any mechanism for the protection of ideas or concepts on which software is based, such as methods, processes or operating systems, would be desirable.

It has always been part of the terms of reference of the work on computer software protection as defined in the original request of the United Nations to study the possibilities in the field of international arrangements with a view to facilitating the access of developing countries to information on computer software. This touches on the nerve of IBI's concern in this field, especially as the organization is involved in many ways in bringing up developing countries into the main stream of Information Technology. As rightly pointed out by Professor M. Najim, the delegate of Morocco at the meeting, when examining questions of international protection for computer software, it is necessary to keep the special conditions of developing countries in mind. (IBI Newsletter, 12.)

United Kingdom: Copyright for software

A new move to get software covered by copyright legislation is to be launched by the British Computer Society next week. The idea is to bring in a Private Member's bill that would remove the doubt on the subject through a simple amendment to the 1956 Copyright Act. Industry leaders see no prospect of the government fulfilling within the next three years its pledge of a general reform of copyright law.

Common Market plans to promote an international law have stumbled on member States' objections, leaving individual nations to put their own houses in order. (Computer Weekly, 1 December 1983.)

United States of America: software copyright case

Apple Computer won its appeal of a software copyright case against Franklin Computer (Philadelphia). The Federal appeals court ruled that all computer programs may be copyrighted, even if they are an integral part of a computer's circuitry. For the consumer, the decision may mean that fewer low-priced imitations of the most popular personal computers and programs will be available on the United States market. Franklin admitted that it had copied 14 operating system programs - the basic instructions that tell a computer where to store and retrieve data - but it claimed that such systems were not protected under present United States copyright law. Apple now wants the Federal District Court (Philadelphia) to prevent Franklin from selling its Ace 1000 computer. Should it succeed, it could deter other firms from imitating computer and software designs. (Technology Update, 24 September 1983.)

Copyright for circuit patterns

Copyright protection for 10 years on semiconductor circuit patterns would be provided under legislation being considered by the Senate Judiciary Committee. According to C. Mathias (R-MD), a co-sponsor of the bill, firms can buy chips on the market, take them apart, copy the design, and then sell duplicate chips on the market, avoiding any R&D costs and underselling the originator. Unwitting purchasers of pirated chips will be protected under the bill by a compulsory licensing provision, allowing such a producer to continue using the device. (Technology Update, 3 September 1983.)

Computer crime is all a fraud say Canadians

The widely-held "tip of the iceberg" theory that 85 per cent of all computer crime goes unreported with billions of dollars lost every year, was challenged in an official Canadian report. "There is very little data which clearly demonstrates that computer crime poses a serious problem", states a Canadian government committee on computer crime instigated by Perrin Beatty, a Canadian MP. The committee, which has been sitting for six months, nevertheless recommended that two new offences be created in Canada; unauthorized access to a computer system, and unauthorized alteration or destruction of computerized data. The committee states that computer crime is over-estimated "because any offence remotely associated with a computer is described as computer crime. For instance, if a dishonest bank employee manually falsifies financial records which are fed unaltered into the bank's computer, it is no longer considered fraud, but computer crime. Therefore, there is a tendency to sensationalize fairly common offences."

Evidence collected by the committee "suggests that approximately 75 cases of computer crime are reported annually worldwide, with an annual loss of about $40 million". The committee concluded that "relatively little is known about the incidence and seriousness of computer crime", but that is "not a justification for legislative complacency." That is why the committee recommended legislation to stop a series of abuses which are not prohibited in Canadian law.

Canadian laws

Canada is moving towards firmer laws for software copyright. The Federal Cabinet is inviting proposals for changes to the law this autumn, although legislation is still several years away. According to Bruce Couchman, a policy-analyst for the Department of Consumer and Corporate Affairs, any changes in the law cannot take effect before 1986. (Computer Weekly, 13 October 1983.)

Software standards take shape

Software professionals have a tendency to greet the subject of standards with a yawn. To most of us, a standard is a restriction foisted upon us either by the government, as a contractual requirement, or by the special interest committees that define programming languages, information interface standards, and so on. But the most active software engineering standards effort under way today is engaging the energy and enthusiasm of many hundreds of software professionals all over the world. The Institute for Electrical and Electronic Engineers has now published four standards, completed one more, and currently has 12 additional standards under development. These standards (the term is used here to include recommended practices as well as standards per se) represent an important step in the growth of software engineering as a profession. They are establishing the basic practices and procedures that will guide this fledgling profession in the years to come.

Computer programs control critical-care medical units and the fabrication of drugs, the timing of our automobiles and the flight paths of aircraft, the flow of our wealth and the launch and guidance of our ultimate weapons. Our society has come to depend on the reliability of software. For the past two decades, the responsibility for the design, production, and ultimate reliability of software based services has been in the hands of people trained in disciplines other than software. In the next two decades, much of this responsibility will be assumed by professional software engineers who will increasingly perform the tasks of specifying, designing, implementing, testing, managing, and delivering software and software-based services according to recognizable and accepted standards of professional practice. This is what the energy and excitement behind the IEEE Software Engineering Standards effort is all about. The standards that have been completed, and those under development, are the first firm steps toward establishing norms of professional software engineering practice. What is more, the process of initiating, defining, reviewing, and voting on these standards is an open one, and anyone in the industry who wishes to participate is welcome to contribute.

The first software engineering standard to be produced and approved was the "IEEE Standard for Software Quality Assurance Plans" (ANSI IEEE Std 730-1981). Among other things, this standard specifies the minimum documentation that should be produced and the minimum reviews that should be held during the development of critical software - programs which, in failing, would endanger people or cause large financial or social losses. The four development documents required by this standard are a software requirements specification (SRS), a software design description (SDD), a software verification plan (SVP), and a software verification report (SVR). The standard requires seven reviews, four of which are addressed to the required documents. These four reviews are a software requirements review (SRR), a preliminary design review (PDR), a critical design review (CDR), and a software verification review (SVR). Although the quality assurance standard provides only the basic definitions for these documents and reviews (the entire standard is only three and a half pages), it nonetheless delineates a minimum set of tasks that should be performed during the development of critical software to provide reasonable assurance that the final product will operate correctly. By only briefly defining the documents and procedures, this standard sets the stage for the creation of additional standards to further define these documents and procedures.

The second standard to be approved addresses the problem of establishing definitions for most of the software engineering terms in general use. The "IEEE Standard Glossary for Software Engineering Terminology" (IEEE Std 729-1983) contains definitions for more than 500 terms. It therefore establishes the basic vocabulary of software engineering and makes a major contribution toward decreasing confusion and facilitating precise communication.

The third standard to be approved is the "IEEE Standard for Test Documentation" (IEEE Std 829-1983). It defines the content and format for eight documents that cover the entire testing process from initial planning to final report. The eight documents are:

1. Test Plan;

2. Test Design Specification;

3. Test Case Specification;

4. Test Procedure Specification;

5. Test Item Transmittal Report;

6. Test Log;

7. Test Incident Report;

8. Test Summary Report.

The "IEEE Standard for Software Configuration Management Plans" (IEEE Std 828-1983), the fourth standard to be approved, is similar in format to the quality assurance standard. It gives requirements for configuration identification, control, status accounting and reporting, and configuration audits and reviews. It was formally approved by the IEEE Standards Board on June 24, 1983.

The fifth standard to be completed is the draft "Guide for Software Requirements Specifications." It is being issued as a guide because the current consensus is that there is not yet any best way to write a software requirements specification.

In addition to the above standards, there are currently active efforts on seven other standards, with four more to be initiated this fall. Some of these efforts are just starting, others are nearing completion. Some provide guidance for implementing standards that have been completed, such as guides for software quality assurance and software configuration management; others are breaking into new areas such as design documentation and software unit testing. The main motivation behind the creation of these standards is to provide recommendations reflecting the current state of the art in the application of engineering principles to software design. It is assumed that these will continue to evolve, and the standards are meant to serve as starting points for further development. For those who are new to the practice of software engineering, the standards should prove an invaluable source of carefully considered advice. For those who are on the leading edge of the practice, the standards serve as a baseline against which advances can be evaluated.

The first paper to cite the application of an IEEE Software Engineering Standard was published in the Proceedings of the IEEE Computer Software and Applications Conference in 1982. This paper, by J. J. Greene, et al, describes how the quality assurance standard was used in a large-scale telecommunication project. A paper by J. A. Kish in the Proceedings of the Second IEEE Computer Software and Applications Conference in 1983 describes how the test documentation standard was used to define test documentation requirements for numerically controlled machine tools. But published references are only the tip of the iceberg; most applications of standards are routine, and the professional doing the work usually does not have the time or support necessary to produce a paper. The real test of these standards is in their practical application in ordinary situations in company after company. We only hear about these routine applications by reading the internal memoranda of our own organizations, by word of mouth, and by exchanges at presentations and seminars. The message that is coming through loud and clear is that the software engineering standards effort is widely appreciated, and the standards are being widely employed. The sine qua non of an IEEE standard is that it represents a consensus of professional practice. To achieve this result, every effort is made to ensure that the process of creating a standard is an open one. The initiation of a standards effort initially requires only a generally perceived need, a volunteer to lead the effort, and the approval of the IEEE Standards Board.

The legwork of collecting information, writing and rewriting drafts, and patiently building a consensus is performed by a working group. The meetings of a working group are open to anyone who wishes to attend, and are rotated geographically. Working drafts and minutes of the meetings are available to anyone. Participation in the work of the group can also be accomplished by submitting written comments. While the participation of most of the members of a working group is supported in part by their employers, they represent only themselves in the deliberations of the group. The reward is likewise personal: a sense of service and the opportunity to learn from and share experiences with others. After a draft document is produced by a working group, it undergoes a thorough ballotting process, managed by the chairperson of the Software Engineering Standards Subcommittee who organizes and runs the ballotting group. With some special exceptions, the members of a ballotting group must be members of the IEEE or its Computer Society. Creating a standard draft and getting it approved takes three to four years.

Given the amount of activity now under way, the software standards effort will have produced 10 standards by 1985, with seven more scheduled for completion by the end of 1986 (see below). The expectation is that these standards will ultimately define the norm of the professional practice of software engineering. The open process of discussion and debate that is needed to create and revise them should ensure that they will not be in conflict with standards in related areas produced by other groups.

The IEEE standards should be widely employed because they represent a professional consensus on what should be done to produce the kind of software our society now depends on. (by A. Frank Ackerman and Fletcher J. Buckley.)

Current software engineering standard project

Standard for Software Quality Assurance Plans (Revision) (P730-1)
Guide for Software Requirements Specifications (P830)
Standards for Software Reliability Measurement (P982)
Guide for Software Quality Assurance (P983)
Guide for the Use of Ada as a Program Design Language (P990)
Software Engineering Standards Taxonomy (P1002)
Standard for Computer Program Unit Testing (P1008)
Guide for Software Design Documentation
Standard for Software Verification Plans
Standard for Software Reviews and Audits
Guide for Software Configuration Management
Standard Classification for Software Errors, Faults, and Failures
Guide to Software Engineering Techniques
Standard for Software Productivity Metrics

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Copies of IEEE Software Standards can be bought from IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854, (201)-981-0060. (Reprinted with permission of Datamation Magazine copyright by Technical Publishing Company, A Dun & Bradstreet Company, October 1983 - all rights reserved.)

Cobol standard due next year

The long awaited Cobol 80 standard looks set to emerge in mid-1984, as the second public comment period closed last week. The first draft standard drew more than 2,200 comments from Cobol users, forcing the American National Standards Institute (Ansi) to produce a revised second draft standard. The second draft standard has drawn less comment. Vony Gwillim, assistant secretary of the Codasyl Cobol committee, said: 'Many of the comments have repeated those rejected during the first comment period. People are saying Ansi should just get on and produce the standard.'

The National Computer Centre (NCC) has been attempting in recent months to make Cobol more visible and portable. It is seeking to achieve widespread awareness of standardization issues before the Cobol 80 standard finally emerges. The NCC, along with its German and French counterparts, is working with Ansi to produce tests for Cobol 80 compilers. Distribution of the suites of test programs and procedures will be controlled by Ansi. Gwillim said: 'When all the new compilers hit the market we will be ready with the new tests for them. When the Cobol 74 standard emerged it was nine months before the tests were available.'

Validation of Cobol 74 compilers is well under way. ICL and GEC applied for validation certificates two months ago. Both companies are being validated at the high intermediate level, the second highest of the four possible levels. They are expected to receive certificates by the end of November.

The validation reports would normally remain secret in the United Kingdom. However, if companies wish their products to be placed on the Ansi approved lists, the reports become subject to United States freedom of information legislation. The validation reports list all problems encountered during the validation process and detected errors. Most compilers are issued with errors for the first year, at the end of which they must have been removed. (Computing, 31 October 1983.)

Standards for Ada blocked

At its biennial meeting last week in Ottawa, the programming languages committee (SC 5) of the International Standards Organization was forced to suspend its work on Ada. The reason is that the Department of Defence has trademarked its version of Ada and the International Standards Organization (ISO) fears that if it makes any changes it will fall foul of United States trademarking laws. The American National Standards Institute (Ansi), which has adopted the Department of Defence version of Ada, tried to steamroller its standard through ISO last week. But Ansi bypassed the normal procedures when it adopted the standard by using a canvassing rather than a formal procedure, which means that there are doubts as to how representative it is.

The United Kingdom delegation at the ISO meeting did not want an Ansi-based standard for Ada, and urged a formal specification of the semantics. However, a compromise was reached: the United States standard is to be circulated among international standards bodies by ISO and they will be invited to comment, so that when the legal wrangle is sorted out, ISO will be able to formulate a working draft international standard quickly. ...

In addition to the Ada problem, the SC 5 committee meeting notched up considerable successes which are beginning to accelerate the pace towards standardizing programming languages. Ansi announced its intention to use the ISO standard for the APL language, which has now reached the status of a draft proposal standard. That will avoid the situation with Pascal and the GKS graphics standard, where Ansi has produced its own versions.

A major advance was also made last week towards integrating the combined experience of programming experts in creating standards and to inaugurate a methodology for future work. "The problem is that many so-called experts in drawing up standards are experts in their languages but not in drawing up standards," commented Brian Meek, director of Queen Elizabeth College London's Computer Centre, who attended the Ottawa meeting.

The meeting decided to take steps towards amalgamating the different standards for common programming languages, and also to set up a committee to make independent the language of graphics functionality, databases and real time functionality respectively. A third innovation was to set up a committee to study how to validate standards. "These innovations will make it possible for experts in languages such as 'C', to draw on the general experience gained by experts in other languages who have worked on standards," said Meek.

"We hope that the new approach to standards production will help to make people take an interest in them. We want to show people that they can contribute broad ideas to what they think standards should contain, and to tell them standards are not at all about fiddly detail," he added. (Computer Weekly, 23 November 1983.)

ISO puts the ball in suppliers' court

The International Standards Organization (ISO) has now done all it can to promote standards in networks, and can only leave it to the supplier to decide which will survive. At a meeting in China, the key computer committees of the ISO met to decide whether or not to give the go-ahead to the Ethernet-type CSMA/CD and token bus networks. The revised CSMA/CD proposals had the backing of the United States IEEE 802 networks committee and European backing from the European Computer Manufacturers Association (Ecma). But ISO is by far the most influential body, and one whose assent was vital if the 20 suppliers backing CSMA/CD were to be successful.

The result was an overwhelming vote for the proposals. In the words of United Kingdom delegation leader, Jack Houldsworth, there was 'an almost unanimous decision to adopt the IEEE 802 local area network standards. The CSMA/CD, token bus and logical link control standards, which are already ratified by the IEEE, are being ballotted immediately without any changes. 'The mood of the meeting indicated that the vote will be overwhelmingly in favour and there should be draft international standards by 1984,' Houldsworth stated. The drafts will become formalized before the year end.

Industry observers see the meeting as a key victory for the Ethernet camp. David Flint, network specialist with consultant Butler Cox, saw it as 'the big hurdle to have got over. The Xerox initiative has succeeded'. The move is also good news for those dp departments which dream of open systems interconnection and the freedom to mix and match the kit of different suppliers. Flint said: 'What it really means is that organizations that seek to operate multivendor environments can go ahead with new and greater confidence."

Despite the considerable activity surrounding Ethernet, the China meeting also saw a beachhead established by supporters of token passing networks. Indeed, Ethernet may have won a key battle, but the war against IBM has yet to be fought. IBM is currently playing both games, by voting for Ethernet in its capacity as a member of Ecma in May 1982, and by making clear its preference for token ring networks. Despite its public statements, however, IBM's interest in CSMA CD is probably little more than passing, according to analysts. Soon after last year's Ecma meeting, IBM was accused by United States analyst, the Yankee Group, of sitting on the fence over network strategy. IBM watcher, Dale Kutnick, said: 'IBM will not go over to Ethernet and the decision to support CSMA/CD is a holding action. If anything it will offer CSMA/CD on bottom end products but not for the higher levels of SNA.' Even IBM would not commit itself much further than a show of hands. A spokesman at the time said: 'While we voted in support of the standard at the recent Ecma assembly, to sign an agreement indicating our intentions to announce products to support these standards would be premature.' Premature indeed. Two months later IBM signed an agreement with Texas Instruments for the chip maker to produce network interface chips based on a token passing system.

Given the magnitude of IBM's market presence, can the Ethernet camp seriously expect to establish their standard with customers? Furthermore, what relevance has a standard to the huge number of non-standard networks installed by the likes of Datapoint, Wang and Corvus? The Ethernet suppliers are predictably bullish about their current installed bases, let alone their predictions of world domination. Stan Smith, network marketing manager at Xerox, told Computing last week: 'Its not a question of giving its backing ... there are several hundred manufacturers with Ethernet kit.' He went on: 'There are hundreds of Ethernet sites around the world (installed by Xerox) - in July alone we attached 500 word processors.'

He concluded that rather than attempt to be the only standard, Ethernet would be 'the best'. Geoff Katz, a marketing manager at Intel, one of the key Ethernet trio alongside Digital Equipment and Xerox, claims that 'Ethernet was a de facto standard before it was a paper standard'. Katz claimed that Intel has sold large numbers of networks without specifically identifying them as Ethernets. 'We have installed several hundred networks linking laboratory instrumentation equipment which have Ethernet as their backbone.' Intel is now preparing for volume production of chip versions of Ethernet interface boards. Katz said Intel was sampling chips at the moment and would move into full volume manufacture by early next year. Semiconductor manufacturers have the key role in market acceptance of networks since they can radically affect the price of connection. ICL is currently looking at CSMA/CD chips from Intel, Seeq and Fujitsu which will cost £50 a connection next year. This compares with a £700 board needed last year. ICL is delighted with the outcome of the China meeting. A spokesman said: 'It's the final endorsement of the initiative taken by ICL through Ecma.' He went on to say that, following the agreement two weeks ago on the first two layers of the ISO model, 'similar initiatives are now being taken by ICL on the higher layers'.

Set against the Ethernet standard are the IBM colossus and the likes of Datapoint, which now boasts 50,000 processor connections to its Arcnet local area network. A Datapoint spokesman did not see the China meeting as much more than another paper standard: 'We are still the de facto standard, because we have more installed stations on networks than all the others put together.' Datapoint has been in local area networks for nearly 10 years with its token bus technology. But the spokesman did say: 'If we saw a genuinely meaningful standard that is workable and beneficial to users, then we would conform to it, even if it meant us adapting the product we currently have.' But he stressed that 'if it can be proved that a new standard, if it exists, is workable' then, and only then, would Datapoint consider a different approach. But, for the record, Arcnet is currently compatible with the first three layers of the ISO model, giving the company some leeway for the present. Wang is the other non-standard network supplier and the company's Wangnet has long been advertized as a superior system - by Wang. Now even this company has announced it can offer Ethernet within its product line. The ISO meeting has settled the technological arguments over standards. It is now an open question for the suppliers to resolve. (Computing, 31 October 1983. Article reproduced in full by kind permission of the editor.)

Users protest in unison on standards

Computer users are to band together to make their voices heard on international standards bodies - with help from the United Kingdom government. The IT Users Standards Association is to be set up early next year backed by the Department of Trade and Industry with the aim of making the users views paramount when computer and telecommunications standards are set. The impetus for the association came from Eric Howe, Chairman of the Users Committee of the Department of Trade and Industry's Focus Group, set up to examine British attitudes to standards. The association will be helped off the ground by the National Computer Users Forum, which is a grouping of computer users associations, also chaired by Howe. "We want to ensure that standards are properly drafted from a user and manufacturer's point of view," said Howe, "with the users view paramount. But draftings need to be tight enough for manufacturers to implement them."

According to John Foote, head of the full Focus Committee, the IT Users Standards Association will be set up early next year "depending on a reasonable indication of interest and financial commitment from industry." The Association will comprise individual companies which will push for more user representation. One of the plans being mooted is for the top 100 United Kingdom user companies to spend £1,000 a year each - a fraction of what they are now wasting because of inadequate standards - which would be put in a kitty to enable British experts to attend international standards drafting committees and help create effective standards where it counts. At present, most experts have to find their own travel expenses to attend standards drafting committees: "It is left to a few enthusiasts to raise their own money to express users' views," said Brian Meek, director of Queen Elizabeth College London's Computer Centre, and member of the recent SC5 programming language standards committee meeting in Ottawa. Meek is sceptical about the new Association: "I'll believe it when I see it," he said. "The government has shown in the past that it recognizes the importance of standards, especially in the military area, but now it is leaving things up to industry even though it is one of the biggest computer users and would benefit considerably by the savings that better standards would bring. (Computer Weekly, 13 October 1983.)

NBS standards aid in new semiconductor measurement technology

The (United States) National Bureau of Standards (NBS) is very actively involved in developing better measurement methods and the results of their research have had a significant impact on the semiconductor industry. According to Robert I. Scace, chief of the Semiconductor Materials and Process Division, "We look for measurement issues, try to understand what the problem is, and then come up with an improved way of solving it." The other division of the NBS which is involved with the semiconductor industry is the Semiconductor Devices and Circuits Division, headed by Ken Galloway. Encompassed by these two separate but co-operating divisions are seven principal groups, each dealing with specific issues of concern to the industry. Under the materials and processes division are four groups including linewidth measurement, defect characterization, measurements on insulators and interfaces and a recently formed group on gallium arsenide (GaAs). (Semiconductor International, October 1983.)

Standards for PCs

The Japanese calculate that they will do better once common standards for the software to run small computers are agreed in the United States. They tried to hurry this along last month, when 17 Japanese firms signed an agreement with an American firm to work on a software standard for writing application programmes (e.g., for accounting). This standard would be based on the (more basic) operating software, known as MS-DOS, written by the American company Microsoft.

Software standards are already emerging in America. Small computers based on 8-bit microprocessors (which took digits) used three competing operating systems. Microsoft's Xenix and AT&T's Unix, which are almost interchangeable, are expected to become the standard operating software for 32-bit machines.

Since IBM took the lead in sales of personal computers, more software houses and computer manufacturers have wanted to make their products compatible with IBM's. Even Osborne, the first firm to produce a (just) portable computer, is making its latest model compatible with IBM products. Apple, however, is spending about $50m to make a range of simple software programmes for its own machines. Though this will help amateurs, it makes most sense in the market for computerizing office work. (The Economist.)

Canadian Standard Association

Incompatible computers may result in a planning nightmare. The most significant advances in standardizing data communications may be seen in the work of the Open Systems Interconnect (OSI) subcommittee, a body operated under the Canadian Standards Association with counterparts in other nations under the International Standards Organization. The subcommittee includes computer vendors, users and government departments and regulatory agencies. If two people are to communicate successfully, three main factors are involved: the physical medium - voice to air to ear, or hand to page to eye, for instance; a common language; and a communicable concept independent of the language or medium. With software prices increasing as hardware costs decline, software incompatibility is a significant business. Fear of software has gone so far that only hands-on testing is accepted as real proof of compatibility. The IBM PC presently has about 25 per cent of the microcomputer market, and its share is growing quickly. Xerox's Ethernet will be considered by the International Standards Organization as a possible industry standard for a local area network (LAN) on the strength of its compatibility potential. An LAN could integrate office equipment and data-processing machines at the lower levels of the 'Open Systems Interconnection Environment' (OSIE) to guarantee the unimpeded transmission of data. But without protocols for the top levels, the meanings of messages could be altered. (Technology Update, 24 September 1983.)

SOCIO-ECONOMIC IMPLICATIONS

Human resources implications of robotics

A major new study of the impact of robotics on the industrial workforce warns that the "poor match" of workers displaced versus new jobs created by the robotics industry will mean several pockets of worker distress in the next 20 years. ...

As major industries like car and truck manufacture adopt new production technologies such as robots, unskilled and semi-skilled jobs will be displaced while skilled jobs are created. "There is an extremely poor match between the jobs that robots will probably displace and similar jobs that will be created through the introduction of robots", says the study, Human Resources Implications of Robotics, by the W.E. Upjohn Institute for Employment Research, Kalamazoo, Mich., USA. Although the study concentrates on the impact of robotics in the United States, the conclusions apply worldwide. On average, the institute figures, each industrial robot will displace one job for every work shift it operates. In the United States, that typically means two shifts per day, so each robot will displace two jobs. The kinds of jobs robots today are capable of performing are currently held by unskilled labourers or semi-skilled machine operators. That largely means spot welding such things as car bodies, painting cars, or simple pick-and-place operations. Even assembly robots, which must await major technological developments in the area of vision and/or tactile feedback sensors before they gain widespread application, will be displacing unskilled blue collar jobs.

Meanwhile, a growing robot industry will create some new jobs. The Upjohn Institute categorizes four areas of new employment due to robotics: robot manufacturing; direct suppliers to robot manufacturers; robot system engineering; and corporate robot users (the latter mainly for maintaining the robots). It estimates that each robot-manufacturing employee today produces 1.3 robots per year, and will be turning out about 1.6 robots annually by 1990.

For each job created by a robot manufacturer, there will be 0.93 jobs created among the direct suppliers. Since a large portion of future robot sales will be embedded in automation systems, Upjohn also calculated that one systems engineer will be needed for each 2.8 robots sold. Finally, robot users will need one robot technician to maintain each 5 robots in use, according to the Upjohn study. ...

And while most of the jobs robots will directly eliminate are semi- or unskilled, more than half of the ones created by robots will require at least two years of college education. So while skilled maintenance workers can be quickly retrained to become robot technicians in, say, auto plants, the unskilled workers that are displaced probably cannot be upgraded to the required level.

Finally, as robots increasingly occupy the bottom rung of the manufacturing employment ladder, there will be a diminishing number of entry-level unskilled jobs for young, uneducated workers. ...

In developing nations, the study speculates, wages for inexperienced labourers are low enough for robots not to have much impact there for some time. But while timing and policy responses will vary because of cultural and political factors in places such as Western Europe and Japan, "there is no reason to think that the same conclusions do not apply". (International Management, July 1983.)

Threat to jobs as telecomms industry expands

The United Kingdom telecommunications industry, despite the efforts of the Post Office Engineering Union (POEU), is set for expansion. But this isn't to say that the union's worst fears are not justified. Telecommunications business will probably grow, but few of the job opportunities will be in the maintenance and servicing sector supplied by POEU members.

As technology advances, staffing for the day-to-day business of maintenance will decrease. Jobs on offer will be for specialised telecommunications skills such as microwave and optical fibre techniques and for project design involving a combination of telecommunications and computing skills.

Like so many industries, job quality in telecommunications is being upgraded, and more skilled staff will be needed. Fewer, however, will be required for the servicing and operations functions. ... (Computer Weekly, 10 November 1983.)

MICROS BLAMED FOR JOB LOSSES

Government sources in Japan say employment losses due to microcomputer applications will total between 210,000 and 480,000 by the year 1985. These were among the findings discussed this month at a world conference association in Tokyo organised by the International Metalworkers Federation (IMF). The 130 union representatives from 32 countries agreed that the picture in these industries is 'one of lay-offs and no increase in employment', and predicted a 'continuation of diminishing employments until 1990, or even up to the year 2000', in contrast to the favourable image of the industry in the '70's.

The IMF general secretary, Herman Rebhan, told Computing that women workers were seen to be under a special threat, since they are given limited skills and engaged as operators and light assembly workers who are 'the first to be dismissed'. IMF estimates showed that, in the UK, women workers in the sector dropped from 52% to 47% between the years 1977 and 1981, and in Japan, from 69% to 56% between 1976 and 1979. The assembly recommended that the fundamental counter-measure to this trend should be 'an extreme shortening of working hours' with wage protection.

Concerning the introduction of new technology, measures advocated included a ban on worker dismissal without alternative employment, provision of information by the employer at an early stage, new management/union bodies to negotiate technological innovation, new training and retraining and early retirement schemes and a prohibition on 'computer monitoring' where it affects an employee's job status. New health risks were said to have emerged from excessive use of display screens, the isolation of workers and the 'ergonomic inadequacies of automated machinery'. Modern technology was also blamed for polarisation of the workforce. ... (Computing, 31 October 1983.)

Robots irritate the US unions

US trade unions are poised to retaliate against industry as factory automation steps up in the US, threatening more jobs, warned a leading US market research company last week. A report, 'Factory Automation Markets' published by International Resource Development paints a bleak picture, which it links with an expected wooling of the US workforce by the Democratic Party in the run-up to next year's presidential elections. Among the main findings of the report are that the US market for factory automation equipment (which includes robots, process controllers, automatic test equipment, computer aided design and manufacture equipment, could reach $82 billion by 1993, while the trade unions would lose out heavily. The report concludes that the main need is to retrain the displaced workforce up to the technical and literacy standards needs in computerised factories. (Computer Weekly, 4 August 1983.)

Effect of Office Automation on Labour Force Reported

Denki Roren (All Japan Federation of Electric Machine Worker's Unions) which is taking a serious view of the effects of microelectronics (ME), such as robots and the OA office automation) on workers, announced the results of the "study on the effect of ME," that "50,000 (about 13 percent) of 370,000 employees have lost their jobs due to the introduction of ME since 1978," at the regular meeting held in Kanazawa City on 7 July. It was pointed out that ME do create negative effects causing psychological strain and exhaustion among workers and the federation confirmed its policy of dealing with this problem by establishing a prelabor and management discussion system, etc. concerning the use of ME.

The study was conducted last October, based on branches (offices) employing over 200 personnel and employees of 5 offices equipped with ME. Responses received numbered 277 from branches (66.9 per cent response rate) and 1,961 from employees. It showed that 255 offices (92.7 per cent) have ME equipment totalling 17,131 pieces, which averages out to 67 per office or one for every 20 employees. The study of these offices with ME equipment showed that 35.7 per cent have "increased," 40.9 per cent have "not changed," and 21.3 per cent have "decreased" the number of employees since 1978. Based on this study, the Denki Roren calculated that 50,000 jobs in the surveyed offices (total employment of 370,000) have been eliminated in the 4 years since 1978. The employment problem created by the use of ME has remained inconspicuous up to now because most of the work force have been absorbed by business expansions and transfers. All branches show a harsh outlook on employment in the study and a "reduction" of around 40 per cent is expected.

On the other hand, the ME equipped work sites are concentrating on men in their 20's and 30's and show a strong tendency that women and older employees will lose their jobs due to ME. The ME process involves (1) programming and system design, (2) maintenance and repairs and (3) operation and monitoring. It has become evident that it is heading toward the undesirable direction of stratification of workers and monotony of work.

In the study conducted on workers, 65.2 per cent replied that the use of ME has "increased" psychological fatigue in the last few years, 28.9 per cent replied "no change" and 4 per cent said that it has "decreased." In regard to actual fatigue, the 43.3 per cent saying "increased" far surpassed those saying "decreased" (12.6 per cent). Many workers complained of symptoms such as "stiff neck and shoulders" (66.2 per cent), "eye fatigue" (65.2 per cent) and "tire easily" (47.5 per cent). In querying work sites, complaints such as "shortage of personnel" (80 per cent), "difficulty in getting promotion" (79 per cent), "wages not commensurate with work" (79 per cent), "bewildering changes in work substance" (69 per cent) and "stringent cost management" (64 per cent) have been given.

Response that "employment will be reduced" (81 per cent), "greater transfer of work and workshop" (79 per cent), "monotony of work and loss of willingness to work" (60 per cent) and "intensification of competition between firms and lesser chance of improvement in working conditions" (69 per cent) were given in regard to future technological innovations. However, optimistic views such as "improved level of work and greater display of creativity" (60 per cent) and "lower cost and upgraded quality for greater contribution to the society" (75 per cent) were also expressed.

Denki Roren is a union which includes many workers engaged in the production of ME equipment; on the other hand, it is directly involved with the "ME revolution" where ME equipment is introduced in the work process. The study shows that the "ME revolution cannot guarantee an optimistic future." A policy to prevent the "minus effects" of the ME revolution by establishing a prelabor and management discussion system pertaining to the introduction of ME equipped, refusing ME which create loss of jobs and establishing a safety and education system was confirmed by the Denki Roren at the meeting.
(Tokyo Mainichi Shimbun, 8 July 1983, translation from Japanese.) (Copyright: Mainichi Shimbunsha 1983)

Human cost of cheap electronics

A terrifying picture is slowly emerging across Southeast Asia of the true cost of the industries that supply the West with cheap computers and video recorders. A meeting in Penang, Malaysia, this week heard that the incidence of industrial disease is rising rapidly in countries such as Hong Kong, Singapore and South Korea – the homes of many new industries, such as microelectronics.

According to the International Labour Organisation, "such cases which reach the public eye represent only the tip of the iceberg". The organisation's regional office says that only three countries in the region - Singapore, Hong Kong and South Korea – supply data on occupational diseases. Even here, the figures suggest that many diseases are not reported. For example, Singapore reported 400 cases of industrial skin diseases in 1981. Hong Kong, with a similar level of industrialisation and a much larger population, reported only 10.

Industrial accidents across the region have sharply increased over the past 10 years. In 1974, Hong Kong reported 30,980 accidents. By 1981, this figure had jumped to 69,428, 270 were fatal, according to the ILO. In many other rapidly industrialising countries, such as Indonesia and the Philippines, it is impossible to get any figures. "But all the facts says that the number of accidents and industrial diseases is increasing sharply in Asia and the Pacific," the ILO reports. The reasons are not difficult to find.

The government of the Philippines, which is trying to persuade companies in Japan and the US to set up factories there, has not released figures on industrial accidents and diseases for a number of years. (New Scientist, 27 October 1983.)

Pollution Problems in the Valley

Silicon Valley, renowned birthplace of the micro revolution, is becoming the target for conservationists, who are increasingly angry about pollution in local water supplies. A three-month investigation by a Californian newspaper reveals that drinking water in the valley is threatened by potentially dangerous levels of contamination from the residues of the chip manufacturing process, including arsenic and phosphorous.
([Ireland Electronics Report], October 1983.)

And after all these pessimistic reports on the effects of microelectronics applications, the following news item reflects an insight into what is required to help coping with these effects: computer literacy. The need for retraining a robot displaced workforce and developing a workforce capable of manning more efficient factories and accepting the elimination of unskilled jobs, is also confirmed by the other reports in this section. (Editor's note.)

Computer literacy

United States trade associations are stressing the need for computer literacy among their members. They sponsor workshops and seminars and offer other educational advice to make their membership aware of advances in computer applications. Through these means they contribute to building a market for future sales of small computers and related peripherals. The National Association of Accountants, American Society of Travel Agents and National Automobile Dealers Association, generally, have members versed in computer operations. The National Association of Wholesalers/Distributors and the Independent Insurance Agents of America are 2 associations whose members are inexperienced with computer business applications. Elec News 9/12/83 ps14+. (Technology Update.)

Computers and Communications to merge by 2000

Over the next 20 years computers and communications will merge into a single field. Society will develop a computer and communications network which will have a major influence on the future of modern civilisation. This was the message in a major speech delivered last month by Koji Kobayashi, Chairman and Chief Executive at Nippon Electric Company, or NEC, which has a large plant in Ballivor, Co. Meath, Ireland. The Commerce symposium was held in Trinity College, Dublin, where Mr. Kobayashi was one of a number of distinguished international speakers.

The NEC Chairman also criticised Europe's attitude to technological developments: "In October last year, the Japan Committee of the Club of Rome, of which I am chairman, hosted a conference of the Club in Tokyo. It discussed the benefits and drawbacks of the microelectronic future, following up one of the topics on the agenda of the Club's 1979 Berlin Conference. Participants from all over the world attended the meeting, but I noticed that European intellectuals voiced the same negative arguments as they had done at the Berlin meeting. It remains to be seen whether Europe adopts a positive attitude or suffers the consequences of its negative approach". Mr Kobayashi maintained that it was around the early '70's that Japan began to jump to the forefront of technology: "Starting at about the time of the first oil crisis, Japanese technology underwent a major transformation. There was a quantum jump in production engineering, beginning with energy conserving technology, that led to improvements in product quality and reliability, higher productivity, and greater adaptation to market needs. This jump significantly increased Japan's industrial capability. New technology fostered by first-class production engineering began to flourish at 'grass-roots'level in areas such as microelectronics". (Ireland Electronics Report, October 1983.)

INFORMATICS

(UN) Advisory Committee for the Co-ordination of Information Systems (ACCIS)

The first session of ACCIS was held in Geneva from 22-23 September 1983. The Advisory Committee reviewed and approved the programme of work and budget for 1984-5. It was recognized that ACCIS' main programme objective is to meet the needs of Member States for UN information. Tools are necessary to improve the information infrastructure within the UN system and thus to facilitate access. Important segments of the work will be carried out by technical panels. These panels will consist of small teams of knowledge people from different organizations concerned with the panels' work assignments, under the leadership of a lead agency designated because of its expertise and interest. Three panels were set up by ACCIS at its September session: computer-based communication services, access to UN databases and the register of development activities.

It is necessary for information of all sorts to be sent readily from one computer to another throughout the UN system. The first panel will study ways of providing necessary links so that, in the first phases, the computers in New York, Geneva, Paris, Washington, Rome and Vienna are able to communicate with each other. UN databases should be made more accessible to users in Member States and the second technical panel aims to do the necessary groundwork so that databases can be utilized freely. The activities of this second panel will include preparation of a guide to UN system databases presently available, and summaries will be made of marketing practices concerning online access, downloading and other types of services. UN agencies will be encouraged to make their databases more readily accessible to outside users.

This third panel will create a pilot database containing information on development projects, will produce experimental information from it, and will prepare a detailed, costed proposal for creating and operating a register of development activities. (ACCIS Newsletter 1, November 1983).

Information and development: IBINET

IBI was invited to the second meeting of the Intergovernmental Follow-up and Co-ordination Committee of the Group of 77, held in Tunis from 5 to 10 September 1983, to participate in the discussions on the multisectorial information system that the Group of 77 is planning to set up with a view to facilitating the circulation of information system between Member States. The importance of information for development has been emphesized by most of the delegations who have often referred to the role of informatics.

The International Data Network of IBI (IBINET) aroused the interest of the participants and, following the meeting in Tunis, the Chairman of the Group of 77, Ambassador Farooq Sobhan, travelled to Rome to attend the experimental demonstrations of IBINET which offers the best conditions for supporting the planned information system. (See Technology section.) (IBI Newsletter No.12.)

Low-cost satellite will up rural access to know-how

Well over a decade ago, Canadian academician Marshall McLuhan entranced the world with his vision of a "global village" in which television would play a starring role. But televison, especially educational television, never quite lived up to its promise, particularly in developing countries. Today it is clear that if there is a successor for that role, it is the communications satellite that uses advanced digital technology to speed low-cost information and messages around the world, even to the remotest locations. Certainly, the lack of accurate and timely information is not the only impediment to rural development. But where it is, the new technology could have a significant impact on those regions that are informations and communications poor. Increasing attention is being paid to low-earth orbit (LEO) satellite concepts as "appropriate" satellite technology for developing countries. In a polar orbit, a single such satellite equipped with an on-board computer would pass over all points on earth at least twice a day and provide message-storing and forwarding and computer conferencing capabilities. Use of VHF (very high frequencies) would keep ground station equipment simple and inexpensive; neither parabolic "dish" antennae nor complex station equipment trained on standard geosynchronous satellites (orbits about 22,500 miles above the earth, where satellite locations appear motionless to observers on the ground) are required.

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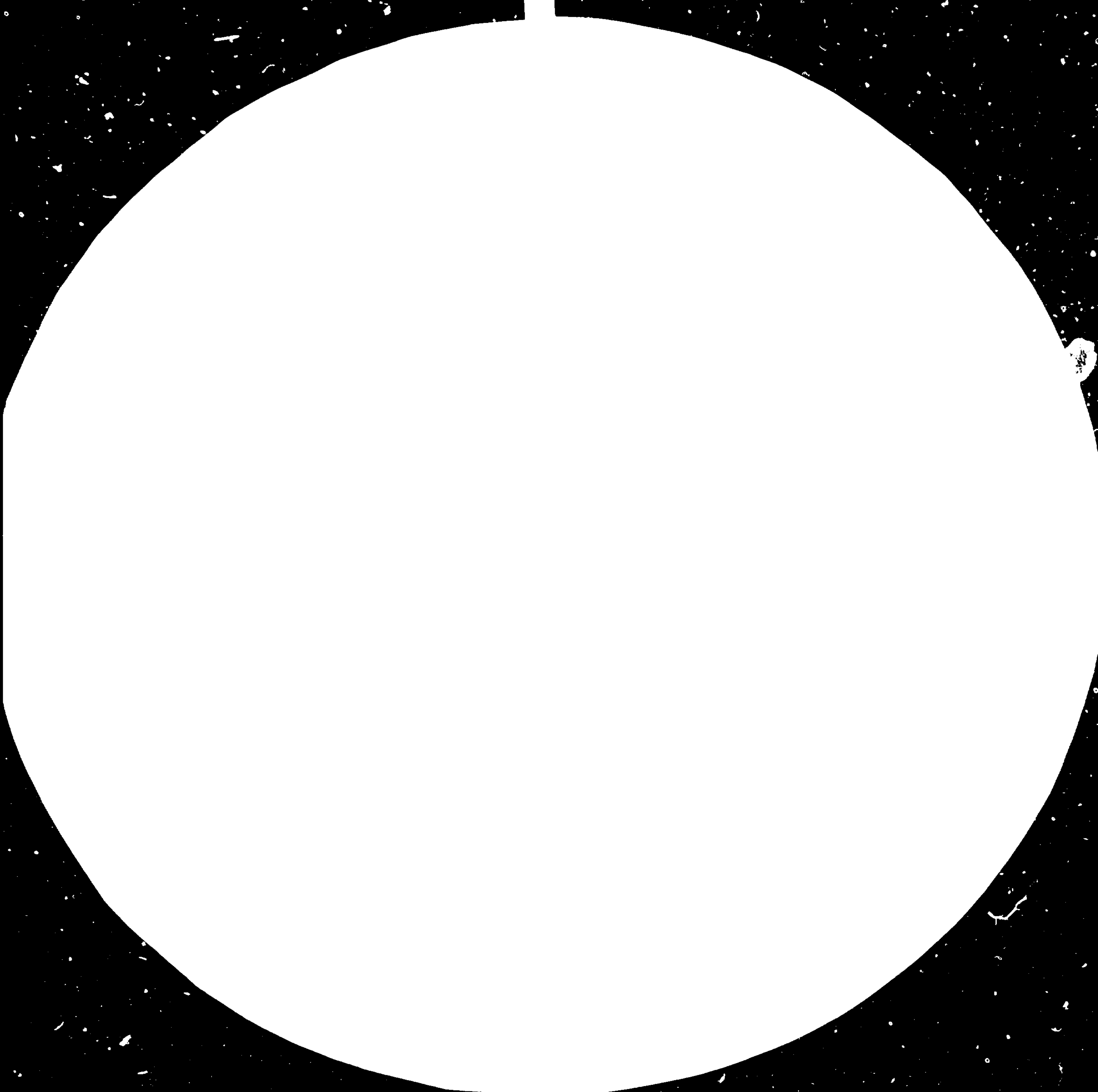

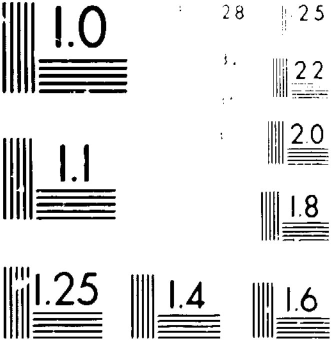

MICROCOPY RESOLUTION TEST CHART

Encouraged by the results from a programme disseminating information on renewable energy technologies to user groups on Pacific islands via the PEACESAT public service satellite system, Volunteers in Technical Assistance (VITA) has joined forces with the Radio Amateur Satellite Corporation (AMSAT) - both non-profit organizations in the United States to design, build, launch, and operate a LEO demonstration satellite using international amateur radio frequencies. Nicknamed "PACSAT" (for the advanced "packet radio" digital processing techniques incorporates), the system will demonstrate how the delivery of technical information required for development purposes can be improved in terms of speed and quality. Other applications, such as rescue and relief missions following natural disasters, are also contemplated.

PACSAT will permit evaluation of the effect that fast and accurate technical information has on selected development projects and programmes. The system will also be able to transmit, store, and forward complete documents through facsimile technology, so that full text as well as tailored technical response transmission is possible. Sophisticated software protocol and communication interface hardware are being developed by AMSAT and VITA volunteer teams. These will allow automatic operation between ground stations and the satellite. For example, let us suppose a UN field technician working on an agricultural project in a remote part of Asia needs to communicate with UN headquarters in New York, the Food and Agriculture Organization (FAO) in Rome, the national UN Development Programme (UNDP) office, and with a similar project in Central America. The technician simply types messages into the computer, leaves all the radio equipment turned on, and goes about his or her business (depending on local regulations, the presence of a radio amateur may be required to "control" the transmissions). When PACSAT comes within range of the ground station, contact is automatically made, the previous prepared messages are transmitted up to the satellite, stored in its memory, and later re-transmitted to the correct recipients (who must have access to their own ground stations), all without operator intervention. Like other electronic mail systems, the technician can transmit "carbon copies" of messages to the Central American project or to the other users, or send "private" messages to the FAO office, etc (government agencies will always be able to monitor the transmissions, however). Similarly, any messages waiting for the technician (for example, technical information from VITA responding to a previous request) are transmitted from the satellite to the ground station, where the technician can read them from a print out or computer screen. Where dependable electrical mains are a problem in rural areas, the entire ground station can be powered by several inexpensive solar panels. Besides remote stations (up to 20 of these will be set up under the demonstration project), a "regional" ground station that would handle simultaneously the information needs of many development groups and/or government agencies is also contemplated. According to the present design, up to three ground stations can be supported, and will constitute the major load on the system. When the system is fully subscribed, VITA will transmit up to 1,400 pages of text per day, for distribution as required among the regional and remote stations.

If the demonstration period (up to a year) is successful, VITA-AMSAT hope that enough interest will have been generated for future PACSATs to be supported on a quasi-commercial basis on non-amateur frequencies. For the demonstration, costs are extremely modest. Given the value and proven expertise of the volunteer technical effort (AMSAT and its predecessor have been successfully launching amateur radio satellites for over 20 years), the PACSAT budget, from design through launch and operation, including all equipment and personnel costs, is well under a million dollars. Ground stations, including radio equipment, computers and accessories, will cost only a few thousand (US) dollars each. Even before the projected mid-1985 launch date, a demonstration of many of the system's functions is planned through an existing amateur satellite. This carefully orchestrated event will give potential users and funders alike the opportunity to grasp the full significance of PACSATs potential for an relevance to developing countries.

For further information on PACSAT, contact: Dr. Gary Garrlott, Senior Technical Co-ordinator, VITA, P.O. Box 12438, Arlington, VA 22209 2079, USA.

Decision time for tomorrow's TV

The BBC is trapped in an argument over satellite broadcasting which it cannot win. The government has given the BBC permission to start direct broadcasting by satellite in 1986, on the job-creating condition that it leases a British satellite from Unisat. But this will cost so much that the BBC cannot hope to make money on direct broadcasting for many years. If the BBC uses a cheap, low-power communications satellite to distribute signals to cable stations, this would get the BBC off the price hook, and give cable television a flying start. But the scheme would then no longer be DBS (direct broadcasting by satellite).

If the BBC follows recent moves in the US, and transmits its programmes through a medium-power satellite, it could save money while still offering DBS. But viewers would need more expensive and more complicated aerials, the pictures would be of poor and erratic quality and Britain would be in breach of an international agreement. Provided the BBC sticks with high-power DBS, British homes will get better pictures than ever before but the BBC will risk crippling costs. Whichever DBS route Britain takes, Japanese firms will prosper because they are developing the electronics to create clear pictures from small aerials or low power signals.

The arguments go back to 1977, when the International Telecommunication Union (ITU) drew up rules for the use of radio frequencies in the 12 GHz band. The signals are for direct broadcasting of television and radio from satellites parked in a geostationary orbit 36,000 kilometres over the Equator. European countries were each allocated five channels. In space, where only solar energy is available, power is at a premium. So is weight, because it governs the cost of rocket launching. So when the ITU recommended around 200 watts per channel for DBS it was known to be an expensive rating. The satellite can support only two channels at this power. By comparison a communications satellite can carry at least 20 transmitters because they have power rating of less than 10 watts. By specifying a high-power, expensive satellite system, the 1977 plan promised viewers adequate quality pictures from receivers expected by the mid-1980s. But improvements in receivers over the past six years, especially low noise amplifiers to boost the tiny incoming signals without introducing circuit noise, can produce pictures from a high-power DBS satellite that are as good as those viewers now get from a conventional transmitter.

The current dispute is based on claims that further improvements in receivers will make it possible to receive equally good pictures from medium-power satellite transmitters, rated at 40 or 50 watts. In the US, which has an "open skies" policy, at least two syndicates plan to start direct broadcasting from medium-power transmitters this winter. They will do this by ganging together low-power transmitters on a communications satellite.

When the UK government allocated the first two DBS channels to the BBC, in March 1982, it added the condition that the BBC had to use a satellite built by Unisat, a consortium of British Aerospace, GEC-Marconi, and British Telecom. Normally the BBC would put such a large contract out to tender but it has had no option but to sign an agreement with Unisat for a rental of £24.4 million a year over seven years. Privately, the BBC resents this high price tag because it puts a large question mark over success of the service. Viewers may refuse to pay the high fees needed to make the service commercially viable. (New Scientist, 22 September 1983.)

Messages in the Jungle

The US Agency for International Development has embarked on a "modest" effort to test the utility of satellite communications as a development tool in Third World countries. The Agency (AID) has committed $10 million to fund a three-year rural satellite programme under which the agency will set up audio satellite communications systems in Indonesia, Peru and the West Indies. In Indonesia, the Eastern Islands University Association will offer courses on agriculture and other topics via an audio satellite circuit from a central campus to nine campuses. Lectures will be transmitted using the Indonesian Palapa system to small earth stations on campus.

In Peru, the government will use Intelsat audio circuits to establish reliable communications service to rural areas. The system will employ earth stations manufactured by Harris Corp. to provide two audio channels to highland jungle areas in eastern Peru. The government will use the system to provide information to agriculture and health ministry workers in that area. The system will also be available for making public calls.

The University of the West Indies started using similar audio satellite communications earlier this year to provide instruction to students unable to attend classes on campus. (IBI Newsletter 12.)

Fully indigenous electronic phone exchange in three years

Difficulties are anticipated in switching over to the fully digital system of E-10-S the technology for which is expected to be transferred by Cit Alcatel, the French collaborators of the Indian Telephone industries (ITI), for building two electronic exchange equipment factories each with an annual capacity for 500,000 lines. Both the Department of

Electronics (DOE) and the Union Communications Ministry are aware of the problems which would crop up in the adaptation of E-10-S to suit Indian conditions. They are considering how best to tackle these problems by extensive indigenisation of the technology. The technology which is being transferred for the factory being set up at Gonda in Uttar Pradesh is that of E-10-S which is hybrid - partly analogue and partly digital. The fully digital E-10-S which is still under development is entirely different in all aspects form E-10-S and it may not be suitable for small exchanges. Apart from this, the ITI will have to ensure adequate and satisfactory hard and software availability for the E-10-S digital exchanges both from indigenous sources and from abroad.

The E-10-S system which is yet to be proven by field trials will use the 16 bit microprocessors. Semi-Conductors Ltd. of Chandigarh which had been hoping to obtain the technology for the microprocessors from the Intel of the US is now approaching two other firms, Motorola and Zilog, for collaboration as the IBM may not give it the technology.

The DOE which has carried out detailed studies on all matters relating to the Electronic Switching System (ESS) has come to the conclusion that it is possible for India to set up a third electronic exchange factory on its own without foreign collaboration. Though no proposals have yet been drawn up for a third factory, the continuing big increase in demand will leave India no choice but to expand the availability of electronic exchange equipment. The transfer of research and development from Cit Alcatel, the DOE feels, should in the meanwhile be put to the maximum use to enable Indian telecommunication engineers to develop a wholly indigenous ESS within this decade.

The studies carried out by the DOE on the ESS and into the content of the E-10-B technology of Cit Alcatel have revealed that the infrastructure available in India (in the Bharat Electronics, the Electronics Corporation of India, the ITI etc.) could be fully utilised and adapted to meet the component requirements of the electronic exchange factories. The report prepared by the DOE on the implementation of the indigenisation programme has, among other things, drawn attention to the fact that the technology advance since 1976 has considerably reduced the hardware development efforts because of the advent of large-scale and very-large-scale integrated circuits and India is very well placed with regard to software availability.

The DOE has also just completed another report on the status of components, equipment assembly, automatic testing and computer-aided testing facilities in the country for assisting the development and engineering programmes on digital ESS. The report says that the components needed for ESS are mainly sub-assembly consisting of line and trunk circuits, digital interfaces, line switch codes, switching sub-systems consisting of time division matrix and speech path controllers etc. The report also reveals that in the E-10-B system of Cit Alcatel integrated circuitry accounts for 18.4 per cent, connectors 12 per cent, printed card boards 16.3 per cent and transistors 7.8 per cent, while the share of a number of other components is individually very much less. The report has pointed out that components like connectors, printed cardboards, relays and diodes are used in large numbers and the infrastructural facilities available within the country should be adequate to produce a good number of these components though the quality of production will have to be improved greatly.

Taking all these factors into account the DOE has stated in its report that it should be possible to develop a fully indigenous state-of-the art electronic exchange system within 36 months. This task will call for orienting the research and development activity to producing a package of designs for the production of both hard- and software and for the setting up of ancillary industries. The report prepared by the DOE on how production of prototypes for field trials and later for commercial use should be organised takes note of the infrastructure available within the country and the items which may have to be imported. The indigenisation which the DOE is working upon is aimed at ensuring that the ESS developed within the country should suit the Indian traffic and environment which is marked by "high busy hour calling rate". If (the ESS) should use standard building blocks and should be economic throughout the size range and should be adaptable for varying applications like voice and non-voice services (telephone and telex). (The Hindu, International Edition, 10 September 1983.)

Switzerland rethinks telecoms strategy

While the debate on the relative merits of state control and privatisation continues to loom large on the European telecommunications scene, interesting developments are reported from Switzerland. The government there recently decided to abandon a scheme to develop a digital public telephone network in conjunction with a group of Swiss firms and, instead, the multinational majors have been invited to compete for the contract. The successful bidder could sell as much as 4 billion Swiss francs worth of switching equipment to modernise 1,000 exchanges around the country.

It is understood that the native firms may still be given a minor role in the implementation of the new network. Indeed, the resulting structure may well look rather like the situation in this country, where the Department of Post and Telegraphs is acquiring its main switching and transmission equipment from multinational manufacturers, but sourcing other items from Irish firms. (Ireland Electronic Report, October 1983.)

Just Browsing

The impact of the new technology was the theme of the annual International Federation of Library Associations and Institutions (IFLA) conference held in Munich in August.

One of the most interesting items on display was the "Browser", a user-friendly touch-terminal, which was set up to show searching on a library and community information database. There is no keyboard. To search for an item, you touch an item on the many which is displayed on the screen. Your finger interrupts a matrix of low-intensity, infra-red beams. The built-in microcomputer interprets your "finger" and helps you quickly locate the desired information. After a number of touches, the specified item is found and displayed on the screen. The screen is split into different work areas and you can scroll replies while still retaining on the screen the menu and your chosen command.

No training is required to use it and the only thing you need to know is when to lift your finger. (Even that can be discovered by a few minutes of trial and error.)

The "Browser" is produced by ALS (Automated Library Systems) and further information can be obtained from them at: Vector House, Brownfields, Welwyn City, Herts, AL7 1AN, UK. (ACCIS Newsletter 1, November 1983.)

RECENT PUBLICATIONS

Relevant UNIDO documents:

UNIDO/IS.392 — The impact of microelectronics on biomedical applications in developing countries, by Cor L. Claeys, UNIDO consultant, based on discussions held at the Fourth Brazilian Workshop on Microelectronics, Campinas, Sao Paulo, February/March 1983.

UNIDO/IS.415 — Informatics For Industrial Development by R.J. Nolan of the Trinity College, Dublin, Ireland. This monograph is based on the discussions and main themes developed at the International Conference on Policies for Information Processing for Developing Countries, co-sponsored by UNIDO and held at the Trinity College, Dublin on 9-13 March 1981.

Studies published recently by the Research Policy Institute, Box 2017, S-220 02 Lund, Sweden:

TC11: Information Infrastructures in India and China. By Erik Baark.

This study focuses on the interaction between technology and cultural contexts as mediated through the process of information dissemination. First, a comparative review of the structure of information dissemination in India and China is presented, focussing on scientific and technical periodicals. A discussion of the relationship to foreign sources of information introduce a key difference between the two countries. Second, the organizational structure of information services in India and China reviewed. Third, the formation and implementation of information policies is compared. The comparison of organization and policy leads to a discussion of the information infrastructure established over the years. Fourth, the comparative effectiveness of information utilization is analysed in relation to Indian and Chinese contexts. A final section attempts to draw some general conclusions from the results of this study. (Lund 1983, 62 pp, ISBN 91 86002 33 7, Price: 30 SEK.)

TCIO: Chicken and egg: Electronics and Social Change in India. By Ward Morehouse and Ravi Chopra

This report addresses the classic chicken-and-egg issue related to technological change: to what extent do socio-economic institutions and cultural values determine what kinds of technologies are developed and how they are used? To what extent does technological change itself open up new options for societies and influence socio-economic change? A detailed study is presented of the organs and current status of government policy regarding electronics in India, the use of electronics at government and industry levels, as well as the interaction between policy and performance. Indian electronics are then discussed in terms of social alchemy and synthesis with Indian cultural tradition. Finally, the future strategies and "models" for government policy are analysed with respect to feasibility in the Indian context. (Lund 1983, 100 pp, ISBN 91 86002 31 7, Price: 45 SEK.)

Industrial Robotics Handbook, by V. Daniel Hunt, Industrial Press Inc., 200 Madison Avenue, New York, N.Y. 10157, $32.50).

This rounded compilation of matter of diverse source and nature fills a volume of unexceptional size and weight, neatly produced. It is an overview for readers with a broad understanding of engineering and economic topics; only here and there, particularly around its account of computer programs and robot control, does the level taken enter the domain of the specialist, say a would-be designer. The text begins with what amounts to a small book on robots in general, their configuration, sensors, tools, programs and control, safety and socioeconomic impact. Then we come to a look at the state of the art: a field guide to "current robotic systems" and a few pages of specifications and figures from each of the 28 US manufacturers of robots, more than 80 species overall. Not at all provincial, the compiler then goes overseas; there is a review of industrial-robot manufacture in 10 countries, including a major review of the industry in Japan, although not in the USSR. The last 40 pages take a look at the robot and the future, by way of invited or cited statements from a wide range of expert and interested sources. The book is completed by a glossary, a bibliography and a brief summary of robot R&D organizations in the US. Reviewed in Scientific American, October 1983.)

Software user guide

The third edition of the CP/M Software Finder, an essential guide for users of CP/M systems worldwide, will be available mid-November from Digital Research distributors. Software Finder is a comprehensive directory of CP/M software that is published in the United States by Que Corporation. It is a full international directory containing details of over 2,000 applications packages. Each entry in the directory is accompanied by a concise, factual description of the products, and the total is sub-divided in o applications categories to help make product selection simple and straightforward. (Electronics Weekly, 9 November 1983.)

Profile of Indian computer industry

(The Computer Directory of India 1983, Ed. Prithvi Haldea, Constellate Consultants (P) Ltd., 505, Vishal Bhavan, 95, Nehru Place, New Delhi-110019. Price: Rs. 500, Update Service Rs. 150 per year.)

The growth of the computer industry in India in the past few years has been substantial and it continues to be the only industry with a growth rate of over 15 per cent per annum. Comprehensive information on the Indian computer scene in a single source was not available till this publication as the earlier publications from ASCI and CSI confined themselves to the computer installations in India.

This 650-page directory, divided into seven sections, covers over 3,000 organisations in India. These include the computer manufacturers (along with their models), importers/agents of foreign computer, peripherals and media suppliers, computer maintenance companies, computer installations, software and data processing service centres, suppliers of computer stationery and related items, magazines on computers and allied subjects, publishers and distributors of books, magazines and journals, computer associations, and government agencies. The cross indices and the glossary of computer terms provided are fairly comprehensive. The coverage on installations is sketchy when compared to others. Applications of computers in India has been completely omitted along with the Government policy on import of computers. Incorporation of summary reports on sectorial distribution of computer installations, teaching and training institutions, price range of computers, approximate fees for various courses, list of leading computer professionals and current research activities in India would have made the publication more useful. There are also compilation errors such as the omission of TDC-312, Nelco-4000, System 1800 in the product ranges of ECIL, Nelco and HCL respectively, while there is no mention of data entry systems from ORG, Nelco and interchanged technical specifications of DCM products. The cut-off date for compiling is not mentioned anywhere in the directory. One can hope that the periodic updates (quarterly as indicated) will cover the missing areas in addition to updating the existing information.

However, the compilation efforts and the elegant presentation deserve appreciation. There is no doubt this directory will be a valuable source of information on the Indian computer industry though the publishers of Computer Age and Data Quest are reported to be working on their annuals covering similar information. (Reviewed in The Hindu, 10 September 1983.)

Computer lingo

The fast growing breed of computer programmers, aided by other computer specialists, have added many colourful words to the English language, particularly slang words. The process shows every sign of continuing.

Debug. In computer parlance, the word usually means an error made by the programmer when he wrote the program, thereby conveying to the computer a scheme of action which is not exactly the one that is needed to get the work done.

Gigo. (Guy-go, abbreviation of Garbage In, Garbage Out). Bad data leads to bad results. Your staff may find that the provident fund values shown on their pay slips don't make sense. The programmer is likely to explain this by saying that this is a case of GIGO. The accounts people feed in "garbage" into his computer program which prints pay slips. So, in turn, the program puts out garbage. You had better check with the accounts people; they are likely to claim that the programmers runs a "bug farm".

Hacker. 1) Refers to a dedicated computer programmer, expert at his job, who spends all his living hours at the computer centre.

2) An otherwise sensible boy who found himself a computer terminal while his friends found themselves girlfriends and/or wives.

Interrupt Mode. The computer goes on doing some specified work, interrupting this occasionally to attend to urgent minor tasks that need a little attention. You are in an interrupt mode when you are handling such a minor task needing immediate attention. Or, you can "turn the interrupts off", or you can have "interrupts stacked up dangerously" waiting for attention.

Kludge. An inelegant, clumsy way to "fix" a bug.

Pert Chart. A graphical way of describing a complex plan of action. Invented in the fifties for handling major government funded projects in the US, the Program Evaluation and Review Technique views a project in terms of "events" and "activities". A Pert chart clearly shows what goes on in parallel with what, and what has to be completed before something else can begin.

Save World. A hacker working at a computer terminal does not want a power failure to wipe out all his work. He gives a "save world" command once in a while, telling the computer to store in a semi-permanent way all that has been typed in. Hackers learn early in their careers to set up the computer to do an automatic "save world" every five minutes or so.

Stack. Computer programmers store key information about what they are doing in a "stack" before they switch attention to an "interrupt". On returning from interrupt they "resume" the previous work by "unstacking" the detail that had been put away. You can get a "stack overflow" if you keep honouring all kinds of interrupts at a rate you cannot handle easily. But don't hesitate to stack up uninteresting jobs when something more exciting comes. You can go back to them later.

Timeshare. Like a wizard playing chess "simultaneously" against a dozen opponents, large modern computers work independently in parallel for a few dozen "users". Even small computers work simultaneously for three to six users who sit at interactive terminals.

By Dr. Ramani, a senior research scientist with the National Centre for Software Development and Computing Techniques. (India). (Science Age, August 1983.)

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