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21895

EMERGING TECHNOLOGY SERIES

4/1996

Information Technology

UNITED NATIONS
INDUSTRIAL DEVELOPMENT
ORGANIZATION
Vienna, 1997

EMERGING TECHNOLOGY SERIES

INFORMATION TECHNOLOGY 4/1996

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UNIDO's *Emerging Technology Series* is established as a mechanism of current awareness to monitor developments in the microelectronics sector and inform governments, industry and academia, primarily in developing countries.

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Published in 1997 by the United Nations Industrial Development Organization (UNIDO)
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Printed in Austria.

TO OUR READERS

This issue's special article brings information on achievements in information technology in Chile. Chile is now the most dynamic country in Latin America as far as information technology is concerned. Software production is a crucial part of this development. Thus, Chile's development of the software sector provides a perfect example of a development scenario advocated and promoted since the early 'eighties by UNIDO. Since then, UNIDO has persistenly emphasized that a country's industrial development through indigenous software production is one of the most promising approaches towards development. It is perhaps worth mentioning that UNIDO put in a great deal of effort in the early 'eighties to convince decision makers that software is indeed an industry. Nowadays, this is obvious, but in those early days of software tinkering, UNIDO's point of view did not have many supporters – at least at the beginning. To all those who may be interested in UNIDO's involvement in the software sector, a book entitled **Software Industry – Current Trends and Implications for Developing Countries**, published in 1993 by UNIDO, can be recommended. Although a period of three years is a long time in such a dynamic industry as software, the book even now has more than solely historical value. Legal protection issues in software covered by the book, for example, can hardly be considered as mere historical presentations.

The special article in this issue of ***Information Technology*** also offers some information on the development of IT in the Latin American region, including indications on the results of a change in IT policy in Brazil and the influence of the "big software neighbour" on Mexican software development. There are also brief remarks on telecommunication technology in Chile and its influence on software, which may be of interest to decision makers from developing countries who could consider the Chilean case as a study for the developmental policy of a developing country.

Readers will also be interested in Global Knowledge 97, which is an ongoing global dialogue on how to harness knowledge and information as tools for sustainable and equitable development. Its focal point is an international conference on Knowledge for Development in the Information Age, co-hosted by the World Bank and the Government of Canada, to be held on 23-25 June 1997 in Toronto, Canada, in cooperation with a broad range of public and private partners, including UNIDO.

In addition to a presentation to be made by Mr. Mauricio de Maria y Campos, the Director-General of UNIDO, UNIDO will host a workshop on "Commercially Sustainable Information Networks for the Private Sector". Case studies will be presented by speakers sponsored by UNIDO from The Gambia, Senegal, Sri Lanka and Russia. In addition, UNIDO is sponsoring participation of delegates to the conference from five more LDCs in sub-Saharan Africa and Asia and the Pacific. Further information can be obtained on the WWW at the following: http://www.globalknowledge.org

Konrad Fialkowski
Scientific Editor

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A. SPECIAL ARTICLE

COMPUTING IN CHILE: THE JAGUAR OF THE PACIFIC RIM?

by R.A. Baeza-Yates, D.A. Fuller, J.A. Pino, and S.E. Goodman

Introduction

In least-developed countries (LDCs) looking to expand and modernize their economies, there is a growing perception that one of the most desirable means to this end is to export products with substantial added value. The development of software industries looks particularly attractive since software products are essentially pure added value. There are additional advantages to this industry: it is environmentally friendly, it requires less initial investment than other industries, it can leverage competitive advantages for other domestic industries, it helps employ college-educated people, and it provides relatively high income to entrepreneurs and employees.

So far few embryonic software industries in LDCs have done very well either in large export earnings or in having significant impact on national economies. The more notable aspirants in other developed economies include Hungary, India, Ireland, Israel and Russia. Each has some successful products and relations in the international software market. Each has had some high-profile publicity. In Latin America, Chile is among the leaders in a growing software market of about two dozen countries and 460 million people.[1]

In the past, Chile's economy was strongly dependent on copper, whose market fluctuations posed problems to economic stability. In 1975, it adopted an open market economic model, developing additional industries such as fish farms, forestry, agriculture (fruit, vegetables, wine, flowers), processed foods, and tourism. As a consequence, copper's export share dropped from 80 per cent to 40 per cent.

The Chilean economy has steadily improved during the last decade, growing roughly 80 per cent over this period. Within Latin America, Chile has the second highest income per capita. Unemployment has declined to 4-6 per cent, and the inflation rate has decreased to 7-8 per cent. Chile has been called the "Sixth Pacific Tiger" (or the America's relative: the jaguar). Despite the impressive record, this is still a developing nation with 4 million of its 14 million people officially considered "poor".

Politics certainly played a role. In 1973, the country's elected Government fell to a military coup led by a right wing general, Augusto Pinochet, who ruled until 1990. His Government established the basis for a strong economy, based on a free market and export quality production. This transformation did not occur peacefully, but with many human rights violations. In 1990, Pinochet handed power over to elected President Patricio Aylwin and democracy was restored.

During his four-year term, Aylwin emphasized economic and political stability. His Government controlled fiscal expenditures, and eschewed the protection of favoured economic sectors. In March 1994, newly elected President Eduardo Frei started a six-year term. In 1995 Chile had an annual inflation rate of 8.2 per cent, a positive trade balance, 8.5 per cent GDP growth, 4 to 6 per cent unemployment, and a record in foreign investment. As stated in *The Economist*, "the Chilean economy is easily Latin America's star performer".[2]

The country has shown a capacity for developing and exporting software products, particularly to Latin America.[3] Indeed, Chile has been proposed as a model for the development of information technology (IT) industries regionally.[1] But can this initial success endure, and is this jaguar ready to compete in the international IT industry?

An overview of IT in Chile

The infusion of computing in Chile began in 1962 (table 1) but, as is the case with most LDCs, moved slowly until the advent of inexpensive imported microcomputers. The number of personal computers (PCs) sold since 1989 has increased by a factor of four (table 2), with the total number installed annually exceeding 500,000 by 1995, when four out of 100 citizens owned a PC. (By contrast, three out of 5,000 owned a PC in 1992 in India.[4] In 1994, more than 20,000 PCs were assembled in Chile.

Initially, the introduction of computers to local enterprises generated a demand for software products, which was initially satisfied by imports and in-house software development. Table 2 shows the total IT and internal packaged software markets during the last few years.[5] About 70 per cent of this is imported, mainly from the USA.

In the early 1980s several large companies were hard pressed to improve their operations and rushed abroad to purchase packaged applications. They soon discovered that many required significant modifications or were completely useless, due to local accounting practices, widespread use of indexed currency, and local regulations concerning banking accounts. Support and program updates were needed at reasonable costs. These problems and needs drove the birth of the Chilean software industry.

In 1992, locally produced software sales totalled US$110 million, 12 per cent of which were exported. In 1991, 57 per cent of the known software exports were to Latin American countries, 12 per cent to Asia, and 31 per cent to other countries, mainly the USA and Europe. Exports of Chilean-designed software came to roughly US$22 million in 1993, up 58 per cent from 1992 (table 3). This rate is expected to decline to 40 per cent in the next few years.

Exported software products include MIS applications packages (e.g., transactional banking systems, integrated management systems and statistical analysis), software utilities (anti-virus software, software distribution systems, text retrieval tools) and applications in which Chile has special experience (mining, forestry).

For years, the Chilean software industry faced double taxation on exported products. Exporters had to pay taxes locally and also in the country where the product was sold. As a consequence of this taxation policy, software companies have been hiding their real export revenues, so the figures in table 3 are conservative. The problem of double taxation has already been solved legislatively. Another law, passed in 1991, has enforced software copyrights, thus decreasing piracy and stimulating sales.

Impressive growth rates aside, the Chilean share of the world software industry is very small. These statistics illustrate the position of aspiring LDC software industries

Table 1. Main landmarks in Chilean IT history

Date	Event
1962	First computer (University of Chile).
1964	First data-processing company (ECOM, State owned).
1967	First data-processing network (Banco del Estado).
1969	First Computer Science programme (University of Chile).
1974	First Computer Science Dept. & M.Sc. programme (University of Chile). Latin American Informatics Conference is launched in Chile (Catholic University of Valparaiso).
1981	Governmental research grants programme begins. First International Computer Science Conference.
1984	First Unix systems (University of Chile, University of Santiago) and Chilean Computer Science Society is born.
1985	International electronic mail (uucp), followed by Bitnet in 1987 (University of Chile).
1987	First automatic banking teller network (union of banks).
1989	First Unix workstations laboratory (University of Chile).
1990	First IT industry participation in CEBIT (Germany).
1991	Digital data networks. Internet connectivity (Catholic University and University of Chile).
1993	First Ph.D. program in Computer Science (Catholic University). Digital telephone switching system goes from 80 per cent to 100 per cent
1994	First Metropolitan ATM network (University of Chile). Multicarrier system for long distance telephonic calls.
1995	Commercial ISDN service. Virtual Banking (Banco de Santiago).

Table 2. Chilean IT and packaged software market (US$ millions). Personal computers sold in Chile (thousands)

Year	IT market	Growth (%)	Software market	Growth (%)	Software exports	Growth (%)	PC units	Growth (%)
1989	n.a.	-	n.a.	-	1.4	-	30	-
1990	n.a.	-	n.a.	-	3.6	157	40	33
1991	n.a.	-	n.a.	-	6.4	88	60	50
1992	439	-	52	-	13.9	117	83	38
1993	496	13	70	35	22.0	58	110	33
1994	555	12	77	10	n.a.	-	120	9

Table 3. Chile in the international packaged software market (in US$ millions)

Item	1994	1998 (est.)
Chilean exports	38.8	170.7
World sales	77,492.0	121,489.0
Chilean share of world sales	0.05%	0.14%
Total Latin American sales (ex. Chile)	1,764.9	3,051.0
Chilean software sales in Latin America	23.7	102.0
Chilean software exports in Latin America	1.3%	3.3%

in today's global market. Even India and Israel, each with a software sector greater than Chile's by an order of magnitude, barely show up at the world level. Within Latin America, Chile's presence is comparatively more substantial (by a factor of almost 30), but is still small. This reflects the dominance of the advanced industrial countries as both producers and consumers of software, the small markets in developing countries, and the effects of widespread piracy.

IT projects have experienced growth pains in Chile. Some projects have been too ambitious or have been poorly done. For example, one university launched an "informatization" project a few years ago, only to end up with too much batch processing hardware and too little modern functionality. Another embarrassing example is Codelco's (Chile's largest mining company) poor computerized futures options system, losing them an estimated US$250 million in late 1993.

The software industry has benefited from dynamic growth in telecommunications, and local telecommunications companies have become the most developed companies of their kinds in the region. All important cities are wired with fibre optics, all the telephonic switching in the country is digital, ISDN was introduced in 1994, and almost all universities and many companies are connected to the Internet. In the last 10 years the number of telephone lines has more than tripled to 1.6 million. Internet penetration in Chile is also high with more than 13,000 hosts in 1996,[6] which can be compared to 47,000 hosts of Brazil, 20,000 hosts of Mexico, and 10,000 of Argentina. These countries have more than 10, 5 and 2 times the population of Chile, respectively. Another important development was the multicarrier system for long-distance calls introduced in 1994. Eight competing companies are offering this service, resulting in major rate reductions. Recently, some cable companies have launched joint ventures with telecommunication companies to provide in the near future, services through the cable such as TV, video, telephone and Internet. Currently, one company is already offering these services experimentally.

The Chilean software industry

A sampler of some of the more innovative software companies in Chile includes:

- AISOFT develops administrative software, and has sold over 3,000 copies on various platforms. Since 1989, it has been exporting to the USA, Venezuela, Peru, Brazil, Uruguay, Costa Rica and Argentina.
- Ars Innovandi is a small software company with expertise in text retrieval and document-based applications. It currently markets a package for Windows in several Latin American and European countries, as well as an API for developing customized applications. Like many small companies in LDCs, it is severely short of the resources necessary to market its products abroad.
- Excelsys is another small company specializing in custom hardware/software solutions. Its products include a wood volume measurement system for lumber companies, and an electronic queuing system with flow sensors, light signals, etc. The queuing system is currently used by Citibank in several countries. They are also customizing automatic teller machines in Colombia and Guatemala.
- Sistemas Integrales is a small software and consulting company that has exported its main software product, the Ariel-plus statistical package, to clients in 35 countries, mainly for government agencies needing to process surveys.
- Sonda is the largest national software company, with offices in eight Latin American countries. Its main business is services and consulting, coupled with the distribution of DEC products in the region. Among other products, it has sold banking systems to customers in Latin America, Indonesia, Malaysia, Thailand and Russia. It employs 1,500 people, with 1994 sales of US$135 million (22 per cent abroad).

The companies mentioned thus far mainly sell software packages or consulting services. Other companies such as Binaria or DTS provide off-shore programming, while some foreign companies partially develop and fully support their software through local offices in Chile.

Other IT products are encapsulated in larger packages exported mainly to Latin America. One example includes management systems for pension funds, sold separately or contributed as capital investments in foreign pension funds companies. These exports have boomed because some countries, such as Argentina or Peru, have replaced their State-managed retirement funds systems with private schemes modelled after Chile's successful experiment in this area, which began in 1981. A similar turn-key system has been exported by the Chilean Stock Market. Its product is a complete electronic stock exchange system, including know-how, software, and installation. The customers are financial markets in Costa Rica and Colombia.

International prospects and problems

Aspiring LDCs often claim to have highly qualified human resources necessary to have a competitive software export industry. Whether true or not for any particular country, more generally human resources make up only one of the required factors. Other factors include financing, strong marketing capabilities, product quality, physical or electronic proximity to the centres of technological innovation and test sites.[3,7] If the other factors are not present, the creation of a mature software industry is impossible. Latin America notably lacks distribution channels for software.

So the question arises: How is it that Chile developed a software export industry, and other Latin American countries, such as Brazil, Argentina or Mexico, with much larger markets, have not? In Chile, the introduction of a free market economy created the need for efficient and competitive industries. The Chilean banking system learned to deal with exporters, making themselves extremely efficient in order to compete with each other and with foreign banks. Mining, fishery, fruits and forestry, discovered "new" markets. All this meant the introduction of technology to produce at international quality standards and at low costs. This need created a growing market for software products, which initially was satisfied with imports. With qualified manpower and capital available, and a stable economy, indigenous software houses formed.

Table 4 shows the total IT and packaged software market in the principal Latin American countries for 1994.[5]

Brazil has not been able to repeat its high GDP growth rates of the 1970s. Economic protection for the national computer hardware industry hurt software exports. This policy was corrected in 1993 by launching an ambitious plan, SOFTEX 2000, to promote a software industry in the coming years. In 1992, according to a Brazilian Government study of 73 companies,[8] the total software market was US$384 million. Included in this figure are US$210 million of imported software. In contrast, software exports amounted to only US$1.1 million.

Table 4. Comparative IT and packaged software markets in Latin America (Year 1994, Data from CELADE, IDC, Latin Finance and World Bank)

Country	Population (million)	GDP per capita	IT market	Software market	Soft/GDP (%)	Soft/capita (US$)
Argentina	34.2	8,317	1,259	140	0.05	4.1
Brazil	159.1	3,298	4,982	1,043	0.20	6.6
Chile	14.0	3,600	555	77	0.15	5.5
Colombia	34.6	1,740	442	43	0.07	1.2
Mexico	89.6	4,321	3,267	401	0.10	4.5
Venezuela	21.4	2,594	509	65	0.12	3.0
Rest Latin America	108.4		673	74		0.7
Total	461.3		11,687	1,843		4.0

The Mexican software market is dominated by products developed north of the border. The geographical proximity to the USA has apparently hurt the development of a native software export industry. The Mexican computer market, opened to foreign companies in 1990, represents about 28 per cent of the entire Latin American market. The software market in 1994 was approximately US$400 million, with only 30 per cent covered by Mexican companies. Currently, software exports are small.[9] Only in 1994 was a national computer association similar to the ACM created in Mexico, in contrast to Argentina, Brazil and Chile, where such organizations existed at least 10 years ago.

Latin America is an obvious market for Chilean software companies. Besides having a common language and traditions, Latin American countries may experience substantial economic growth in the coming years. Furthermore, Chile has recently signed free trade agreements with several Latin American countries, which will increase trade with them. This Latin American emphasis in foreign relations was underlined with the Chilean association with MERCOSUR (Common Market of the Southern Cone) (the economic union of Argentina, Brazil, Paraguay and Uruguay), approved by the Parliament in September 1996. Unfortunately, the services sector (which includes consulting and software) was left for later discussion.

Markets beyond Latin America are needed, not only as a source of additional income, but also as a quality test for the industry. The Pacific Rim countries are an interesting market for Chilean companies to explore since most have booming economies and their growth eases entry for newcomers. Chile was accepted during 1994 in the APEC (Asia-Pacific Economic Council), which should reduce trade barriers and bureaucratic red tape. Another related factor is Chile's possible incorporation to NAFTA (North American Free Trade Agreement), although during 1995 the USA did not approve a fast negotiation track in spite of the support from Canada and Mexico. Near-term consequences may include imported IT goods with lower prices (following reduction of the current 11 per cent import tax) and greater foreign investment. Note that Chile has already an economic trade agreement with Mexico and negotiations for a similar agreement with Canada have already been finished.

Will Chilean software companies grow in markets beyond Latin America? This is not yet clear. On the positive side, there is an internationally-minded generation of businessmen in the country who are experienced in export ventures. Also, Chile has the highest per capita level of published IT-related scientific papers in Latin America.[10] On the negative side, many Chilean software companies lack the needed capital and know-how to reach mature markets. The higher standards in software quality and rising standards of living will likely increase the cost of Chilean software. There is no strong overall technological environment to foster a large-scale internationally competitive industry. In general, the Government fosters exports, but is not inclined to subsidize business and is unlikely to give special treatment to the IT industry.

Chile arguably has the most internationally successful software industry in Latin America. So far, this industry has been as capable as almost any from an LDC in exporting to emerging markets with low entry requirements, that is, where the local competition is weak, the customers are less demanding and where language and cultural advantages exist against USA or European products. The industry is also relatively healthy in that most of it is based on products of domestic origin that have proven value, rather than on cheap, educated programmers whose time is sold to European, Japanese or USA companies.

But where does this industry go from here? The future may be rosy for some companies, but is more questionable at the national level, as indicated by the modest numbers in our tables. So far, Chile, and almost all LDCs, have relatively small domestic market shares for domestic software. This is even true for large countries with large domestic markets in most other respects, e.g. Russia, India, Brazil and Mexico. Regionally-produced products account for even smaller shares of an LDC's software market. These markets may have low entry requirements, but there is often little to do once inside. More generally, in comparison with their geographic and demographic bases, there is very little intraregional IT trade in many parts of the world, notably Latin America, Africa, many parts of Asia, or the Middle East. Although some countries or subregions show high growth rates in certain statistics, the bases are still very small. Except in the dubious domain of providing bodyshopping labour, it is proving very difficult

for embryonic software industries in LDCs to be competitive in mature markets.

Domestic software industries should be of more value to an LDC in leveraging greater efficiencies and other competitive advantages for larger infrastructure-building industries, e.g. tourism, than in direct software export sales. Successful systems for demanding, internationally successful domestic customers are what is most likely to lead to the best kind of exports.

Acknowledgements

This work was partially supported by Chilean Science and Technology Fund grants Nos. 1950622, 1950880 and 1940269, and a grant from CYTED (RITOS). We would like to thank Gloria Bensan, Marcos Borges, Vladimir Estivill-Castro, Jose Piquer and Ricardo Stevenson for their help with statistics, and Robert Dailey and the referees for their constructive comments.

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B. NEWS AND EVENTS

European and Japanese trade collaboration

Senior executives of European and Japanese producers meeting in London in June 1996 agreed to collaborate towards a global trade network for semiconductors. Although this meeting was organized as a private sector initiative, it was arranged in close collaboration with the European Union and the Japanese Ministry of International Trade and Industry with a view to increasing European sales in Japan.

Representatives of Siemens (Germany), Philips (The Netherlands) and SGS Thomson Microelectronics (France and Italy) met with Japanese representatives from Toshiba, Hitachi and NEC. They agreed that the European industry should ask representatives of the US Semiconductor Industry Association to attend joint talks. Companies from South Korea and Taiwan and other major manufacturers will be approached later with a view to forming a World Microchip Council. (Extracted with permission from *Semiconductor International Magazine*, July 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

OECD meeting makes progress on cryptography guidelines

OECD member countries have moved ahead in drafting Cryptography Policy Guidelines that would provide internationally comparable criteria for encryption of computerized information. Drafting should be complete by the end of the year for Guidelines which governments would adopt and businesses, individuals and law enforcement officials would apply in safeguarding electronic transactions, communications and data storage.

The OECD Guidelines identify the issues countries should take into consideration in formulating cryptography policies at the national and international levels. The Guidelines could play an important part in the development of the Global Information Infrastructure (GII) and Global Information Society (GIS) but national policies must be harmonized at the international level to meet the needs of global technologies and applications. Discussions have focused on the rights of users to choose cryptographic methods, the freedom of the market to develop them, interoperability, consequences for the protection of personal data and privacy, lawful access to encrypted data, and reducing the barriers to international trade.

The OECD Guidelines will be non-binding recommendations to member Governments, meaning that they will not be part of international law, nor will they endorse any specific cryptography system.

The process of drafting of Guidelines for Cryptography Policy began in March, when the OECD formed an Ad hoc Group of Experts composed of government representatives and experts from OECD countries. The group met in Washington DC in May, and a second time in Paris in June. The third meeting took place on 26-27 September in Paris.

The Group will continue discussions the week of the 16 December, with a view to completion this year of a draft of the Guidelines which would be forwarded for approval by the Council of the OECD early in 1997. (Source: *OECD News Release*, 1 October 1996)

Operational aspects for international freephone approved

The International Telecommunication Union recently approved a new revised standard which describes the service, the ordering processing and other operational aspects including access methods and implementation between carriers for the provision of the International Freephone Service (IFS). This new standard completes the conditions and principles which were recently approved.

"Freephone" is a service which permits the cost of a telephone call to be charged to the called party, rather than the calling party. It is used by businesses to bear the charges of long-distance calls made to them by their customers. A Universal International Freephone Number (UIFN) enables an International Freephone Service (IFS) customer to be allocated a unique freephone number(s) that may be the same throughout the world.

A UIFN is composed of a three-digit country code for global service application, i.e. 800, followed by an 8-digit Global Subscriber Number (GSN), resulting in an 11-digit fixed format. This number is to be preceded by the access code to reach the international network. For example, a UIFN from the US would look like this: (011) 800 xx xx xx xx. 011 is the number to dial to access the international network from the US. The xx xx xx xx part is referred to as the Global Subscriber Number (GSN) to be administered by ITU.

The Council—ITU's governing body between Plenipotentiary conferences—has endorsed ITU's proposed role as Registrar of these new numbers and set the cost of registration for each international freephone number at 200 Swiss francs.

Requests for UIFNs by customers will be addressed to the international carriers (or national administrations depending on the country) who will then conclude bilateral agreements with each carrier of the countries in which the customer will offer the service. After having concluded such agreements, which include the operational aspects for implementation, the carrier of the IFS customer concerned will submit an application to ITU on its behalf. Once confirmed by ITU, the carrier of the IFS customer will inform the carriers of the other countries concerned of the assigned number. Customers offering a service within a single country or between countries having an integrated numbering plan (for example between the US and Canada) will not be eligible for UIFNs.

IF UIFNs are not implemented within a maximum period of 90 days, the reservation will be cancelled and the number will go back into a pool of numbers available for assignment. The possibility for customers to take advantage of worldwide UIFNs is scheduled to be effective as from 4 February 1997.

More information on UIFN is now available on the World Wide Web at http://www.itu.ch.uifn/. (Source: *ITU News Release*, July 1996)

Recovery of global warming gases

Praxair Inc. (Danbury, CT) was awarded a patent for a cryogenic system that recovers potential global warming gases that would otherwise be emitted to the atmosphere. Praxair said its patent (No. 5,502,969) is the industry's first

patent for a system that allows the separation and recovery of gases known as perfluorinated compounds (PFCs) from an effluent gas stream.

While these PFCs—halocarbons 116, 14 and 23; sulphur hexafluoride; nitrogen trifluoride; and perfluoropropane—are essential to many manufacturing processes, many environmental scientists believe they may last as long as 50,000 years when released into the atmosphere.

Praxair said that until now, semiconductor manufacturers have had two choices: exhaust PFCs into the atmosphere, or burn them at considerable financial and environmental cost. A third option, as covered in the patent, is to recycle the gases. (Extracted with permission from *Semiconductor International Magazine*. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Policy issues in the multimedia age

The European information services market is growing rapidly. According to a survey carried out by the Deutsche Gesellschaft für Dokumentation, it increased by nearly 40 per cent between 1992 and 1994, and the growth rate is expected to accelerate as additional multimedia products become available. This development raises various technological, market, human and legislative issues, which can be discussed both in the context of organizations and of society as a whole.

The main technological issues relate to ease of access: standardization, compatibility, improved search and retrieval tools, helpful and intuitive user interfaces. Many proprietary information systems require extensive training before they can be used, but further expansion of the market will require that the resources can be searched by people who have only an intermittent need for information.

The market issues concern, *inter alia*, the reliability, timeliness and relevancy of information. In addition, consumers need better information regarding what material is available and convenient mechanisms to purchase it.

There is a pressing need to examine how skills requirements are changing: a shortage of illustrators and animators, for example, might mean that the creation of new products is delayed.

The future role and skills requirements of intermediaries and information brokers must be considered.

The information industry depends on the security provided by the legislative and regulatory system in such areas as the protection of intellectual property rights. Other concerns relate to liability, privacy and the security of electronic data transmission. The legal framework, however, must adapt and change to reflect the changing nature of the industry. (Source: *Journal of Information Science*, 22(3) 1996)

Know-how: the hidden information asset

A report produced as part of an impact programme highlights the know-how within an organization as something that distinguishes it from its competitors and is an essential ingredient used and exploited in its processes. Success in business is likely to result from decisions and actions based as much on personal knowledge and experience as on any other information. Know-how could thus be regarded as one of the organization's most valuable assets.

However, if that knowledge and experience is not harnessed and organized for precise and easy retrieval it will be neither used nor useful. This requires recognition of its potential, the acquisition of appropriate systems with which to organize and access it, and acceptance by everyone in the organization of the need to share their own expertise in a more formal way.

The purpose of adopting a more systematic approach to know-how is to be able to record, analyse and arrange information which has not been systematically organized previously, to allow for its future retrieval as part of a more comprehensive and structured use of personal expertise. In the legal firm, for example, this includes precedents, rulings, fact and legal opinions.

Such developments have obvious implications for library and information service providers, often responsible for the management of internal as well as external information resources. The introduction of know-how systems in combination with other sources of information will have considerable impact on the overall provision of and access to information within organizations. Related working practices are likely to change, bringing with them the need for additional training and skills acquisition. (Source: *Information Management Report*, September 1996)

Information products and presentation in organizations: accident or design?

Research based on a number of case studies has been conducted to determine how different types of organizations manage the process of creating information products and presenting information. In addition, it is examining if the way this process is managed has any effect on the achievement of strategic objectives in terms of information flow, communication, cost-effectiveness, and efficiency. Questions asked in interviews covered the existence of a specific strategy that relates to information products to key organizational objectives; the relationship of information products to the management of information resources; how decisions are taken on information products and who makes them; management's attitudes towards information products and who makes them; management's attitudes towards information products and presentation; in-house or out-of-house creation of information products and training of people involved; technologies used; product costing and budgeting; and evaluation. Case studies show that none of the organizations have a specific strategy for their information products or a special management forum where such a strategy could be developed.

When devising a strategy for information products, it would seem reasonable to look at the information resources and their potential for supporting existing products or developing new ones, but in most of the organizations studied, this is an under-exploited area. In other cases, information resources with a high potential for contributing to value-added information products are designed and managed in such a way that potential cannot be realized. Strategy is discussed in terms of management attitudes; decision-making; costs and budgets; human resources for information products; approaches to presentation; corporate identity; presentation of internal products; and testing and evaluation. While the research is based on practical experience, it is necessary to have a sound theoretical basis. The special area of information science has traditionally been the knowledge structure, but as information science becomes more human-driven, professionals are becoming concerned with adding value by developing actual information products. The next stage of the project will be action research which should result in a practical information product designed to help organizations manage their information products as a process; use organizational self-knowledge in making decisions; and establish their true

cost and value. (Source: *International Journal of Information Management*, 16(5) 1996)

Data warehousing

Computer users have long complained that they are drowning in data but starved of information. Enter data warehousing, a system that scans vast quantities of information for patterns that cannot be found manually. Manufacturers and financial institutions have adopted the technology early on. Capital One, the US credit card company, has segmented the marketplace so minutely by means of a data warehouse that it has been able to issue not three or four types of credit card but hundreds. In the UK, Churchill Insurance is using a network of data warehouses to meet its goal of providing every caller with a quote in under three minutes. Meanwhile Reuters has gone live with a massive system containing up to 10 years' history of prices on almost every financial instrument, including equities and options, as well as company information, money rates and third party data.

However, there is already a significant amount of disenchantment with the technology. It often begins when new adopters learn how expensive data warehouses can be to run. Data warehouses also incur substantial training costs. While ultimately data warehouses will be easy enough for the most technophobic of managers, in the meantime the tools and commands can be difficult to master. The most significant cost associated with late warehousing is not the system but the people. Even after implementation, the cost benefits are hard to quantify because data warehouses tend to help with softer activities, such as marketing.

Much of the installation cost is caused by the need to overhaul existing data before it can be stored in the warehouse. Most organizations with multiple databases have inconsistencies, for example in employee addresses, customer identities, or product and service definitions. Ironing these out is expensive. (Source: *Management Today*, September 1996)

Perils of outsourcing

According to ITNet, the outsourcing market in the UK is still growing by 37 per cent a year: contracts worth £546 million were signed last year. Recent reports, however, suggest that the outsourcing of IT does not always bring the benefits anticipated. Outsourcing has many hidden costs and can lead to loss of business control and a lack of innovation and flexibility.

Organizations that rush into outsourcing for the wrong reasons can pay the penalty. A study of IT outsourcing in more than forty companies in the US and Europe concluded that the key to successful outsourcing was to be selective. Firms that locked themselves into long-term contracts—usually more than five years—with ill-defined and inflexible clauses often discovered that the arrangement failed to respond to changes in technology or the economic climate. If the organizations down-sized or re-engineered their operations, they found they had to continue paying for services no longer required.

It is important that companies outsource for the correct reason. It is generally agreed that to do so simply to offload an expensive or incomprehensible part of the business is a recipe for disaster. The majority of the firms studied were not trying to obtain better IT services, but simply to reduce their costs. In many cases, they ended up paying more than they anticipated. There is also the danger of losing control of strategically vital technologies, and of the systems required to maintain a competitive advantage of the marketplace.

If outsourcing is to be a success, the client must retain overall control of the contact. This requires a lot of time and effort, since attention to detail is essential. (Source: *MicroScope* 15(35), 4 September 1996)

Indexing and cataloguing in the Web

Locating specific items on the Web presents major difficulties, given the sheer volume of information displayed on it. There are two major techniques for generating databases which can be used to locate information resources: manual cataloguing and automatic indexing. The ephemeral nature of much Web-based material means that the high cost of the former often cannot be justified, in which case, users must depend on the latter.

Examples of catalogues created using human intervention include the Intercat project, OCLC's *NetFirst* and the UK Subject Based Information Gateway (SBIG) services. Intercat is a group of mainly academic libraries, in association with OCLC, which are cataloguing on-line resources to augment traditional paper-based holdings. *NetFirst* is a commercial service. SBIGs are funded as part of the UK Electronic Libraries programme. Another group is represented by mass market review services, such as Point Reviews (a subsidiary of Lycos) and Magellan (part of the McKinley Group).

Indexing services employ a robot, or Web crawler, to retrieve and index documents. A couple of weeks of constant work by the crawler may be necessary to explore all the embedded links so as to create a comprehensive index. None the less, even crawlers cannot index more than a fraction of the total information available, since many of the pages visited will be no more than the front ends to databases. Leading indexes include Lycos and Alta Vista.

Various current developments include attempts to standardize the metadata attached to a document so as to improve the quality of indexes, and the creation of distributed indexing and cataloguing services. (Source: *EPJournal*, 10(3) July/August 1996)

Web indexing: an exercise in hypertext navigation

As the Web grows, Web indexing has become a sought-after skill. A new tool—WEBIX—has been developed for the inaugural AusSI Web indexing prize in Australia. WEBIX comes in DOS and Windows versions and it can be used to produce potted indexes on the Internet, in addition to use at Web sites or for electronic journal indexes. The indexer's skills of analysing and sorting information can be used to lever unattached pieces of information on the Web and incorporate them into bibliographies of new electronic books. This means that there is a basic shift in the direction of indexing and the creation of a kind of kinetic indexing or "bookbot" which points the reader outward to the universal on-line bookshelf with the aim of creating a customized index to a bookshelf area. Hypertext links are represented by highlighted text or icons and the information is organized in chunks—an information block is a basic subdivision of a subject-matter.

The way to access or locate a piece of hypertext is to name it. In the Web's version of hypertext, these names are file names or Universal Reference Locators (URLs). The indexing processes used in WEBIX are illustrated together with the specifications of Web conversion from HTML to WEBIX. WEBIX has the capability to be extended for use on the Internet itself by using the full URLs instead of

local file names. WEBIX can be used to create a Web index using basic tools such as Netscape and HTML Writer. There are tools such as Adobe's Site Mill for Macintosh that can keep track of changing file names and update all the pages that refer to them in the indexing. WEBIX can also be used with these tools to automatically update locators in the index. (Source: *LASIE*, 27(3) September 1996)

Organization of knowledge on the Internet

The enormous increase in the quantities of information made available by electronic means presents society with both a threat and a new opportunity. The danger is that the information will be fragmented and disorganized, effectively rendering it inaccessible. At the same time, however, the technology is integrative, enabling us to find new links between items in a manner not previously possible.

Libraries will have to find new models for their operations, and explore new working methods. Increasingly, academics are moving from the use of hardcopy serials in an academic library to directly accessing individual articles via services such as UnCover. Increasingly, it is becoming feasible for cataloguers to work from home, as those working for the Australian Bibliographic Network (ABN) already do.

Metadata approaches will prevail, providing means to discover what data exists and documenting the content, quality and features of a given data set. At present, there is little or no filtering of material, so duplication is rife and quality variable. Present search tools are not adequately structured and information not organized so as to facilitate local control.

Intelligent Web crawlers and language algorithms may soon produce accurate and timely indexes, largely without human intervention. There is still a need, however, for human cataloguers to overlay structures on the mass of information available so that sense can be made of it, as well as to add value by providing assessments of its worth and relevance.

Some initiatives are already under way. They include the Text Encoding Initiative, the IETF working group on document identifiers, and work done at the Research Data CRC in Brisbane. (Source: *Information Management Report*, September 1996)

A dinosaur in danger

The early hard discs had a capacity of 10 Mb: today, the standard is one hundred times larger (1 Gb). Over the same period, however, the floppy disc has increased its capacity only four times, from 360k to 1.44 Mb. As a result, it has been referred to as a "sad dinosaur".

This may be the case, but it is still a reliable and standardized product. There is now the very real prospect of there being *three* formats for the discs which will replace the conventional floppy.

Iomega was the first to market is Zip drive, offering 100 Mb, an average seek time of 29 ms and a sustained data transfer rate of up to 1.4 Mbps. In March this year, Compaq introduced the LS 120, developed in collaboration with 3M and Matsushita. This offers a capacity of 120 Mb, an average access time of 70 ms and a maximum transfer rate of 580 kbps. The drive is backwards compatible with 1.44 Mb and 720 kb floppy discs. Ironically, the technology is derived from a device called the Floptical, originally developed by Iomega. Mitsumi is also working on a high-capacity floppy system, which will have a capacity of 128 Mb. The third "standard" currently on the market, however, is SyQuest's 135 Mb EZ135, based on familiar Winchester storage technology. The company has also launched the EZflier 230, a 230 Mb drive using removable cartridges.

To complicate the matter even further, two other technologies are waiting in the wings: CD writers and magneto-optical storage. Both have been around for some time, without making a breakthrough, but their position may be about to improve, given recent technical developments. (Source: *MicroScope*, 15(35) 4 September 1996)

Break the bandwidth barrier

Microprocessors become twice as powerful every 18 months. Analog modems, however, are only about 10 times as fast as they were 20 years ago. This situation is about to change, with the appearance of a new generation of broadband modems, which promise speeds of 1-5 Mbps. These devices work on both telephone (using asymmetric digital subscriber line (ADSL)) and cable networks. Which type of network will dominate the broadband market in the future—or whether they will share it between them—is as yet unclear.

Before the promise can become reality, however, a number of problems must be overcome. Standards for ADSL and cable modems are shaky or incomplete, resulting in modems from different manufacturers that are unable to communicate with each other. Prices remain relatively high (about $500). The infrastructure will require upgrading (only 10-15 per cent of the US cable network is currently able to handle two-way traffic at megabit speeds).

Moreover, real-world speeds are constrained by bottlenecks elsewhere in the system, such as those imposed by 10Base-T Ethernet ports. None the less, even 1.5 Mbps (to take a worst-case example) is 50 times faster than a 28.8 kbps analog modem, 12 times faster than basic rate ISDN, and equal to a digital T1 line which costs thousands of dollars a month.

These difficulties will be overcome over the next few years. Both types of broadband modems will probably standardize on ATM as the network transport protocol, and replace 10Base-T connections with internal cards plugged into expansion slots. Some PCs (and especially network computers) will integrate a broadband modem as a condensed chip set on the motherboard, which will drive prices down. (Source: *Byte*, September 1996)

Electronics recycling

Electronics recycling is big business. A number of companies have developed the capability to recycle electronic components, turning them into their constituent materials for profitable re-use.

Many of these are simply companies who handle scrap metal and who have spotted an opportunity to extract precious metals from electronic/electrical equipment. However, a few companies have emerged that are dedicated to the task of recycling PCBs, ICs and other electronic components. For example, the Mann Organization recycles as much as possible from a product, while others, such as Asset Reclaim, which pulls ICs from PCBs for resale, concentrate on extracting those components that they regard as most profitable.

The main driver for the recycling phenomenon, at present, is cash. Large companies, who generate a lot of waste, are beginning to recognize the pecuniary advantages of sending waste for recycling rather than to landfill sites.

In the long term, motivators will include EU legislation affecting electronics companies that is expected to arrive within a couple of years, as well as the kudos of being called an environmentally aware company.

The Mann Organization is at the heart of EMERG (Electronic Manufacturers Equipment Recycling Group). EMERG was launched in May last year and aims to establish a comprehensive and fully-integrated recycling system. The group recognizes that landfill and incineration are still the main disposal routes for industrial waste, and wants to eliminate this environmentally unfriendly approach to dealing with members' waste. At the moment EMERG has around 20 members, and is attracting interest from several global material suppliers.

Asset Reclaim of Coventry, a division of Dionics, was set up over a year ago to recycle integrated circuits (ICs) from PCBs. There is a market for "pulled" ICs outside the UK, where they are used in various kinds of electronic products. The main advantage of buying these ICs is that they are much cheaper than brand new ones, usually about a third of the price. But some companies see advantages in buying second-hand ICs since these components, which do not usually deteriorate with age, have already been tried and tested.

The IC recycling industry looks likely to boom, with companies like Asset Reclaim able to offer companies many times the return they would get from sending PCBs for scrap.

The equipment used by Asset Reclaim is manually operated, due to the difficulty in automating extraction apparatus for the variety of boards they have to deal with. The instrument uses warm air to melt the solder that connects an IC to a board and has a vacuum device for the removal of ICs. With this, five or six ICs can be removed in a minute.

Concerns of companies reluctant to hand over PCBs for recycling include warranty fraud and software being downloaded from ICs that could be used for technological espionage. Most electronics manufacturers will not hand over surplus goods without stringent safeguards.

However, the anticipated EU legislation is putting manufacturers under pressure to find ways to dispose of electronic waste in an environmentally acceptable way. In Germany, this kind of legislation is already in place. In Britain, the Industry Council for Electronic and Electrical Equipment Recycling (ICER) is trying to have guidelines formulated in time for the introduction of the legislation.

ICER is a cross-industry organization that includes such companies as Apple, GEC-Marconi, ICL and Hewlett-Packard. Some of the areas in which ICER is currently researching include the problem of collecting end-of-life equipment; the importance of stimulating markets for recycled material; and the role of industry-led initiatives.

Whatever the impact of EU legislation on the European electronics industry, recycling is an effective strategy for electronics companies that want to cut manufacturing costs. Also, as companies become increasingly obliged to take responsibility for products right up to the end of their life cycle, it looks like recycling will be the way forward. (Extracted from *Electronics Weekly*, 17 July 1996)

Internet (traffic) overload: disaster in the making?

For the past year or more, there has been a growing volume of complaints regarding slow performance and service "brownouts" on the Internet. The more pessimistic voices are predicting that the Net is facing imminent collapse due to the sheer weight of traffic on it.

The problem is at least in part due to the popularity of the Web. Two years ago, there were about 1,000 Web sites; now, nearly 1,000 new sites appear *each day*. The number of users is predicted to reach one hundred million by 1998, and the volume of data in transit is boosted by the popularity of audio and video material.

A poll of 30 analysts, however, suggests that a full-scale meltdown is unlikely. They point to the robustness of the system, originally intended to withstand a nuclear assault. Moreover, companies such as MCI and Sprint, which have an enormous financial stake in the continuing health of the Net, are investing hundreds of millions of dollars in its infrastructure. Even so, users can expect to experience the effects of congestion for at least the next few years.

This has produced suggestions that the best way to fund investment in the infrastructure is to charge for Internet use on a hourly or per-packet basis. This might severely limit use by educational institutions and small businesses. Such a scheme, however, would be unlikely to appear in less than two years.

For the present, actions which can be taken by the user include choosing a service provider offering more direct connection to the major backbones, downloading in the background, and using products such as *OM-Express* and *WebMax* to download pages at night when the network is less busy. (Source: *PC World*, October 1996)

Trans-European telecommunication networks: towards global interoperability

The European Union (EU) has initiated a programme—telecom-TENs—intended to provide a framework for the development of trans-European telecommunications systems. Telecom-TENs covers such issues as a common stance on ISDN and the widescale deployment of integrated broadband networks. The objective is to establish a series of interconnected and interoperable systems essential for the creation of the information society. In addition, however, these trans-European networks will also need to be *globally* interoperable, using a three-layered approach (applications, generic services and basic networks).

A number of existing trials will be consolidated within the development of the European Information Infrastructure (EII), which parallels similar schemes in the US and Japan. The three key players in the global market are already extending their networks into adjacent regions: the US to the rest of the Americas, Japan to the Asian-Pacific Rim, and the EU to Eastern Europe.

More specifically, applications development within telecom-TENs will be within the context of coordinated action among the Group of Seven (G7) States. The G7 summit in Brussels early in 1995 highlighted four broad groups of applications, which will form the basis of the new infrastructure.

Initially, the generic service environment will be based on such facilities as e-mail and file transfer systems, but over time it is expected that multimedia products will emerge. At present, however, the relevance of, and demand

for, mass-market global services has yet to be determined. (Source: *Information Services & Use*, 16(2) 1996)

"Virtual laboratory" takes shape

The Web offers a tantalizing prospect for research chemists: the integration of computational chemistry, productivity tools and information servers. Through the Web, simulation can be seamlessly linked with Internet-based information sources such as structural databases. Web browsers are interoperable with word processors and spreadsheets. Emerging standards such as Java, Netscape Plug-ins, MDL's Chime and Microsoft's ActiveX permit easy interchange of images and data. These technologies can, for example, allow chemists to distribute structural data embedded within reports as images or data files. Recipients can extract and manipulate the structures and return the reports with their comments added. Molecular Simulations Inc. (MSI) is a privately-held company formed out of the August 1995 merger of MSI and Biosym Technologies. The company employs around 260 people, half of them PhD scientists; headquarters is in San Diego, California, with an additional research and development facility in Cambridge, England. The company has launched its free WebLab family of products that will link MSI's scientific applications to established Web server technologies. WebLab allows chemists to run scientific programs through browsers such as Netscape Navigator, and interact with browser pages to guide computations and information retrieval on servers that could be in the next room, at another site, or anywhere on an accessible public or private network. Crucial to WebLab is its ability to exchange molecular information, complete with all of its chemical attributes. Molecular structures can be transferred through a Web browser and then displayed using the WebLab Viewer. This allows chemists to share chemical information across the Internet—in itself a valuable resource for current users of simulation, enabling them to work more effectively with other computational chemists and share the results of their work with collaborators and members of their research teams. In addition, WebLab will build on MSI's existing simulation technology to provide a "virtual laboratory" of computational instruments and experiments via the Web. (Source: *Monitor*, 186, August 1996)

Smart windows

Materials that change colour reversibly during electrochemical charge and discharge are called electrochromic. An electrochromic ("smart") window contains, as a supplement, a regulating device that induces a change in the window's colour depending on weather conditions. Controlling the amount of sun radiation or heat passing through the glass of such a window may offer an elegant way of saving energy when heating and cooling buildings or cars. A low-voltage electrochromic device for photovoltaic-powered "smart" windows has been described by C. Bechinger *et al.* (*J. Appl. Phys.*, 1996, **80**, 1226). The device consists of lithium-doped tungsten trioxide as the electrochromic material, an ion storage V_2O_5 layer and an ion-conducting MgF_2 layer, all sandwiched between two semi transparent electrodes (indium-tin oxide and gold) with careful exclusion of moisture. Voltages well below 1 V were necessary to switch the device from colourless (WO_3) to dark blue (when electrochemically doped with lithium, Li_xWO_3). The power was supplied by an amorphous silicon solar cell capable of producing an open-circuit voltage of 0.87 V when irradiated with white light. It took about a minute for the electrochromic window to reduce its transmittance to 40 per cent. When irradiation ceased (and, consequently, the photovoltaic voltage dropped), bleaching occurred within several minutes. (Source: *Chemistry & Industry*, 7 October 1996)

Telework: threats, risks and solutions

The benefits of teleworking are compelling. It is not surprising that telework, or telecommuting, has become popular and is growing. There is considerable debate about the continuing viability of the Internet in its present form, but, whether the electronic highway emerges in a somewhat different form by the end of this decade or remains as it is, there is no question that electronic commerce and communications will continue to increase.

Security issues still remain one of the major concerns for companies or governments embarking on telework arrangements with staff. Recognition of the inherent vulnerabilities is now widespread. The threat and risk assessment of the telework situation shows there are problems that must be addressed if telework is to be completely accepted as a normal way of working. Physical, personnel and procedural safeguards can be implemented with relative ease, but the major concern is with electronic communication and transmission of sensitive information.

Most important for organizations is planning for telework. A security policy should be in place, and it should require that an assessment be conducted for each telework arrangement that will point to the most appropriate and cost-effective procedures and safeguards to be implemented for each case. Security procedures should be documented and both procedures and safeguards reviewed with each teleworker. A security architecture for the home worker should be developed and it too should be reviewed with the teleworker. Once the appropriate safeguards are in place and the telework arrangement has been implemented, the situation should be reviewed periodically to ensure that there are no weaknesses to be remedied and that proper procedures are being followed. (Source: *Information Management and Computer Security*, 4(2) 1996)

Computer users reach out with Internet phone programs

The biggest attraction of Internet calling is, of course, the unimaginably cheap service rates. For instance, about 15 minutes of international calls from Seoul to Los Angeles or Sydney via Korea Telecom lines cost 24,000 won. But charges for the same calls, if routed through the Internet, go down to as low as 240 won.

Such exceptionally low costs of Internet phoning will surely pose a serious threat to existing international and long-distance carriers, such as Korea Telecom and Dacom. Lately, "Internet faxing" is also rapidly catching on among business enterprises, anxious to cut costs of non-voice international traffic. A US survey shows that as many as 50 per cent of trans-Atlantic Internet connections carry fax messages.

Alarmed at the prospect of Internet calling, America's Carriers Telecommunication Association (ACTA), a trade group representing 130 small long-distance companies, has petitioned the Federal Communications Commission (FCC) to ban Internet calling. But the FCC turned down the petition, saying that Internet calling is a result of technological innovation.

Without doubt, Internet calling, which began as an amusing pastime among on-line chatterers one-and-a-half years ago, is rapidly going mainstream in the phoning

industry. According to the US research firm IDC, the number of Internet-calling users, which stood at about 500,000 in 1995, is expected to rise to as many as 16 million by the end of 1999.

Phone companies and critics point out the drawbacks of Internet calling, such as poor sound quality and the need to make sure the person being called is simultaneously logged on. But many industry analysts forecast that rapidly advancing technology will gradually erase such limitations.

US software maker VocalTec, which invented the Net-calling software early last year, has already developed the second-generation software and gateway which can directly connect Internet calls to and from the public phone networks. Thus, a seismic upheaval will be inevitable for the current international-call rate structures. The pricing gap that makes Internet calling so attractive may gradually narrow, with Internet charges steadily going up and ordinary phoning service rates going down.

Intensifying competition in the phoning industry will force rates down for ordinary services. And as more calls and videos occupy traffic on the Internet, carriers are likely to charge more for Internet-calling services.

The market for Internet-calling software is projected to grow from $3.5 million (2.8 billion won) in 1995 to $56 million in 1999. IDC expects the proportion of business corporations to the entire Internet-calling population to rise from 1 per cent now to 63 per cent in 1999.

White Pine of the United States has produced a so-called "Q-See Me" software, which lets people converse while viewing and jointly editing a document on the Web. VocalTec researchers are also working on the Internet video-phoning software and a far more advanced gateway that will make possible the Internet-relayed voice communications among public phone systems. Microprocessor maker Intel recently made public the "Applelet" software, which is completely compatible with all varieties of Internet-calling software. By year-end, Internet phoning will be a standard feature in Web browser programs from Netscape Communications and Microsoft, opening Internet calling to millions of Internauts. At AT & T, researchers talk about ways to help corporations build phone or even video-phone connections into their public Web pages, in a bid to enhance on-line shopping or game-playing or give potential customers quick lines to a supplier's help desk.

In Korea, Hyundai Electronics Ind. Co. and Daewoo Telecom Ltd. have signed with VocalTec and IDT, respectively, to introduce their Net-calling software here, while PC on-line service Nowcom is looking for a partner.

Many PC-illiterates question why there is a vast difference in the service charges between Internet-calling and regular phoning systems.

Low-cost calling on the Internet is made possible as software makers are taking advantage of an imbalance in the pricing of communications capacity. Phone companies charge according to time and distance. The longer you talk and the farther you call, the more you have to pay.

Internet connections, even though they travel through the same wires, are sold at flat monthly fees to Internet-access service firms, which is devised with e-mail in mind. And the connection to an Internet access company is usually a local call.

Equipped with the proper software, therefore, personal computers almost anywhere on the Internet can create the cheapest voice-communication links around.

Those wanting to use Internet calling are required to buy a multimedia PC, equipped with a modem speed of above 14,400 bps, sound card, microphone and speaker, as well as one of the 10-odd Internet-calling software products available on the market now.

Notably, the sound card should be two-way as regular one-way sound cards allow just one person to talk at a time.

You have to enter the Internet's phoning server and channels where aspiring users of Internet calling are standing by, before selecting the ID number of the person you want to call. (Source: *Newsreview*, 24 August 1996)

Hardware for DVD-Rewritable

Digital video disk (DVD) rewritable hardware may appear as early as 1997 following the plans of the principal developers to collaborate on a common hardware standard.

Although DVD-Rewritable was not expected to appear before 1998, Philips, Sony, Matsushita and others have identified the next twelve months as crucial if DVD players are to become established.

This period is seen as vital in that the launch of DVD players can be synchronized with the appearance of other digital technology hardware such as digital video broadcasting receivers. This would enable received Internet and video content to be stored onto DVDs.

The disc will be two-sided, offering storage capacity of up to 5.2 Gbyte per side.

DVD-Rewritable drives will be developed earlier and will be the first form of DVD machines to appear on the market, mainly driven by the PC industry, which wants to integrate the drives initially into high-end machines.

DVD machine makers claim that they will have OEM available drives within the next nine months and at prices lower than $300. (Source: *Electronics Weekly*, 17 July 1996)

United Nations Conference explores how low-cost small satellites can help meet developing countries' needs

Space agencies in a number of countries have been increasingly interested in using low-cost small satellites, which offer new prospects for meeting the needs of developing countries in communications, Earth resource monitoring, disaster warning, long-distance education and various agricultural tasks.

Ways to increase international awareness and cooperation in promoting the development and use of such satellites was the focus of an international conference held from 9 to 13 September in Madrid organized jointly by the Vienna-based United Nations Office for Outer Space Affairs (OOSA), the National Institute of Aerospace Technology (INTA) of Spain and the European Space Agency (ESA).

The meeting brought together engineers, scientists, space agencies and space industries, in order to analyse the state-of-the-art technology related to small satellites. It also addressed ways in which developing countries, with small research budgets and limited experience with space technology, can increase their capacities to engage in small-satellite projects.

Small satellites generally weigh up to 400 kilograms and microsatellites less than 100 kilograms. A typical small-satellite mission, including launch, usually costs less than $20 million, and most microsatellite projects cost

around $3 million. Because of their small size, they can be launched easily and need less power on board.

The conference participants considered:

- The use of payloads in small experimental satellites, with emphasis on logistics of design process and system development methods associated with these satellites;
- Current and feature programmes of small satellites in industrialized and developing countries;
- Economic and legal aspects;
- Small mission launchers; and
- Opportunities that can result in developing countries' participation in the design and manufacture of small satellites.

The conference was conducted as part of 1996 activities of the United Nations Space Applications Programme, which is promoting awareness of advanced space technologies and greater cooperation in space science and technology between developing and developed countries. To that end, the Programme conducts an annual series of training courses, seminars, workshops and regional conferences. It also administers a long-term fellowship programme for in-depth training of specialists in space science and technology, provides technical advisory services on request and initiates programmes for the development of indigenous capability at the local level. (Source: *News Release*, September 1996)

Long live the Net

Today, most traffic on the Internet is made up of program files, ordinary text and graphics from Web sites. This is expected to change. The arrival of Internet phones, which will allow people to make international calls for the price of local ones, and the use of video streams will greatly increase traffic. The obvious response to increased data flow and growing traffic jams is to increase the capacity of the Internet's connections. Busy Internet sites are already taking action. One of the most popular, the Walnut Creek CD-ROM site, which offers 75 gigabytes of shareware, has upgraded the link to its ISP to 100 megabits per second.

Telecommunications companies are also getting in on the act. Global operators such as Sprint, MCI and BT are keen to enhance their data networks and build new ones, either to sell capacity to ISPs or to use for their own Internet services. This frenzy has spread beyond traditional telecoms companies. The British company Energis, for example, has more than 4,100 kilometres of fibre optic cable installed along the National Grid's transmission lines.

However, even if the data pipes can always keep up, the points at which they interconnect may not. At present, the routers, which direct traffic around the Internet, can forward data at a few gigabytes per second, but they are coming under increasing pressure, so manufacturers are working to create a new generation of machines. The Boston-based company, BBN, for example, is designing a router to handle about 50 gigabytes of data per second. (Extracted from *New Scientist*, 17 August 1996)

Remote instrumentation

The manipulation of instruments and experiments over the Internet is one of the key areas that virtual instrumentation and experiments over the Internet is one of the key areas that virtual instrumentation specialists are currently concentrating on. At the moment, the kind of applications software being offered for remote experimentation over the Internet allows viewing of data from experiments, the operation of virtual instruments on remote platforms and the ability to download instrumentation software. In the long term there will be software that will enable interaction between desktop users and remote instruments with applications that include viewing tests on the factory floor from your office and running instruments, from your desktop PC, that are across the world.

But the Internet may not be ready for remote instrumentation. One of the main hurdles that needs to be overcome is that of Internet data rates. Present data rates can usually only support "snapshots", updated by the minute or so, from experiments that are controlled at the experimental site.

National Instruments (NI) has developed an easy way to trigger a program so that it will take a "snapshot" of that data and send it over the Internet to a remote location.

The first major example of this kind of "live" dissemination of data was BETSCE (Brilliant Eyes Ten-Kelvin Sorption Cryocooler Experiment). This was an experiment conducted on the Endeavour shuttle in May. It involved a cooling device that can produce temperatures in space below 10 Kelvin without the vibration associated with previous refrigeration techniques. The data retrieved from the experiment was downloaded to the Johnson Space Center in Houston, before being transferred to an Apple Macintosh running NI's LabVIEW software at NASA's Jet Propulsion laboratory in California. From there the data was sent to an Internet (or Web) server at NI's facility in Austin, from where it could be viewed by anyone equipped with Netscape Navigator 2.0.

A more interactive application of the Internet for instrumentation purposes has been carried out by the United State's Oak Ridge National Laboratory (ORNL). In its "Harsh Environment Laboratory" project, ORNL aimed to develop an Internet-accessibleData Acquisition and Control System (DACS) that includes real-time videoconferencing capabilities. This allows interested parties to discuss the results of tests as they are running. The harsh environment, which simulates steam vents with high-humidity and high-temperature gas streams, was constructed at ORNL to address continuous emissions monitoring issues as they relate to advanced instrumentation. It also demonstrates the "virtual laboratory" concept, in that its operation can be remotely operated, and interrogated, by instrument manufacturers and researchers. (Extracted from *Electronics Weekly*, 28 August 1996)

Quality assessment

The compression techniques used in digital broadcasting and recording exploit the natural redundancy within audio and video data. For example, most television pictures have areas of similar colour or texture, both within each frame and across successive frames.

A news or chat show programme may have perfectly acceptable quality, but when the advertisements come on at the same bit rate, with their short, fast-moving scenes, quality suffers. One way of redressing the balance is to increase the quality of the audio.

As with many other areas of the electronics industry, bandwidth has its part to play. Any company thinking of transmitting digital video or audio will have to decide on their trade-off between the number of channels and quality.

Most experts believe that broadcasters and service providers will only transmit pictures at a quality equal to that of the current analogue PAL system. It is in their interests to squeeze in as many channels as possible.

The issue of perceived quality in broadcast video has been addressed by a European project called Mosaic whose partners include the Independent Television Committee (ITC), the European Broadcasting Union and other national PTTs.

Mosaic has established methods of relating the quality of compressed digital video to that of analog picture scales.

The testing differs from previous attempts in that it aims to assess the commercial broadcast quality. A transmission may have gone through nested levels of compression and decompression on its way to the viewer.

Test programmes chosen for their specific content were watched by viewers armed with electronic sliding scales. The 20- to 30-minute programmes thus gained a graph of time versus perceived quality.

Some preliminary French studies normalized and averaged the viewers' scores, categorizing the different methods of picture transmission. The 4:2:2 studio system came out on top, closely followed by MPEG2 at 15 Mbit/s with PAL third and 4 Mbit/s fourth. Fifth and last were VHS video and MPEG2 at 2 Mbit/s, but these lagged a long way behind in terms of perceived quality.

More research in this area is currently being carried out at the University of Essex for Dr. Nick Lodge of the ITC who has done much of the research for Mosaic. (Extracted from *Electronics Weekly*, 28 August 1996)

Do portable electronics endanger flight? The evidence mounts

According to a new study, the risk that radio frequency emissions from carry-on electronic devices will affect avionics, although not high, is still high enough to warrant tougher government regulations.

RTCA, formerly called the Radio Technical Commission for Aeronautics, recommends standards and offers guidance to the aviation industry. Currently, most airlines in the United States and elsewhere voluntarily follow an RTCA recommendation issued on 16 September 1988, that prohibits the use of portable electronic devices (PEDs) during takeoff and landing. That recommendation was issued mostly to lessen any possibility of interference with aircraft avionics, but also to reduce the chance of passengers being injured by PEDs that might bounce around on a flight and to prevent passengers from being distracted from safety announcements.

A new study that RTCA has been working on marks the organization's third visit to the issue of interference from portable electronics. (The first time was in the 1960s.) The SC-177 committee has made recommendations concerning the use of PEDs, in a draft report now wending its way through a lengthy approval process. (Extracted from *IEEE Spectrum*, September 1996)

Banking on SET

Secure electronic commerce has moved a step closer with the announcement of a second, revised version of the Secure Electronic Transactions (SET) protocol. The protocol was announced in June 1996 by MasterCard, Visa and their technology partners IBM, Microsoft, Netscape and VeriSign.

The SET specification protects bankcard information when used for transactions over the Internet. It first appeared in February 1996, but was revised to take into account suggestions made from over 2,000 financial institutions.

The next step will involve the upgrade of existing software that implements SET, and its testing. SET-based Internet solutions are expected on the market by the end of 1996. (Source: *Electronics Weekly*, 3 July 1996)

Information metering: paying the way for pay per view information

The basic concept behind metering is that an entire collection of information is distributed at very low cost to a user in encrypted form. Some of the information or a description, such as an abstract, is furnished in open text so the user can decide whether to purchase part of or the complete item. The information provider (IP) can determine the pricing, which information to encrypt, and which to make freely available.

Deciding which and how much information should be given to a user without charge is often a difficult decision. The information is the product and, if too much is given to the user or if the product is described in too much detail, there may not be much left to sell. If too little data is given, the user cannot make an informed buying decision and may decide against a purchase. This is an inherent characteristic of information products and will always be a dilemma for information providers.

Metering systems are particularly appropriate in multiple user situations, such as a library. A separate account can be established for each user, who then enters the account number to access the information. The same information can therefore be accessed by several users, each generating revenue for the IP. A variation on the metering/decrypting payment scenario is advance payment from a deposit account that is debited every time a user accesses information. When the deposit account is exhausted the metering software refuses to decrypt any more information until the user replenishes the account. (Source: *Online*, 20(4) July/August 1996)

300 mm wafers a matter of economics

Both the manufacturing and the supply side of the global semiconductor industry are in agreement on the need to convert the production of computer chips to larger wafers to increase productivity. They also agree that the conversion will be costly, with the original estimated price tag of $14 billion beginning to look conservative. Beyond that, however, the two sides appear to be divided on such fundamental issues as when the transition is needed and how development of the necessary technology will be funded.

This was the conclusion drawn at the SEMI Global 300 mm Initiative Executive Symposium. The main item on the agenda was a summary of the findings from extensive interviews the SEMI team has been conducting with executives from the major semiconductor companies, equipment manufacturers and silicon suppliers in most circuit-producing markets.

Typical of the mismatch in opinions on the transition was the response to the question "What is the most critical element in the 300 mm migration?".

It is the extent to which equipment manufacturers will fund their own research and development (R&D) that represents a major stumbling block. Another major cost factor is the price of 300 mm silicon wafers for the testing of new systems, which are now being quoted by materials producers at around $1,500 each, with anywhere from 100

up to 5,000 needed for test runs, depending on the type of equipment or process under development.

SEMI acknowledged the need to develop an industry-wide strategy for dealing with the test wafer stumbling block. Some of the possible solutions to the problem raised during the meeting include: multiple use (sharing) of wafers on non-competing pieces of equipment; exploring with either equipment suppliers or the circuit manufacturers themselves the funding of a "wafer pool"; or jointly funding such a pool through the suppliers and the two primary consortia, I300I and SELETE. (Extracted with permission from *Semiconductor International Magazine*, August 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

IT, distance learning and professional development

The idea of gaining professional or educational qualifications by distance learning is not new. The Open University started in the UK in 1970, and it now provides a well-established route to obtaining degrees and diplomas. MBA degrees using the same methods have been accepted widely. The increased use of IT and its all-pervading nature have led to an interest in its educational applications, especially in the area of continuing professional development (CPD). Searching the Web using the Open Text search engine, the term distance learning generated about 100 hits. These showed that most interest in IT and distance learning is restricted to specialist departments in universities or to software developers and companies offering training in software packages. The development of distance learning programs within professional associations is still in its infancy.

The UK universities most heavily involved are Heriot-Watt, Edinburgh (Institute of Computer Based Learning); Manchester University (Distance Coordination Unit, School of Education); Sheffield University (Distance Learning Unit); and the Open University (International Centre for Distance Learning). These all have a considerable presence on the Web. ON a smaller scale, there is interest at other universities—Lancaster University (Department of Management Learning) and Dundee University (Distance Learning Section, Department of Orthopaedic and Trauma Surgery).

Although many professional associations have Web sites, moving into computer-aided learning for their members is taking longer. There is interest, but also recognition that an investment is needed to produce good IT-based learning materials.

The electrical engineering, accountancy, and legal professions are taking some first steps int his area. While the future looks promising, professions are currently at the academic research stage. It is predicted that the breakthrough will come as managers use these types of learning aids to gain their own qualifications and recognize the potential, thus demanding access in the workplace for themselves and their staff. Libraries will have to consider their role in providing such services, and also the copyright implications of providing CD-ROM or Internet-based learning packages for self-learner downloading. These and other questions have to be considered if the advantages of this area of service provision are to be explored. (Source: *Information Management Report*, October 1996)

C. NEW DEVELOPMENTS

Technique for manufacture of quality uranium compound single crystal

The Advanced Science Research Centre of the Japan Atomic Energy Research Institute has succeeded in growing a quality "uranium compound" single crystal that has attracted attention in recent years as a superconductor coexisting with magnetic moments, shedding light on the correlation between superconductivity and magnetism. The research team also confirmed that the electrons revolving around the atoms display a characteristic behaviour when the superconducting phenomenon occurs in uranium compounds. The team observes that this discovery will provide a clue for the establishment of a new theory on the superconducting phenomenon.

It is known that some uranium compounds under cryogenic temperatures of approximately 1 K (-272° C) undergo a superconducting transition, and that this phenomenon differs with conventional superconductors such as niobium, titanium and Nb_3Sn. The research team established a technique to produce pure uranium compound single crystals by applying the zone melting technique in a high vacuum environment, and by using this single crystal, attempted to resolve the unique superconducting phenomenon of uranium compounds.

When conventional types of superconductors display a superconducting phenomenon, they are regarded as not displaying any magnetic property. The experiments conducted by the research team clearly revealed that in connection with uranium compounds they became superconductive while retaining an anti-ferromagnetic property (they possess magnetic moments). It was also estimated that the "5f electrons" revolving around the atoms are responsible for causing this superconducting mechanism.

The research team has engaged in research on the manufacture of cerium-ruthenium, platinum-uranium, uranium-palladium-aluminium and uranium-iron. As a result, they have confirmed that the temperature for conversion into superconductability is 7.2 K for cerium-ruthenium, 0.55 K for platinum-uranium, 2 K for uranium-palladium-aluminium, and 3.9 K for uranium-iron. Platinum-uranium displays a weak anti-ferromagnetism at 5 K, and that uranium-palladium-aluminium displays an anti-ferromagnetism at 14.5 K.

These phenomena cannot be explained by the conventional BCS theory that elucidates the superconducting phenomenon. Further research into the phenomenon will hopefully lead to the establishment of a new theory regarding the superconducting phenomenon. Further details from *The Advanced Science Research Centre (Research Group for Superconductivity in Uranium Compound) of the Japan Atomic Energy Research Institute*, 2-4, Shirakata-shirane, Tokai-mura, Naka-gun, Ibaraki Pref. 319-11. Tel.: +81-29-282-5641; Fax: +81-29-282-5927. (Source: *JETRO*, August 1996)

Superconductors in zero-resistance wires

A superconductor research team in the US may have opened the way for greater commercialization of superconductors in zero-resistance wires.

The researchers, under Dr. Milan Lelovic of the University of Pittsburgh, claim that the maximum current density that some high-temperature superconductor (HTS) wires can carry depends strongly on non-superconducting material around it. The discovery could result in more compact zero-resistance wires.

It has been discovered that most of the DC current in tape-type HTS wires flows in the material right next to the interface with the supporting metal sheath.

High-temperature superconductor is brittle, like china. One way to make a flexible conductor is to surround a thin strip of the material with a sheath of silver. The tapes are normally a few millimetres wide and around 100 μm thick.

The location of the current was determined by slicing such a wire, then carefully removing various parts of its structure and seeing how much current was needed to cause a 1 μV/cm voltage drop. (Source: *Electronics Weekly*, 28 August 1996)

Storage technique gets more on CDs

Compact disk media may experience a major advance in the amount of data they can store. Scientists from the University of Buffalo have announced a storage technique that allows 1,000 times more data to be crammed onto CDs.

The design puts the data in layers, similar to the pages of a book, on a disc made of new polymer-based photonic materials made using inexpensive plastic and new dyes.

To read the stacked data, the disc scans laterally across, similar to conventional CDs, but when it reaches the end of a layer it refocuses the read beam onto the next layer, running across the disc again.

The new technology is called two-photon absorption where a molecule absorbs two photons of light simultaneously if the light beam has enough intensity. Since conventional plastics are only capable of weak light absoprtion, they are useless for such applications.

By coating plastic with new dyes, the material shows the strong two-photon absorption needed to tightly focus the laser beam. (Source: *Electronics Weekly*, 4 September 1996)

Fractals for antennas

A US researcher claims to be using fractal patterns to produce smaller antennas for mobile phones and other wireless applications.

Dr. Nathan Cohen, of Florida-based Fractal Antenna Systems claims that a fractal antenna can produce 4 dB more gain at a given frequency than a dipole of the same length.

As well as size reduction, bandwith expansion is said to be possible because each generation of fractalization proliferates additional resonances, which eventually join each other.

A further application of fractal antennas is active surfaces, where a multitude of antennas is printed on an insulating or dissipative surface to form a controlled bandwith reflector or absorber. (Source: *Electronics Weekly*, 28 August 1996)

New chip developed

Mitsubishi Electric Corp. of Japan has developed the M32R/D 32-bit RISC MCU with 8 Mb of internal DRAM. The new chip combines low power dissipation and high-speed processing at a low cost, and is designed for use in portable equipment and other multimedia products.

Until now, MCU have offered internal peripheral circuits but external main memory, and the narrow bus width connecting the CPU and memory prevented the CPU from achieving maximum performance. In addition, power dissipation rose proportionally with processing speed. Mitsubishi integrated the DRAM into the MCU for portable equipment, and moved the peripheral circuitry to external chips to attain low power dissipation and high speed.

The core CPU is the firm's 32-bit M32R RISC chip, and integrates 8 Mb DRAM, 4 kb cache SRAM, a 32 x 16 bit product sum operator and the main memory controller. Performance at 66 MHz is 52.4 MIPS. The internal bus width is 128 bits, running at 66.7 MHz. External circuits like the timers and ADC are connected through a 16-bit wide bus.

As a result, the bandwidth between MPU and memory is 1 Gb/sec, which is about 10 times faster than conventional designs with external memory. The lower speed on the external bus drops power dissipation in operation to 40 MW and standby to 2 MW, which is about 60 per cent less than conventional designs. (Reprinted with permission from *Semiconductor International Magazine*, August 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA.)

Patent awarded for isolation structure

Genus Inc. has received a patent for the Buried Implanted Layer for Lateral Isolation (BILLI) process, based on MeV-range high-energy ion implant technology. The process can substantially reduce semiconductor fabrication costs and boost fab output capacity. BILLI can eliminate one or two masking steps from current standard MeV retrograde well processes and three to four masking steps from conventional diffused well processes.

According to VLSI Research, device manufacturers using the BILLI structure can achieve a cost-per-wafer savings of $229 annually per 200 mm wafer for a 0.35 μm, 20,000 wafer-per-month CMOS logic process, compared to a conventional diffused well process. The reduction in process steps enables cycle-time reduction of up to 16 per cent, effectively increasing fab capacity. (Reprinted with permission from *Semiconductor International Magazine*, August 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Tool developed for high-speed, 1,100 mm pattern writing

A mask writing tool for large areas, the LRS-1100, has been developed by Micronic Laser Systems (Taby, Sweden) to meet the demands of flat panel photolithographic masks. The equipment uses UV laser technology to draw circuitry and colour filters onto photomasks as large as 1,100 mm (43 in.) on a side.

Speed, precision and image quality are all critical to pattern writing. To address speed and precision, the LRS implements a step-wise movable drawing table and a low-mass writing head that moves orthogonally to the drawing table to create a grid as small as 0.05 μm. The Acousto Optic Modulator (AOM) is located in the writing head for fast deflection of the laser beam.

When writing a repetitive pattern over a large area, moiré effects can distort the pattern image. This effect can be minimized with the appropriate grid size and corresponding placement precision, according to Sven Lofquist, vice president at Micronics. By using laser interferometry and proprietary control system technologies, orthogonality exceeding 0.2 μm/m or 0.2 ppm is achieved and moiré effects eliminated.

For control of motion and placement over large distances, the system is built on a granite platform and all moving parts are supported on air bearings for vibration-free printing. The final lens floats on a cushion of air over the mask and thus follows the actual physical surface.

The resulting photomask is targeted for full field exposure systems although they can also be used in steppers when writing on standard 7 in. masks. The large photomask eliminates the expense of multiple reticles and the time of stitching patterns, and can produce multiple panels per mask. The result may increase throughput in FPD production.

There are both technical and economic advantages of large masks. While the large size increases the potential for material and process defects, reduced total equipment costs give this method an economic advantage and total throughput a technical advantage. (Reprinted with permission from *Semiconductor International Magazine*, August 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Counter-doped implants rely on channelling

Japanese researchers have found a way to take advantage of ion "channelling", a phenomenon that is usually considered a troublesome problem during ion implantation. In a new technique designed to minimize parasitic junction capacitance, researchers from NEC's ULSI Device Development Labs (Kanagawa, Japan) are using ion channelling to create a self-aligned counter-doped well during the same mask step as source/drain implantation. The technique is described as a cost-effective alternative to SIMOX technology. The work was reported in the July 1996 issue of *IEEE Transactions on Electron Devices*. (Extracted with permission from *Semciconductor International Magazine*, August 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Project makes systems-on-a-chip simpler

Oxford University is collaborating with ARM and Atmel's ES-2 foundry to simplify the development of systems-on-a-chip.

The Aspire project, part of the European Open Microprocessor Systems Initiative, is being undertaken by Oxford's hardware compilation research group and is addressing the integration of processors, dedicated logic and memory on the same chip.

Current design practice sees hardware and software defined and developed independently. When the two are integrated, serious problems can arise in designs.

At Oxford, a complete system is defined in a high level language which is compiled to produce both hardware net lists and software source code. The hardware is implemented on an FPGA, while the software runs on an ARM processor. A board containing the ARM, FPGA and memory is used for development.

Once the design is fixed, the ES-2 foundry can then manufacture a single device, replacing the FPGA with an ASIC. (Source: *Electronics Weekly*, 9 October 1996)

Phone callers hit Web with only one computer

Mobius Computer and VocalTec say they have developed a system that allows regular phone users to use the Internet to make calls without requiring a computer at each end. Phone Gateway is the first Internet telephony system that can take incoming phone calls from regular phone lines, convert them into digital format and route them over the Internet for free. Calls are routed to either PCs running Internet Phone software or to another Mobius Net Phone Gateway, which then converts the call from the network back to traditional phone lines. The gateway does phone-to-phone calls over the Internet, PC-to-phone calls (available later this year) and PC-to-PC calls. (Source: *Electronics Weekly*, 9 October 1996)

Novel micromachine

A team from the University of Alberta, Canada, has designed a micromachined structure that can act as both a deflectable mirror and a weight sensor, sensitive to 1 ng. It consists of a nested array of cantilevers supporting a central flat leaf. The whole structure is made from two layers of conductor separated by a layer of insulating, and supporting, SiO_2. Current is fed through the structure in such a way that it flows one way in all the cross-bars at one end, and the opposite way at the other end. These currents interact with an external magnetic field (running in the plane of the device, at right angles to the cross-bars). This causes an upward force at one end and a downward force at the other. Rotation is up to 2.5° normally, or 25° at resonance. An aluminium layer on the central leaf makes the device a steerable mirror while a water absorbing layer makes it a humidity sensor by altering the mass, and resonance therefore the structure's resonance frequency. (Source: *Electronics Weekly*, 9 October 1996)

Bellcore reveals how to unlock smartcards

US Bellcore Labs has given further details about how it is possible to compromise the security of smartcards. However, the method is extremely sophisticated and is unlikely to be available to computer hackers or crooks. Moreover, Bellcore's claims are theoretical—it has yet to break smartcard security.

Bellcore scientists say that by using high voltages or radiation, it is possible to make the microprocessor within a smartcard produce an error in calculating encryption algorithms and thus deduce the card's encryption key.

The discovery relies on a highly sophisticated algorithm which compares the card's faulty performance with its real one. The algorithm can then calculate the cryptographic code contained within the card.

A key feature of what Bellcore calls "Cryptanalysis in the Presence of Hardware Faults" is that it only works against public key encryption systems such as those offered by RSA Data Security. And unlike other factoring attacks on public key encryption, it is not dependent on the bit length of the public/private keys used.

Bellcore's algorithm will not crack secret key systems such as the Data Encryption Standard (DES) or Bellcore's own Video Rate Algorithm, but an algorithm to attack those cryptographic systems is being developed.

Bellcore says its threat model is not limited to smartcards but could also be used against computers, since computers produce occasional errors and thus give clues that will reveal the cryptographic keys being used.

Although Bellcore has not managed to crack the security of a smartcard, it claims that "it is not, however, necessary to mount the attack in order to emphasize its seriousness".

Bellcore suggests that smartcard chips will have to be made fault tolerant in order to protect their internal security systems, and that computers will have to check their calculations several times to ensure they do not produce tell-tale faults, with an inevitable degradation in computer performance. (Source: *Electronics Weekly*, 9 October 1996)

Beyond the outer limits

Optical techniques, using deep ultraviolet light, are used in today's quarter micron (250 nm) production lines. But deep UV is close to its performance limit.

The UV used in 250 nm steppers comes from krypton fluoride lasers with a wavelength of 248 nm. Professor Ron Lawes, head of the central microstructure facility at the Rutherford Appleton Laboratory reckons that, with phase shift masks and other tricks, this will work down to 0.15 μm, perhaps approaching 0.1 μm. Argon fluoride lasers (193 nm) will push feature size down to 100 nm.

Adding phase shift masks will allow more production latitude at 100 nm. Indeed, IBM has produced 80 nm features using deep UV and a phase shift mask. Fluorine lasers (157 nm) already exist.

The main contenders beyond 100 nm are electron beam (e-beam), ion beam and X-ray lithographies, with the "cookie cutter" embossing technique as an outsider.

E-beam lithograhy has existed for years in serial write (vector scanning) form. This produces 50 nm images on good equipment and 20 nm in its advanced laboratory form. But serial write e-beam cannot be used for production because features are drawn one at a time. Patterning a wafer takes hours.

Projection e-beam uses a wide beam of electrons and a mask. Bell Labs demonstrated recently 80 nm (0.08 μm) features with experimental projection equipment.

IMS of Vienna, Austria, was probably the first company to demonstrate ion beam technology in a practical form and it is now being championed by the Advanced Lithography Group from Maryland.

Hydrogen or helium ions are accelerated and pass through a series of electrostatic lenses and a mask to form an image. Features at 100 nm have been reported and studies predict image sizes of less than 10 nm.

X-rays of a few nanometres wavelength can be used to produce 30 nm images. The challenges are producing the rays cost-effectively and in the mask technology.

UK-based Oxford Instruments makes synchrotron X-ray sources. These are room sized, but can feed up to 18 steppers. This necessitates an unconventional fab layout and worries chip makers that a source failure will shut down 18 steppers.

That said, IBM's Oxford-produced synchrotron has run well since its installation several years ago.

Suitable masks, including experimental focusing reflectors for X-rays have been demonstrated. (Source: *Electronics Weekly*, 31 July 1996)

Self-aligned implantation used in pressure sensor fabrication

A group in Greece has developed a process based on self-aligned ion implantations and a silicon fusion bonding (SFB) technique for fabricating miniature capacitive pressure sensors. Circular devices of only 170 μm radius have been produced for biomedical applications that operate with a full-scale range of 0-36 mm of mercury. (Extracted

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Philips demonstrates blue-green laser playback

Philips Research (Briarcliff Manor, NY) demonstrated the use of a green semiconductor laser to read information stored on a high-density DVD (digital video disk) optical disk. The laser, which operated at a wavelength of 520 nm, was developed jointly by Philips Research Briarcliff and 3M's Phototronics Research Laboratory in St. Paul, MN. Prior to the Philips demonstration, only red semiconductor lasers had been used to read DVDs.

The impact of this demonstration has particular significance to the consumer electronics and computer markets.

Blue-green semiconductor lasers have shorter wavelengths and smaller focal points than the infrared and red semiconductor lasers currently used to read audio CDs, CD-ROMs, newly-developed DVDs and other optical disks. This property enables blue-green semiconductor lasers to record and read smaller, more densely-packed pits of information. The result is optimal use of disk space and significantly enhanced data storage capacity. Additionally, blue-green semiconductor lasers are also expected to create novel and improved applications in the printing and medical industries.

Infrared semiconductor lasers have been mass produced for several years and world-wide production now exceeds 70 million units. (Reprinted with permission from *Semiconductor International Magazine*, July 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Carbon nanotubes

An international group of scientists has successfully measured the electrical properties of a single carbon nanotube for the first time. They report that carbon nanotubes show a variety of electrical properties, both metallic and non-metallic.

Until now, the electronic properties of carbon nanotubes have been measured using bulk samples. These show various behaviours, none of which can be singled out. However, theory predicts that the conductivity of individual tubes should vary according to their structure.

Thomas Ebbesen at the NEC Research Institute in Princeton, and colleagues in the US, Germany and Japan, report that individual tubes can act as conductors, semiconductors or non-conductors, and their behaviour can change more dramatically with structure and temperature than predictions suggested.

The researchers studied the tubes by depositing them on an oxidized silicon surface, and then depositing 80 nm wide tungsten wires across them, using vapour deposition. The microscopic tungsten wires were also connected to gold contact pads on the silicon surface. They found a wide variety of behaviour among the eight tubes studied, which they attribute to differing helicity (twisting), as well as to interactions between concentric carbon layers in the tubes and possible structural defects.

The tubes fell into distinct groups. The first were metallic and their resistance fell consistently with increasing temperature. The second group were non-conducting, with a strong decrease in resistance at higher temperatures, suggesting some kind of thermal activation. Others showed sudden jumps in resistivity, up or down, at different temperatures. (Source: *Chemistry & Industry*, 15 July 1996)

Bell rings in e-beam chip plan

Bell Labs has developed an 0.08 μm electron beam (e-beam) lithography process which has potential for use in volume chip manufacturing.

Existing "serial write" e-beam technology can only be used for prototyping because it writes only one line at a time, making it extremely slow. In contrast, optical lithography projects the whole chip at once, so is considerably faster than serial write e-beam, but runs out of steam around 0.18 μm.

Scattering with angular limitation projection electron beam lithography (SCALPEL) from Bell Labs keeps the fine resolution of e-beam, but projects the whole chip onto the silicon.

The mask is held on a thin membrane that is transparent to electrons. Metal areas on the membrane cause electrons to be scattered from the beam where exposure is unwanted.

The SCALPEL mask is made so that waste electrons are scattered well out of the main beam into an absorber.

In addition to the narrow line that projection e-beam makes possible, it is also highly tolerant of wafer distortions. An 0.25 μm line width optical set-up has a depth of field of 0.6 μm. If the wafer is not flat within 0.6 μm, chip yield will drop due to blurring on some parts of the wafer. SCALPEL has a depth of field of 70 μm at 0.25 μm line width, allowing less flat wafers to be processed successfully.

The SCALPEL assembly is no bigger than conventional excimer laser optical systems. (Source: *Electronics Weekly*, 17 July 1996)

Has death had its chips?

A computer chip implanted behind the eye that could report a person's every lifetime thought and sensation is to be developed by British scientists.

Dr. Chris Winter, of British Telecom's artificial life team, predicted that within three decades it would be possible to relive other people's lives by playing back their experiences on a computer. "By combining this information with a record of the person's genes, we could recreate a person physically, emotionally and spiritually."

Dr. Winter's team of eight scientists at BT's Martlesham Heath Laboratories near Ipswich calls the chip "the Soul Catcher". It would be possible to imbue a newborn baby with a lifetime's experiences by giving him or her the Soul Catcher chip of a dead person, Dr. Winter said. The proposal to digitize existence is based on a sound calculation of how much data the brain copes with over a lifetime. Ian Pearson, BT's official futurologist, has measured the flow of impulses from the optical nerve and nerves in the skin, tongue, ear and nose.

Over an 80-year life, we process 10 terrabytes of data, equivalent to the storage capacity of 7,142,857,142,860,000 floppy disks. Dr. Pearson said: "If current trends in the miniaturization of computer memory continue at the rate of the past 20 years—a factor of 100 every decade—today's 8 megabyte memory chips norm will be able to store 10 terrabytes in 30 years".

British Telecom is investing in the project and is said to be taking Soul Catcher 2025 very seriously. However, there are profound ethical considerations, but BT is embarking on this line of research to enable it to remain at the forefront of communications technology.

Dr. Winter said that an implanted chip would be like an aircraft's black box and would enhance communications beyond current concepts. For example, police would be able to use it to relive an attack, rape or murder from the victim's viewpoint to help catch the criminal. Other applications would be less useful but more frightening. (Source: *Electronic Telegraph*, Issue 430, 18 July 1996)

Ultraclean FPD process uses SF_6 chemistry

The mass production of amorphous-Si (a-Si)-based thin film transistors (TFTs) for flat panel displays (FPDs) at suitably high yields requires extremely low contamination levels in plasma enhanced chemical vapour deposition (PECVD) equipment. Gases such as nitrogen triflluoride or fluorocarbons are typically used, but Balzers Process Systems (Alzenau, Germany) has developed a low-cost sulphur hexafluoride chemistry which, with a corrosion-resistant alloy for the reactor, eliminates the risk of device contamination by dust particles because of flaking from the walls.

This system also greatly simplifies the cleaning of the plasma etching reactor, which is claimed to be immune to post-cleaning contamination. The reactor is kept permanently hot at the process temperature, so outgassing of the etching by-products from the reactor walls is very rapid. This reactor or plasma box is a gas-tight enclosure placed inside a conventional high vacuum chamber. The box and the vacuum chamber have separate pumping systems to allow independent evacuation of each enclosure. The pressure in the vacuum enclosure is kept below that in the reactor during PECVD processing by a large turbo-molecular pump. The use of separate pumping systems ensures that the growing PECVD deposited film is not exposed to impurities present in the vacuum chamber.

The whole surface of the plasma box is kept at a uniform temperature, typically 250° C-280° C. Its compact, confined volume and high temperature results in a gas residence time in this box of under two seconds. This permits rapid changes of the process conditions with virtually no contamination risk from the previous processing. All layers of a standard TFT are deposited in the same reactor in a carefully controlled sequence.

Work at Balzers showed that single-temperature processing with a single reactor box enables high purity films to be obtained with contaminant levels far below those needed for good TFT production. (Reprinted with permission from *Semiconductor International Magazine*, August 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Hitachi media chip in 6.4 Gbyte/s transfer

Japanese researchers at Hitachi have achieved data-transfer rates of 6.4 Gbyte/s on an experimental 8 Mbit media processor. The chip combines DRAM and data processing elements on the same silicon. This has removed pin-count limitations, allowing a 128-bit wide data bus to be used.

Each bank of DRAM has a capacity of 256 kbit and is cascadable with up to seven other banks. Using common voltage generators and amplifiers reduces auxiliary circuitry to a minimum.

This whole chip design is used as a macro, and, reproduced four times, gives the 6.4 Gbit/s performance at 100 MHz achieved by the test chip.

The total of 8 Mbit of RAM and four processors is aimed at 3-D graphics manipulation and can draw at 800 million pixels per second. Chip size is 8.35 mm x 14.60 mm, on a 0.4 μm triple well below CMOS process. Consumption is 1.5 W at 3.3 V. An eight-macro, 12.5 Gbyte/s chip is being proposed. (Source: *Electronics Weekly*, 3 July 1996)

Sony video chip ready by 1997

Sony says it has developed a video camera on a chip that it plans to embed in monitors, cellular phones, still-cameras and hand-held computers for videoconferencing applications.

The device is just 17.5 mm square and 9.5 mm thick. It is built on a double-sided circuit board and a 52-pin leadless chip carrier.

The charge-coupled video camera is on one side of the package while the reverse side has a timing generator and an A/D converter. The video camera generates a 362 by 492 pixel colour image. Device samples will be ready by early 1997. (Source: *Electronics Weekly*, 3 July 1996)

IBM breaks 0.1 μm barrier with inverter

Scientists at IBM's Semiconductor Research and Development Centre (SRDC) have built a CMOS inverter using a 0.08 μm process.

Although this process is at least four steps away from what is available commercially, it proves that sub-0.1 μm devices are possible.

Formed from a 0.07 μm n-channel FET and a 0.09 μm p-channel FET, the tiny device runs at 1.8 V and has a propagation delay of just 26 ps.

At these lengths, the NFET draws 0.8 mA per micron of gate width when switched on. Leakage current when the transistor is switched off is a mere 6 nA per micron. This ratio of on/off current is claimed to be the highest measured in any research to date.

The main problems in the development of this process are said to be controlling the channel length during doping and forming the thin gate dielectric. Another worry is the damage done to the device through high voltage levels. An overvoltage of just 2.75 V can cause a permanent 20 per cent drop in current.

Researchers have concluded that new mechanisms will be needed to combat this. (Source: *Electronics Weekly*, 3 July 1996)

Increased growth rates of YBCO single crystal production

Superconductivity Research Laboratory (SRL) has been working on solidification processing of bulk superconductive oxides and has succeeded in increasing growth rates of bulk YBCO single crystal production by controlling oxygen partial pressure in the growth atmosphere during crystal pulling.

SRL developed the SRL-CP (Solute-Rich-Liquid Crystal-Pulling) method for continuous production of large YBCO single crystals in 1992. Although the growth rate was still slow and it took a long time, which resulted in

difficulty in producing much larger single crystals, the 15 mm x 15 mm class large single crystals have been grown by means of a larger apparatus and larger crucibles.

This time, SRL changed the oxygen partial pressure in the growth atmosphere from air (PO2=0.21 atm) to 100 per cent oxygen (PO2=1.0 atm), and the YBCO crystal growth rate increased by 2-5 times. Large 20 mm x 20 mm class single crystals were obtained. This size is the largest in the world. The superconducting transition temperature, Tc, of 92.7 K was confirmed by SQUID, which is equivalent to that of the grown single crystal under the air atmosphere.

These large single crystals are expected to be used for the substrates of superconductive thin film devices. SRL has also carried out research on developing this application, including polishing the bulk single crystal for wafer preparation and Josephson Junction production.

For further information contact: Superconductivity Research Laboratory, 1-10-13 Shinonome, Koto-ku, Tokyo 105. Tel.: +81-3536-5703; Fax: +81-3536-5717 (Source: *Science & Technology in Japan* No. 57, 1996)

Silicon dioxide deposited at low temperature

A Spanish-German collaboration has resulted in the deposit of silicon dioxide layers on silicon at substrate temperatures as low as 70° C. A 193 nm wavelength from an ArF excimer laser was used to photolytically activate the process in the gas phase. The ratio of N_2O/SiH_4 in the gas mixture controlled the film composition. Stoichiometric silicon dioxide was obtained when the ratio was above 40.

The role of the substrate temperature on the growth kinetics was not critical, but did strongly influence the density of the film. Higher growth rates and enhanced oxidation could only be achieved by increasing the energy density, though this may lead to lower densities in films.

The work was carried out by Betty León et al. of the Departamento de Fisica Aplicada, Universidade de Vigo, Spain, and Armin Klumpp et al. of the Fraunhofer Institut für Festkörpertechnologie, Munich, Germany. (Reprinted with permission from *Semiconductor International Magazine*, September 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Radiation-hardened circuitry

Space Electronics Inc. (SEI) has developed radiation-hardened latchup protection circuitry for space-born applications. Their latchup protection technology (LPT) was designed to detect, protect, circumvent and recover an integrated circuit (IC) from the effects of single event latchup.

The objective of the LPT circuitry is to allow the single event latchup to occur, but provide the following protection to the IC:

- Limit the single event latchup current.
- Prevent burnout and/or catastrophic failure.
- Protect any/all inputs or outputs which could be damaged during the single event latchup.
- Provide an automatic shutdown of the power supply to the IC.
- Provide an automatic power supply re-application after shutdown.

According to Space Electronics, by meeting the above objectives, an LPT protected device becomes substantially more usable in a space application. When a single event latchup occurs, the protected IC will still experience the latchup, but in place of the potentially fatal effects described above, it will only have a brief period of off-time. During the off-time, the device will lose its functionality for a preset time period and then will automatically be brought back to its normal power-up state.

Currently, the LPT circuitry has been specifically developed and validated for a 16-bit A-D converter, the SEI 7805LPRP. SEI is accepting orders to develop customer specific LPT protected ICs, and has more than 75 space radiation-hardened products, including 32-bit microprocessors, 4 Mb SRAMs, 1 Mb PROMs, and 1 Mb EEP-ROMs. (Reprinted with permission from *Semiconductor International Magazine*, September 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Progress in EUV lithography

Researchers at Lawrence Livermore National Laboratory have made great strides in overcoming two necessary hurdles to the use of extreme UV lithography for Si wafer manufacturing. They are reporting a 300,000-time reduction in the number of defects for multilayer photomasks and a 20 to 50-time improvement in accuracy measurements for optical components used in the lithography process.

The work being done by Lawrence Livermore is part of a Department of Energy research effort consisting of eight US microelectronics firms and three national laboratories whose goal is to make EUV lithography practical for manufacturing 0.1 μm Si chips. By using extreme UV light, a wavelength 20 times shorter than current state-of-the-art, chips can potentially be 10 times faster with 1,000 times more memory than today's chips, according to Nat Ceglio, head of Lawerence Livermore's Advanced Microtechnology Programme.

For EUV lithography to be ready for commercialization, the measurement accuracy of the Laboratory's new interferometer would need to be improved by a factor of 3. The basic principle, however, has been proven with 0.6 nm accuracies. The goal of 0.2 nm accuracies will simply require optimization of the system. (Reprinted with permission from *Semiconductor International Magazine*, September 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

0.25 micron copper process demonstrated

NTT researchers have demonstrated a 0.25 μm copper metallization process using copper chemical vapour deposition (CVD) and chemical mechanical planarization in a dual damascene approach. Noteworthy aspects of the process include the cleaning process used to remove copper contamination and the use of borophosphosilicate glass (BPSG) to stop copper diffusion.

Copper contamination on the back of the wafer was of particular concern, since it is difficult to remove by conventional HF cleaning. To combat this, the NTT researchers deposited a 200 mm thick ECR SiO_2 film deposited on the back of the wafer before copper CVD. Copper did not grow on the back of the wafer during copper CVD, but copper was detected at concentrations greater than 10^{12} atoms/cm^2 after the process. Copper concentration was reduced to about 10^{11} atoms/cm^2 after 10 nm of the back SiO_2 was removed by buffered HF solution. This level is compared to that of conventional aluminium processes. After the CMP step, a cleaning process consisting of an ultraclean water scrub, an organic alkali scrub, a dip in dilute HF and a water rinse also resulted in low levels of Cu.

The team also investigated the use of BPSG as a barrier material against copper diffusion and described its ability as "remarkable". TiN was also found to be an

effective barrier. By comparison, LPCVD TEOS SiO_2 films had virtually no diffusion barrier ability.

Plasma CVD silicon nitride was deposited on exposed copper surfaces as a passivation film. The resistivity of the fabricated copper wire ranged from 1.9 to 2.1 $\mu\Omega$-cm. (Reprinted with permission from *Semiconductor International Magazine*, September 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Is titanium contamination a concern?

Titanium-containing films such as TiN and $TiSi_2$ are widely used in semiconductor manfuacturing as diffusion barriers and silicides—but is there a danger that titanium can be poisoning the silicon? That question was asked by a group of Motorola researchers who were worried by reports from the solar cell community that titanium contamination was significantly reducing carrier lifetimes in silicon substrates through the formation of deep level traps. Adding to the concern was the fact that it is not clear how and to what extent titanium may be transferred onto wafers and whether or not titanium contaminants can be removed from wafers in an IC manufacturing process.

To resolve these concerns, the Mesa, Arizona-based researchers—Li-Hsin Chang, William Codwn, Jim Christiansen, Dennis Werho and David Theodore—undertook a series of experiments designed to determine:

- The critical level of titanium that significantly reduces device carrier lifetime;
- The effect of silicon surface preparation on titanium affinity;
- The diffusion of titanium in silicon;
- The distribution of titanium after oxidation, and
- The effect of cleaning substrates intentionally contaminated with titanium.

As reported in the July 1996 issue of the *Journal of the Electrochemical Society*, it is "highly unlikely" that large amounts of titanium could be transferred onto a wafer surface through contaminated equipment, such as a wet-etch bath or a furnace. Furthermore, any titanium contaminants transferred onto a clean wafer by cross-contamination are easily removed by normal wet cleaning processes.

The researchers said that titanium contamination residing in the silicon segregates into the oxide during a oxidation process and therefore can be removed during a subsequent oxide strip. In short, with reasonable safeguards, titanium cross-contamination in silicon wafer processing fabs seems not to be a problem. (Reprinted with permission from *Semiconductor International Magazine*, September 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Light emitting diode made of polysilane

Assistant Professor S. Koshihara at Tokyo Institute of Technology and the Photodynamics Research Center, Institute of Physical and Chemical Research (RIKEN) have developed an ultraviolet light emitting diode (LED) made of polysilane.

All conventional blue or ultraviolet LEDs are made of inorganic semiconductor, so the new device is the first ultraviolet LED using a partly organic polymer semiconductor for the active layer. Polysilane is soluble in some organic solvents (e.g., toluene and xylene), and is easily made into a large area thin film with the spin coating process. The new LED consists of a polysilane light emitting film with an electrode on each surface of the film. When in use, the device is cooled below -63° C, and then energized for the film to shed ultraviolet electroluminescence light from 364 nm to 380 nm. With fluorescence materials deposited on the surface, the new LED film can be used as the screen for a flat display.

The mainstream development of ultraviolet LEDs has been concerned with inorganic materials, such as ZnSe compounds. RIKEN suggests this achievement shows that partly organic LEDs are more promising for shortening output wavelength than inorganic types. The new materials may allow the development of LEDs emitting wavelengths shorter than 360 nm, which value theory predicts no inorganic LEDs can achieve. Shorter wavelengths of ultraviolet light are suitable for ultrahigh-density optical recording for data storage, and for optical parallel computing.

Further details from Photodynamics Research Center, Institute of Physical and Chemical Research (RIKEN), 19-1399, Nagamachi, Aoba-ku, Sendai City, Miyagi Pref. 980. Tel.: +81-22-228-2041; Fax: +81-22-228-2017. (Source: *JETRO*, August 1996)

Smaller defects visible with green lasers

Diode-pumped all-solid-state lasers are improving laser-based inspection tools needed for semiconductor manufacturing. Diode-pumped lasers are about 100 times more efficient and 1/20 the size of conventional lasers. The 532 nm green beam of Coherent Laser's (Santa Clara, CA) Compass 315M laser (4 x 1.6 x 1.3 in.) generates a $TEM_{(0,0)}$ low-noise beam which is nearly diffraction limited; in other words, according to Mark Gitin, product manager, with the proper optics its beam can be focused to a diameter of within 10 per cent of the diffraction limit for green light (about twice the wavelength, or 1 μm). Since it is hermetically sealed, no maintenance is required. Its beam power can be either 50 or 100 mW, with a $1/e^2$ diameter of 0.32 mm. Green light, with its smaller wavelength, permits sharper imaging than red light. (Reprinted with permission from *Semiconductor International Magazine*, September 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Eyeing up new protection

Researchers in the US have designed a new material that shows promise for use in protective eyewear for laser operators. It could also be used to protect optical sensors.

Laser light can present a considerable hazard in the laboratory. Much research has been focused on optical limiters, devices that can absorb high-intensity light beams while allowing through low intensity, background light.

However, most efforts to develop optical limiting materials have fallen short of the blocking level needed to protect the human eye by two orders of magnitude or more. Now Joseph Perry and colleagues at the California Institute of Technology have found a compound that appears to be dramatically more effective. They have also devised a way to arrange this material in an optical limiting device to boost efficiency even more.

Previously, Perry has shown that metallophthalocyanine complexes containing heavy central metal atoms are excellent absorbers and optical limiters. Now he reports that using an indium-phthalocyanine complex in a polymeric optical limiting device improves light absorbance and exceeds the benchmark optical limiting material, C_{60}, by a factor of 64.

Absorbing too much radiation can damage the optical limiting material. Ideally, the concentration of material would increase along the path of the beam, cutting down

the light gradually. Perry achieved this by incorporating his compounds in discs of polymethylmethacrylate plastic. The device contained three discs, each holding more limiter than the one in front. The arrangement is 10 times more effective than a single, homogenous disc, he says.

To use this system in goggles, for example, Perry explains that it would need a focusing device to intensify the laser beam so that it triggers the absorbance reaction. (Source: *Chemistry & Industry*, 16 September 1996)

3-D imaging display creates actual 3-D images

A Stanford University researcher, Elisabeth Downing, has devised the first 3-D imaging display that creates an actual three-dimensional image, not just an illusion that requires special eye glasses.

A new technique in 3-D imaging in which intersecting infrared laser beams illuminate rare earth elements inside a glass cube has been patented. Downing calls the luminous particles voxels, or 3-D pixels.

Downing is able to illuminate such particles using a concept called upconversion where the laser light going into the 3-D image has a lower frequency than the display itself. Two invisible low-energy, infrared light beams intersect to produce visible light. Upconversion, with ions absorbing the lasers and increasing the frequency of the light, is the opposite of commonly-used laser light source applications.

Although upconversion has been known since about the early 1960s, Downing says she has achieved a breakthrough in creating new types of glass materials that do not interfere with the rare earth element ions needed to create 3-D images.

Another breakthrough for Downing has been finding rare earth materials such as praseodymium, erbium and thulium that stir only voxels of specific colour frequencies. This is essential for multi-colour displays.

Downing's research has the potential to provide the most cost-effective 3-D images seen to date. Using relatively inexpensive laser diodes, she is able to conduct her experiments with a small, compact, rugged light source which costs a few thousand dollars, rather than larger argon lasers which cost up to $100,000 each. (Extracted from *Electronics Weekly*, 18 September 1996)

Recent developments in battery technology

In recent years, the number of practical applications for electrochemical power sources has increased dramatically, so that what was seen up to the 1980s as a relatively mature industry, has now become one with significant growth. This renaissance has been led largely by the development of micro-electronics-based high value consumer products which need easily portable primary or secondary batteries—for example, "smart" cards, electric watches, calculators, mobile telephones, "camcorders", personal CD players and "lap-top" computers. At the other end of the capacity scale, developments in industrial traction, military and stationary applications, and especially in the vehicle industry market, are demanding greatly improved power sources which have both high power and energy densities. Here, a cell or battery is defined as a closed electrochemical power source, where, in contrast to a fuel cell, the reactants are incorporated during manufacture. A primary system is one whose useful life is ended once its reactants have been consumed during the discharge process, whereas a secondary system can be recharged by passing current through the cell in the opposite direction to that of the discharge.

While the number of chemical reactions which can be successfully harnessed to provide electrical energy is limited, the range of energy requirements for particular applications extends over many orders of magnitude: from 100 mWh for a button cell to 20 kWh for an electric vehicle battery. The same is true for power: from 25-100 μW for a cardiac pacemaker to 50 kW for a military thermal reserve battery. The diversity of use also requires many specific electrical characteristics which in turn call for different battery chemistry, materials and cell design.

The past few years have seen significant developments both in "traditional" aqueous electrolyte-based batteries and in high energy density cells based on lithium or sodium anodes. As far as zinc carbon and alkaline zinc cells are concerned, probably the most significant advance has been the reduction and now elimination of mercury. A new development in this area has been the introduction of a sealed rechargeable alkaline manganese cell as described below. It is anticipated that these relatively inexpensive rechargeable cells will replace many of the 10^{10} primary cells which are currently manufactured each year for consumer products. A further important innovation has been the commercialization of the nickel-metal hydride cell in which the cadmium negative plate in sealed nickel-cadmium cells is replaced by hydrogen absorbed in a metal alloy. Such metal hydride electrodes have a higher energy density and a reduced problem with disposal.

Perhaps the most significant recent change has been the rapid advance of lithium battery technology. As far as primary systems are concerned, this technology is becoming mature, with over 50 companies in the market. The excellent electrical characteristics and outstanding performance of such cells now make them the normal choice for primary applications where cost is not the overriding consideration. Some research is continuing on improving high-rate solid cathode cells and on thin laminated cells for "smart" card and similar applications. In contrast, research and development of secondary lithium batteries both for consumer products and for electric vehicle application is now seen to be the most important activity in the battery field. Possibly the most advanced is the all-solid-state laminated lithium battery called the Ultralife *Solid State System* which is set to go into full-scale production later this year.

By the end of the decade, it is probable that lithium-based secondary cells will make significant inroads into the portable consumer product market, with nickel-metal hydride batteries becoming the norm for the high power/fast recharge sector, and rechargeable alkaline manganese taking over the low-cost end of the market. These developments will be accompanied by an expansion of the "smart battery" concept, as suggested by IBM, in which a specialized computer chip is incorporated into an application to undertake power management, monitor charge levels and optimize the charging process.

In the primary consumer market, lithium cells will be used almost exclusively for all high-value/high-capacity applications, while there will be a further increase in the "alkaline ratio", that is, the number of alkaline manganese cells compared with all zinc cells for low-cost applications.

Development of battery systems which are able to meet the stringent energy and power requirements for electric vehicle use is likely to continue well into the next century. (Extracted from Article by Professor Vincent, Head of the School of Chemistry at the University of St. Andrews, St. Andrews, Fife KY16 9ST, Scotland, in *Chemistry & Industry*, 16 September 1996.)

Beyond voice recognition

Researchers at New York's University of Rochester hope to help computers to make the leap from voice recognition to intention recognition. Funded by the National Science Foundation, the US Navy, and the Advanced Research Projects Agency, the project uses a commercial speech-synthesis system and a speech-recognition system provided by Carnegie Mellon University, plus some special programming. While the researchers are not predicting the demise of such computer-centric assists as pop-up menus, icons, or the mouse, they are demonstrating that it is possible to create a conversational computer that can be used by novices. (Source: *Industry Week*, 2 September 1996)

D. MARKET TRENDS AND COMPANY NEWS

Market Trends

Electronic chemicals

Materials suppliers to the semiconductor industry will face a downturn in demand as early as the fourth quarter of 1996. Indeed, chip makers are expected to add 47 fabrication units this year, 39 in 1997, and 28 in 1998, according to the latest statistics from consultants Dataquest (San Jose, CA). Dataquest estimates the industry's average backlog for materials and equipment at about six months.

The backlog is largely contingent on what happens in the chip market. With glutted supply and falling prices for certain memory chips, many producers have cut production and delayed or cancelled expansion plans. Others, who have recently converted or have plans to convert fabrication units from 4 megabit (Mb) dynamic random access memory (DRAM) to 16 Mb DRAM, appear to be "confused" over what to do next.

The confusion is the result of a handful of competitors having already made the leap to the next-generation, 64 Mb DRAM. As a result, revenues in the $154 billion semiconductor industry are expected to grow a modest 6.7 per cent this year—significantly lower than the 29 per cent/ year-plus growth rate the industry has enjoyed for much of the 1990s.

While growth for suppliers has fluctuated between 12 and 20 per cent/year in the 1990s, most industry observers expect a drop to three to four per cent from now through the third quarter of 1997. They say, however, that the decline will be temporary. Despite production cuts and delays by chip makers, most of the announced fabrication units and expansions are expected to go through.

Suppliers say they will keep pace with growth by making investments in plants and technology world-wide.

The semiconductor industry received some good news. One closely tracked indicator, the "book-to-bill ratio" for North American firms, rose slightly to 0.90 (for every $100 in shipments, chip firms received $90-worth of new orders) from 0.86 the month before. World figures, which arrived a month late, looked even better: 0.95 for July. But both are still far below the 1.16 figure of a year ago, suggesting that the industry is coming out of its year-long slump only slowly. (Extracted from *Chemical Week*, 17 July 1996 and *The Economist*, 14 September 1996)

DRAMs continue as Achilles' heel of semiconductor market

The metal-oxide semiconductor (MOS) memory market, principally the DRAM, continues to be the Achilles' heel of the semiconductor market. The much heralded pricing debacle continues to be problematic for chip makers, many of whom derive over a third of their semiconductor revenue from DRAMs. Recent announcements to curtail production or diversify into other types of chips by some chip manufacturers have been welcome news. However, the outlook in the near term remains rocky as the industry moves to shift production to make the next generation of memory chips.

Pricing for DRAMs has been thrown askew as manufacturers shifted production of 4 Mb fast page mode devices to 16 Mb extended-data-output devices. This, coupled with slower than expected sales of PCs at the year-end of 1995, brought prices down by as much as 70 per cent. According to the International Data Corporation, the price of 4 Mb DRAM has dropped to $3.60 from $13.40 at the close of 1995. The price of 16 Mb DRAM has dropped to $14.40 from $50.30. If a cut in output is not realized, prices could drop another 10 per cent.

Semiconductor manufacturers are focusing on the production of the next-generation memory devices, principally the 64 Mb synchronous DRAM. Full-scale production of these chips will not happen for 18 months or more under the best of circumstances. However, as the memory market sours, chip makers are moving into other areas. (Reprinted with permission from *Semiconductor International Magazine*, August 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Multimedia PC market doubled in 1995

The worldwide multimedia desktop PC market had another explosive year in 1995 according to Dataquest, growing from 10.3 million units in 1994 to more than 20.8 million units in 1995, fuelled largely by growth in the Pacific Rim and Europe. While the US market grew by 35 per cent, Europe grew by 144 per cent and Japan and Asia and the Pacific grew by an astounding 391 per cent. (Reprinted with permission from *Semiconductor International Magazine*, July 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Revised chip forecast

Despite a poor first quarter, the global semiconductor market will expand by 6.7 per cent in 1996, then return to double-digit growth rates during the rest of the decade, according to the Semiconductor Industry Association.

The spring forecast of the World Semiconductor Trade Statistics (WSTS) projects that chip sales will exceed $154.0 billion this year, up 6.7 per cent from the 1995 sales of $144.4 billion. The forecast, while lower than previous industry estimates, is significant because global chip sales actually declined by 4.6 per cent during the first quarter. The lion's share of this year's positive growth will surface in the third and fourth quarters, the WSTS said.

Moreover, chip sales are expected to climb another 10.3 per cent in 1997 to $169.8 billion, then increase 16 per cent in 1998 to $196.9 billion. In 1999, the WSTS foresees a 19.1 per cent growth rate as chip sales surpass $234.5 billion.

As a result of the revised forecast, which was prepared at a meeting of industry statisticians in Vienna, 1996 should mark the eleventh consecutive year of growth for the chip industry.

World chip revenues increased by 41.7 per cent in 1995, following 31.8 per cent growth in 1994 and 29.1 per cent growth in 1993. The three preceding years, from 1990 to 1992, showed modest growth rates of 1.7, 8.1 and 8.6 per cent, respectively.

Last autumn, during a year of phenomenal industry sales, the WSTS predicted at 26 per cent growth rate for 1996. After the WSTS autumn forecast, the market started

changing. The pace of personal computer sales slowed during the Christmas season and DRAM prices started plummeting as inventory exceeded demand.

The DRAM market, which represents 27 per cent of the world chip market, is going through a period of tremendous fluctuation and the dramatic price drops in DRAMs are having a major impact on the overall global chip market. If DRAMs were taken out of the WSTS calculations, the global growth rate would be 10.2 per cent for 1996.

A second major factor—depreciation of foreign currencies—is also affecting revenue growth. The appreciation of the US dollar against the Japanese yen and European currencies has had the perverse impact of reducing the industry's growth rate by 4.3 per cent. The worldwide growth rate would be 11 per cent without these currency impacts. (Extracted with permission from *Semiconductor International Magazine*, July 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

High growth ahead for cluster tools

Reflecting a growth in the integration of semiconductor processes, a recent study predicted a four-fold increase from $359 million to $1.44 billion in the flexible cluster tool market between 1995 and the year 2000. The Information Network (Williamsburg, VA) issued the forecast based on an annual unsponsored survey of cluster tool producers.

Flexible cluster tools are designed to meet the requirements established by SEMI's Modular Equipment Standards Committee (MESC). Conforming to the MESC definition, the tools consist of two or more process modules (single wafer or batch) that are linked together by a wafer transport, facilities support and a communication system. These modules can perform sequential operations in semiconductor processing.

The use of cluster tools that do not conform to MESC standards, currently a $7.67 billion market, is also projected to grow. According to the report, the manufacturers of these tools integrate modules that are within their own product offerings and are primarily represented by Applied Materials Inc. (Santa Clara, CA). These manufacturers can expect continued strong momentum of 29 per cent annual growth, reaching $27.4 billion in the year 2000.

In the early 1990s, the market for MESC-compatible equipment was in the tens of millions and mostly made up of smaller equipment manufacturers. Flexible cluster tool's high rate of growth started in 1994 with the introduction of new equipment models.

Adopting MESC in the equipment design gave flexibility to both the equipment supplier and the semiconductor manufacturer. Both can act as system integrators, because MESC defined for specialized vendors and the fabs how an integrated system interacts with the shop floor. (Reprinted with permission from *Semiconductor International Magazine*, July 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

World pressure sensor market forces niche applications

New technologies emerging in the past 30 years have prompted significant growth in the pressure sensors market. In 1995, revenues grew to $1.99 billion at a 6.3 per cent annual growth rate, indicating recovery from economic recession in the US and Europe, according to Frost & Sullivan's most recent report, *World Pressure Sensor Markets*.

Several changes are characterizing the marketplace, including the increasing trend towards smart sensors, price decreases in silicon micromachined technologies, new opportunities for development in fibre optics and growth in demand for vacuum pressure sensors from the semiconductor industry.

The silicon micromachined pressure sensor segment is the largest and fastest-growing area of the market, the report notes. These sensors can be combined with electronics to form smart sensor capabilities. The production costs for these sensors are lower, making the price for customers lower as well.

Though the fibre optic pressure sensor segment is still considered to be in its infancy, the technology has a lot of potential in opening new markets. Applications implementing fibre optics are still to be found through research and development.

The pressure sensor market is mature and competitive. Because of the industry's competitive nature, companies are focusing on niche markets, geographic regions, potential mergers and acquisitions, productive improvements, and customer service. Developing countries in the Pacific Rim and the rest of world regions continue to enter the marketplace and experience high growth. Pressure sensor markets in the US and Europe show slightly smaller growth rates but are still large markets. (Reprinted with permission from *Semiconductor International Magazine*, July 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

DSP sales booming

Digital signal processors (DSPs), once thought to be an application-specific cousin of microcontrollers, have become a necessary and growing component in consumer electronics and communications products. Worldwide DSP sales have increased remarkably over the last three years, reflecting the broadening usage. In many instances they are a lower-cost alternative to microcontrollers. The DSP market is expected to remain very healthy as the technology becomes much more mainstream.

At the close of the third quarter of 1996, DSPs accounted for almost $1.9 billion in sales worldwide, with an outstanding 64.2 per cent annual average growth rate. We anticipate sales to approach $2.5 billion by year-end 1996 with a remarkable 42.3 per cent annual growth rate. The annualized growth rates have decreased since the latter half of 1995 but the dollar volumes have remained healthy. Sales should be closer to $3.2 billion by the close of 1997 with an annual growth rate of 30.4 per cent.

DSPs are stand-alone devices used to process real-time data. They are designed to do specific tasks. That makes them well suited to a myriad of uses from motor controls in household appliances to computer applications. In addition, DSPs have been embedded into other chips to perform specific tasks. They are increasingly used in multimedia engines, fax/modem chips, disk drive controllers and wireless communications circuits. The sheer diversity of consumer products in which DSPs are used will ensure that they will have a larger share of the microcontroller market. (Reprinted with permission from *Semiconductor International Magazine*, July 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Strong PC sales boost electrical component shipments

Manufacturers' shipments of electrical components remained at healthy levels at the close of the third quarter of 1996. Electrical component shipments, which include printed circuit boards, semiconductors, capacitors, resistors and connectors, have mirrored the ebb and flow of the personal computer (PC) market. The relative strength and direction of the PC market can be gauged from electrical component shipments because they contain elements from all categories. Shipments peaked in the first quarter of 1996, reflecting the rebounding PC market. The demand for electrical components is expected to be strong with PC growth slated to stay at near-record levels.

Despite the recent misfortunes of Apple Computer and AST Research, component sales are likely to grow at a double-digit pace. Declining prices for semiconductors, principally memory products, could have a detrimental effect on chip makers. However, cheaper component prices translate into lower street prices for PCs. Compaq and Dell both have reaped the benefit of lower prices for some components. Both manufacturers announced record profits in the first quarter of 1996, due in part to lower costs for components. (Reprinted with permission from *Semiconductor International Magazine*, July 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

European capacitor market

The capacitor markets of Europe and the UK continue to be dominated by four product types: multi-layer ceramic, plastic, aluminium and solid tantalum. According to the 1996 Profile of the Worldwide Capacitor Industry from Elsevier Advanced Technology, the solid tantalum has overtaken multi-layer ceramic as the fastest-growing product category.

The European tantalum market is predicted to grow between 15 and 20 per cent until 1997. This is despite reports of a worldwide shortage of tantalum.

Which is not expected to ease for at least another two years. According to the report the availability of surface-mount parts is now making a big impact on the market. Tantalum is benefiting from its use in mobile phone handsets in particular.

The European market for multi-layer ceramic (MLC) capacitors in contrast has levelled off from 1993 when it grew by 37 per cent. The report says the growth figure is now closer to 15 per cent and will finally level off at 12 per cent.

As with tantalums, the MLC market in Europe has benefited from the mobile phone boom and growth figures for Europe continue to lead the world market as a whole.

According to Elsevier, an important factor has been the move to digital mobile phone technology, which leads to 25 per cent more capacitors of various types per handset compared to older analogue designs.

The third major product type, the aluminium electrolytic is traditionally dependent upon the television market, which is flat and even declining in some areas. However, the report points out that new application areas are generating a revival of interest in the aluminium electrolytic, particularly the motor drive market, which is reported to be growing by 25 per cent in Europe. There is also a warning that a shortage of aluminium foil is pushing up the prices of some parts.

The European plastic capacitor market is growing by 8 per cent and will continue this way until the end of the decade. The biggest market driver is the need for EMI protection with the introduction of the European directive. (Source: *Electronics Weekly*, 14 August 1996)

Microcontroller and analog component sales

National Semiconductor has backed up its recent restructuring with data from the World Semiconductor Trade Statistics (WSTS) organization. WSTS figures show a strong correlation between sales of micro-controllers and analog components. According to Dataquest, the 1995 microcontroller sales of $10.7 billion will double by 1999. National sees no reason why the analog sector should not follow this trend, and as such has restructured its divisions: three will concentrate on analog while the fourth, Fairchild group, will address digital components. (Source: *Electronics Weekly*, 3 July 1996)

Wafer fab equipment: up or down?

Semiconductor Equipment and Materials International (SEMI) has conducted a special mid-year edition of the SEMI Capital Equipment Consensus Forecast that reveals SEMI members expect worldwide sales of semiconductor capital equipment to reach nearly $37 billion in 1998, up from $24 billion in 1995.

Participating in the survey were 52 member companies from the USA, Europe and Japan, representing about 65 per cent by volume of the semiconductor equipment industry. Survey responses were collected from mid-June through mid-July 1996.

The Consensus Forecast is normally conducted during the autumn planning period, but uncertainty in the semiconductor equipment marketplace prompted a special mid-year edition. The survey shows that SEMI members expect a 22 per cent growth in equipment sales worldwide in 1996.

Order activity is expected to pick up again in mid- to late-1997, contributing to a higher growth in shipments of about 17 per cent in 1998.

In November of 1995, survey participants were slightly more positive regarding the outlook for the semiconductor capital equipment industry. At that time, expectations were for 37 per cent growth in 1996, 11 per cent in 1997 and 15 per cent in 1998. By comparison, Dataquest is predicting that the semiconductor equipment market should grow 17 per cent in 1996, down from 77 per cent growth in 1995. The outlook gradually worsens from now until the industry bottoms in the first half of next year, making the 1997 market growth -16 per cent.

The slow-down in spending that began in the Americas region has been followed in Japan by companies that have drastically scaled back spending. The hardest hit region in 1997, as DRAM capacity dramatically scales back, will be Asia and the Pacific. (Extracted with permission from *Semiconductor International Magazine*, September 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Semiconductor market predicted to prosper with DVD

With the first digital video disk (DVD) systems expected later this year, the semiconductor opportunity generated by the DVD market is forecast to exceed $3.6 billion by the year 2000, according to Dataquest. This includes chips for DVD-Video players, DVD optical drives, and DVD-Video decode and encode boards. More than 2.3 million DVD-Video players and optical drives are expected to be shipped into the market between the first product

introductions in October and November 1996 and the end of 1997.

Dataquest projections show the combined annual market shipment of DVD-Video players and DVD optical drives growing to more than 33 million units by the year 2000, making it one of the most successful products introduced in the 1990s. This will drive the strong semiconductor demand. (Reprinted with permission from *Semiconductor International Magazine*, September 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Worldwide semiconductor growth slows

The worldwide semiconductor market is experiencing an unprecedented period of retrenchment. The growth in sales, at mid-year, has dropped dramatically from the record-setting pace at the close of 1995. Many semiconductor companies have moved aggressively to curtail production in order to slow price declines and retain their margins. However, their actions have proved to be fruitless as earnings continue to slide. The growth pattern has shifted into low gear. Growth in sales has slowed precipitously in four of the last five months. Worldwide sales are anticipated to be $144.7 billion at the close of 1996.

The worldwide semiconductor market grew at a 24.6 per cent annualized growth rate to $147.6 billion in May. While this is exceptionally robust by any measure, it is well below last year's 42 per cent annualized growth in sales. Monthly sales have dropped below single-digit levels over the last two consecutive months. In addition, the three month moving average (3MMA) for May was -2.2 per cent. Worldwide sales are expected to stall late in the year with growth projected to be 0.2 per cent, totalling $144.7 billion. We expect sales to rebound in 1997 with an annualized growth rate of 10.2 per cent totalling $159.5 billion.

The healthiest growth is expected in the European and Other Asian (non-Japanese) sub-markets. In the European market, sales in May grew at a 27.5 per cent annualized growth rate, totalling $29.7 billion. Sales are expected to grow at a 5.3 per cent annualized growth rate at the close of 1996 and reach 11.6 per cent by 1997, totalling $33.2 billion.

Sales to the Japanese market, on the other hand, are expected to take a nose-dive. Monthly sales have slowed markedly in the last three months. The 3MMA has dropped off as well, with growth rates well below one per cent. At the close of 1996, sales are expected to decline by 6.9 per cent, totalling $36.9 billion. (Extracted with permission from *Semiconductor International Magazine*, September 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Industrial production for electrical machinery tapers off

Industrial production figures for electrical machinery have slowed markedly in the last 12 months. This segment is comprised of household appliances, communications equipment, household audio and video equipment, and semiconductors. The annual growth rate topped out at 16.2 per cent in early 1995 and has dropped steadily through mid-1996.

The industrial production figures for electrical machinery are a useful benchmark to gauge the relative strength and direction of the semiconductor market. This is particularly true on the demand side since an increasing portion of semiconductors go into or are used in the manufacture of other finished products. All sectors are anticipated to slow in the latter half of the year.

Industrial production for electrical machinery is expected to grow at a 9.9 per cent annualized growth rate for 1996, below the first quarter's 12.2 per cent and mid-year's 11.6 per cent. (Extracted with permission from *Semiconductor International Magazine*, September 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

IT: the new wave in chemicals

Information technology (IT) is washing like a wave over the chemical industry. It is enabling companies to gear activities towards the year 2000 and hone their manufacturing, administration and marketing skills to compete in a tough global environment. Already, many Western multinationals have responded to the last chemicals downcycle by undertaking a managerial revolution, downsizing and refocusing activities under the re-engineering umbrella. Some are now moving into phase two, where the emphasis is on growth and more extensive customer service.

In step with these strategic changes is a focus on IT and how it will allow companies to manage data, reduce costs, and better interface around the world with employees and customers.

The new customer focus is critical in an industry that has traditionally put its main efforts into manufacturing operations and process technology expertise. This is partly why, compared with other industries, the chemical industry has also been slow to realize the potential of IT.

New modelling, networking, data gathering, transfer and storage tools can enable the industry to do things that were technologically impossible five to six years ago.

One of several trends driving IT in the chemical industry has been increasing globalization in recent years. Although many chemical companies have operated on a worldwide basis for a long time, new management structures have prompted a shift away from central or regional control to global business unit structures. The headquarters location is no longer important, but seamless worldwide communications with staff and customers has become critical.

Globalization is particularly associated with a push into Asia and the Pacific. High growth opportunities in new markets such as China, together with the need to spread heavy innovation costs in domestic markets, is driving multinational companies further overseas and requiring better communications networks. New IT features such as the Internet allow companies to exchange information more easily.

In Asia, new companies are poised to enter the big league in global chemicals with the full benefits of modern business and technology. Witness Reliance Chemicals (Bombay) and the numerous South Korean *chaebol* that are building manufacturing capability fast and approaching the market differently from Western companies.

Although the reality of a virtual office, where people rarely come into the workplace, is a long way off, the value of modern communications via the laptop is particularly evident in Asia, where the regional headquarters may be modest and the need to travel great. A trend in Asia and the Pacific that requires greater use of IT is documenting and tracking transactions, since tariffs in the region continue to change rapidly.

As companies downsize and focus their attention on fewer core activities, IT also nurtures the prospect of doing

things better or differently with products that are reaching the end of their life cycle. Computer-based modelling is one tool that has brought new life to certain sectors, for example, the development of metallocene catalysts, which have revitalized the plastics sector.

Scientific information systems such as the client-server system supplied by MDL Information Systems (San Leandro, CA) are moving from pharmaceuticals and agrochemicals into chemicals. MDL provides scientists with the ability to search across databases by drawing all or part of a molecular structure on screen. Lately such systems are facilitating research in the area of combinatorial chemistry.

A European Community initiative, the Process Industry for Manufacturing Advantage (PRIMA) is examining the use of IT to achieve higher productivity. ICI is a European company frequently mentioned as a standard bearer for effective IT use. The company has a decentralized IT approach that involves businesses clearly understanding and shaping their own strategy.

ICI has a single global telecommunications network that links the company and the businesses that has been outsourced.

Even though the chemical industry is so behind the times on apparently straightforward areas of IT, times are changing fast, and as the re-engineering era turns into second-wave re-engineering, IT is inevitably in its footsteps. (Extracted from *Chemical Week*, 21 August 1996)

Company News

The CRT dream

The world wants its computer, TV and monitor screens to be as large as possible. It may be nice if they were on a flat panel, but few PC and TV manufacturers are going to sacrifice picture size or resolution in any move from the large but trusted cathode ray tube (CRT) to slimline liquid crystal displays (LCDs).

But there are signs that the lucrative CRT replacement market in TVs and desktop PCs, may not be the impossible dream for LCD suppliers for very much longer, and the belief is that the LCD's ability to offer 1280 x 1024 pixel resolution will eventually start to impact the CRT market.

Top of the pile of high resolution LCDs is Sharp's 40-inch thin film transistor (TFT) liquid crystal display. However, this is not a single panel but two placed side by side.

Of the true single panel displays Hosiden has demonstrated a 23-inch diameter LCD with SXGA 1280 x 1024 resolution. NEC claims that its 20.1-inch SXGA resolution TFT LCD is the equivalent of a 22-inch CRT and will be available in 1997 with a $9,000 price tag.

IBM is already delivering a 16.1-inch SXGA colour TFT and Toshiba has recently launched a 15-inch LCD with 1024 x 768 resolution, which it claims can be used to replace 17-inch CRTs in desktop PCs, but samples cost around 3 to 4 times that of the CRT.

Matsushita Electric has demonstrated in Japan a 17-inch SXGA LCD based on passive-matrix supertwisted-nematic (STN) technology. (Source: *Electronics Weekly*, 9 October 1996)

Microtec Java deal

Microtec has entered an agreement with Sun Microsystems' JavaSoft division to create a development and debugging environment for Java. Microtec will license from Sun's JavaSoft its Java virtual machine, required to execute Java code, and the Java OS run-time system. In return, Microtec will create a real-time development and debugging environment for Java, based on its XRAY debugger, and apply its multitasking VRTX real-time operating system technology to Java, to enable it to tackle real-time embedded applications.

A number of US companies are said to already be developing embedded systems such as set-top boxes and high-end pagers using Java. (Source: *Electronics Weekly*, 9 October 1996)

Java Fund to develop Web software

Work has started to find the next big moneymaker in the Internet market with a $100 million fund that will invest in the development of technologies related to Sun Microsystems' Java language.

Leading Silicon Valley venture capital firm Kleiner Perkins Caufield & Byers (KPCB) has established the Java Fund and attracted investments from 10 leading computer firms including Sun Microsystems, Compaq and Oracle.

The Java Fund is an attempt to attract some of the more promising start-up companies developing Java-related products and services. There is no shortage of cash at venture capital firms hoping to make money by taking an Internet-related company public in less than two years rather than the normal five-year cycle.

KPCB and Sun Microsystems are the two largest investors in the Fund followed by Cisco Systems, Comcast, Compaq Computer, IBM, Itochu, Netscape Communications, Oracle, TCI Technology Ventures and US West Media Group. (Source: *Electronics Weekly*, 28 August 1996)

ICs in IP alliance

System-on-a-chip and system-level integration came to the fore with the formation of the virtual socket interface (VSI) alliance by EDA suppliers, semiconductor manufacturers and intellectual property (IP) providers.

Comprising some 25 companies including Advanced Risc Machines (ARM), Cadence, Fujitsu, Mentor Graphics, Toshiba, Virtual Chips and VLSI Technology, the alliance will develop standards for the use of IP.

This will lead to an open industry model so chip designers can easily combine silicon from many sources onto one chip.

The VSI alliance will not only address the standards for interfacing, but also the questions of how much the IP provider gets paid in royalties for its section of the chip. (Source: *Electronics Weekly*, 4 September 1996)

Packager arranges to provide chip-scale service

The world's largest supplier of integrated circuit (IC) packaging foundry services took a step towards providing chip scale packages with a recent license of manufacturing technology from Tessera Inc. (San Jose, CA). Amkor Electronics Inc. (Chandler, AZ) has completed a μBGA pilot production line in Metro Manila, Philippines, that is planned to output 100,000-250,000 packages per week in the first quarter of next year.

Amkor selected the advanced package partly because it handles standard wire bondable ICs and is suitable for use with the foundry's eutectic solder ball technology. Another advantage of the chip-scale package is that it has the potential for further miniaturization due to a novel method of interconnecting the chip with the package.

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Motorola and Mosel Vitelic in foundry agreement

Motorola and Mosel Vitelic have agreed to fabricate TMOS wafers in the wafer fabrication plant of Vitelic Hong Kong Ltd. in Taipo Industrial Estate. Under the agreement, Motorola will transfer its proprietary TMOS wafer processing technology to Vitelic, which in turn will commit a portion of its wafer capacity to Motorola.

The agreement is for a period of six years. Activities in the first year will be focused on technology transfer and certification. Production is planned to start in mid-1997. The wafers will be assembled in TO-220 and DPAK packages in Motorola's assembly factories in the region.

TMOS power transistors (TMOS stands for T-metal oxide semiconductor) are discrete transistors used for switching applications in various consumer products including monitors, disk drives, power suppliers, AC motors, lamp ballast, and other automotive, industrial and consumer applications. (Reprinted with permission from *Semiconductor International Magazine*, August 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

NEC cut price shock for portable storage

In a revolutionary move for computer memory, NEC of Japan is to introduce chip-based storage for portable computers that is less expensive than hard disk storage. This will allow laptops to run off AA batteries and reduce their weight significantly.

NEC is currently supplying engineering samples of 256 Mbit flash memory and expects to start volume production in September/October 1996. It will be used to replace the hard disk drive in laptop computers and PDAs where the storage size is up to 100 Mbytes.

Currently, the highest density flash memories in volume production are the 16Mbit flash chips of Intel, so the 256Mbit memories of NEC represent a substantial advance in the state of the art.

NEC's chips are based on the SanDisk flash technology which uses memory mapping techniques to route around faulty bits and find good cells in which to store information.

NEC could become the first company in the world to commercialize multi-level storage technology—the ability to store more than one bit of information on one memory cell. (Extracted from *Electronics Weekly*, 31 July 1996)

Silicon micromachining produces sensitive accelerometer

The Daimler-Benz Research group in Germany is issuing a silicon micromachining technique to build extremely sensitive accelerometers that can reduce the running costs of road vehicles and improve their safety features. The sensor section of each chip, known as the "butterfly wafer", is an etched silicon wafer that lies above its carrier. It is supported only by two extremely thin silicon supports and a thin silicon bridge.

This sensor is fabricated by cutting a small square from a silicon chip, leaving only the thin strip and two small supports at the corners to link it to the chip. The square is the thickness of the wafer, about 300 μm, with a weight of 1 mg, so it is extremely sensitive to forces due to acceleration. The connecting strip contains resistive elements so that any vibrations of the butterfly wafer are converted into electrical signals. The chip also contains a signal-processing section that can deliver suitable signals to the vehicle control unit.

Potential applications include the control of air bags after an impact and suspension control in which the suspension is automatically adjusted as the acceleration of the vehicle varies. (Reprinted with permission from *Semiconductor International Magazine*, July 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

IMEC and National Semiconductor collaborate on R&D

The Inter-University Microelectronics Centre (IMEC, Leuven, Belgium) has agreed that National Semiconductor Corporation, CA, will work with IMEC's Advanced Semiconductor Processing Group to develop process technology that will be critical to 0.25 μm and 0.18 μm semiconductor manufacturing.

Gilbert Declerck, vice president of IMEC's advanced semiconductor processing division has said that this was the largest research and development contract signed with a US-based semiconductor company. IMEC saw the relationship with National Semiconductor as a strategic alliance for developing technology critical for future semiconductor manufacturing. National Semiconductor is the first company to work with IMEC on research and development in three major focus areas of advanced optical lithography, silicidation and interconnect, and cleaning process technology. (Extracted with permission from *Semiconductor International Magazine*, July 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

IBM partners with Hughes on SiGe

IBM and Hughes have signed a multi-year agreement to create high-speed communications products based on silicon germanium technology pioneered by IBM. SiGe-based chips are said to be several hundred per cent faster than current commercial offerings and, compared to GaAs, cost less, require less power and provide higher density and quality.

Under the agreement, several of the Hughes Electronics Companies, including Hughes Network Systems, Hughes Aircraft Company, Hughes Telecommunications and Space Company and Delco Electronics Corporation, are exploring the integration of IBM's SiGe technology into a variety of high-speed wireless and sensing products, such as automobile radar systems, interactive television and wireless networks.

According to IBM, silicon germanium chips offer dramatic improvements over today's silicon circuits—either by increasing circuit speeds by a factor of two to four, or by reducing circuit power consumption to a similar extent. Moreover, IBM has developed a manufacturing process that enables the chips to be produced on existing silicon chip fabrication lines. (Reprinted with permission from *Semiconductor International Magazine*, July 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Oak Ridge and SEMATECH join to improve processes

A work-for-others contract has been established between Oak Ridge National Laboratory (ORNL) and SEMATECH to improve semiconductor manufacturing processes. Through this agreement with SEMATECH and

their equipment suppliers, ORNL researchers are providing a radio frequency (rf) benchmark facility to evaluate and standardize components used to manufacture chips.

Semiconductor device manufacturers use rf power to drive their plasma processes such as oxygen ashing. The evaluation of rf subcomponents is necessary for optimum system performance and reliability. As device feature sizes get smaller, the need for precision in rf driven plasma processes further increases. Knowing the exact amount of rf power being coupled to the plasma becomes critical. Therefore, ORNL is involved in evaluating subcomponents such as the rf generator, connecting cables, matching network components and power sensors. Each is vital in determining the amount of rf frequency power reaching the plasma and thus the amount of etching, for example, taking place. This directly impacts device performance. (Reprinted with permission from *Semiconductor International Magazine*, July 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Britain plans first light-emitting polymer plant

The UK companies Xyratex and Cambridge Display Technologies (CDT) are collaborating to set up the world's first high-volume manufacturing plant for light-emitting polymer devices. They will initially have a pilot plant in the Cambridge area. This will be followed by a British volume manufacturing facility at a location yet to be determined. Production is scheduled to commence in the last quarter of next year with high volume production in place by late 1998.

The devices are expected to offer strong competition to LCDs and LEDs. They can be produced economically by applying a thin film of the light-emitting polymer onto a plastic or glass substrate coated with an indium-tin-oxide transparent conductive electrode. A layer of aluminium is evaporated or sputtered on top of the polymer to form the second electrode. The polymer emits light when a voltage is applied between the two electrodes. Most of the displays are green, but red and blue versions have also been produced.

The first commercial use is likely to be as a display backlight, as the displays operate on just a few volts, eliminating the inverter supply normally needed for electro-luminescent backlights. The lifetime of flexible displays made on plastic film is not yet as long as those on glass. (Reprinted with permission from *Semiconductor International Magazine*, September 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

First order for laser interferometric metrology system

Nikon Precision Europe (Langen/Frankfurt, Germany) has announced the first order of its laser interferometric x-y metrology system, the XY-6i, to Align-Rite International (Los Angeles, CA). The system will be used in the development of photomasks and reticles for 4 Gb DRAM and other integrated circuits using 0.18 μm and lower design rules. The XY-6i will complement Align-Rite's European expansion programme which will increase manufacturing capacity by more than 40 per cent. The system is scheduled for installation in spring 1997. (Reprinted with permission from *Semiconductor International Magazine*, September 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Multi-level cell flash technology

Every memory designer's dream is to double density without increasing chip size or decreasing process geometries. Multi-level cell (MLC) technology is a way of doing it, but for years it has remained a dream. Now companies are preparing products based on the technology.

NEC is talking about an MLC-based ROM for this year; SGS-Thomson Micro-electronics is talking about an MLC-based one-time programmable (OTP) EPROM for next year; Intel is talking about MLC-based flash memory for 1997 and San-Disk, Samsung, Toshiba and NEC are all pursuing MLC flash in the laboratories.

MLC allows the storage of more than one bit on a non-volatile memory's floating gate cell which, in the case of a ROM, EPROM or flash memory, is made from a single transistor.

A cost comparison between MLC flash and conventional flash—based on die size—was seen at this year's ISSCC. To achieve the same density from an older, and therefore cheaper, process, motivates the companies which are developing MLC.

MLC's economics are compelling. If two bits of memory are stored on one transistor then MLC halves the cost of producing a chip. If four bits are stored per transistor then chip cost is reduced to a quarter.

If two bits are to be stored on a transistor then four voltage levels have to be read or written; if three bits are stored on a transistor—eight voltage levels have to be read or written; if four bits per transistor—then 16 levels.

NEC is discussing with customers a 64 Mbit MLC ROM games cartridge, storing two cells per transistor, for introduction this year.

Since, by the year 2000, 0.18 micron processes are expected to be used in production, clearly MLC offers the theoretical prospect of very dense memories—up to 16 Gbits—in the first few years of the next century.

In theory, MLC is a memory designer's heaven, but there are problems with MLC: write and read times are increased; read/write cycles are reduced; and getting down to 3.3 V is more difficult. (Extracted from *Electronics Weekly*, 28 August 1996)

E. APPLICATIONS

Molecular electronics

The search for molecular components for optical electronic devices may have been advanced by researchers in the Netherlands. They have come up with a novel approach for designing a molecular optical switch using chiral light to control the switching reaction.

Ben Feringa and his team at the University of Groningen have developed a switch that relies on two optical isomers, or enantiomers. For the first time, they have shown that the chirality of molecules can be controlled by altering the chirality of irradiated light.

The team used polarized light which can be made with a left- or right-handed bias using a particular optical technique, called circular polarized light. By shining left-handed light on an equal mixture of enantiomers, called a racemate, Feringa produced a tiny excess of left-handed molecules; right-handed light produces more right-handed molecules. Enantiomers are indistinguishable if they are irradiated with ordinary light of a single wavelength because they have identical optical spectra.

Scientists already know that when a small amount of chiral material is added to a liquid crystal in the archiral nematic phase, the material will convert into the cholesteric or twisted nematic phase, which is chiral. In the nematic phase, the molecules are lined up in orderly layers, but these layers become twisted in the cholesteric phase.

Feringa added his racemate mix to a nematic liquid crystal and then irradiated them with circular polarized light. The resulting excess of one enantiomer is enough to switch the liquid crystal onto its chiral cholesteric phase. Shining ordinary light on the mix will convert the liquid crystal and the racemate back again. The result appears to be a reversible optical switch. So far, the work is very far from application as the effects are so small, but Feringa is working on it. (Source: *Chemistry & Industry*, 7 October 1996)

Direct LAN linkage type Internet Fax system

Matsushita Graphic Communication Systems, Inc. and Keio University have jointly developed the industry's first direct local-area network (LAN) linkage facsimile (Fax) system, Internet Fax, allowing transmission and reception of facsimile (image) data via e-mail.

This new Fax system incorporates standard Internet protocols such as TCP/IP, SMTP and MIME and can be used for scanner input and printer output to personal computers linked to the network system. Since the machine sends data via e-mail, it enables the communications cost to be reduced substantially, especially for business enterprises which use the Fax system frequently for international communications.

Internet system's e-mail service can be utilized without key manipulation, and diagrams, complicated documents, and photographs can be transmitted and received through the e-mail service. Simultaneous transmission to multiple addresses is also performed with ease and speed. Interlinkage with a LAN system is possible with a single telephone circuit, so the new Fax system serves the function of a LAN terminal with the additional function of a G3 facsimile. It also features a gateway function which enables two-way relay communication between a LAN terminal and a G3 facsimile connected to the telephone line, and is capable of expanding and improving communications systems on a global scale with ease.

For further details contact: Matsushita Graphic Communication Systems, Inc., 2-3-8, Shimo-Meguro, Meguro-ku, Tokyo 153. Tel.: +81-3-3491-9191; Fax: +81-3-5434-7149. (Source: *JETRO*, August 1996)

Scanners for multimedia

Conventionally, it is usually assumed that scanners need to offer at least 300 dpi resolution for output to a laser printer. For multimedia, however, the output device is a monitor which displays at about 72 dpi. An inexpensive desktop colour scanner, therefore, is more than sufficient for most multimedia projects.

The Hewlett-Packard ScanJet 4p ($499) is aimed at small offices and home users. It comes bundled with Corel's *PhotoPaint Select 5.0*, Caere's *OmniPage Direct* OCR software, and Visioneer *PaperPort* for document management, as well as HP's own *PictureScan 2.0*.

The smallest and simplest in the group was the Logitech PageScan Color ($399). It offers only two resolution options—100 and 200 dpi—and the default file format is JPEG, which makes the unit ideally suited for Web graphics.

The Relisys Infinity Scorpio ($449) has a 300 x 600 dpi resolution, making it suitable for both multimedia and print applications. Options include a memory upgrade to increase the speed of scanning, and another module which increases the resolution to 600 x 1,200 dpi.

The Ricoh CS-300 ($499) was the only three-pass (one each for red, blue and green) scanner in the group, which made it slower. It was also the only unit without bundled document management software. On the other hand, the Caere *OmniPage Direct* delivered the best OCR performance of the machines examined.

The Umax Vista-S6E ($399) offers 600 x 300 dpi resolution, as well as software with the options of gamma management and 8-bit colour scans. Bundled with it are *PageManager* document management software, ProLab's compact *Image Folio* and Maxsoft-Ocron's *Wordlinx* OCR software. (Source: *Multimedia World*, June 1996)

Blind flight

The University of Southampton has used neurofuzzy logic techniques to fly a helicopter in blind conditions using a simulator. "It is a severe real-time problem where the aircraft may be flying in fog in a hazardous terrain. The pilot needs to know where the obstacles are and how to avoid them", said Professor Chris Harris, head of the group undertaking the work. (Source: *Electronics Weekly*, 19 June 1996)

Chip understands sleight of hand

Seeking to ease the dialogue between humans and multimedia computers, Mitsubishi has turned its artificial retina chip to human gesture recognition. Originally developed to read Japanese Kanji script, the artificial retina is an image sensor with inherent processing capabilities. The chip consists of an array of 32 x 32 interactive pixel core circuits and a 16-bit microcontroller. Gesture

recognition is achieved by detecting the centre of gravity, size and tilt angle of the hand, which is approximated by a rectangle. This is claimed to take only 16 ms, far faster than that achieved using CCD sensors, for instance. (Source: *Electronics Weekly*, 15 May 1996)

Digital radiography system

Shimadzu Corp. and the Department of Radiology, Kobe University, School of Medicine have jointly developed the world's first digital radiography system that introduces a digital technique in place of the conventional film-screen method and uses a unique semiconductor detector to convert X-ray photons into digital values.

Compared with the film-screen method, clearer images can be obtained with about one half of the X-ray dose, so these images are highly effective for lung cancer diagnosis. The images can be stored in magneto-optical disks, and are ideal for remote medical diagnosis based on image transmission that is certain to come into wide use in the future.

With this new radiography system, the conventional film is replaced by a cadmium-telluride (crystal) semiconductor sensor to count the number of X-ray photons permeating through the body and to obtain a digital X-ray image. This sensor has roughly 6,000 cadmium-telluride elements over a length of 360 mm and width of 2 mm, which are linked with the X-ray tube to scan the image area.

Very clear images are produced due to the wide dynamic range, low noise and high sensitivity.

Further details from Shimadzu Corporation, Public Relations Dept., 1-3, Kandanishiki-cho, Chiyoda-ku, Tokyo 101. Tel.: +81-3-3219-5547; Fax: +81-3-3219-5676. (Extracted from *JETRO*, April 1996)

Talking PCs

After 30 years of speech-recognition R&D, AT&T has announced the commercial release of Watson ASAP (advanced speech applications platform) that enables users to speak to personal computers, either through a microphone or over the telephone. Boasting more than 95 per cent accuracy, it provides software vendors and PC manufacturers a platform to develop a new generation of speech-enabled products for business users, telecommuters and consumers. (Source: *Industry Week*, 6 May 1996)

New chip technology foils code grabbers

Few consumers realize that the code transmitted by their car's remote-keyless-entry (RKE) fobs or garage door openers can be quickly captured by a high-tech thief. Crooks need only an inexpensive code grabber or scanner to gain entry into cars, homes and businesses.

Code grabbers can receive and decipher access codes in 10 minutes or less. A scanner rapidly examines every possible security access combination of a specific system until it finds the correct one.

A new family of code-hopping devices from Microchip Technology Inc. promises to solve such security problems in systems using infrared, radio frequency or microwave transmissions, as well as smart cards. The Chandler, AZ, company acquired Keeloq code-hopping technology developed by Nanoteq of South Africa.

It relies on a long code word length together with encryption and synchronization techniques. A complex non-linear algorithm encodes the transmission sequences, resulting in sending a different code each time. Previously transmitted codes are never accepted again. Microchip's first HCS300 and HCS301 code-hopping encoders are designed to be the transmitter portion of secure RKE systems. (Source: *Machine Design*, 23 May 1996)

The SMBus (system management bus)

SMBus is a smart battery-control system developed between Intel and Duracell. Based on the two-wire I^2C-bus from Philips, the bus allows the system host, such as a laptop, camcorder or cellular phone, to communicate with the charging system.

The charging section interfaces the unregulated DC input to the main system power supply and the battery.

Data from the battery is used to control its charging when the equipment is linked to the mains. When the battery is supplying power, the charger gauges the remaining lifetime. The system host or processor can interrogate the charging system to gain information and convey it to the user. This includes assessing the current state of charge, predicting remaining operational time, controlling the discharge/rechargecycle and operating with alternative battery technologies.

Events such as overcharge, over-voltage and excess temperature can be flagged to the system, forcing partial or total shutdown to avoid damage to the battery.

Along with Intel, Duracell have worked with other manufacturers so they can offer a system solution. Maxim, Benchmarq, Linear Technology and Microchip have, among others, developed charge control chips for SMBus.

The charger chips access the data from the battery's on-board Asic to assess the best charging strategy. Charge and discharge current can be measured to an accuracy of 0.2 per cent and temperature of the battery is measured in 0.1° C steps. (Source: *Electronics Weekly*, 17 July 1996)

Virtual reality in engineering design

Designers are beginning to catch on to the idea of using virtual reality (VR) for engineering designs. There are various advantages in using it for such purposes, and VR software companies are developing the technology for a number of applications within the field.

The main advantage of using VR as a tool for design is that non-technical end-users, as well as engineers, can check and alter structures, without having to make physical models. The physical modelling alternative is often far from cheap and modifications normally require expert assistance. In addition, as a virtual model exists in software, it can be tested using virtual tools, without damaging or destroying a real-world prototype. (Extracted from *Electronics Weekly*, 26 June 1996)

Network PCs give up secret

Technology to allow remote monitoring of networked PCs, even when powered down, is available on the first 100 Mbit/s Ethernet controller device from Advanced Micro Devices (AMD).

The PCnet-FAST is AMD's first LAN controller to support the 10 and 100 Mbit/s Ethernet protocols, but it is also the first device on the market supporting remote PC power-up using the Magic Packet message protocol developed by AMD and Hewlett-Packard.

Shut down PCs are "woken up" when a dedicated data frame is transmitted over the network. PCs fitted with the Magic Packet controller detect the "wake up" data frame and their power management systems are booted into life.

The Magic Packet controller is automatically enabled on system power-down and only becomes disabled again

while the remote monitoring is in progress or when the user switches the PC on again.

This is AMD's first LAN controller for the 100 Mbit/s Fast Ethernet protocol. (Source: *Electronics Weekly*, 12 June 1996)

Texas Instruments unleashes 0.18 μm process

Texas Instruments' latest manufacturing process at 0.18 μm is now available for use in standard cell and gate array designs.

The standard cell CMOS family includes libraries for phase lock loops, A/D converters and cores such as DSPs, ARM microprocessors, MPEG and ATM.

Memory in the form of SRAM, DRAM, flash and ROM can also be implemented. With up to 16 million gates, tens of megabits of memory can be made available.

Standard cells have a claimed dissipation of 0.4 W/MHz if all 16 million gates are used. If supply voltage is reduced from 1.8 V to 1 V, consumption drops by 90 per cent. (Extracted from *Electronics Weekly*, 18 September 1996)

GPS for the blind

Blind people are using GPS (global positioning system) technology as a guidance aid which may ultimately replace traditional guide-dogs.

A £1 million research project involving the universities of Birmingham and Hertfordshire, BT and the Royal National Institute for the Blind, has developed the first GPS guidance system for the blind.

Called MoBIC (mobility for the blind and elderly interacting with computers), the system uses positional information broadcast from the GPS satellites to tell blind people their position in relation to a pre-programmed software street plan.

The £4,000 system will also prepare a "best route" for the user. The route software is loaded into the mobile terminal which is carried in a backpack and minute-by-minute positional information is relayed to the user through a headset. (Source: *Electronics Weekly*, 12 June 1996)

Polymers detect document forgery

Scientists in the US believe they have come up with a cheap system for security tagging documents such as credit cards.

Forging and counterfeiting valuable documents are becoming increasingly simple as technology advances. Current security techniques, such as the embossed hologram on credit cards, are no longer reliable because they can be copied, according to Nasser Peyghambarian of the University of Arizona and the Center for Advanced Multifunctional Polymers.

Peyghambarian and his colleague Braham Javidi at the University of Connecticut have developed a device that hinges on a polymer composite which is photorefractive. This means that its refractive index changes through interaction with light. The polymer can record and retrieve optical information when an electric field is applied.

In Peyghambarian's system, a credit card would be labelled with a phase mask, optical elements that hold information coded as the varying intensities of transmitted or reflected light. For approval by the checking system, the pattern held on this mask would have to match a mask used by the security system.

The device works by comparing the light intensities transmitted through the two patterns—one on the credit card and one in the checking system—that are encoded by the refractive index changes in the polymer. If the patterns match, the device produces a sharp peak. No peak means a counterfeit document.

Phase masks are difficult to forge and are practically invisible—they can be a few square millimetres in size, says Peyghambarian. And they can be permanently attached.

Scientists have proposed using phase masks for security applications before, but the cost of expensive components, such as spatial light modulators and high-speed computers, has prevented their commercial development, explains Peyghambarian. Using photorefractive polymers with phase masks makes this system unique, he adds. "All the elements can be made in plastic with no need for expensive elements, making our system suitable for commercialization".

The Arizona researchers claim that their system would be useful for many applications. It is small, compact, relatively cheap to make and its operating wavelengths are compatible with those of commercial low-power semiconductor laser diodes, they point out. It is also fast because the processing is done optically and in parallel. What is more, the stored pattern can be easily erased and a new one rewritten. (Source: *Chemistry & Industry*, 16 September 1996)

Photochemical pattern etching on silicon carbide

Professor M. Murahara of Tokai University Electrical Engineering Department has developed a photochemical pattern etching technique for silicon carbide using a KrF laser and an Xe_2 excimer lamp.

Silicon carbide has properties such as high melting point (2,830° C), wide band gap (2.2 eV for b-SiC) and high resistance to vacuum ultraviolet light and X-ray radiation, so is a promising electrical device for etching to form circuit patterns. Silicon carbide also has high refractivity in the soft X-ray range. Moreover, SR light is refracted with an etched grating pattern. However, silicon carbide is extremely difficult to etch, as it is very hard and inert. Diamond cutting and thermal etching by ablation method are common, but entail manufacturing problems. This direct drawing method is very difficult to use to etch patterns.

The resistless pattern etching was studied in which the silicon carbide surface is selectively irradiated by excimer laser light to induce chemical reaction. The surface is placed in an NF_3 gas atmosphere irradiated by a Xe_2 excimer lamp light in parallel, and the circuit pattern is projected with KrF laser light of 248 nm normal to the sample surface. The lamp light decomposes the NF_3 gas, and the laser light excites the sample surface. Photochemical etching is detected by SEM, XPS, QMS and FTIR measurement. The area vertically irradiated was exclusively etched. An etching depth of 180 nm and a line width of 1 μm were achieved.

Further details from Tokai University, Faculty of Engineering, 111, Kitakaname, Hiratsuka City, Kanagawa Pref. 259-12. Tel.: +81-463-58-1211; Fax: +81-463-58-1812. (Source: *JETRO*, June 1996)

High-dielectric-constant barium-strontium titanate for Gbit-DRAM mass production

NEC Corp. has developed a high-dielectric-constant barium-strontium titanate (BST) material for use as a capacitor dielectric film for Gbit DRAMs that can be used in existing mass production lines. Experimental evaluation of influences of barium and strontium in the material as

silicon impurities has been conducted, but it has been confirmed that these elements do not deteriorate the minority carrier lifetimes, even when diffused into silicon wafers; it can therefore be used in existing lines without fear of device deterioration.

Thin films of BST feature dielectric constants, approximately 50 times those of silicon nitride films, which are currently used for Mbit DRAMS, rendering BST the most promising material as the capacitor dielectric for Gbit DRAMs.

During the subsequent experiments, to diffuse the elements into silicon excessively and exaggerate their influence, silicon wafers were directly spin coated with barium and strontium solutions and annealed at 950° C for four hours, isolated from the severe situations of DRAM processes. It was confirmed that the lifetimes of the minority carriers in both P- and N-type silicon wafers do not deteriorate, even when the impurity concentrations formed during annealing surpass the realistic range of metallic contamination in LSIs. In addition, investigation of depthwise distributions showed that these impurities have very small diffusivities in silicon, remaining in the vicinity of the surfaces of the oxide films. Large portions of these elements were confirmed to form oxides without electric charges and not to form deep levels that could cause device operation failure.

Further details from NEC Corporation, Public Relations Div., 5-7-1, Shiba, Minato-ku, Tokyo 108-01. Tel.: +81-3-3798-6511; Fax: +81-3-3457-7249 (Source: *JETRO*, August 1996)

Rapid prototyping products

Ciba, with its industry partner 3D Systems, offers a complete range of prototyping materials including complementary stereolithography techniques. The Ureol rapid prototyping products are low-viscosity, two-component, fast-curing polyurethane systems that can produce parts in minutes and with the qualities of high-impact resistance that this technique requires.

Ureol 5145A/5145B gels in 45 seconds and can be demoulded in around 15 minutes. It is formulated for castings with maximum wall thicknesses of 5 mm which will have thermoplastic-like qualities when produced.

Ureol 5145A/5167B has similar gelling and de-moulding qualities and produces castings, which in addition to excellent mechanical properties, have a high thermal distortion resistance up to 130° C.

Other products in the range are pigmentable, and overall these rapid prototyping grades cover applications in major industries such as automotive, electronics, photographic and domestic appliances.

Further details from Ciba Polymers, Cambridge, UK. (Source: *Rapid News*, Vol. 4, No. 4, 1996)

An electric vehicle for today

While electrically propelled automobiles are charging along technologically at an admirable pace, they are not quite ready for prime time. Bicycles, however, with their much higher ratio of payload-to-vehicle weight, are another story. They are fairly inexpensive and can play a practical role in many situations.

An excellent case in point is the ElectriCruizer from Zap Power Systems, Sebastopol, CA. It may be propelled by pedalling in the usual way, or by a pair of electric motors, or by a combination of the two. When powered by its 600 W motor pair, the bike will run at about 25 km/h over flat terrain.

As offered today, with a standard 200 Wh lead-acid battery, the ElectriCruizer's all-electric range is 15-30 km, depending on such factors as wind, terrain, and the rider's weight. With a larger, higher-density battery, which should be available in the not-too-distant future, the range can be as high as 70 km.

Regenerative braking extends the bicycle's range by charging the battery on downhill runs. When used with a bicycle stand, it can in addition be exploited to let the ElectriCruizer act as a combination stationary exercise bike and battery charger.

The ElectriCruizer is being peddled by The Sharper Image through its stores and mail-order catalogue for $995. Electric propulsion is also offered as an add-on kit for existing bicycles for $495. The kit weighs 10 kg. It consists of a motor assembly that mounts on the bicycle frame and drives the rear wheel through a friction drive; a sealed lead-acid battery; a battery case; control and charging circuitry, which is housed in the battery case; a momentary-contact switch that mounts on the handlebar; and cabling.

Contact: Zap Power Systems, 117 Morris St., Sebastopol, CA 95472; 707-824-4150; Fax: 707-824-4159; e-mail: zap@nbn.com (Source: *IEEE Spectrum*, July 1996)

Semiconductor fingerprint sensor

A direct-reading semiconductor fingerprint sensor named FingerLoc is currently under development by Harris Corp., according to Karl McCalley, AuthenTec Div., (Melbourne, FL) and associates. As described on the AuthenTec Web page, a direct-sensing electronic fingerprint reader can satisfy the need for a small, inexpensive, reliable and easy-to-use sensor for personal electronic identification. Since the sensor can be placed anywhere that a button or switch may be placed, potential applications include PC user verification, door-locks, point-of-sale terminals, smart cards and TV set-top cable access units. An electric field fingerprint sensor requires no critical alignment of components, no focusing of lenses, and has no moving parts.

According to McCalley, an electric field can be used to determine the shape of the ridges and valleys of a fingerprint. Electric fields form in the regions surrounding any accumulation or movement of electric charge. An electric field-sensing system applies a small electric field close to the skin surface through a conductive element called an excitation antenna. The body serves as a ground reference for the field voltages at various points between the excitation antenna and the skin; the voltages reflect the shape and composition of the skin. An array of tiny sensing elements positioned between the skin and the excitation antenna can sense the spatial variations in the field voltages.

Viewed from a circuits perspective, the skin of the subject acts as one plate of a capacitor. An array of sensors between the skin and the excitation antenna sense variations in the field due to the varying distances to the ridges and valleys of a fingerprint. The elements of this kind of system can be fabricated at the necessary scale on a silicon chip by using typical semiconductor manufacturing processes.

A human finger is rather hostile when viewed by a naked semiconductor chip. Electrostatic discharge, salt from sweat, and physical wear are potentially lethal to a semiconductor sensing chip. Experience with existing live scan devices has shown a wide variety of temporary skin conditions and sensing artifacts that can affect the sensed

image, and confuse the subsequent steps of ridge detection and minutia extraction.

Within Harris' sensor, antenna structures and electronic circuitry for the electric field-generating and sensing elements control and focus the sensing region of each sensing element to overcome the effects of sensor fringing and parasitic capacitances. The sensor develops clean ridge images from very dry, cracked, worn or otherwise damaged fingers that are difficult to image effectively using optical techniques.

A fingerprint sensor is typically exposed to human sweat, various other contaminants, and various cleaning and disinfecting agents. Sodium ions are particularly destructive to silicon integrated circuits; they migrate through silicon, leaving a trail of damage through the semiconductor crystal lattice. A special surface coating is under development to protect the chip from these kinds of chemicals.

The cost of the fingerprint sensor is expected to be roughly an order of magnitude less than existing live scan products. (Reprinted with permission from *Semiconductor International Magazine*, August 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Smaller, most reliable LEDS—and brighter, too

Not satisfied with the reliability and cost of existing LEDs, Hewlett-Packard Co. has come up with a better way to make them. In testing, diodes made with the new process have already passed 1,000 temperature cycles and 1,000 hours of power temperature cycling without failure, and they are still going.

HP researchers eliminated the weakest component, the bonding wire, by developing a unique manufacturing process in which a very small diode chip is laid on it side, instead of standing up straight as in most LEDs, and soldered to both the cathode and anode contacts without the wire.

Laying the diode on its side and eliminating the wire also means that the overall height of the package can be about half that of other LEDs—0.6 mm as opposed to 1.1 mm. This means that an electronic system with LEDs—a modem, say—can come in a package no thicker than a credit card. The flip-chip devices come in four colours—orange, yellow, green and red—whose typical luminous intensities range from four to nine millicandellas (Mcd) at 20 mA.

If high brightness is mandated, another new HP series—SunPower LEDs—may be of interest. More conventionally constructed, with a wire bond, they are made of aluminium indium gallium phosphide, a material that provides a very high luminous intensity. Their amber, orange, or reddish-orange light has typical luminous intensities of 50-65 mcd. Thus a designer can use just four LEDs for a job that in the past would have needed 12 gallium phosphide diodes. This is doubly beneficial, particularly in a portable application for, possibly, backlighting a liquid-crystal display, since both power consumption and parts count, not to mention weight, are reduced by a factor of three.

Further details from Hewlett-Packard Co., Inquiries, Box 58059, Santa Clara, CA 95052-8059; Tel.: 800-537-7715, ext. 1777; Web: http://www.hp.com. (Source: *IEEE Spectrum*, July 1996)

Miniature telephone

A wristwatch phone weighing just 70 grams has been developed by Nippon Telegraph and Telephone (NTT) in Japan. The prototype personal handyphone system (PHS) is said to weigh 20 per cent less and be 50 per cent more compact than existing handsets.

This level of miniaturization is achieved through the use of voice recognition for dialling, removing the need for a keypad. The voice recognition software is located in the base unit, reducing the PHS's software requirements.

Users can either say a number or a previously recorded name. The system transforms the instruction into a telephone number.

The cordless phone uses a built-in microphone and loudspeaker, with the option of an earpiece.

Because the software features are located in a dedicated base unit, the current system cannot communicate with a standard PHS basestation. NTT predicts that by the end of 1997, these functions will be placed in a low-power LSI device inside the phone. The wristwatch unit will then be used like a standard PHS system. (Source: *Electronics Weekly*, 3 July 1996)

64-bit SPARC computing solution

The Fujitsu HALstation 300 series combines a 64-bit SPARC V9 architecture with a fully Solaris-compatible 64-bit operating system, and offers capabilities that are usually only found on mainframe systems.

Designed for current technical workstation users requiring greater power, such as CAD/CAM, electronic design automation, mechanical computer-aided engineering, and software analysis users, the manufacturer claims that existing 32-bit Solaris applications will run faster unmodified on the HALstation, and recompiled with the SPARC V9, will run faster still. Fujitsu states that this increased speed will make the difference between being first to market or being one of the also-rans. In addition to increased speed, the 64-bit power also allows users to tackle larger, more complex tasks in their entirety, without dividing them into smaller components, with improved accuracy and precision.

This new generation of uniprocessor workstations is also able to offer guaranteed binary compatibility. The base model HALstation 330 with a 100 MHz CPU delivers 181 SPECint92 and 230 SPECfp92 ratings, with a base configuration of 2 GB disk storage, 64 MB, 4SBUS slots, keyboard, mouse and 17-inch colour monitor. The HALstation 350 with a 118 MHz CPU delivers 212 SPECint92 and 271 SPECfp92 ratings with a base configuration of 2 GB disk storage, 64 MB RAM, 4SBUS, keyboard, mouse and 20-inch colour monitor.

In addition, several leading vendors of SPARC-based software can offer new versions of their applications optimized to run on the HALstations', these include PV-Wave (Visual Numerics), Verity Toolkit (Systems Science), LS-DYNA3D (Livermore Software Technical Corp.), UAI/NASTRAN (Universal Analytics), CSA NASTRAN (Computerized Structural Analysis and Research), ADM (Anagram Design Solutions, Inc.), GARDS II (Silicon Valley Research), and Ansys (Ansys Inc.)

The HALstation hardware supports all internationally accepted software interface standards, and all major open systems standards for networking and interoperability, to fit seamlessly with existing IT infrastructures.

Further details from Fujitsu ICL Computers Ltd. Bracknell, UK. (Source: *Rapid News*, Vol. 4, No. 4, 1996)

The fax connections

The year has seen rapid growth in the market for fax machines connected to PCs or networks, but the move to plain paper technology has also encouraged upgrade in both

memory and modem speed. The move to plain paper looks obvious, except that the engine alternatives of laser, ink-film, LED or inkjet can still deliver vastly different costs of ownership, depending on the amount of inward traffic and therefore how many pages are to be printed out. It is the aspect of running costs which has exercised the attention of the Pitney Bowes fax group, whose products are now all plain paper laser engined devices but more importantly also use the 14.4 modem for fast, sending of faxes.

Against this background ITU, which governs fax regulations have just approved the use of the faster 28.8 modem on PSTN lines. The first fax machine with a 28.8 Kps modem was shown by Jetfax at Cebit and is now available in the UK with the even faster 33.6 Kps modem. This unusual machine can provide the user with simultaneous output and input on two 14.4 Kps ports being connected to two telephone lines. Sending a long report from memory need not therefore impede another user awaiting the arrival of an urgent fax.

The increasing importance of fax software can also be seen in the market sector where two or three suppliers dominate but whose products are essential to provision of extra facilities such as those required by the multi-functional product. For example, Winfax Lite is used by Toshiba with the TF461 multifunctional fax system which also makes use of the Toshiba colour inkjet printer. (Source: *Business Equipment Digest*, August 1996)

Holographic storage becomes practical

Holographic data storage units that boast at least a 1 terabyte (TB) data storage capacity and a 1 gigabit per second transfer rate are being developed by a consortium of US industry, university and government entities. Like many other projects to develop three dimensional data storage systems, these holographic storage systems use lasers to imprint the data on media. Unlike other three-dimensional storage methods, however, a holographic storage page contains more than one million data bits.

These holographic storage systems are being designed to compete with CDs for storing massive databases. Currently, one commercial CD stores about 650 MB of data. In contrast, holographic storage offers about a TB of storage in one cubic centimetre. If their potential is realized, holographic storage systems could replace CD-based jukebox systems that currently store our largest databases.

There are three major integrators involved with the project, and each has significantly different applications. For example, Rockwell is targeting avionics for in-flight information systems, IBM is focusing upon data storage and retrieval, while GTE and Optitek are concentrating upon image-based services and systems, such as video-on-demand, medical databases and digital motion pictures.

The consortium expects to have a write-once-read-many (WORM) system ready to demonstrate by the end of the third quarter of 1997 and, one year later, an erasible holographic demonstration storage system. Commercialization of individual models will probably take an additional two or three years. (Source: *Inform (AIIM)*, July 1996)

ISD chip answers mobile phones

Information Storage Devices (ISD), the specialist analog storage company, has introduced a chip which can store four minutes of speech for adding answer-phone functions or for recording telephone conversations to mobile phones.

The chip does not need A/D or D/A—since it stores analog wavelengths directly on the chip. All an ISD chip needs is a microphone and a speaker. Storage is non-volatile and does not require a battery. That means the four-minute chip is likely to be used in voice organizers, voice pagers, tapeless pocket recorders, PDAs and portable instruments.

ISD is now preparing a 30-minute chip based on single transistor cell flash technology. So far it has used two transistor cell E^2. It can store 30 minutes on 7.2 m flash transistors—well within the capability of flash technology. (Source: *Electronics Weekly*, 28 August 1996)

Micron combats terrorism with ID chip

In an effort to combat terrorism, Micron Technology has introduced a new chip designed to be used as an identification device on shipping containers or luggage. Dubbed MicroStamp, the postage stamp-sized chip includes radio telemetry, processing and memory functions. The emitted signal can be detected within a range of three metres by an electronic scanner. Along with replacing bar codes, the company believes that the chip can be used to help combat terrorism through its ability to track packages throughout their journey. Sources state that Micron has been awarded a research contract by the Federal Aviation Administration involving the use of MicroStamp in the development of a luggage security system. (Source: *Electronics Weekly*, 14 August 1996)

FibreGuard takes on PC thieves

Computer thieves in the UK will soon have to overcome a new weapon in the armoury of those PC owners who want to hold on to their machines.

FibreGuard is a Swedish invention that makes use of optical fibres and coded light signals to protect valuable components contained within computers. The cable is looped within the chassis of a PC, threaded through the components and connected to an alarm system. If the cable is broken, the alarm is triggered. (Extracted from *Electronics Weekly*, 28 August 1996)

Controlling paperwork at the United Nations

A document management system has been developed for the United Nations that consists of over 800 seats, using Digital Equipment's Alpha 7000 servers, an ATG Cygnet optical jukebox, Fujitsu scanners and IBM compatible PCs as client workstations equipped with HP LaserJet compatible printers. Documents are entered into the system either by scanning in a centralized location or text file input directly into the system at workstations throughout United Nations Headquarters in New York and Geneva. If a document is created at a workstation, it is archived directly to an optical disc over the LAN, before it is printed. Maps and letters that must be annexed to documents are entered directly into the system using scanners.

There is a trend towards increased document usage, with retrievals up to 3,000 per day in New York. Despite increasing usage, the only potential bottleneck in retrieval is on the jukebox. In total, the jukebox is capable of 16 simultaneous retrievals, with a three- or four-second retrieval time to the desktop. If the system received simultaneous requests for 48 retrievals, the last person in line would have to wait only about 30 seconds for the document to appear on the computer screen, a fraction of the time it would take to walk to the basement.

In the coming months, new capabilities to be added include full text search and additional print on demand stations. By the end of the year, Internet users will be able to access the system directly through the United Nations Web page. These documents will be available in Adobe Acrobat format. (Source: *Inform (AIIM)*, July 1996)

Rimage's Perfect Image CD Printer

Rimage Corporation of Minneapolis, MN, has developed the Perfect Image CD Printer which adapts thermal transfer technology for CD-R labelling. At a cost of $3,995, the Perfect Image CD Printer offers good quality monochrome 300 x 300 dpi results over a wide range of disk surfaces. The currently available versions of the printer driver and label software are for PC-compatible systems. Advantages of the Perfect Image CD Printer are that it does not require specially coated CD-R disks and it works well with a number of different surfaces. Disk labelling is achieved by pressing a stationary print head containing small heating elements against a travelling ribbon which contacts the disk surface. It is concluded that the equipment does an excellent job for the labelling applications for which the equipment is intended. Disappointing aspects of the Perfect Image package is its mediocre software. Printer drivers for Windows 3.x and 95 are included, together with a proprietary labelling application.

While it functions well as a stand-alone system, it could be most useful when integrated with an automated recording solution. There are currently three different implementations of the printer. Revelation Products Corporation of Valley Forge, PA, have integrated the printer with their K&S CDJ-M200 CD-ROM jukebox. The Rimage Perfect Image Producers RP-1 (announced May 1996 and expected later in the year) combines disk recording, handling and surface printing capabilities into a single automated system. Already available from Rimage is the Perfect Image CD-R Automated Publishing System (APS).

Compared with other printing solutions, the Perfect Image offers faster printing speeds with no drying time; lower media and per-unit printing costs; and greater label durability. However, its capital cost, noisy operation, need for friendlier software, and lack of true colour capability make it a specialized product for those whose needs match what it can offer and who can justify the expense. (Source: *CD-ROM Professional*, 9(9) September 1996)

Fax gains power

The development of the multifunctional equipment based on the fax machine as the core resource has brought new growth to a well-established sector. The new Canon UK MPC30 is a multi-functional PC peripheral which offers round-the-clock fax facilities together with colour printing, black and white scanning and fax-based copying. Priced at £700, it is claimed that this is half the price of maintaining separate comparable products. The MCP30 is based on the Canon Bubble Jet 4100 colour printer and is also a popular printer for either black and white, or full-colour documents. Cost-saving features are an Inksaver mode which almost doubles the number of pages obtained from the ink cartridge. It prints 4.5 pages a minute at 360 dpi and has an hour's back-up memory.

Another new machine is Muratec's M3700, priced at £449 and based on ink-film imaging technology. It has the benefits of low capital cost with low per-page cost and the output is on bond paper. The machine has a built-in PC interface so it can be used as a printer and is compatible with most fax software. An unusual feature is the inclusion of a fax scrambler for confidential material. (Source: *Business Equipment Digest*, September 1996)

Securing e-commerce

In a significant advance for the security of electronic commerce, VeriSign Inc. has published the first comprehensive document that establishes a legal infrastructure and the operating metrics for transactions between two parties via the Internet. The company focuses exclusively on digital authentication services and has been working with companies such as Netscape, Microsoft, America Online and Visa, to set standards for Internet-based transactions. In effect, VeriSign will serve as a Certifying Authority (CA)—a trusted third party that issues digital IDs to companies and individuals. Experts see the document, known as a Certification Practice Statement, as a milestone for e-commerce that other CAs will draw from. The document may be viewed at http://www.verisign.com/repository/ CPS. (Source: *Industry Week*, 2 September 1996)

High-temperature superconductor applications

Scientists at DuPont say they have demonstrated the first chemical processing application for high-temperature superconducting (HTS) magnets. DuPont says the work, which uses a HTS magnet to separate mineral contaminants from kaolin, points to the feasibility of a range of HTS applications in industrial processing, including those involving polymerization.

DuPont's success comes after 10 years of work to commercialize high-temperature superconductors. While superconductors have lost much of their lustre since the late 1980s, the company says it is still positive on their prospects. (Extracted from *Chemical Week*, 7 August 1996)

Hoechst develops ferroelectrical liquid crystal

After improvements in television screens, computer monitors are also to become flatter and better. This development is to be helped along by Felix, a ferroelectrical liquid crystal developed by Hoechst AG of Germany. It makes it possible to produce high-resolution flicker-free flat screens of practically any size. As a result, a 20-inch monitor could eventually only require as much space as a large world atlas. Felix was conceived by New Business Development, a group within Hoechst's globally organized Corporate Research Division, in collaboration with Hoechst Japan. (Source: *Deutschland*, No. 5, 1996)

Revolution in optical data processing

First predicted 10 years ago, it has now become a reality: researchers working at Siemens AG have been able to develop an optical semiconductor for the first time. The device makes it possible to construct minute optical cables and extremely sensitive switches for optical systems. This could eventually mean that a television station will no longer have to convert images and films into electrical signals, but will be able to transmit them directly to the receiver by optical means. The minute channels of this revolutionary semiconductor have a diameter only a thirtieth the thickness of human hair. (Source: *Deutschland*, No. 5, 1996)

F. SOFTWARE

Selecting optical storage

Probably the most common storage technology that many offices currently use is CD-ROM, especially in the area of applications software and reference libraries for images. But the question remains "what can these new technologies actually provide in addition to simply distributing application software?". The different approaches need to be addressed to fully appreciate what a particular subset of optical storage will actually deliver, not what the vendor promises.

The most important area to explore is how to increase the secondary storage issue so that client data which is inactive can be moved to a more economical medium, thereby freeing valuable primary hard disk storage. The first essential is to try and adopt a medium that is a "computer peripheral" type of product. This generally excludes Recordable CDs and leaves either magneto-optical (MO) or phase-change optical drives as the obvious choices. These drives behave in much the same way as a conventional storage peripheral with data sectors being addressable individually for both reading and writing. The main difference is that MO drives require two revolutions of the disk to rewrite data, whereas phase-change rewrites in a single pass. Compact Disk Recordable (CD-R) has some excellent characteristics, which makes it suitable as a companion product for existing storage solutions once the technical limitations are really understood. Data can only be recorded in "sessions" where the data must be kept flowing to the drive at a constant rate. Any interruption in this data flow will cause errors and render the disk unusable. Also, the medium is unprotected and as such is susceptible to handling issues. (Source: *Document World*, September/October 1996)

Machine translation tools can save money

A mantra that international organizations are constantly chanting is "think globally, act locally". However, for large corporations the total costs of translating can come to several million dollars a year. The problem is especially acute for European corporations which usually provide documents in at least three or four of the European Union's nine official languages. Companies are looking for sophisticated, multilingual translation tools that can reduce costs. Linguists and computer scientists have been working on machine translation techniques for decades. Perfect translation without human intervention is still a dream, but there are products that can now deduce subtle contextual language differences. However, even the most sophisticated systems are far from automatic, but they do provide useful support tools for professional human translators.

Globalink's new generation (Barcelona) allows translators to include their own rules of how words should be translated in a certain context. Logos' Semantha lets users fine-tune the translation process with an expandable context-sensitive dictionary. Rank Xerox Research Centre (RXRC) in Grenoble, France, has a Terminology Extraction Project which aims to facilitate the building of dictionaries, and works in Dutch, English, German, French, Italian, Spanish and Portuguese. This project is part of Xerox Lexical Development Architecture (XeLDA), a translation framework with tools that can detect phrases. RXRC is planning to make services available in corporate LAN environments or over the Internet.

A more casual market for translation tools is emerging as there is a need for quick multilingual information scanning. New products in this area are being offered by a number of companies in Europe. Another force driving translation technology is on-line chat and communication in newsgroups. Multilingual translation is also reaching the World Wide Web. (Source: *Byte*, October 1996)

Data encryption issues

The development of large-scale electronic commerce urgently requires a reliable mechanism for verifying identities, creating audit trails for transactions, and for ensuring that contracts are honoured. For most businesses, these issues are of far more concern than those of privacy on the Net.

Encryption technology, however, may offer some sort of solution. If everyone entrusted their "digital signature" and private key encryption algorithms to a third party, it would be possible for that organization to monitor transactions and verify that those involved were who they claimed to be. Such key-holding agencies are referred to as trusted third parties (TTPs). VeriSign is already offering such a facility in California, and the first independent UK TTP will probably be established next year.

The question then arises of how TTPs should be regulated. Some favour self-regulation, or accreditation by an independent, private organization, but the UK Government, for example, is keen to establish some form of administrative framework to oversee their operation.

Major issues such as legal liability remain unresolved. Further problems arise from the politics associated with encryption: governments fear the use of encryption by terrorists and criminals to hide their activities. As a result, they are offering to license TTPs and permit the use of encryption across national borders only if they are given access to the keys and signatures. Some fear that this will deter potential users, although others believe that government access to commercial transactions will be largely irrelevant. (Source: *Computing*, 29 August 1996)

Inferno

Java has sparked so much response from industries of all kinds in the last year that almost any word associated with coffee—espresso, latte, coffee grinder—has been copyrighted by software developers. So Lucent Technologies Inc., the Murray Hill, NJ, spin-off of AT&T's systems and technologies divisions and Bell Labs, came up with Inferno.

While both Java and Inferno look to make distributing applications easier, there are significant differences between them, most notably that Java is a language and Inferno is a complete software system. Inferno consists of:

- Limbo, a programming language.
- Dis, a virtual machine program to run Limbo applications.
- Styx, a set of communication protocols.
- The Inferno kernel operating system.

The Inferno crew, with help from Dennis Richie and Ken Thompson who originated C and Unix, do not see the two as being mutually exclusive; in fact, they say that Inferno will support programming languages other than Limbo, most notably Java.

Limbo and Java both use C-like syntax, compile to a virtual machine that can be interpreted or compiled on the fly for portable execution, use garbage collection to manage memory, and support the Unicode character set.

But Java, derived from C++, uses the object model to provide interfaces to system services. Limbo avoids the object-oriented features of C++, adding more basic data types (lists, strings, tuples) and programming concepts (threads and communication channels).

The complete Inferno system addresses the need for security and authentication. These functions are difficult to handle in a language alone, as recent reports of "rogue" Java applets that can harm systems make clear. (It should be noted that Web security is also being worked on by the W3 Consortium, and others, seeking a secure hypertext transport protocol, or S-HTTP, to underlie the transfer of data on the Web.) Moreover, Inferno was created so that it could be used to manage the network and its elements, not just the client application. (Source: *IEEE Spectrum*, July 1996)

Subject guides to the Internet: where will they end?

There are a large number of subject guides—created by robot search engines—to the contents of the Web. They range from simple lists of somebody's favourite sites to evaluated, organized directories of Web resources.

The longest-established and best known of the general indexes is *Yahoo!*, which lists over 200,000 sites under 14 top-level categories. Similar in nature and layout, but less comprehensive, are Tradewave's *Galaxy* and *GNN Select* (formerly the *Whole Internet Catalog*).

Several libraries have attempted to produce more ordered lists. The UK's BUBL project uses the Universal Decimal Classifications, while the University of Iowa's *CyberStacks* employs the Library of Congress system. OCLC is trying to catalogue resources by creating MARC records.

Some lists attempt to produce reviews and rankings of sites: examples include *Magellan* and the *Lycos A2Z* site. (Source: *NFAIS Newsletter*, 38(7), July 1996)

Searching the Net for business information

The *Netscape Navigator* browser offers two buttons which represent useful starting points when searching for information on the Web: *Net Directory* and *Net Search*. These give access to filtering and indexing tools such as *Yahoo!*, and search robots, respectively. For specialized searches, it may be necessary to go deeper, and interrogate the full-text archives of the information providers themselves, using Boolean searches rather than the less effective natural language equivalents.

Finding resource guides is not always easy, but a good place to start is the Clearinghouse for Subject-Oriented Internet Resource Guides (*www.lib.umic.edu/chhome.html*) maintained by the University of Michigan. One way of adding to a personal list of resources is to subscribe to relevant newsletters. The list can be maintained using version 2.0 of *Netscape*, perhaps with the addition of plug-ins such as *Web Arranger* or *Smart Marks*.

Personalized filters are increasingly being offered by publishers. Examples include that found on ZDNet, IBM's *InfoSage* and Stanford Netnews Filtering Service (*woodstock.stanford.edu:2000*). It is also worthwhile regularly checking the *Directory of Internet-Accessible Information Filtering Resources (www.wam.umd.edu/oard.Welcome.html)*. Software such as *Milktruck* and *Surfwatch* can be programmed to visit specified sites at regular intervals. "Active agents" are also under development. (Source: *Business Information Review*, 13(2), June 1996)

Information sources

The Net now allows us to access information from sources around the world and this competition will surely bring prices down. There are some curious anomalies that highlight how shopping around is still the best policy on the Net, just as it is in the high street.

Take Medline. It is the world's largest biomedical database, with over 7.5 million references to articles from 4,000 journals. Accessing it and some other medical databases through CompuServe costs between £12 and £16 per hour. Yet you can also get Medline through Healthworks Online on the Web (*http://www.healthworks.co.uk/*) for £35 per month. But for any American readers (or anyone who can convincingly pretend that they and their computer are in America), there is an even better deal at Healthgate (*http://www.healthgate.com*), where you can get Medline free thanks to commercial sponsorship.

For several years, the Library of Congress (*http://www.loc.gov*) has offered the ability to search its catalogues for free. These include some 27 million books alone. The British Library's Net scheme, on the other hand, has only just launched on the Web (*http://blaiseweb.bl.uk*). However, Blaiseweb is an extension of a commercial service, and costs an arm and a leg. To access it you have to pay an annual fee of £59 plus £8 per hour and 30 pence per record retrieved, or a flat rate of £478. You can use the same interface to access several other databases through Blaiseweb (including the Library of Congress catalogue) but you cannot search across several databases because they are all in different formats.

Academics on JANET can access the British Library's catalogue for free using a different system called the Network OPAC (*http://portico.bl.uk/access/network-opac.html*), which has so far been installed at 200 sites in the UK. It also uses the Net but provides a custom interface and requires Windows. Eventually, public libraries will be given access to this system as well, but since its expansion depends on government funding, this could be years away. (Source: *New Scientist*, 1 June 1996)

Web sites

When the Web was first used by scientists at CERN, the European Laboratory for Particle Physics, where it was developed, they found it invaluable for sharing information about their work with their peers. Since those early days, the Web has evolved into an open medium used by people throughout the world in every walk of life, primarily for getting news and being entertained.

While the Web's use in these ways (and new ones, like on-line shopping) will undoubtedly grow, businesses

are realizing that the Web has another, extremely valuable application more similar to its original one. Companies now see that using Internet and Web technology to conduct their business in private, over a so-called Intranet, can help employees share corporate information more efficiently. Concert, British Telecommunications PLC's and MCI Communications' joint venture will invest US$ 100 million this year to build at least eight new Internet hubs, which it calls superhubs, in Australia, Germany, Japan, the Netherlands, the UK, and the United States. In Europe, the speed of the new backbones—the primary data lines between major Internet sites—would be 45 Mb/s, while those in the United States would carry 155 Mb/s. Overall, the company estimates that international capacity would be boosted by 30 per cent. (Source: *IEEE Spectrum*, July 1996)

Multimedia functions in software

Custom hardware is normally needed to execute multimedia tasks. For processing audio, graphics and especially video, the specialist hardware is required because the computation is usually beyond the capabilities of general purpose CPUs.

Despite this, considerable development effort is being made to execute multimedia tasks purely in software, recognizing the advances being made in processor performance.

Hewlett-Packard, Sun, Intel and Digital are all in various stages of developing instruction set extensions to their microprocessors to enhance the execution of multimedia functions in software.

The benefits of a software-only implementation include flexibility, widespread usage and, most importantly, low cost. Performance is automatically upgraded with each generation of processor.

A team at Bath University aims to exploit such benefits by developing a real-time software-based video encoder.

As with the JPEG and MPEG video coding standards, the coder uses the discrete cosine transform (DCT) to encode image blocks. Unlike JPEG and MPEG, however, it can also use a fractal-based encoder or even a hybrid fractal/DCT.

The Bath encoder is not confined to operating on fixed-sized image blocks, using a hierarchical blocking scheme instead.

Its main difference compared with MPEG is that it does not use motion compensation. Motion compensation predicts the movement of objects between images to exploit the commonality between adjacent frames, and requires searching many pixels.

The group at Bath is concentrating on applications more suited to the encoder's characteristics, such as surveillance and videoconferencing.

With the encoder, seven days' surveillance information can be stored on a 1 Gbyte disk.

The group has been working with Vision, the Edinburgh digital camera-on-a-chip firm, to use the video coder in Vision's camera.

For desktop videoconferencing, the video encoder can process 160 by 128 pixel full colour images at four frames a second on a 100 MHz Pentium-class machine. This translates to 20 frame/s when running on a Silicon Graphics' Indy workstation.

The Bath group is also working with SGS-Thomson as part of a framework IV Esprit programme to develop tools and algorithms for advanced multimedia applications. (Extracted from *Electronics Weekly*, 31 July 1996)

Doubts about Java as OS fails to impress

Although Sun's *Java* is being adopted by virtually everybody in the online world, so far it has been grafted on top of the *Windows* or *Macintosh* environments. If the network computer is ever to prove viable, however, it will need a leaner, simpler operating system (OS). That OS, perhaps, might be *JavaOS*.

JavaOS is a minimal OS which will run *Java* and nothing else, ideally (from Sun's viewpoint) on one of the company's *Java*-specific chips. It is claimed that it will run using 4 Mb of ROM and 4 Mb of RAM.

Effectively, however, it is an interpreted OS, which although it has discarded the machine-specific mappings and general overhead of its rivals, is likely to be slow in operation. Success might be a matter of waiting for processor performance to improve yet further to offset this shortcoming. (Source: *PC Magazine*, September 1996)

Managing a large CD-ROM network

This describes the implementation of a CD-ROM network at the University of Vienna. The first version of the network used NETBIOS as its networking protocol, but the latest version is based on Ultra Net, which uses the TCP/IP protocol and Windows NT as the operating system for the server. The network is based on a DEC Alpha 300 MHz server running under Windows NT with 64 MB of RAM, one 4 Gbyte internal hard disk drive, an internal CD-ROM drive, and 18 external 10 Gbyte hard disk drives. It also features seven 6-speed CD-ROM drives, which are used for caching purposes.

By mid-June 1996, there were 918 registered users of the network, an increase of 42 per cent since the end of 1995. The whole target group, University of Vienna academic staff with PC equipment and network access, can be estimated to consist of between 3,000 and 4,000 users. Of the 918 registered users, 10 are public workstations located in the main library and primarily used by students; however, these make up about one third of the total usage of the system. Public access to the CD-ROM network is also offered in several departmental libraries.

The CD-ROM network generally runs smoothly; however there are a few aspects which need improvement. The system software on the server still shows some instability, while the ability to use Apple and UNIX workstations would be desirable for certain segments of users. On the client side, the use of the system requires familiarity with MS-DOS memory management. (Source: *AVL*, August 1996)

Windows-based financial information project

OneSource's *UK Companies, Volume 1* is a *Windows*-based financial information product, first launched early in 1995. It gives up to 10 years of data on 110,000 private and public companies, supplied by ICC Information. A sister product, *UK Companies, Volume 2*, gives up to five years of information on 250,000 companies. Its most obvious competitor is *FAME for Windows*.

The *Quick Search* and *Quick Reports* features make the database easy to search, while *Full Search* enables very detailed and specific queries to be made. Report options are very flexible (more so than those in *FAME*). There is no graphics facility or statistical analysis software (unlike *FAME*), but data can be exported to Microsoft *Excel* or

Lotus *123* for further analysis. The subscription includes training and unlimited technical support. (Source: *Online/CD-ROM Business Information*, July/August 1996)

Software reads, digests then summarizes text

British Telecom's (BT) research centre at Martlesham (UK) has developed a text-summarizing program that can reduce pages of text into paragraphs, or sentences. The program, called "Netsumm", is currently being trialled on the Internet, but BT plans a stand-alone version, for use with Microsoft Windows.

The software has come about because of the modern complaint of information bombardment.

Textual intimidation can be overcome by using Netsumm, which uses statistical methods to summarize a piece of text. The summarizer program accepts any plain-text document and automatically picks out sentences it considers to be the most relevant part of the text.

One application in which BT will use the program is the "Dealing Room of the Future". This exists, at present, only as a prototype and will be demonstrated in the coming months to City dealers to draw out key elements from detailed company reports.

The "Dealing Room" will feature other technologies, including speech-to-text conversion and video-conferencing, as well as improved presentation of market information. The overall aim is to improve the speed and efficiency of City dealers. (Source: *Electronics Weekly*, 26 June 1996)

Web without HTML

A team at Southampton University have developed *Microcosm*, an architecture and supporting software package which offers open hypermedia capabilities. As such, it could transform the Web, releasing users from the present need to employ HTML. *Microcosm* treats links as objects which are managed independently, rather than integrated within individual documents. All links are placed in a "linkbase", which is separate from documents and other information sources, and can be managed using standard database management systems, while the documents are controlled by standard packages. In addition to HTML-like connections, it allows for "generic" and "dynamic" links. The former allow users to move from any point on any document to other information sources, while the latter are generated automatically with the aid of intelligent-agent filters.

Full multimedia capabilities are being developed by the university's *Microcosm* Architecture for Video, Image and Sound (MAVIS) project. (Source: *Computing*, 8 August 1996)

Artificial intelligence agents

Intelligent autonomous agents represent the latest tool for extracting useful information from Web archives. There are growing concerns, however, that such technology could be dangerous, and that agents could get out of control.

One example of such an agent, *AutoNomy*, combines artificial intelligence (AI) techniques, neural networks and fuzzy logic to provide agents that can be "trained" to recognize the type of document required as they roam the Web. They search for patterns of information—rather than specific words or phrases—established by giving them sample patterns from which to work. Some agents come ready trained: the "press agent hound" is designed to access all newspapers and magazines on the Internet, while the "mail agent hound" scrutinizes incoming e-mail to determine which items are worth examining. If the Internet service provider (ISP) offers this facility, it is possible to place the agent on the server, allowing it to continue searching until the owner next logs on.

Some agents go even further. *Firefly*, for example, can communicate with other agents, absorbing preferences in a manner analogous to human "word of mouth" communication. *Kasbah* is a software marketplace, within which agents "negotiate" with each other.

The proposal to place agents on servers, however, alarms some people already concerned about security and rogue applications. The fear is that interactions between agents will cause actual damage to the system. Webmasters at a US Government site have barred agent access, on the grounds that they attempt to download every link encountered, even if this means transferring an entire database. Polite suggestions that some pages are off-limits to agents have been ignored, causing Webmasters to go to the length of creating a page expressly for the purpose of trapping agents. (Source: *Computing*, 1 August 1996)

The embedded Web site

Computer communications with equipment at factories and remote sites has in the past relied on a modem to establish a direct link between the computer and an embedded controller. For applications in which several users may need to access controller information at the same time, a World Wide Web site would make more sense.

For instance, traffic-control personnel, police, firefighters, and local radio and TV station reporters would all like access to video cameras atop traffic lights at major intersections. Linking the cameras to a Web site is the simplest way to make the information available to all who want it.

But constraints on equipment size, location and weight imposed by the intended site often prohibit installing full-fledged Web servers—workstations or PCs. Phar Lap Software is therefore beta testing a way around this problem. The company has developed software that runs on the on-site equipment's embedded controller, and has support built in for corporate intranets, the Internet and the World Wide Web.

The company has built a demonstration Web site around a 386-based computer on a 100 by 100 mm board. Software running on it sends control signals through an RS-232C link to a Weather Wizard III measurement system, from Davis Instruments, Haywood, CA. Anyone may browse what the company claims is the world's smallest Website (http://smallest.pharlap.com) to see what the current temperature, humidity, barometric pressure, and wind speed and direction are at Phar Lap's headquarters, in Cambridge, MA.

Eventually, embedded Web technology (EWT) is to be bundled with the Realtime Edition of Phar Lap's Embedded Tool Suite. In order to create code for the embedded system, the suite links EWT code with other Phar Lap code, as well as with code from existing Windows C++ compilers.

EWT supports the Web's hypertext mark up language (html) and the Internet and Intranet's Transmission Control and Internet protocols (TCP/IP), as well as Ethernet drivers. Software is also available for implementing point-to-point and serial line-interface protocols (PPP and SLIP,

respectively) for linking to a net by modem. So existing point-to-point connections, too, can be upgraded to Web sites. Contact: Phar Lap Software Inc., 60 Aberdeen Ave., Cambridge, MA 02138, Tel.: 617-661-1510. (Source: *IEEE Spectrum*, September 1996)

Ready for business: MT and the Internet

Machine Translation (MT) software is now being integrated with World Wide Web browsers as well as with major Windows word processors. Globalink's translator software is integrated with the latest versions of the popular Netscape Navigator and will translate texts between English as a source or target language and German, Spanish, French and Italian. You click on an icon while browsing the Web and the software abstracts the data from the page, generates a translation and then reassembles text and graphics into the translated page. You need a powerful PC with 16 Mb of RAM running Windows NT or Windows 95. Globalink's Barcelona translation technology enables linguists to play a greater role in MT development without needing expertise in computer programming.

The MT systems may never create translations with style and other literary qualities rivalling a competent professional, but already they can be more productive and economical than human translators for many routine business and research tasks. In some situations they produce a more useful end result than a human translator because of their particular ability to cope efficiently with standardized technical texts.

Another important factor increasing the viability of MT is that there is a shortage of competent human translators in certain areas and fields, particularly as a result of such trends as the unification of Europe, the emergence of the former Soviet Union into the world community, and the need to rapidly develop such political and economic pockets of multilingualism as the new South Africa with its eleven official languages. (Source: *Managing Information*, 3(6), June 1996)

Computer

The ability to unearth any information, device or activate programs simply by conversing with the computer may soon be available on the desktop of every user of IBM Corp.'s Warp operating system, and be available to others as well. Merlin—the "next generation" Warp—will feature a speech user-interface (SUI), based on a subset of the VoiceType technology previously marketed by IBM for automated dictation. VoiceType technology will also be available for Windows 95.The technology resembles the original television series Star Trek's far more closely than earlier methods of speech recognition did, because just as any crew member could speak with the ship's computer, so, too, can anyone use VocalType without special training. In most cases, a few words can be strung together in natural speech patterns without confusing the software system. For situations where errors cannot be tolerated, IBM offers a costly add-on for "highly accurate recognition", which also requires special hardware.

Developers using Merlin or Windows 95 to create "hands-free" applications can do so in five languages and two dialects (French, German, Italian, Spanish, and the two Englishes—American and British). The system is context-sensitive—the meaning of a word or phrase will change as the focus, that is, the active window, changes. Also, the vocabulary may be extended by spoken example. Contact: IBM Corp., 1133 Westchester Ave., White Plains, NY 10604; *http://www.software.ibm.com/workgroup/voicetype*. (Source: *IEEE Spectrum*, September 1996)

US researchers tell the whole story to the Internet

In future, computer users will surf the Web by talking to their terminals. So claim researchers at the Massachusetts Institute of Technology (MIT).

The spoken language systems group at MIT is working on its third generation of voice recognition and understanding systems called Galaxy.

In an Internet system, the local user will have a client program that ferries the digitized speech, such as "What are the flight times from London to New York?", to a central server. The server attempts to recognize and understand the speech, forms the correct response and delivers the answer back across the Net to the client, either through a text transfer or a voice synthesis system.

A working system for tailored applications using specific knowledge bases could be in use within five years.

Apple Computer's PlainTalk system already provides plug-ins for Netscape Navigator that allows control of the navigator via speech. Users can speak hypertext links, bookmarks and commands such as "Go Back" and "Reload". (Source: *Electronics Weekly*, 12 June 1996)

G. COUNTRY NEWS

China

One in ten homes to own PCs by 2000

China could become the next burgeoning PC market with a prediction that one in 10 Chinese households will buy a PC within the next five years. This claim of the Chinese Ministry of Electronics Industry may result in an annual market of 10 million PCs.

In 1995, about 1.1 million PCs were sold in China, with about 20 per cent going into homes. This year, 1.5 million PCs are expected to be sold with 40 per cent for home use. The Ministry points out that Shanghai, China's largest city, has about 5 per cent of households with a PC. This compares with about 35 per cent of US households with one or more PCs. (Source: *Electronics Weekly*, 5 June 1996)

Heavy investments in China, but doubts remain

Over seven new fabs are planned for China in the next few years, but many fear that this country does not have the infrastructure required to maintain them. There is also a shortage of production equipment. Motorola will start the construction of a $1,300 million fab this year, Advanced Semiconductor Manufacturing (ASMC) has recently completed a $1,400 million facility and plans to invest an additional $1,500 million in another fab in 1998, and Shanghai Belling Microelectronics(a collaboration between Alcatel and China) is considering an additional fab with possible US partners. (Reprinted with permission from *Semiconductor International Magazine*, February 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Latest development of the Internet in mainland China

In March 1994, China was formally connected to the Internet via the Institute of High Energy Physics network. The National Computing and Networking Facilities of China received the country-level domain name ".cn" in May 1994. Many universities and institutions are now connected to the Internet. Library catalogues, e.g., Peking University Library, are accessible through national networks, including the ChinaNet and the China Education and Research Network. These national networks are the gateway to the global information highway. Internet services such as e-mail, Telnet, FTP, Archie, Usenet (listservs), Gopher, WHOIS, and WWW, are available on the Internet in China. Global Internet users can subscribe to several Chinese electronic magazines published in China.

The Chinese Government has established an office, the State Information Coordinative Committee, to oversee the development of the Internet connection in China. Cooperation is called for among the various network systems, and a high-speed network is needed to further develop the Internet connection in China. More users are expected to have access to this information superhighway. In fact, the number of Internet users in China may increase exponentially in the next few years. Training on the use of the Internet is needed and should be provided by the library and information professions, and educational institutions. (Source: *Micro-computers for Information Management: Global Internetworking for Libraries*, 12(3) 1995)

European Union

MEDEA sets out plan for Europe

The Micro-Electronics Development for European Applications (MEDEA) programme, the follow-up to JESSI, will focus on six core applications and technologies.

Sponsored by EUREKA, the European body for industrial R&D cooperation, the MEDEA programme will start on 1 January 1997 and run until 31 December 2000.

The three application areas are communications technologies, automobile and traffic applications, and multimedia technologies.

For technology, CMOS-based technology platforms, manufacturing technologies, and design techniques have been chosen. The aim of focusing on these technologies is to ensure that Europe will be able to build single-chip systems that match the best from the US and the Far East. (Source: *Electronics Weekly*, 3 July 1996)

European Union chooses assessment site

IMEC (Inter-University Micro-electronics Center, Leuven, Belgium) has been named the first equipment assessment site for optical lithography under the European Union's Semiconductor Equipment Assessment (SEA). Optical lithography equipment constitutes the largest single investment by a semiconductor facility, so this programme is of great importance, with ASM Lithography (Veldhoven, The Netherlands) as the largest European supplier of such equipment. The programme aims at the promotion of the wider use of European-sourced equipment in semiconductor manufacturing.

The European Union selected IMEC because of its worldwide reputation and achievements in lithography and its strong connections with the industry. IMEC is leading a team of industrial users in the evaluation of a deep-UV stepper from ASM Lithography towards future 0.25 μm CMOS processes. Some exploratory work on 0.18 μm CMOS will also be undertaken. The overall budget for the project, exceeding $8 million, is funded by the European Union and the project partners.

The team members, including both ASM Lithography users and non-users, are distributed throughout the world in order to achieve the most efficient dissemination of the assessment results. (Reprinted with permission from *Semiconductor International Magazine*, February 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Europeans initiate work on 193 nm lithography

A European ESPRIT project known as "Ellipse" plans to develop 193 nm argon fluoride excimer laser lithography to achieve 0.18 μm lithography that will be required for 1 Gb DRAM production in about six years' time. The collaborative work is coordinated by GRESSI (Grenoble Submicron Silicon, Grenoble, France). The other partners include laser machine tool integrator Exitech (Oxfordshire, UK), Lambda Physik (Göttingen, Germany) which pro-

duces the lasers, Korth (Germany) which manufacture the calcium fluoride and magnesium fluoride optical crystal materials for 193 nm optics, the Central Microstructure Facility (CMF) of Rutherford Appleton Laboratory (Oxfordshire, UK), IMEC (Inter-University Microelectronics Center, Leuven, Belgium), fused silica manufacturer Heraeus (Hanau, Germany), stepper manufacturer ASM Lithography (Veldhoven, The Netherlands) and lens producer Carl Zeiss (Oberkochen, Germany). The project, which began in January 1996, will run for 18 months.

A 193 nm Series 8000 microlithography exposure tool developed by Exitech over the past two years was installed at the CMF in August 1995. The exposure system uses a standard Lambda Physik excimer laser which Exitech has modified to reduce the laser linewidth from some 370 pm to around 5 pm for operation with the refractive lens. This equipment can provide a resolution of 0.18 μm and is being used to develop the 193 nm lithography process and to assess experimental photoresists.

There is currently no satisfactory commercially available resist for 193 nm exposures. PMMA (polymethyl methacrylate) has been used in initial trials by Exitech at exposure doses of around 1 J/cm^2, but it is unsuitable for production use, as it is unable to withstand plasma etch processes. (Extracted with permission from *Semiconductor International Magazine*, February 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

EU information access

The need for coordination and resource pooling among EU information providers is evident from the initiatives taken to develop a network of European Information Relays, notably in the UK. Their aims are to bring facts concerning the established policies and programmes of the EU closer to the users in the localities where they have the greatest impact, to draw public attention to the fact that EU policies form an integral part of the national and local system of law, government and administration, and to refer anyone approaching any of these information services to the appropriate organization for further assistance.

National Coordinating Committees are providing a national forum for the Network of European Relays in order to coordinate their activities, exchange information, provide training, participate in joint projects and to promote the development of the network. As an example, in the UK some 150 library authorities have joined the Public Information Relay (PIR). This network of localized information focal points provides a significant access to EU information and a gateway to further sources.

There are also 44 European Documentation Centres (RDCs) based in university libraries, which target the academic community. In addition, the UK boasts 18 European Reference Centres, based in academic institutions, which provide reference manuals both to students and other visitors, with small in-house collections of EU documentation. Three depository libraries make all documents and publications produced by EU institutions available through the UK library system. (Source: *International Journal of Information Management*, 16(2) 1996)

The European Information Association

The European Information Association (EIA) is an organization concerned with information from Europe, particularly from the EU institutions. Membership currently stands at 470 and consists of European documentation centres, European information centres, local authorities, government departments and agencies, public, academic and commercial libraries, solicitors, banks, publishers, charities, pressure groups and EU institutions.

The Association's overall aims are to coordinate and improve the provision of EU and related information services. With these aims in mind, it has identified three specific and important objectives. First to provide a forum in which members can share experience, discuss common problems and concerns, develop ideas and disseminate information. Second, to improve services through a programme of education, training and publications. Last, to represent the views of information service providers to the EU institutions and other appropriate bodies.

The Association has a growing number of publications to help its members locate EU information. Its material includes guides to basic sources of EU information, the Common Agricultural Policy, social policy, enlargement, the environment and a new series of Quick Guides which help members find out about and use specific documents such as the Official Journal and COM documents. (Source: *The Law Librarian*, 27(1) March 1996)

Germany

German collaboration helps smaller producers

The German Bundesforschungsministerium has provided $14 million to start a national collaborative programme involving seven chip producers. This programme is led by the Fraunhofer Institute for Solid State Technology (Munich, Germany). The initial partners are Bosch, Elmos, Siemens, SMST (IBM/Philips), Temic Telefunken, Thesys, Zentrum für Mikroelektronik Dresden and the Verbund Mikroelektronik der Fraunhofer-Gesellschaft. They are to develop new production techniques suitable for small organizations that would find it difficult to undertake the heavy investment required for a modern silicon device facility.

Some Fraunhofer researchers felt that while JESSI has brought much new knowledge and technology to Europe, there is little chance of its continuing successfully after this year, owing to conflicting national and European requirements. The partners aim to give Germany the capability to meet current international competition, especially in ASIC devices, for which they feel there are excellent market opportunities. (Reprinted with permission from *Semiconductor International Magazine*, May 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Ireland

Reports from the Product Design and Development Centre, where creative ideas can be worked up into solid prototypes

Rapid prototyping techniques available at the recently established Product Design and Development Centre (PDDC)—a joint University College Dublin (UCD) and Queen's University Belfast (QUB) venture—are enabling Irish firms to reduce the "cycle time" from raw material to finished product. The PDDC activities in both of the participating universities also benefit academic programmes.

The PDDC is associated with UCD's Department of Mechanical Engineering and the Automotive Design Centre at QUB. The cross-border element of the initiative has

meant that £650,000 in funding could be secured from the International Fund for Ireland (IFI). This figure will cover 50 per cent of the running costs over the next four years.

The Director of the PDDC and site manager at UCD, Michael Muntner, sees the Centre providing leadership in product design and development on the island into the next millennium. The primary goals are to increase the overall level of knowledge in rapid prototyping and CAD among Irish companies and to develop markets for other Irish providers of product design and development services. The Centre does not, however, want to engage in competition with these outlets, and when specific needs are best provided elsewhere then the customer will be pointed in that direction.

The industrial members of the PDDC advisory board are confident that the shared and complementary technologies at the Dublin and Belfast sites will ensure that each becomes 100 per cent self-sufficient by 1999. The expectation is that non-IFI funds will increase from the steady expansion of services such as consulting, demonstration projects as well as research and development.

Many of these product are world-class and would sell without the need for modern marketing techniques. However, the chance to show customers 3-D virtual representations or to present them with miniaturized solid models must be seen as a fine opportunity for those individuals or small firms that are looking to seek out new customers. (Extracted from: *Technology Ireland*, May 1996)

Japan

New project

ASET, the Association of Super-Advanced Electronic Technology, has begun planning its R&D budget for fiscal 1996. The research style will mix centralized and distributed research, with three of the nine research themes using a centralized approach.

Twenty-one members established ASET as the body to implement the MITI directive for super-advanced electronic technology. Development targets, with completion dates ranging from 2005 to 2010, consist of basic technology for next-generation semiconductor devices, magnetic storage and display devices. The 21 members have already been assigned their research work through NEDO (New Energy Development Organization).

There are a total of nine themes in three fields, and the research period is set for five years. R&D budget for fiscal 1996 is $93.4 million, which is budgeted with $72.9 million to semiconductors, $18.7 million to magnetic storage, and $900,000+ to display devices. The remaining $900,000+ is for equipment, facilities and operating expenses. The budget for the remaining four years is planned to be $12.15 million, $28 million annually, making the total budget for the five years "about $280 million", according to Hideyo Setoya, executive director.

The three themes of the first research department (X-ray and ArF lithography and plasma reaction measurement, analysis and control) will be handled as centralized research projects, and the remaining six as distributed projects at individual firms.

R&D results will in principle be disclosed to the public through presentations and workshops. ASET will also take out patents. However, there are problems with the handling of patent rights, with NEDO and the developer each holding half the rights. If the developing manufacturer wants to use the patent, half of the patent fee goes to NEDO. They are still discussing how to split proceeds when a third party uses it. (Extracted with permission from *Semiconductor International Magazine*, July 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

400 mm wafer project begins

The Super Silicon Crystal Project, which aims to develop 400 mm wafer manufacturing technology by the year 2001, has finally started to move. The Super Silicon Laboratory was established jointly with the Japan Key Technology Center and leading Japanese manufacturers, with its headquarters at Shin-Etsu Handotai Co. Ltd. in Annaka City, Gunma. Process technology and equipment will be developed for crystal growth, wafer fabrication, inspection and evaluation, and epitaxial growth. Development results will be announced through the Japan Working Group. (Extracted with permission from *Semiconductor International Magazine*, July 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Japanese S&T

The Japanese Science and Technology Agency has a very comprehensive and attractive Web site at http://www.sta.go.jp/welcome-en.html which gives information on research in fields from atomic energy to earth sciences, from inorganic materials to mathematics. Its space development agency has a newsy section, and you can also access White papers and even budgets. (Source: *Technology Ireland*, July/August 1996)

The Netherlands

World's largest IC fabricated in the Netherlands

Philips Imaging Technology, a research and production group of Philips Research (Eindhoven, The Netherlands), has fabricated the world's largest single IC, a solid-state image sensor containing more than 66 million pixels on an 86 mm x 100 mm chip. It was made using a revolutionary sensor design and production technique that allows sensors to be constructed in modular fashion. This reduces the development time and costs by up to a factor of 10 for sensors containing between one and 66 million pixels.

The modular approach takes advantage of the repetitive nature of charge-coupled devices (CCDs). Elementary sensor blocks are divided into pieces that can flexibly form larger sensors to meet custom needs. Very large sensors that almost completely fill a six-inch wafer can now be accompanied in production by smaller sensors without having to change masks in the production cycle.

An initial application of this unique sensor will be in professional astronomy, but medical imaging and professional photography are also possibilities. (Extracted with permission from *Semiconductor International Magazine*, August 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Russia

US chip firms turn to Russian GPS satellite

A number of US chip makers are talking to the Russians about using the GLONASS satellite constellation for global positioning systems (GPS). The talks have started because the chip makers are becoming increasingly pessimistic about the Pentagon removing the inbuilt

degradation in the accuracy of the NAVSTAR constellation known as "selective availability".

Although, by using the NAVSTAR constellation, the military can get highly accurate positioning fixes, commercial users can only access an artificially degraded signal, limiting the accuracy of the positioning fix.

Even Rockwell, which built the NAVSTAR satellites and is the leader in the GPS chipset market, is believed to be considering using GLONASS.

The moves have come about because the Pentagon, which at one time looked like removing the selective availability degradation, now appears less inclined.

Even with selective availability, Philips can achieve accuracy of down to ±10 m. By the year end it expects to have a two-device GPS chip-set—one chip for the RF and one for the correlator/controller—out in the market. It will cost only $25 when in volume production. At $25 it could go into a cellular phone, PDA and laptop, making them easily traceable should they be lost or stolen. (Source: *Electronics Weekly*, 17 July 1996)

FPD production begins

Integral (Minsk, Russia), one of the country's largest semiconductor manufacturers, has started the pilot production of 150 mm diameter active matrix flat panel displays (AMFPDs) for television applications. Edward Kaloshkin, assistant to the director general of Integral, said that Integral is using an active matrix diode technology instead of the conventional active matrix thin-film transistor technology used by most of the world's large producers.

The Flat Planel Display Company (a Philips subsidiary in Eindhoven, the Netherlands) also uses a diode-based technology to simplify the manufacture of AMLCDs for a variety of consumer applications. However, Kaloshkin said, "Our active matrix diode process is our own technology which we have been developing since 1980". (Reprinted with permission from *Semiconductor International Magazine*, September 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Singapore

SGS-Thomson to build in Singapore

SGS-Thomson Microelectronics announced it is strengthening its presence in the Asia-Pacific region with the construction of a new state-of-the-art submicron manufacturing plant in Singapore. The new plant will be located adjacent to the existing manufacturing and Asian headquarters sites at Ang Mo Kio Industrial Estate. This advanced 200 mm submicron facility will bring the total number of such plants operating or announced by SGS-Thomson to six worldwide.

The new unit, called Ang Mo Kio 8, will add a new dimension to SGS-Thomson's manufacturing capabilities in the Asia-Pacific region. It will be designed to handle ULSI (Ultra Large-Scale Integration) products with geometries starting at 0.5 μm, but with capability for future upgrades, in BiCMOS and CMOS technologies.

SGS-Thomson said it was the first semiconductor company to set up a wafer fab in Singapore. The existing fab, which when started in 1984 was also the first one set up in Asia by a company of non-Asian origin, is today a mass volume manufacturing engine with a capacity of 32,000 five-inch wafers per week.

The new wafer fab will occupy 32,000 m^2 of land. The cleanroom will be designed to use mini-environments to reduce the total amount of Class 1 cleanroom area needed.

The new facility will employ, at completion of the project, about 600 highly skilled people, half of which have diploma qualification or university degrees. It will manufacture up to 5,000 wafers per week, with flexibility for further expansion. (Reprinted with permission from *Semiconductor International Magazine*, August 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

Taiwan

200 mm wafers produced in Taiwan

Taisil Electronic Materials Corp. produced the first 200 mm (8 inch) polished silicon wafers at its new factory located in the Science Based Industrial Park, Hsinchu, Taiwan. Taisil began construction of the plant in February 1995 and is Taiwan's first large-diameter, advanced silicon wafer producer.

Taisil's Phase I facility will produce 85,000 polished wafers per month. Equipment installation for Phase II expansion has begun and will increase the output to more than 200,000 wafers per month by the third quarter of 1997. The Phase II expansion will also provide capacity for production of epitaxial wafers which will be available in the fourth quarter of 1996.

Taisil is a joint venture between MEMC Electronic Materials Inc. (USA), China Steel Corp. (Taiwan), China Development Corp. (Taiwan) and Chiao Tung Bank (Taiwan). The joint venture agreement was officially signed on 24 May 1994. (Reprinted with permission from *Semiconductor International Magazine*, July 1996. Copyright 1996 by Cahners Publishing Co., Des Plaines, IL, USA)

H. AUTOMATION

Many hands make the robot work

Bizarre shapes have always been a hallmark of robots, and NASA's latest design is no exception.

As part of its Advanced Concepts Research Program, the agency is financing robotics researchers at Carnegie Mellon University in Pittsburgh to look at the possibility of creating a remarkably dextrous, bush-shaped robot.

Hans Moravec says the robot would resemble an animated bush, centred around a thick stem with lots of swivelling branches. Each branch would split into twigs and these would sprout even finer twiglets which would act like fingers. Some of the fingers would have smaller, jointed sections which could operate on a microscopic level, while others would be equipped with tools to perform particular tasks.

Because the robot could bring several "hands" and tools into play at any one time, Moravec says it would be far more adept than a human.

Moravec says there is no point trying to build a bush robot at the moment because the technical obstacles are too great. He says NASA is funding the two-year research programme because construction may be practicable in 50 years' time.

The researchers will draw up a preliminary design with four levels of branching and 16 tools on its fingers. They will also look at the control systems that the bush robot will need. In addition, the group aims to produce a computer animation of a bush robot running through a variety of tasks. (Source: *New Scientist*, 1 June 1996)

Soft touch brings robot breakthrough

Much work has gone into designing robot grippers that are sensitive to force, so that, for example, the robot can pick up an egg and hold it firmly without breaking it. Two US researchers have found an answer—robot fingertips.

These are actually an electrorheological (er) fluid of particles of polymers suspended in a dielectric fluid. In the presence of a strong electric field, their behaviour changes from that of a viscous, approximately Newtonian fluid, to that of a plastic, with a finite shear strength as well as a viscous coefficient.

Prasad Akella and Mark Cutkosky had observed that the ability of human hands to make contact smoothly is partly due to fingertips that deform and dissipate energy.

Taking this as their starting point, the two workers have now produced their latest prototype fingertip that seems to reproduce that effect in a robot.

The soft fingertip consists of a non-conducting rubber skin containing the fluid, with the electric potential applied across a series of plates oriented perpendicular to the skin surface. As the skin is pressed, er fluid is forced to flow between the plates with a resistance that varies with the applied voltage. A second membrane at the back of the plates provides a restoring force that returns the system to a standard equilibrium configuration when unloaded.

Building a fingertip whose stiffness and damping properties can be directionally controlled still remains a challenge. Even when so, the researchers report that the current generation of fingertips can provide compliance and damping that are very similar to human fingertips. The research was carried out in the Department of Mechanical Engineering and the Center for Design Research, Stamford University, Stamford CA 94305, USA. (Source: *Electronics World*, April 1996)

Some robot surgeons

PROBOT is a prostate surgeon currently being tried out at Guy's Hospital, London. It is the first robot that has been specifically designed to remove soft tissue from a person (although other robots, in factories, may occasionally do so by accident).

In the first stage of the operation, once the robot's frame has been strapped into place, an ultrasonic scanner is fastened on to its front. This acts as the machine's eye and, as befits robotic vision, it can see through flesh. With it, the robot scans the patient's prostate gland and translates the readings into a three-dimensional image of the tissue to be cut away.

After considering this image, the (human) surgeon who controls PROBOT can mark out for it the bits of tissue to be excised, replace the scanner with a cutting device, and set the machine in motion. Instead of slicing away with a scalpel, PROBOT vaporizes the offending tissue with an electric probe. The surgeon watches the operation throughout, and can stop it at any time. So far, PROBOT has performed 12 operations, and several more patients are waiting.

ACROBOT is a robotic knee surgeon built on similar lines. ACROBOT is currently practising on corpses (PROBOT started off on potatoes—their consistency is, it seems, similar to that of prostate glands), and will, however, give the surgeons more control than PROBOT does. Because much knee surgery consists of cutting through bone without severing any ligaments, ACROBOT does not actually chisel the bone itself. Instead, it steadies the blade wielded by the surgeon and prevents him from cutting beyond a predetermined bit of the knee. If he tries to exceed this boundary, ACROBOT will increase the pressure that he has to use to cut, helping to prevent mistakes.

In Germany and America, converted industrial robots are used to carry out hip replacements dubbed "Robodoc". And researchers at the California Institute of Technology in Pasadena are developing miniature robots to wriggle their way through intestines.

Robodoc brings machine-tool precision to the art of hip-replacement surgery. Once a surgeon selects a given hip prosthesis, Robodoc drills the same size hole in a patient's thigh bone to ensure the optimal fit. The surgeon can monitor the process on Robodoc's computer screen as the cutting tool follows a programmed path. (Extracted from *The Economist*, 15 June 1996 and *Technology Review*, May/June 1996)

I. STANDARDIZATION AND LEGISLATION

Standardization

Modem makers speed V.34

Modem makers have gained a little more bandwidth out of the V.34 analog line modem standard and have introduced first products offering 33.6 Kbit/s data rates. Motorola, US Robotics, and Creative Labs are some of the first suppliers to offer the faster modems.

In June 1996 the US standards body ratified a variant of the V.34 (28.8 Kbit/s) standard, known as V.34 bis, defining the 33.6 Kbit/s data rate.

It is not a new modulation scheme, just a refinement of the existing one which enables higher speeds to be supported over poorer quality telephone lines.

However, modem specialists believe the 33.6 Kbit/s is pushing the physical limits of most analogue telephone networks. Indeed, a call success rate at 33.6 Kbit/s of only 50 per cent is all that has been achieved on some international and US connections.

An anticipated application for the V.34 bit rate is analogue line videophones.

The design makes better use of the line bandwidth by adding a few more points to the trellis code constellation, which defines the number of modulation points in the QAM phase space of the telephone line. (Source: *Electronics Weekly*, 17 July 1996)

Information technology: future multiple technology card standards

By Dick Mabott, Chairman of ISO/IEC JTC 1/SC 17

Identification cards and related devices

The February 1996 edition of the *ISO Bulletin* contained a retrospective on the work of ISO/IEC JTC 1/SC 17, *Identification cards and related devices*. This present update looks forward to some of the major technology challenges facing the subcommittee in the future.

SC 17 provides generic standards for plastic cards and has an extremely active work programme keeping up with the rapid pace of change of today's card technology.

Machine readable technologies have been standardized from the early embossing and magnetic stripe technologies through to the present-day chip cards and optical memory cards. Chip Cards—or, more properly, Integrated Circuit Cards (ICCs) are standardized both with contacts and without. ICCs with contacts have a small contact plate on the face of the card through which the terminal connects in order to communicate with the chip embedded in the card. Contactless ICCs do not require such a contact plate as they link to the terminal via radio.

ICCs with contacts have been adopted by the banking industry for its next generation of payment cards. Contactless cards are favoured by the transport sector for applications as diverse as ticketing (e.g. bus and train fares) to the collection of road tolls at high speed on the motorway. Optical Memory Cards offer high storage capacity using write-once-read-many (WORM) technology and are being tried out by the health-care sector for holding digitized X-rays, patient records, etc.

SC 17 has developed standards for these different technologies as each has progressed from emerging technology to a commercially viable system. Although separate standards exist for each technology, it has been a principle of SC 17 that these separate technologies should be capable of coexisting on the one piece of plastic if the card issuer so chooses.

Applications are now starting to emerge where several technologies are required to be co-resident on the same card, e.g. magnetic stripe, chip contacts and optical memory on the same card, IC card with both contact and contactless coupling.

Several Governments around the world are seeking to build on the success of machine readable passports, standardized by SC 17 in conjunction with the International Civil Aviation Organization and featured in the April edition of the *ISO Bulletin*. Different Governments are evaluating different combinations of technology in order to speed checking at the point of entry for frequent travellers. SC 17 is actively considering such combinations of card-reading technology as a matter of urgency.

There is a great deal of competition for the limited space available on the normal ID-1 sized plastic card (i.e. credit card size). Such features as the Issuer's card design (extremely important to marketeers in differentiating their card from the opposition's), a hologram, several card scheme logos, a signature strip plus the rigorous ISO requirements for each chosen reading technology all vie for this limited real estate.

The challenge for the future will be to manage technology coexistence and provide standards that dovetail the different technologies in a mix-and-match environment to support the card applications of the twenty-first century. (Source: *ISO Bulletin*, October 1996)

What makes a standard

Standards form the backbone of bibliographic control and generally take the form of shared practices which are established by authority, custom or general use, and are endorsed either formally or informally. The most formal standards are those developed by the American National Standards Institute (ANSI); National Information Standards Organization (NISO), and the International Organization for Standards (ISO). Other sources of relatively formal standards are various industry groups including libraries. Formal standards are subjected to relatively broad-based development and maintenance processes and consensus is achieved before completion of the standard and implementation begins. Informal group standards are usually developed quickly by a closed circle of interested parties with limited review and approval being sought. If such standards fulfil a need and it is appropriate, a formal procedure can be set up to validate them for wider acceptance.

New procedures are being used to formulate standards for the Internet by an industry group called the Internet Engineering Task Force (IETF). Within the Internet community, it was felt that the formal procedure was too bureaucratic and slow. Proposed Internet standards are made available for review over the Internet as soon as they are drafted and stakeholders are responsible for reviewing and responding electronically in tight time frames. The IETF process is having positive effects on formal standards development, which means the ANSI and ISO are moving

rapidly as they are able to streamline procedures and use electronic media in the development process, especially for computer and telecommunications standards. There are three major standards of importance to libraries—ISO 2709 Format for Information Exchange; ISO 8879 Standard Generalized Markup Language (SGML); ISO 9735 Electronic Data Interchange for Administration. The consistent use of the MARC standard for bibliographic data has been the key to the extensive sharing of data and the proliferation of vendor systems for library automation. A great benefit will result if at least partial standardization of electronic document and ordering format can be achieved. (Source: *Cataloging and Classification Quarterly*, 21(3/4) 1996)

ITU finally grapples with multimedia services and systems

The Telecommunication Standardization Advisory Group (TSAG) reached an important agreement concerning the future work of the ITU's Standardization Sector (ITU-T) on audiovisual multimedia services (AVMMS). The agreement was reached at TSAG's seventh and final meeting before the World Telecommunication Standardization Conference (WTSC) in Geneva from 9 to 18 October 1996.

It is proposed to create a new Study Group to carry out studies on multimedia services and systems in the next study period (1997-2000), which were until now undertaken by five study groups coordinated by a Joint Coordination Group known as JCG/AVMMS. If approved by WTSC, the newly created Study Group will, in particular, be responsible for studies related to multimedia service definition and multimedia systems, including the associated terminals, modems, protocols and signal processing. It would also serve as the focal point for coordination with other organizations and forums and consortia developing standards in this field. This coordination will be essential for global interconnectivity of networks and the global interoperability of applications and services. This approach to standardization should provide consumers with access to an increasing range of products and services and reduce the risk of market chaos.

Other key questions to be studied by the proposed new Study Group include: audiovisual multimedia services, data protocols for multimedia conferencing; modems for switched telephone network and leased-type circuits, ISDN adapters, circuit switched network (CSN) audiovisual communication systems and terminals, B-ISDN multimedia systems and terminals, common protocols, advanced video coding, interaction of high-speed voiceband data with signal processing, software and hardware tools.

The agreement is another step taken by the ITU to respond quickly to the requirements of emerging services and market expectations. This move is seen by many participants as a significant stride in addressing the concerns of the evolution towards the convergence of different technologies and communications media such as broadcasting, cable television, and the computer industry.

This consolidation of activities in a single study group is expected to:

- Significantly reduce the number of liaison statements between ITU-T study groups and other standards-making bodies, not always seen as an effective way of collaborating;
- Reduce the delay in consensus forming among the various study groups of the ITU-T;
- Reduce the overlaps and/or incompatibilities between studies and recommendations;
- Provide logical interfaces to other organizations involved in studies concerning multimedia services and systems;
- Align the workplan of different players both in terms of content and deadlines;
- Produce relevant and consistent recommendations in a timely fashion.

For more information, please contact: Mr. Fabio Bigi, Telecommunication Standardization Bureau, ITU. Tel.: +41-22-730-5860; Fax: +41-22-730-5853; Internet: fabio.bigi.@itu.ch (Source: *ITU Press Release*, 12 July 1996)

Information technology: Special Working Group on Conformity Assessment (SWG-CA)

SWG-CA was established as a standing committee by ISO/IEC JTC 1 in March 1993, in response to JTC 1's growing recognition of the importance and value of conformity assessment (CA) in the creation of international standards. SWG-CA was asked to advise and recommend to JTC 1 concerning JTC 1's CA role, policies and related CA matters.

The national standards bodies which have contributed to SWG-CA's work include Canada, France, Germany, Ireland, Italy, Japan, the Republic of Korea, Sweden, the United Kingdom and the United States. In addition, SWG-CA has established liaisons with AOW, ECITC, EWOS, ITU-T, NAOSTC, OIW, and the World Federation of MAP/TOP (Manufacturing Automation Protocol/Technical Office Protocol) User Groups.

Among the first activities for SWG-CA was to work with a joint Working Group which was established by JTC 1 to develop an IT interpretation of ISO/IEC Guide 25. This interpretation is about to be published as ISO/IEC TR 13233, *Information technology—Interpretation of accreditation requirements in ISO/IEC Guide 25, Accreditation of information technology and telecommunications testing laboratories for software and protocol testing services*. SWG-CA soon evolved an ongoing activity to review ISO/IEC Guides on CA to determine their relevance to IT and the potential need for further interpretation.

SWG-CA also developed a Policy on Conformity Assessment for JTC 1, which was adopted by JTC 1 at its October 1994 Plenary and incorporated into the JTC 1 Directives. The policy defines JTC 1's role with respect to CA. It delineates the authority and responsibility of JTC 1, its subcommittees, and SWG-CA with respect to CA, and encourages worldwide recognition of CA results.

Interoperability

SWG-CA also recognized the importance of interoperability, and the role that standardization should play in facilitating it. Accordingly, SWG-CA developed a JTC 1 Policy on Interoperability, defined as "the ability of two or more IT systems to exchange information", which JTC 1 adopted at its March 1996 Plenary and which is being incorporated into the JTC 1 Directives. The policy defines JTC 1's role, and delineates the authority and responsibility of JTC 1, its subcommittees, and SWG-CA, with respect to interoperability. The policy specifically calls encourage and promote interoperability.

To ensure that JTC 1 standards adequately address the policies on CA and interoperability, JTC 1 has requested its subcommittees and SGFS to provide action plans on how they intend to implement these policies. SWG-CA will review these action plans, provide SCs with appropriate guidance, and advise JTC 1 on what actions it must take to ensure the policies are implemented consistently.

Through the SWG-CA, JTC 1 has determined and established its role with respect to CA and interoperability and has defined its authority and responsibility. JTC 1 is actively working to ensure that the standards it produces adequatelyaddress CA and interoperabililty. Through these actions JTC 1 has established itself as the focal point for conformity assessment and interoperability issues in IT standardization. (Source: *ISO Bulletin*, September 1996)

MPEG-4 standard

The latest multimedia hardware standard known as MPEG-4 moved a step closer to commercial products with new component standards agreed at a meeting in Finland in July.

MPEG-4 is being developed to enable the efficient communication of, and interaction with, audio and video objects. The standard is still on course for ratification in November 1998.

The scope of the new standard means that whereas MPEG-2 was concerned with the delivery of TV to enable more channels or reduce cost, MPEG-4 reflects the advent of multiple, separate audio and video "objects". "Virtual" TV studios and films such as "Independence Day" are examples of what is being done at present with composited objects.

The current MPEG-4 work includes the development of verification models (VMs) for video, audio and the systems and description language. Currently, over 150 contributions to the video VM are being evaluated.

The audio group is investigating an audio standard which is non-backward compatible to MPEG-2's audio standard. It uses multiple channels and offers comparable quality at a lesser bit rate. Meanwhile, the systems group is working on the definition of how the various objects are to be multipled into a single bit-stream.

The group is also defining the various Application Program Interfaces (APIs) for the various decoding and composition tools. (Source: *Electronics Weekly*, 14 August 1996)

Legislation

On your marks: changes to trade marks legislation

The UK 1994 Trade Marks Act has replaced the 1953 Trade Marks Act and associated legislation. The international trend has been towards greater uniformity in registration procedures, with the European Union requiring greater harmonization between member countries. The 1994 UK Act updates British law and brings it more into line with other countries. The 1994 Act introduced four major changes—wider definition of what constitutes a trade mark; rights now go to the first person to register the mark rather than the previous user; greater range of protection for registered marks; and reduced bureaucracy in mark registration.

Previously, UK trade marks had to be registered in each individual country. The Community Trade Mark Registration (CTM) and the International Registration of Trade Mark Procedures (Madrid Protocol) have been developed to alleviate the problem by making it cheaper and simpler to obtain multi-country protection, but there are some problems. A CTM application will provide protection in all European Union countries through a single application, but weaknesses in the CTM system are that it is possible to lose a CTM if a mark is not acceptable in any member country. In addition, it is up to individual companies to discover and block infringements of their own registered marks. Under the Madrid Protocol, it is necessary to obtain national registration of a mark or apply for registration through the World Intellectual Property Organization (WIPO) in Geneva, through the UK office. (Source: *Refer*, 12(2), Spring 1996)

Protecting rights in cyberspace

How can works delivered electronically be protected in international copyright law? According to Dr. Mihaly Ficsor, Assistant Director General of the World Intellectual Property Organization, amendments to the Berne copyright convention required unanimity among the 118 signatory countries and this was no longer realistic with so many competing interests. Although the digital issues had been discussed at joint sessions of the committees doing the preparatory work for the Berne Protocol and New Instrument, not too much progress has been made.

Of the various ways to define digital transmissions over the Net, none was sufficient by itself and each had been more or less favoured, or more or less rejected, by the various national delegations. Chief among the candidates for bringing the law to this area is the right of reproduction. WIPO wants to see the right of reproduction applied in the electronic context, however. Dr. Ficsor points out that if the reproduction right was to do the job, it would have to be interpreted as having maximum scope. (Source: *The Bookseller*, 17 May 1996)

Statement on copyright

The new electronic environment, although inevitable, is not yet here, so the dominant technology has not yet been determined. All concerned groups should respect the role of copyright in encouraging creativity and the publication of valuable information content, and it should be seen not as an obstacle to the information society but a necessary building block. The new electronic environment is very different from the analog print environment and both librarians and publishers need to redefine the way services are provided to patrons and customers. This new environment means that words like browsing and lending need to be redefined. Many national and international library groups argue that they should be able to use digital formats of copyrighted works in the same way as printed versions. This concept disregards the fact that digital uses are not the same as non-digital and when the former are used without regard to copyright there can be harmful consequences.

Many national and regional libraries contemplate digitizing their print collections to facilitate a virtual library to provide services to patrons in remote locations and facilitate resource sharing. This concept could destroy the incentive to create new copyright works and reduce the revenue available for investment in new works. The differences between libraries is an important consideration which should be discussed with reference to technological impact. Digital document delivery is a new service being offered by publishers and is not the same as print-based

inter-library loan. Libraries that copy digitally and store copyright works electronically, even temporarily, as part of electronic document delivery services are infringing copyright law. In addition, transmission of copyright works to remote locations is a violation of copyright. Lending electronic products carries more risks than lending print products. In addition, preservation and conservation does not mean unrestricted use when a library has converted them to digital form for preservation purposes.

It is concluded that libraries should realize that publishers exist to make information available in as useful and valuable a form as possible. The rules and patterns of behaviour have to be developed according to the purposes of copyright laws and the interests of creators. Libraries and publishers must work together to explore the new digital environment. (Source: *Information Europe*, No. 2, July 1996)

Government initiatives relating to the political and legal framework for multimedia products

A number of initiatives and projects have been launched by Governments to prime the market for multimedia products. Success may be depend on getting the legal and political framework correct rather than spreading the new technology. The business forum of the Group of Seven Leading Industrial Nations (G7) has identified the harmonizing of intellectual property rights as a most important question. Multimedia products are exposed to wide-scale abuse through copying and worldwide piracy. The European Commission issued a consultative document in October 1995, and received more than 300 submissions. A big question is how existing copyright laws can be strengthened to cope with the world of multimedia. UK lawyers have concluded that copyright is the best way forward, although existing law may need reinforcing. In the US a draft bill was introduced in the House of Representatives in May 1996, to give databases copyright protection against piracy, but this has little chance of becoming law. Europe has been moving steadily to a single policy on copyright with the EC's directive setting criteria for applications copyright, and its database directive will create copyright protection for databases from 1 January 1998. When member States incorporate these principles into statutes, databases will be protected for 15 years. However, piracy is a serious problem even in countries with strong copyright laws. Across Europe, 58 per cent of software is pirated, rising to 97 per cent in some East European countries. The Federation Against Software Theft (FAST) says the CD-ROM piracy threat in the UK is growing. BSkyB is engaged in a campaign to improve the security of its systems. The Business Software Alliance has urged the European Commission to direct member States to amend their laws to protect software developers disseminating products over the information superhighway. The US is taking a very strong stand on intellectual property rights. The Trans-Related Intellectual Property Issues (TRIPS) initiative of the World Trade Organization (formerly GATT) requires Governments to pass laws to protect intellectual property rights, including software. Developed countries have to comply by January 1997, and developing countries have until 2001 to comply. The UK's FAST is seeking to build alliances with enforcement agencies in other countries to tackle the problems of the illegal international information trade. (Source: *Information Management Report*, October 1996)

Legal aspects of electronic publishing

Protection of intellectual property rights begins when a work is being developed, not when it is published and placed on the market. One approach to the acquisition of electronic publishing rights is to include them in the transfer of traditional print rights. In 1993, the US National Writers Union developed a statement of principles on contracts between writers and electronic book publishers covering: copyright; grant of rights; creative control; manuscript acceptance; royalties; royalty statements; termination; option; non-competition; arbitration; and affordability and access. In the electronic environment, copyright becomes more complex because of the potential for collaboration among creators and integration of various works which is the whole essence of the multimedia movement. The issue of moral rights is looming larger in the US and is posing particular problems in the electronic environment. The granting and termination of electronic rights is clearly one of the biggest sources of potential conflict between book authors and publishers.

The electronic publishing potential, the potential market, and the expertise and track record of the publisher are some of the factors which must be taken into consideration in deciding who should get which electronic rights and for how long. Electronic publishing means that thinking has to go beyond the traditional book contract and take into account the nature and the role of the author-publisher relationship. Electronic rights will be one of the most difficult issues that publishers will face in the electronic world. A successful transition from the legal practices developed for the print world to those required in the electronic world will depend on the degree of understanding and openness which all involved—authors, publishers, software firms, etc.—bring to the table. Some issues will be resolved easily, while others will require ongoing negotiation and careful balancing of potentially competing interests. Awareness of the law and underlying business realities will be essential for a sensible legal framework for electronic publishing to be developed. (Source: *Acquisitions Librarian*, No. 15, 1996)

J. PUBLICATIONS

Read all about it

Despite the enthusiastic talk about publishing magazines on the Web, not all publishers have rushed to embrace the medium fully. There is a lack of market research available to convince advertisers that the medium is viable, and it is difficult to determine the true number of users "visiting" a site. Publicizing the existence of a site also presents difficulties.

Some publishers have put up Web versions of established titles, but there are marked differences in the way these have been implemented. At one end of the scale, there are Web sites containing as little as 20 per cent of the editorial content found in the printed equivalent. At the other, there are purpose-built sites which are independent of the hardcopy version, offering specially-written editorials, as well as features and services not possible with printed products.

As yet, the Internet market is insufficiently large to justify abandoning print. The key to success appears to be to complement print by using the interactive capabilities of the medium, without compromising the revenues from the printed copy. IPC's two Web titles, *Planet Science* and *NME.com*, offer a "taster" of their printed equivalents (*New Scientist* and *New Musical Express*), but with added functionality. *Planet Science*, for instance, includes a searchable employment database.

At present, would-be publishers on the Web are well-advised to have the backing of a well-known name. Examples of this are the *Empire* site (EMAP Metro) and *Slate* (Microsoft). A new generation of publishers with unfamiliar names, however, is slowly emerging as the market develops. (Source: *Personal Computer World*, October 1996)

Publishing on CD-ROM

It is just over 10 years since CD-ROMs saw the light of day as a variant on the audio compact disc. The technology was the same, but directed to retrieval and playback of data as text on a computer instead of as music. The best established directory of published CD-ROMs, from TFPL, identified some 13,000 separate titles at the end of 1995. This continued a very healthy rise in which the previous year-end totals were (approximately) 3,500 for 1992, 5,400 for 1993, and 9,500 for 1994.

However, multimedia CD-ROMs for the consumer market have failed to attract the size of market anticipated by pundits in the early 1990s, so that the past year has seen retrenchment in this area. It is the business and professional side of CD-ROM publishing which has enjoyed the steadiest growth. CD playback facilities are becoming taken for granted in personal computing, rather than (as in the early days) expensive and bothersome add-ons which needed a special motive to acquire. This in turn has been fuelled by the trend towards distributing major applications software on CD-ROM and towards the use of CD-Recordable discs for data archiving.

Another stimulus to optical publishing in the professional arena has been the rise of encryption and metering software from the likes of CD-Max and C-Dilla Ltd. This enables a single disk to be distributed at low cost from which customers can pay to unlock portions as and when they decide they need them. (Source: *Digital Publisher*, 1(8) August 1996.

Corporate tool

Among the many potential uses for Intranets—document sharing, videoconferencing, and remote multimedia training—once that appeals strongly to software engineers is software maintenance. Software is already widely distributed over the Web, but it would be even better if it were possible to simplify the process of keeping each version of the software—one for Windows 95, one for Windows NT, and one for each of the various Unixes, for example, that a single company might be using—up to the same level of revision.

The advent of the Java programming language promises such a simplification. Java allows the people responsible for software maintenance to maintain one set of source code for any program, which they can revise and distribute to any machine that has a Java interpreter. Because the interpreter translates the distributed software into the machine's code, whatever operating system it is running, the same source code fits all.

Understandably, this makes Java—and those individuals who can understand and apply it—highly attractive to corporations. So that anyone can learn about the programming language from the horse's mouth, its sire, Sun Microsystems Inc., has published the Java series of books under the SunSoft Press imprint, a title of Prentice Hall, Upper Saddle River, NJ.

There are four books in the series: *instant JAVA* by John A. Pew, *JAVA by example* by Jerry R. Jackson and Alan L. McClellan, *just JAVA* by Peter van der Linden, and *core JAVA* by Gary Cornell and Cay S. Horstmann. Each is aimed at people with a different level of experience.

The books range in price from US$30 to $40, and each includes a CD ROM with the official 1.0 release of the Java Developer's kit for Windows 95, Windows NT, and Solaris. (There is also a beta release for Macintosh OS 7.5.) For information on where to get the books, contact Prentice Hall on the Web at http://www.prenhall.com/~java_sun. (Source: *IEEE Spectrum*, July 1996)

IEE Proceedings—Software Engineering

Starting in 1997 the IEE Proceedings series will be increased from 11 to 12 titles with the addition of *IEE Proceedings—Software Engineering*.

This bi-monthly periodical will publish papers on all aspects of the software life cycle including design, development, implementation and maintenance. Particular focus will be on state-of-the-art techniques, technology transfer, systems engineering applications, project management, novel and theoretical areas, education and training, including continuing professional development, and software dependability.

The existing periodical, *Software Engineering Journal*, co-published by the Institution of Electrical Engineers (IEE) and the British Computer Society (BCS) will cease publication at the end of 1996. However, cooperation between the IEE and BCS will continue in the production of the new *Proceedings*.

In addition to availability in print and microform, *IEE Proceedings—Software Engineering* will join the other *Proceedings* titles and *Electronics Letters* in the IEE's Online Journal collection. Available at the IEE's Web site, articles will be stored in PDF format and may be viewed and printed using the Adobe™ Acrobat™ Reader.

All current subscribers to *Software Engineering Journal* will be entitled to a reduced subscription price for the new *IEE Proceedings—Software Engineering* with preferential rates for members of the IEE and BCS.

Further information appears on the IEE's World Wide Web server: http://www.iee.org.uk/publish/journals/journals.htm/

For further information contact: The Marketing Department, The Institution of Electrical Engineers, Michael Faraday House, Stevenage, Herts. SG1 2AY, United Kingdom. Tel.: +44(0)1438 313311; Fax: +44(0)1438 742840; E-mail: inspec@iee.org.uk. (Source: *IEE Press Release*, October 1996)

IEE journals available on World Wide Web from January 1997

The IEE's rapid-publication letters journal, *Electronics Letters*, and all 12 titles of *IEE Proceedings* will be available on-line from 1997 at the IEE's Web site. Articles will be stored in PDF format and may be viewed and printed using the Adobe™ Acrobat™ Reader.

Features include:

- Cross-journal searching of bibliographic records (including authors, titles, abstracts);
- Browsable table of contents pages for each journal issue;
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Software by numbers

Computer software plays a critical role in many aspects of our lives, from transportation and communication to financial services and medical care. Software programs make cars run, prevent planes from flying into each other, and keep pacemakers—and therefore hearts—ticking.

But in spite of software's ever-increasing importance, the development of most computer code remains more a craft performed by artisans, rather than a science based on measured and replicable techniques. The result is software that in many cases is more expensive, takes longer to produce, and may be less reliable than it otherwise could be.

The need for a more scientific approach to software development has been recognized since at least 1968 when the term "software engineering" first was coined, but relatively little progress has been made towards that goal. A new report from a Research Council committee says that the key to fully converting computer programming for large software systems into a cost-effective engineering process is for software builders to make more use of statistical modelling and analysis.

Equipment manufacturing reached a crossroads in the 1950s when statistical techniques were shown to be essential for controlling and improving the production-line process. Software manufacturing is at a similar juncture today, the report says. To revolutionize software production in a similar manner, however, will require that the industry take a lead position in research on statistical software engineering. A major focus of this research must be the development of high-quality, quantitative data about the processes by which software is created. The current lack of such information is a major impediment to applying statistical approaches to software engineering.

Obtaining these data requires measuring the right things at the right time for each of the important stages in software development. And the key to making the correct measurements and solving the right problems, the report says, is for research to be a collaborative effort between statisticians and software engineers. Vital areas for collaboration and education between the two groups include designed experiments, exploratory data analysis, modelling, risk analysis, and statistical computing tools.

Statistical Software Engineering. Committee on Applied and Theoretical Statistics, Board on Mathematical Sciences, Commission on Physical Sciences, Mathematics, and Applications (1996, 73 pp.; ISBN 0-309-05344-7; available from National Academy Press. Tel.: 1-800-624-6242; $29.00 plus $4.00 shipping for single copies). (Source: *NewsReport of the US National Research Council*, Spring-Summer 1996).

TECHNOLOGY AND INVESTMENT OPPORTUNITIES

SELECTED INVESTMENT/TECHNOLOGY OFFERS

MANUFACTURE OF ALUMINIUM SUBSTRATES (for computer hard disks)

The project proposed is to manufacture approximately 35 per cent of the world market for 3½ and 5¼ aluminium substrates (disks) for fixed disk storage of information and data on computer hard disk drives for a large fixed disk drive manufacturer. The local manufacturer has a commitment from a large hard disk manufacturer to buy the output if this meets quality specifications. Support needed includes some financing (with the possibility of a buy back), equipment purchase and management expertise. The proposed site for the project is Misamis Oriental, Region 10, Mindanao, Philippines.

Estimated investment: US$ 36,155,9300.15 million (initially US$ 25,033,000).

Preferred mode of cooperation: Joint venture.

(For further information, please contact: Mr. Ramon A. Laconico, Jr., Aarone Corporation, c/o 518 W. San Carlos Street, San Jose, Ca. 95126, USA. Tel: (408) 292 3700, 800 830 5111; Fax: (408) 971 8010)

PRODUCTION OF COMPUTER MONITORS

A company located in Bahia (Brazil) with a long-standing experience in the wholesale distribution of computers and computer accessories would like to expand production to produce 14 inch (later on 15 and 17 inch) analog monitors through (in the first stage) assembly with CKD process; and (in the second stage) full assembly with a PHT line. The project would allow substantial cost reductions as it would save import tariffs and benefit from advantageous fiscal incentives, thereby making the final products more competitive.

Estimated investment: US$ 3.5 million.

Preferred mode of cooperation: Joint venture, technology transfer, joint R&D, equipment purchase.

(For further information, please contact: Mr. J. Carvalhi, GRAFFITE Industrial e Comercial Ltda., Rua Metodio Coelho 55 - Cidadella 1 - Candeal, CEP 40275.440 Salvador, Bahia, Brazil. Tel: (55 71) 358 5322; Fax: (55 71) 358 2116; e-mail: pondebar@magiclink.com.br)

THICK FILM HYBRID MICROCIRCUITS

Thick film hybrid microcircuits is manufactured for use in the fields of aeronautical, defense, medical, space, electronic and entertainment devices and communication. The technology is already commercialized.

Estimated investment: US$ 3 million (machinery), US$ 100,000 (know-how).

Preferred mode of cooperation: Know-how, equipment purchase.

(For further information, please contact: Mr. N.K. Sharma, National Research Development Corporation, 20-22 Zamroodpur, Community Centre, Kailash Colony, New Delhi 110 048, India. Tel: 91-11-6432121; Fax: 91-11-6449401)

ENERGY METER

Microprocessor-based single-phase card-operated energy meters. Pre-paid card operated energy meters for energy tariffing applications have been developed. In such systems, the IC card holds either number of units of electricity or the equivalent monetary value. When such cards are inserted, the energy meter reads the card and connects the supply to the consumer loads. This meter is designed around an 8-bit microprocessor. The sub-modules in this meter are alarms/indicators, display, card reader mechanical assembly, card reading circuit, IC card and a contactor. The IC card is programmed to have a definite number of units and an identification code. The technology offered is at the prototype stage.

Estimated investment: US$ 50,000.

Preferred mode of cooperation: Know-how.

(For further information, please contact: Mr. N.K. Sharma, National Research Development Corporation, 20-22 Zamroodpur, Community Centre, Kailash Colony, New Delhi 110 048, India. Tel: 91-11-6432121; Fax: 91-11-6449401)

ELECTRONIC BALLAST

Ballasts are fabricated by assembly of various electronic components such as ICs, transistors, etc. They are used in fluorescent lamps. The technology is at the commercialization stage.

Estimated investment: US$ 10,000 (machinery), US$ 3,000 (know-how).

Preferred mode of cooperation: Know-how.

(For further information, please contact: Mr. N.K. Sharma, National Research Development Corporation, 20-22 Zamroodpur, Community Centre, Kailash Colony, New Delhi 110 048, India. Tel: 91-11-6432121; Fax: 91-11-6449401)

CAD/CAM AND GIS RELATED SOFTWARE DEVELOPMENT

A full range of digitisation and conversion services and CAD/CAM and GIS related software development expertise is offered. The technology is at the commercialization stage.

Estimated investment: US$ 100,000 (machinery), US$ 50,000 (know-how), US$ 20,000 (training).

Preferred mode of cooperation: Joint venture, know-how.

(For further information, please contact: Mr. P. Ranga Mohan, Infotech Enterprises Ltd., 42 Nagarjuna Hills, Panjagutta, Hyderabad 500 082, India. Tel: +91-40-398141; Fax: +91-80-3344593)

ELECTRONIC BALLAST/ENERGY MANAGEMENT SYSTEMS FOR HOTELS

Technology is offered to manufacure UPS (uninterupted power supply) system, electronic ballast and energy management systems for hotels. The technology is at the commercialization stage.

Estimated investment: US$ 20 million (cost of project), US$ 200,000 (machinery and equipment).

Preferred mode of cooperation: Licensing; know-how; technical expertise.

(For further information, please contact: Mr. P.S. Sasidharan, Pamba Electronic Systems Pvt. Ltd., G-274, Panampilly Nagar, Ernakulam 682 003, India. Tel: +91-484-323111; Fax: +91-484-317191)

SOFTWARE SERVICES

Provision of on-site and off-shore software services and modern and integrated software products for educational institutions, hotels, hospitals, clinics and multimedia services. The technology is at the commercialization stage.

Preferred mode of cooperation: Licensing; know-how; joint venture; consultancy; sub-contracting; compensation agreement (buy back), marketing expertise.

(For further information, please contact: Mr. Issac Philip, TIFFS, C7,9 Ramanathan Street, T Nagar, Chennai 600 017, India. Tel: +91-44-4343297; Fax: +91-44-4344633)

RURAL RADIO TELEPHONE – MARR SYSTEMS

Provides technology for the assembling and testing of single channel radio telephone and 2/15 shared radio system. This product is used for extending the telephone facility to remotely located or thinly populated areas. The technology is at the commercialization stage.

Estimated investment: US$ 0.3 million (cost of project), US$ 0.15 million (machinery).

Preferred mode of cooperation: Licensing; know-how, technical expertise.

(For further information, please contact: Ravichandra Systems and Computer Services Ltd., 1029 Avanashi Road, LIC Building 2nd floor), Coimbatore 641 018, India. Tel: +91-422-211961; Fax: +91-422-214844)

PHOTOVOLTAIC LIGHTING AND PUMPING SYSTEMS

Manufacture of street lights, lanterns, domestic lights, etc., which convert sunlight into electricity using photovoltaic modules. The resultant electricity is stored in batteries and used when power is required for lighting, etc. The technology can also be applied directly to drive a motor pump set to lift water. The production of the cells is carried out by manufacturing various parts and sub units in different shops of the factory and integrating them into the final product at the assembly line. This facility is quite useful as it provides basic electric light and other consumer amenities in rural/remote areas, hamlets, etc. using photovoltaic energy.It can also be used for pumping irrigation and potable water. The technology is at the commercialization stage.

Estimated investment: US$ 0.32 million (cost of project), US$ 0.2 million (machinery and equipment), US$ 40,000 (know-how).

Preferred mode of cooperation: Joint venture, know-how, licensing.

(For further information, please contact: Mr. Ramesh Kannan, Kaynes Technology, No. 23-25 Belagola Food Industrial Estate, Metagalli P.O., Mysore 570 016, India. Tel: +91-821-511612; Fax: +91-821-512701)

HYPERMEDIA COMPUTER SOFTWARE

WEB is a new approach to managing information based on a concept of threads which represent particular topics of interest to the user. Information can be linked to a number of relevant threads to allow users to model their ideas. The first product, WEB-Information Assistant, runs in a multi-window environment on IBM PC and compatibles. Information can be keyed in or impoted as a text file and moved from point to point within a WEB or between WEBs, providing a powerful HYPERTEXT environment for general information. Links to the user's existing word processor, spreadsheet, etc. The technology is at the commercialization stage.

Preferred mode of coopertion: Licensing, joint venture.

(For further information, please contact: Mr. Brian Padgett, Managing Director, The Technology Exchange Ltd., Wrest Park, Silsoe, Bedford MK45 4HS, United Kingdom. Tel: 44-1525-860333; Fax: 44-1525-860664; E-mail: tech-ex@dial.pipex.com)

FM AUTO CALIBRATION

Provides a method of calibrating the FM characteristics of a VCO against a precise low frequency path using the DC coupled FM system in a phase locked loop incorporating two port modulation. Typical applications include Frequency Shift Keying (FSK) systems (e.g. pagers) and Telemetry Systems. The technology is at the commercialization stage.

Preferred mode of cooperation: Licensing.

(For further information, please contact: Mr. Brian Padgett, Managing Director, The Technology Exchange Ltd., Wrest Park, Silsoe, Bedford MK45 4HS, United Kingdom. Tel: 44-1525-860333; Fax: 44-1525-860664; E-mail: tech-ex@dial.pipex.com)

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INVESTMENT AND TECHNOLOGY PARTNERSHIP INITIATIVE

Investment and technology play a vital role in the industrial growth of developing countries as well as in their gradual integration into the international economy. However, the changing national and international economic environments are prompting developing countries to take a fresh look at their efforts to secure and widen investment and technology flows.

While UNIDO is one of several institutions promoting investment to developing countries, it is the only one with a comprehensive background in industrial development and technology transfer. UNIDO can therefore be instrumental in linking investment promotion with technology upgrading and the enhancement of technological capabilities. UNIDO is in the position to provide a wide range of services to facilitate developing countries in gaining access to investment resources, technology and know-how, marketing and managerial skills, as well as in upgrading their domestic capabilities in these fields

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- Information Resource Management System (IRMS)
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- Guidelines for the Development, Negotiation and Contracting of Build-Operate-Transfer Projects
- Manual on Technology Transfer Negotiations
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- Investment and Technology Partnership Initiative
- Technology Transfer and Development Issues for Developing Countries arising from the Uruguay Round Agreements

For further information, please contact the Industrial Information Section, Investment and Technology Promotion Division, UNIDO, A-1400 Vienna, Austria. Telephone: +43-1-21131-3730, Fax: +43-1-21131-6843