

Innovation & Technology Transfer

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Intellectual Property:

Hot commodity *of* the new century

Plus

- New assessment method for concrete structures saves maintenance costs
- Chaos theory used to prevent runaway reactions at chemical plants
- Bringing business-to-business e-commerce within the reach of SMEs
- IST 99 – key role for SMEs in building the Information Society

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Innovation & Technology Transfer

Challenges and Opportunities Ahead

"The reorganisation of the Directorate-General for Enterprise creates an opportunity for us to rethink and refocus our priorities," said Erkki Liikanen, Member of the European Commission responsible for Enterprise and the Information Society, in a recent interview with CORDIS. "Bringing together industrial, enterprise and innovation policy means that in future each will support the others."

The need to promote innovation permeates enterprise policy, he said, and should be taken into account in all policy decisions. In order to boost competitiveness, enterprises – especially those in traditional industries – must be encouraged to exploit new technological opportunities more rapidly.

"To encourage the creation and rapid growth of small and medium-sized enterprises, we must simplify the legal frameworks. Training people with technical ideas to build a business is a priority. Financing the development of new companies requires new risk capital options to be explored.

"We also need to break down communication barriers between large and small enterprises, so that the resources and marketing power of bigger companies, and the entrepreneurial spirit of small ones, can support one another more effectively.

"In fields such as mobile telecommunications, where Europe leads the world, we have to move fast to take advantage of our strengths. That requires us to reinforce the spirit of enterprise which enables people to run with their ideas in order to achieve progress."



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Concrete Progress

Proper maintenance of concrete buildings is essential for public safety, but many repairs are carried out unnecessarily. Collaboration between researchers and building owners to develop the framework for a European code of practice holds important lessons for other industrial fields.

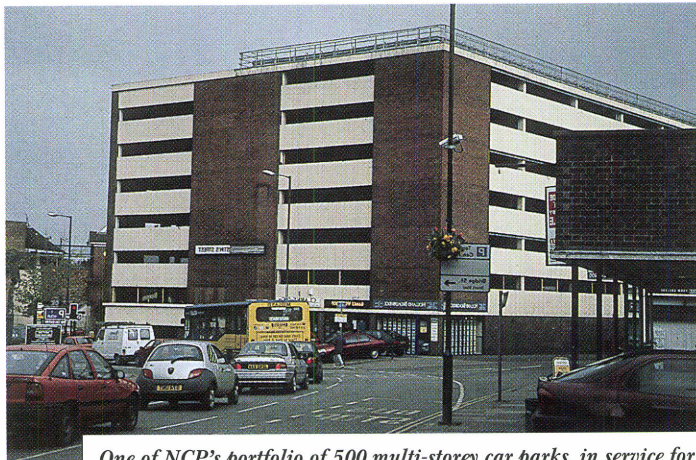
"Repair, maintenance, refurbishment and upgrading now account for at least half of the British construction industry's total output, and the proportion is rising by around 2% each year," says Dr George Somerville of the British Cement Association (BCA). "The trend is the same throughout Europe, with growing pressure to extend the lives of existing structures for both economic and environmental reasons. Structural assessment will be of huge importance in the 21st century."

Structural assessment is the process of inspection, testing and analysis used to predict how long a building will continue to perform its intended function safely, when repairs will be needed, and what form those repairs should take.

"For owners, public and environmental safety are paramount," says Somerville. "But the potential savings, if repair work could be deferred by five or ten years without any increase in the safety risks, are enormous. The problem is that until now there has been no scientifically-based procedure for making accurate predictions of residual life. Lacking authoritative guidance, consulting engineers have erred on the side of safety, with the result that each year hundreds of millions of euros are spent on unnecessary rebuilding and repair work."

Between the cracks

Rain, frost and aggressive salts affect concrete bridges, dams and buildings in different ways, depending on their design, location and materials. In recent years,



One of NCP's portfolio of 500 multi-storey car parks, in service for more than 30 years.

sophisticated new testing devices have enabled engineers to collect ever more assessment data - but have not equipped them to interpret this effectively.

"Traditionally, investigation and remedial work have focused on cracks and other symptoms of deterioration, instead of their effect on the structure's actual load-bearing capacity," Somerville explains. "Organisations have developed their own assessment procedures, but the calculations involved have lacked a sound technological basis."

To fill this gap, BCA has brought together a 14-strong transnational partnership of research institutes and large building and infrastructure owners - including Sweden's National Road Administration, Spanish hydro-electric dam operator Iberdrola, and National Car Parks (NCP), which owns 500 multi-storey structures throughout the United Kingdom.

A new assessment procedure is being tested and calibrated at 34

pilot sites. Feedback from the owners and their engineers will be used to prepare a practical manual outlining the new approach. The partners hope that this will form the basis for a European standard for structural assessment, of the kind which already exists for the design of new structures. Simple, computer-based analytical tools, together with complementary documents setting out detailed guidelines for particular types of structure, will also be developed.

Attitude to innovation

Changing the innovation culture is no easy task in the conservative construction sector. "The fact that so many owners wanted to take part in Contecvet is evidence of the demand for authoritative guidance," says Somerville, who co-ordinates the Innovation project⁽¹⁾. "But there is also an understandable reluctance to abandon traditional procedures.



The Innovation/SMEs Programme In Brief

Part of the EU's Fifth Research Framework Programme, the 'Innovation and participation of SMEs' programme promotes innovation and encourages the participation of small and medium-sized enterprises (SMEs) in the framework programme. The Programme Director is Mr G.C. Grata (Innovation Directorate, Enterprise DG).

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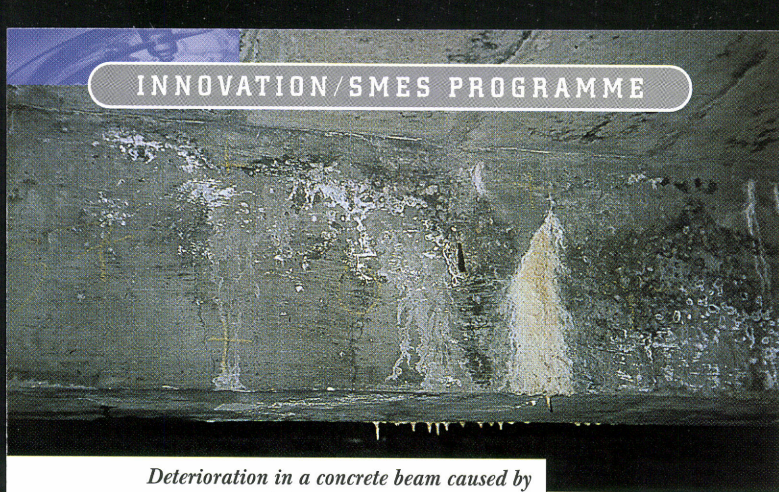
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(1) IN30902I - A validated users manual for assessing the residual life of concrete structures (Contecvet).

EUR 85



Deterioration in a concrete beam caused by penetration of de-icing salts. The Contecvet methodology helps engineers to determine whether remedial work is necessary.

•••

No one feels that they can afford to act as guinea-pig for an untested method."

Recognition of these barriers to take-up underlies both Contecvet's aim of creating a European standard and the assessment philosophy itself – which is straightforward and pragmatic and, in contrast to conventional procedures, starts from the priorities of the structure's owner.

The involvement of owners

themselves is also critical. "If technological advances are to be widely applied, those who can make use of them must be fully engaged in the development process," Somerville says. "It is not enough for researchers simply to make their findings available and move on to the next project."

The rewards for the owners taking part in the project may be spectacular. "Once it has been finalised, they will apply the new

method to all their structures," he says. "In some cases, we think it will cut annual maintenance bills by at least 25%."

Once its advantages have been demonstrated, Somerville expects the method's roll-out to be driven both by consultants, keen to pass these benefits on to their clients, and by demand from other owners. To ensure that take-up is not confined to the three partner countries, BCA plans to extend its programme of seminars and workshops across Europe after the end of the project.

Somerville also predicts that European consultants will find markets for assessment services based on the new method in Japan, Hong Kong, Australia, Canada and the United States, where current procedures remain relatively underdeveloped, outside the nuclear industry. ●

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SME NATIONAL CONTACT POINTS



Spreading the Word

As the contrasting examples of the United Kingdom and Latvia show, proactive support from the dedicated network of SME National Contact Points is helping technology-oriented SMEs in all 31 Member and Associate States to take part in Community research.

The SME Specific Measures of the Fifth Research Framework Programme (FP5) encompass Exploratory Awards and Cooperative Research – also known as CRAFT projects – in which transnational consortia of small and medium-sized enterprises (SMEs) undertake research jointly, or contract it out to third party research performers⁽¹⁾.

Under contract to the UK government, the independent consultancy company Beta Technology has been helping British SMEs to take advantage of these

schemes since 1992. "The schemes have become more flexible, application and evaluation procedures have been streamlined, funding has been increased, and new support services have been created," says Dr Bob Keown, Beta's Managing Director. "But essentially, our job has not changed."

Meet the people

That job's first element is a continuous campaign to inform SMEs about the research schemes

– both directly and through an extensive network of intermediaries. "Only 10,000 of the UK's 3.5 million SMEs are likely to benefit from these measures," says Keown. "We have already contacted about half of these, but reaching the other 5,000 requires a continuing, proactive approach. Our staff give around 250 talks a year to explain the advantages of CRAFT projects, and how they work – principally at meetings of local or sectoral organisations, which companies attend anyway for other reasons."

Many SMEs are referred by multipliers such as the UK's one-stop shop Business Links and its seven Innovation Relay Centres (IRCs), as well as trade associations, chambers of commerce, universities and consultants.

Beta Technology also maintains close links with key industrial and academic contacts. "We no longer maintain a formal network of partners, as we did under FP4," Keown explains. "But research organisations in particular are important sources of information for SMEs in their own sectors.



Left to right: Bob Keown, Linda McAvan, MEP, and Robert-Jan Smits of the European Commission's SME and Innovation Unit, at the opening of Beta Technology's new offices in Doncaster, UK.

Twice a year, for example, we bring together the leading UK agriculture, fisheries and food research centres to make sure they have all the latest information on the research programmes."

One-to-one assistance

Sometimes, research centres themselves assemble a consortium of SMEs⁽²⁾. More commonly, Beta Technology provides assistance directly to one or more SMEs with a product or process development, or a problem which they think might be solved through research.

"Typically, the SME co-ordinator is a company of 20-40 people with testing facilities but no in-house research capacity," says Keown. "They probably have an established relationship with a local research institution, and may have some European links, perhaps through a supply chain."

In the course of a 20-minute initial phone call, Beta's helpline staff run through preliminary eligibility and novelty checks before inviting the company to submit a one-page project description. On the basis of this, a face-to-face meeting is arranged. The service is free and confidential.

"The Commission has made a big effort to simplify the application forms, but because public money is involved they inevitably remain complex," Keown says. "SMEs are focused on their own problems, and have little patience with this kind of documentation. We do not write proposals, but we guide them through the process, helping them to formu-

late their projects, and to find suitable transnational partners and research performers."

Steep learning curve

Latvia's status as an FP5 Associate Country has given its SMEs the opportunity to participate in EU research for the first time.

"Our research institutes had some involvement in FP4 through the INCO, Copernicus and Phare support programmes," says Janis Stabulnieks, Director of the Latvian Technological Centre (LTC) in Riga, the non-profit-making body which runs the country's SME-NCP. "But none of the SMEs have any previous experience, and the learning curve is very steep."

LTC runs a business incubator for 30 technology-based firms, predominantly university spin-offs. "Not all of them are ready to take part in transnational research," says Stabulnieks. "But I make sure that they are aware of the possibilities, and they have direct access to our support in preparing proposals."

LTC is also well known in the wider Latvian research community as a member of the consortium which operates IRC Latvia, whose 800 clients include many SMEs. Its information days regularly draw over 100 companies, and – like Beta Technology – it works closely with research institutes which have the skills and facilities to act as CRAFT research performers.

Stabulnieks is delighted with the early response from high-tech Latvian SMEs which, by mid-September 1999, had already produced ten Exploratory Award proposals.



A microlaboratory for schools developed and produced by Biosan, one of 30 high-tech companies located within LTC's business incubator in Riga.

Under FP4, 400 proposals coordinated by British companies were supported by Beta Technology, leading to 200 Cooperative Research contracts – 23% of the European total – and Keown anticipates a similar level of UK success in FP5. But, through the SME-NCP network, the company is actively transferring its skills to less experienced National Contact Points like LTC, and recently approached Stabulnieks with a proposal for a joint UK-Latvian project.

(1) See 'Opportunities for SMEs', edition 3/99, for further details.

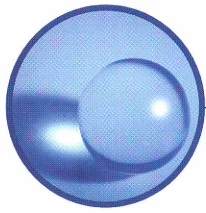
(2) As in the accompanying case study on page 6.

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• **A full list of the SME-NCPs can be found at:**
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Crystal Clear

Crystal glass manufacture – a traditional European industry – is threatened by growing regulatory pressure to exclude lead from consumer products. Now, scientific research undertaken for a consortium of SMEs has examined the safety of alternative crystal glass compositions.

Lead oxide has been added to glass since the Middle Ages – both to improve its optical properties, and to extend the temperature range at which the molten glass remains workable. A 1969 EU Directive specifies a minimum lead content of 24% by mass in glass sold as 'crystal', and there is a strong perception within the industry that lead crystal products command premium prices.

"But manufacturers are now under pressure to adopt alternatives to lead crystal," says Professor Nick Priest of Middlesex University in the United Kingdom. "The use of lead involves risks to workers and to the environment. Although, when solidified in glass, lead poses no threat to users, countries such as Denmark and the United States are attempting either to ban or restrict its use in consumer products."

Toxic or not toxic?

There are other metal compounds available which perform in a manner similar to lead. Indeed, some companies have already switched to compositions based on barium carbonate and oxides of strontium, zinc and titanium.

"The compositions are more complex," says Priest. "To come close to the qualities of traditional lead crystal, you need to use a mixture of different compounds. But, although regulatory pressures are greatest in Scandinavia, the whole industry recognises the need to prepare for the possibility that it



Production of high-value glass-ware at Royal Brierley Crystal. Molten crystal glass (right) produces fumes which condense to form an ultra-fine aerosol. This poses a greater threat to workers' health than the insoluble dust produced during glass cutting (above).



may eventually be forced to adopt alternatives to lead."

However, no one had thoroughly investigated the safety of the new materials – despite the fact that some, like barium, are known to be toxic. Whether they had already adopted lead-free compositions or were simply considering the possibility of doing so, crystal glass producers, including a number of small and medium-sized enterprises (SMEs), wanted authoritative, life-cycle information about the dangers of non-lead crystal glass.

Information gap

As technical advisers to the International Crystal Federation, Priest and his colleague Michael Hynes from University College Galway in Ireland already had well-established links with many of these companies.

"SMEs in particular lacked the in-house technical facilities and know-how to test and evaluate the safety of new compositions," Priest recalls. "Two of them – Royal Brierley Crystal in the UK and Galway Irish Crystal – asked

us to design a study on their behalf."

Following an Exploratory Award phase, in which the two research performers carried out a review of existing safety information in order to identify the gaps, Royal Brierley assembled a consortium of five SMEs – including a ceramic glaze manufacturer – and one larger company. A further three specialised research institutes also joined the partnership. With a little advice from Beta Technology, the UK's SME National Contact Point⁽¹⁾, the consortium prepared a successful application for a co-operative research (CRAFT) project⁽²⁾, which was launched in November 1997 and completed at the end of October 1999.

"The aim was to assess the environmental safety implications, and the health risks to workers and consumers, of lead-free crystal glass compositions," Priest explains.

"We defined six compositions, representative of the spectrum of glass types, each of which was produced for testing by one of the consortium's members."

In each case, the researchers studied possible leaching and consumer take-up of metals from glass products. They also measured possible workplace hazards from the inhalation both of glass powder produced by cutting and grinding and of vapour released from molten glass, and developed a method for testing levels of bismuth absorbed by workers. Finally, they examined

the potential problems of recycling and of landfill disposal of waste crystal glass.

Out of danger

"We were unable to identify any significant hazards to consumers, workers or the environment from the use of any lead-free crystal glass compositions, including those based on compounds which are themselves toxic," Priest confirms.

The study's findings provide reassurance both to those companies already producing crystal

glass without added lead, and to those which are planning to switch production to new compositions.

For those who still employ traditional methods of production, there are also valuable lessons to be learned. "Our work on the ultra-fine aerosols produced by the condensation of vapours rising from molten glass will help all manufacturers to reduce blood lead levels among their workers, by shifting the focus of safety measures to the melting and blowing processes, rather than cutting and grinding," Priest says.

"And the landfill study showed that leaching of metals from any crystal glass is toxicologically insignificant, even when it remains in contact with groundwater for a year. Waste glass, including lead crystal, is effectively inert." ●

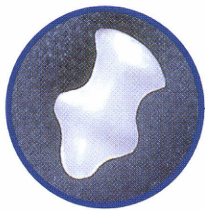
(1) See this edition, page 4.

(2) BRST-CT97-5122 – Evaluation of the biosafety of lead substitutes in the manufacture of unleaded crystal glass.

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INNOVATION RELAY CENTRE



A non-toxic Denzir filling, ready to be cemented in place. It was precisely machined to fit a particular cavity, using CAD/CAM technology.

Taking the Toxin out of Teeth

Composites, introduced to replace the mercury amalgam traditionally used to fill teeth, are themselves a serious health hazard for dentists who handle them on a daily basis. With the help of the Innovation Relay Centre network, a Swedish SME has developed an innovative alternative.

These days, having a tooth filled rarely involves anything worse than momentary discomfort – for the patient, that is. Dental staff, on the other hand, face the threat of serious damage to their health, as a result of regularly handling toxic filling materials throughout their working lives.

Long-term exposure to mercury, on which the amalgam traditionally used to fill tooth cavities is based, can cause brain damage. Modern alternatives, based on polymeric materials, wear out

much more quickly, and involve toxicity problems of their own. A small Swedish company, Dentronic, has recently developed a completely new dental system called Decim, which looks set to provide a real solution.

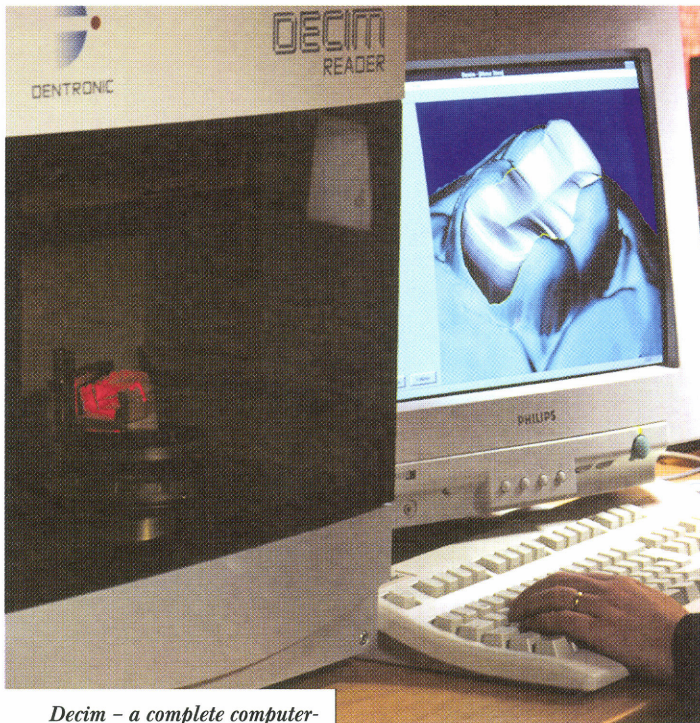
Perfect fit

"The answer was to use new materials," says Göran Nilsson of the Northern Sweden Innovation Relay Centre, which has been helping Dentronic to develop and commercialise the system. "Cera-

mics offer the necessary strength, and are both chemically inert and non-toxic. The company homed in on materials based on zirconiumdioxide, which provide all the right properties."

But identifying the right materials was only half the story. Using them to make dental fillings required a special system involving both software and hardware. "Unlike amalgam, ceramics cannot be mixed as a paste in the surgery," explains Nilsson.

Dentronic – a young company, started as a spin-off from the



Decim – a complete computer-aided design and manufacturing system for dental fillings.

•••

University of Umeå – recognised at an early stage that developing the new system would require outside technical expertise. To find this, it enlisted the help of the IRC.

"It was in 1995, just as the IRC network was getting off the ground," Nilsson recalls. "Dentronic approached us with a requirement for sophisticated computer-aided design and manufacturing (CAD/CAM) software. We put them in touch with a British software house with the necessary expertise, helped them to negotiate a licensing agreement, and we have been working with the company ever since. Decim, a fully integrated dental system, is the result."

The system involves a sequen-

ce of steps more commonly associated with advanced manufacturing than with dentistry. After preparation of the cavity, a cast is made as the model for CAD/CAM preparation of a corresponding inlay. The precise size and shape of the cast, captured by a special laser scanner, are converted into a three-dimensional drawing, with manual adjustment of the exposed chewing surface. A numerically controlled manufacturing unit automatically machines the inlay to shape, and after polishing, it can be cemented in place in the tooth.

It is the very high precision of the manufacturing process which makes possible the use of zirconiumdioxide – every filling fits perfectly.

Strategic advisers

"IRC Northern Sweden has a very hands-on approach, based on a long-term partnership," says Nilsson. "The extent of this particular partnership can be judged by the IRC's present role as permanent strategic adviser to the Dentronic directors. As far as questions of development are concerned, we have what amounts to an associate position on the company's board. We are always there to assist and advise."

Such close collaboration depends upon complete mutual trust. This has been reinforced by a secrecy agreement, which allows the IRC access to sensitive information on Dentronic and its technology, while guaranteeing the company absolute confidentiality.

Dentronic's recently signed agreement with French ceramic materials supplier Norton Desmarquet provides further evidence of this close working relationship. "The IRC has helped in drawing up contracts, using specialist legal advisers," says Nilsson. "The French company will develop and manufacture, exclusively for Dentronic, even more advanced ceramic materials for the Decim system."

Under the brand name Denzir⁽¹⁾, the new filling material was

launched nationally at SweDental last November, and internationally at the IDS fair in Cologne in April this year. Available in a range of shades, Denzir is CE certified, and an application for United States FDA approval has been submitted. But it has already attracted considerable attention among dental engineers, who have been waiting for some time for the development of a system capable of handling zirconiumdioxide.

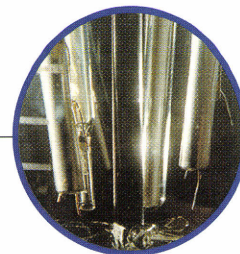
Dentronic has quadrupled in size in the three years since it first came into contact with the IRC, and is again recruiting new staff. "The next step will be to find international marketing partners," says Nilsson. "The company has already signed contracts with eight users of the Decim system in Sweden, and one in Germany. It has now entered a phase of rapid expansion. I am confident that this technology will be a winner." ●

(1) Denzir is a registered trademark.

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Keeping the Lid on Chemical Reactors



The 1984 explosion at Bhopal's chemical reactor killed thousands of people and injured tens of thousands more, while hundreds were injured in the accident in Seveso, Italy, in 1976.

Until now, it has been almost impossible to predict – and therefore prevent – such explosions, due to the very high number of false alarms produced when so many factors must be monitored. But a new warning system, which uses chaos theory to chart how apparently unrelated events can interact, is proving more reliable.

Repeats of Bhopal and Seveso will be much less likely, thanks to the work of the Institute for Systems, Informatics and Safety (ISIS), part of the European Commission's Joint Research Centre.

Trouble brewing

The safe operating condition of chemical reactors is essential to protect the environment and people inside and outside the plant, as well as the installations themselves. Severe difficulties can produce runaway events, when the rate at which the chemical reaction produces heat exceeds the rate at which it is removed by the cooling system. In certain circumstances, this can quickly lead to chain reactions, an explosion and plant shut-down. Although the number of major accidents is thankfully small, 'near accidents' are frequent.

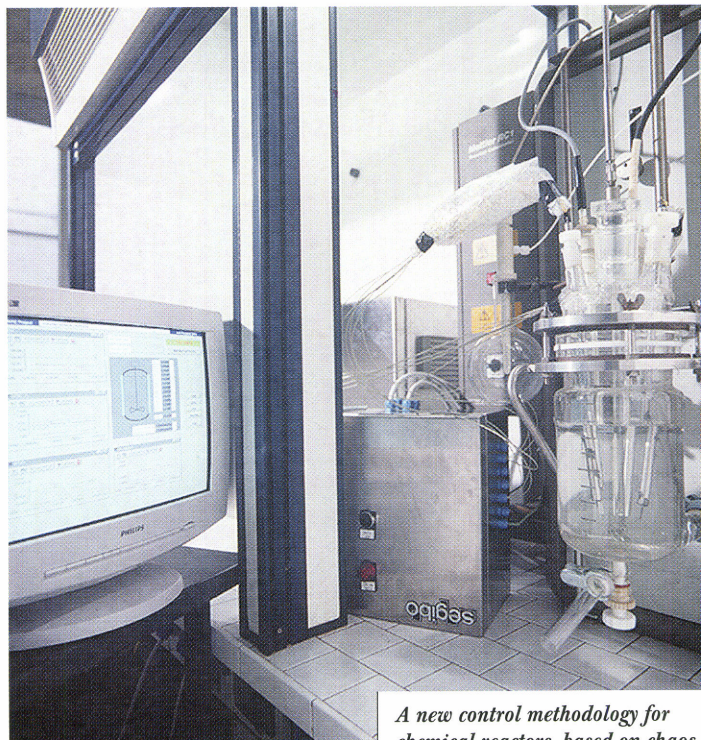
Creating a reliable advance-warning system is of the highest importance. "After Seveso and Bhopal, the European Commission was determined to develop new techniques to detect and prevent runaway events," explains José-Manuel Zaldívar of ISIS, who

co-ordinated the Competitive Support Action project Aware (Advanced Warning Against Runaway Events)⁽¹⁾. "What was needed was a system which would alert plant operators that they were heading for a dangerous situation. Aware's purpose is to give them enough time, when something is going wrong with the process, to take effective preventive action."

Batch processing plants pose special problems not faced in continuous reactors where the same forces are at work all the time – and 75% of chemical reactor accidents, including that in Seveso, occur in batch reactors. "It is like cooking," explains Zaldívar. "You put in one item, then another, and then another. This is different from the continuous processes employed in the petrochemical industry. In a small batch reactor, the process is changing all the time."

Sensitive plant

Transnational co-operation spanning academic and scientific disciplines was crucial in the development of an improved early-warning system. Following a three-year PhD study at ISIS conducted by an Italian mathematician from Twente University of Technology in the Netherlands, the final solution involved was obtained by chemical engineers working with control engineers as well as mathematicians. Together, they worked up a hypothesis and tested it on a bench scale



A new control methodology for chemical reactors, based on chaos theory, was successfully tested on the laboratory scale.

two-litre reactor run using a prototype device developed by the Segibo company in Bergamo in Italy, which manufactures reactor control equipment.

Traditional warning systems use measurements of temperature, pressure, acidity and viscosity to predict what reactions will occur. By contrast, the Aware system monitors changes in temperature in a number of key parts of the reactor, evaluating their significance using chaos theory, and triggering an alarm when the emerging patterns point to an explosion. The project made use of two central principles of chaos theory. First, chaotic systems are very sensitive to small changes in conditions. Second, rates of divergence – in this

⁽¹⁾ CSA97P05. For a general account of the Commission's CSA programme, see 'Competitive Support Actions', edition 5/99.

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instance, of temperatures – can be used to predict runaway events.

A patented solution

In the key markets of Europe, the United States, Canada and Japan, the Joint Research Centre has submitted patent applications for three technologies incorporated in the Aware system. The primary aim is to protect the project's work for exploitation, with licence rights held by Segibo for future application.

Aware is likely to have an enormous impact in the chemical and pharmaceutical industries. It is also expected that the project's findings will be used in other

industrial and mechanical processes where systems behave chaotically, including use in the control of impact oscillators. The new theoretical understanding of non-linear systems is also being applied in the area of water management in Venice, where it has been found to offer more reliable flood warning than traditional methods.

For Aware itself, the immediate priority is to conduct industrial-scale trials. Three chemical reactor operators are keen to run full-size exercises in the near future, while the UK's Health and Safety Executive's laboratory is to conduct runaway experiments with the system.

Aware is not just an excellent example of Commission support for industrial innovation. It has also shown how important it is to bring together the public and private sectors, and the disciplines of academia and industry. The signs are that the outcome will be a much safer operating environment for some of industry's most hazardous operations. ●

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SECOND CALL FOR INNOVATION PROJECTS

Calling All Innovators!



A second call for Innovation projects under the Fifth Research Framework Programme is likely to be published in mid-2000. A proactive campaign to inform potential proposer groups about the call is expected to yield a healthy crop of new projects.

In addition to the traditional channels used to announce new calls – the Official Journal and CORDIS – the Innovation Directorate plans to make use of its close partnership with the Directorate-General for Research's single entry-point for SMEs to ensure that as many small and medium-sized enterprises as possible are aware of the opportunity to take part. It will also highlight the fact that they can use the Exploratory Award scheme⁽¹⁾ to help them prepare this type of proposal.

Exploratory Awards

The 15 projects selected following the first call were laun-

ched at the beginning of January. In the new call, the Directorate will once again be looking for projects which help to identify common non-technical barriers to innovation, and to develop widely applicable strategies and tools for tackling them – as well as supporting the industrial take-up of specific new technologies through research and demonstration activities.

It will prepare new printed material to explain how an Innovation project works, using examples taken from existing projects, describing the different project phases and their financial management in detail. By disseminating information about the call through Innovation Relay Cen-

tres, National Contact Points and Chambers of Commerce, at conferences and in the trade press, it hopes that it will attract a good response. ●

(1) See 'SME Specific Measures', edition 3/99.

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Busquin Gets to Grips with Research

Within days of his appointment as the Commissioner for research, Philippe Busquin visited Ispra, the largest of the five sites of the European Commission's Joint Research Centre (JRC), for which he is responsible along with the Director-General for Research.

After exploring the JRC's participation in the Fifth Research Framework Programme (FP5) as well as its primary mission to support the conception, development, implementation and monitoring of European Union policies, Mr Busquin declared himself impressed with the JRC's work to date. Now it was time to consolidate in order to strengthen the JRC's expertise in areas of primary concern to Europe's citizen, he said.

On 9 November, Mr Busquin reported to the European Parliament's Industry, External Trade, Research and Energy Committee that there has been a 91% take-up of the budget available for the first year of FP5, with 17% of responses to the first calls for proposals having come from small and medium-sized enterprises.

The progress of FP5 will have a major influence on the future direction of research policy, about which Mr Busquin is already thinking seriously, in the context of early preparations for the Sixth Research Framework Programme. Mr Busquin has made clear that his main strategic concern is the creation of a common European research area, addressing differences between national financial, tax and education systems in order to maximise research potential throughout the Union.

CERN to Exploit its Intellectual Property

CERN, the European Laboratory of Fundamental Particle Physics, has always been an important source of industrial technologies – with the World-Wide Web the best-known spin-off from its fundamental research. Now it has launched a new initiative to facilitate such transfers of technology. This will enable the laboratory to exploit its intellectual property more efficiently, in areas where there is significant market potential, or where European strategic interests are at stake.

Action will be taken in three areas: to protect the intellectual property rights (IPR) related to new technologies developed at CERN, to provide IPR and entrepreneurship training for young scientists, and to strengthen the role of CERN's Industry and Technology Liaison Office. The Office will establish links with technology parks and incubators in Member States, and has created an on-line database of available technologies.

<http://www.cern.ch/CERN/Technology>

Eastward Extension of the European Research Area

On 1 October the 11 countries which are soon to join the European Union signed association agreements which give them full access to the Fifth Research Framework Programme (FP5). This allows their companies, universities and research institutes to participate in EU research on equal terms with colleagues in the 15 Member States.

In practice, they already enjoyed this status for the evaluation of FP5's first calls for proposals. Awareness-raising campaigns in the 11 countries produced strong representation among the proposals received – especially

from Hungary, Poland and the Czech Republic, each of which has around 100 participants in FP5. At the same time, all 11 have opened their own research programmes to EU scientists.

The European Commission views the likely strengthening of the associated countries' scientific and technological capabilities as a key component of the modernisation and restructuring which full integration into the EU will require.

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CORDIS Provides Regional Research Information

A new website has been launched, dedicated to research activities in the Oslo region. Hosted by CORDIS, the site gives useful information about the Norwegian capital's research strategy and infrastructure, with frequently updated articles presenting the latest news from the region. The first area highlighted on the site is Oslo's RITTS plan for innovation and technology transfer, which involves close collaboration between Norway and the EU.

Meanwhile, the Swiss Italian University has launched a new scientific research information service, which uses automatic links with the CORDIS News database, as well as Swiss-specific information provided by the university. Researchers can define personalised profiles of their areas of interest, using the scientific index codes employed by CORDIS. New matching records are forwarded to them by e-mail.

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Commission and Eureka will Co-operate to Help SMEs

Following an October meeting of its High Level Group, Eureka is likely to increase its cooperation with the European Commission, to boost the innovative capacity of Europe's small and medium-sized enterprises (SMEs).

Eureka believes that collaboration with the Commission's existing research information networks – in particular those which are proving so successful in encouraging SME participation in the Fifth Research Framework Programme – could help to raise its profile among smaller businesses.

Representing the European Federation of High-Tech SMEs, Emmanuel Le Prince told the meeting that research funding is not usually a problem for SMEs. More often, their main difficulty is in finding suitable transnational partners, and in gaining access to expert advice about conducting research in an international context.

<http://www.eureka.be>

Hot Commodities the New



Paul Schwander of the EPO explains the benefits of the esp@cenet on-line patent information retrieval system to Evangelos Venizelos, Greek Trade, Industry and Research Minister.

Patinnova '99 gave patent professionals an opportunity to influence Union policy in an area which is increasingly critical for industrial competitiveness. Debate focused on patent information system mechanisms for raising awareness – with a call to the 380 million intellectual property more attractive.

But to judge from stock market activity in mid-October as Patinnova was taking place in Halkidiki, Greece, intellectual property is already one of the hottest commodities around.

Just 18 months after its simultaneous flotation on Nasdaq and the London Stock Exchange, UK-based ARM Holdings, whose business is based on licensing its intellectual

property (IP), had seen a nine-fold increase in its market capitalisation, to €4 billion. The company does not make a single chip itself, but licenses its designs to partners such as Intel, Texas Instruments, Philips and Nokia, and derives 67% of its revenue from fees and royalties.

By mid-November, ARM was valued at €6.5 billion.

The complexity of the present patent system places European companies at a huge disadvantage.

1. Dreaming of a Single Community Patent

To the enterprises represented at Patinnova, reducing the cost of protecting their inventions is the top priority.

"Patents are a means to an end – a way to get a return on our investment in innovation," said Hans Rump, the owner of a high-tech micro-business⁽¹⁾ with a portfolio of 350 patents.

For Nokia, a Community patent cannot come too soon. "My dream is that by Patinnova 2001 we will have a single EU-wide patent, supported by streamlined court procedures," said the company's Vice-President, Esko Friman.

The complexity of the current European system (see 'European Patents – How They Work') undoubtedly imposes additional costs on business, acting as a brake on innovation. Rump describes its simplification as an economic priority, and Friman says that the cost of patent protection in Europe has been a sig-

nificant factor in the growth of Nokia's US research activities. "The need for a cheap and accessible system is urgent," he insists.

Political support

Both the European Commission and the European Parliament are already committed to the introduction of a Community Patent at the earliest opportunity.

In February 1999, following extensive consultation, the Commission published a Communication on promoting innovation through patents⁽²⁾. As its top priority, this calls for urgent action to prepare a draft Regulation for a Community Patent. A single, affordable patent offering a guarantee of legal certainty is, it says, "vital to ensure the competitiveness

(1) See 'Technology – the Healthy Alternative', edition 2/98.

(2) The full text of the Communication is available at <http://www.europa.eu.int/comm/dg15/en/int-prop/indprop/99.htm>

(3) esp@cenet is a registered trademark of the European Patent Office.

ity of Century

*fluence European
ustrial
, litigation, and
legates to make*

of enterprises in the Union [and for] a fully integrated European market in innovation."

Emphasising the Parliament's deep concern for small and medium-sized enterprises (SMEs) in particular, Ana Palacio Vallelersundi, who chairs the Legal Affairs and Internal Market Committee, said that it eagerly awaited the Commission's proposals. Delegates were further encouraged by a message of support from Erkki Liikanen, Member of the Commission responsible for Enterprise. "I attach the greatest importance to questions concerning patents," he said.

Such high-level backing will be essential if the European Union is, finally, to implement the single system of patent protection envisaged by the Luxembourg Convention on the Community Patent of 1975.

CONTEXT

European Patents – How They Work



Patents protect technical inventions: normally, products or processes. In granting a patent, a state allows the holder sole rights to the exploitation of an invention which usually last for 20 years. Since the system enables inventors to profit from their work, either directly or by selling a patent or a licence to a third party, it creates an incentive for innovation.

But by obliging holders, in return, to publish detailed descriptions of the patented technologies, patent law also reduces innovation's overall costs. Disclosure permits others to avoid infringing existing patents, or wasting resources on problems which have already been solved, and accelerates progress by enabling them to leapfrog over the state of the art.

Each country has its own patent laws, courts and procedures. The European Patent Convention has, since 1977, provided a mechanism whereby protection in as many signatory states as the applicant wishes

may be granted on the basis of a single application, processed by the European Patent Office (EPO). A European patent has the same legal effect as a national patent in each of the designated states, so protection is therefore not uniform.

The legal framework for a single Community patent, uniformly enforceable across the entire EU, was established by the 1975 Luxembourg Convention, but has not yet been ratified by the 12 Member States of the time.

The Patent Cooperation Treaty (PCT) offers a simplified system for filing patents for 100 countries around the world.

2. Global Market Place for Ideas

With or without a Community Patent, the management of intellectual property rights is being transformed by the Internet.

Patent documents have been accumulating in libraries since 1790, when the first modern patent law was introduced in the US. Until recently, gaining access to this information was difficult, and although it is estimated to contain 80% of mankind's entire store of technical knowledge, it was seldom referred to except by patent examiners and lawyers.

In the last ten years, much has been made available on CD-ROM. But today, the Internet allows anyone to read any patent document they want, easily, quickly and cheaply. This has stimulated demand, and numerous on-line patent information services have rapidly sprung up – both free, publicly funded services such as *esp@cenet*⁽³⁾, an initiative of the

European Patent Office (EPO) endorsed by the European Commission, and commercial services offering added-value features.

Ever closer

With 150 million scanned pages of text and drawings, *esp@cenet* is the largest on-line

PATENTING FOR SMES

Protect Your Mobile (and your ideas)



Markku Lehtinen never expected to file a patent. Then one day he left his mobile phone in a taxi ...

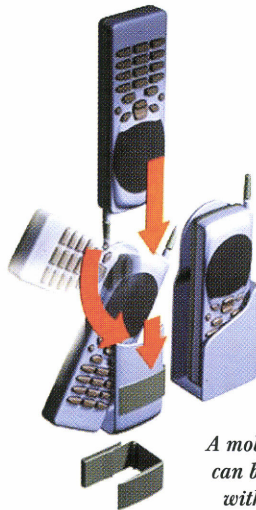
"Mobile telephony is a wonderful technology," he says. "Companies like Ericsson, Nokia, Panasonic, Sony and Motorola make great phones. But their accessories are terrible."

In the mid-1990s, Lehtinen grew irritated at the way his own mobile kept falling from its belt clip. "I looked into it, and discovered that the clips sold by all the major manufacturers were both unreliable and expensive to make," he says. "A typical clip has four plastic parts and two metal springs, and costs €0.5 to produce."

Secure, but mobile

In the course of an evening, he came up with a simple but effective design for a one-piece injection-moulded belt clip. "If you turn the phone upside down, it slides easily in or out," he explains. "But in any other position, the clip holds the phone securely by a stud on the back, so there is no way it can be lost or stolen." The Teleclip will cost just €0.1 to make, and could also be used for other portable equipment such as pagers, personal stereos and cameras.

With backing from the Foundation for Finnish Innovations (FFFI) – which has put up two-thirds of the €50,000 spent on IPR protection to date – he started patent procedures, and in 1996 his first Finnish patent was



A mobile phone can be inserted with a simple twist, and lifted out again just as easily – but the Teleclip protects it against theft or accidental loss.

granted. The next year he founded a company, Oy DevEduc, to commercialise his IPR in the Teleclip and a range of related designs based on the same idea.

"My aim was to sell patents to the big mobile phone manufacturers," he says. "Using the PCT (Patent Cooperation Treaty) procedure, applications were filed in 1998 for patents in a number of European countries and in the United States."

Not invented here

Negotiations with several companies are in progress, and one has signed an evaluation agreement. But Lehtinen is still waiting for the big breakthrough.

He identifies two main barriers to innovation. The first is cost. "For a product with international market potential, using the PCT procedure from the outset saves time," he advises. "But the high costs are a real obstacle for small companies."

Even with the FFFI's help, Lehtinen could not afford to patent the Teleclip in the Far East, where he knew that he would be unable to pay for litigation in the event of an infringement. In an effort to save costs, he has also used the utility model, which offers cheaper and simpler protection than a patent, but for a shorter time. "Unfortunately, the current system gives the holder of the rights only 12 months to convert them to a patent. To meet the cost of conversion, I need a deal. And if I miss the deadline, the value of the IPR will be greatly reduced."

The second barrier is cultural. Every human being is inventive, Lehtinen believes, but few think of profiting from their creativity, while the enterprises to which new ideas could be of greatest value tend to dismiss them as 'not invented here.' "Good ideas are easy. Protecting and marketing them is much more difficult," he concludes. "Basic understanding of intellectual property should be taught in high schools."

This version of the clip can be permanently attached to jeans or other clothing. A slotted stud on the back of the phone (silver) secures it in the clip.

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technical library in the world. And, just 12 months after its launch, the site receives around 15 million 'hits' each month. "The distance between information and users has definitely been reduced by *esp@cenet*," said Paul Schwander, on secondment from the EPO to the Commission.

He warned that where commercial interests are at stake, however, restricting a novelty search to such free services is hazardous. Trained professionals are required to operate the more powerful information tools used by patent offices and professionals, and to interpret their outputs.

Commercial patent information providers, a number of which were represented at Patinova, fill the gap between these two systems. According to Thierry Sargentini of Questel Orbit's Qweb service, SMEs in particular need pre-processed information, rather than raw data. "They want a fast, confidential service which delivers relevant and authoritative information in a form that they can readily use," he said. "Information is of no value when there is too much of it."

Several speakers predicted that such patent information services would soon lead to the on-line trading of intellectual property rights themselves. They looked forward to the creation of virtual technology market places in which enterprises of all sizes could license the new technologies they needed rapidly and efficiently⁽⁴⁾.

User-oriented

To maximise the stimulus to innovation provided by the patent system, however, much wider understanding of the value of patent protection and patent information is required – both in industry and among academic research institutions.

Echoing similar findings in Europe, a 1994 survey by the Canadian Intellectual Property Office (CIPO) found that significant numbers of Canadian businesses neither sought to patent their own inventions, nor made use of patent information as a source of technical or market intelligence.

"SMEs tend to focus on day-to-day operations," says Jean-François Luc, a member of the team which developed the BIX (Business Intelligence Express) on-line toolkit for the Department of Industry's Forest, Metals and Building Products Branch. "Issues like IPR do not readily attract their attention. We approached it as a matter of risk management – a perspective companies relate to directly."

BIX provides interactive IP diagnosis, identifying the risks to which users are exposed by their current IP strategy – or lack of one. It also

offers tailored technology-watch bulletins via e-mail, based on the latest Canadian patent and trademark information. Initial response from users has been so positive that BIX is now being rolled out to other industrial sectors.

Industrial liaison

In Europe, the IPR-Helpdesk⁽⁵⁾, established in response to demand expressed at Patinova '97, offers similar first-line IPR assistance aimed at participants in research supported by the Fifth Research Framework Programme (FP5). A number of national patent offices have also developed industrial patent awareness services, often with the help of the EPO's Co-operation Programme (see 'Catalysts of Innovation').

But more still needs to be done, especially in the academic sector, if Europe is to match the impressive performance of US universities. There, highly qualified technology transfer professionals each year file thousands of patent applications, converting academic research into millions of dollars of licensing income and helping to create hundreds of spin-off companies.

Patinova heard vigorous calls for basic IPR awareness training in all Europe's technical universities, as well as for dramatic improvement in their capacity to manage their own IP portfolios.

In response, Manfred Schmiemann of the Commission's Innovation Directorate announced that FP5's Innovation and SMEs programme had recently launched a study to assess the current status of IP training and exploitation in European universities. In addition, selected transnational consortia of pa-



Left to right: L. Meyer, interpreter, G.C. Grata, E. Venizelos and C. Koyas.

tent offices, information brokers, universities, Innovation Relay Centres and others would begin to develop models of good practice in the delivery of patent awareness training during 2000.

(4) In a knowledge-based economy, many products can also themselves be traded electronically. See this edition, page 20.

(5) See 'A Personal Service', edition 3/99.

Websites like the Patent and License Exchange (<http://www.pl-x.com/>) and PricewaterhouseCoopers Intellectual Property Exchange (<http://www.ipex.net>) are already creating an efficient on-line market for those seeking to sell or license intellectual property rights.

NATIONAL PATENT OFFICES

Catalysts of Innovation



The European Commission envisages an enhanced role for national patent offices as promoters and facilitators of technological innovation.

Among the plans set out in its recent Communication, 'Promoting innovation through patents' (see main text), is a pilot action to support national patent offices in promoting innovation. As the Communication makes clear, some have already made progress towards adoption of this new role as providers of patent information, and as sources of expert advice in the planning of IP protection strategies.

Customer focus

One of those which has moved forward from the traditional functions of conducting searches and examining national applications is the Danish Patent and Trademark Office – as its Marketing Director, Poul-Erik Nielsen, explained at Patinnova '99.

"We have developed a set of services much broader than our core tasks," he said. "Our primary job today is to support Danish SMEs to protect and exploit their intellectual property."

Part of the Ministry of Trade and Industry, the Office operates as an independent business unit, with a market-oriented approach. "Staff no longer speak of cases or applications,

but of customers," Nielsen boasts. Its range of innovation support products includes a sectoral IP monitoring service to keep companies informed about legislative and technical developments in their field of activity.

Transforming patent data into accessible information products is part of a wider mission to promote IP awareness. "Responsibility for IPR is only allocated as an explicit management task in 17% of Danish companies," Nielsen says. "We are striving to develop a patenting culture, running regular training sessions for business groups and trade organisations."

In close partnership with academic bodies, the Office also works hard to develop the capacity of Danish universities to exploit their research-based IP.

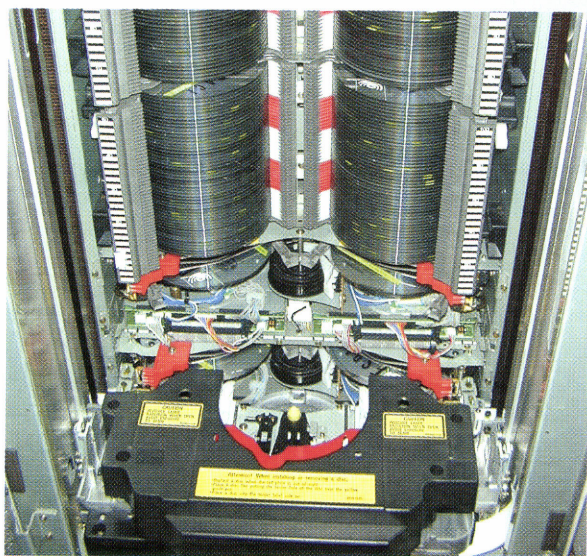
EPO Co-operation programmes

Since 1989, the European Patent Office has helped many national patent offices to stimulate innovation by improving access to patent information, especially for SMEs.

The EPO's co-operation programme, now in its third phase, began by offering national

offices a menu of standard projects in the field of patent information, which individual countries could choose to implement or not. "In 1995, a broader and more flexible framework was adopted," explains Georg Pantoglou, the EPO's Director of Co-operation Programmes. "Our objective is still to harmonise platforms and standards in order to reduce the overall costs of improving access to patent information. But differing national infrastructures demand that these are tailored to meet a variety of needs." Ten three-year national projects were 50% funded by the EPO in the second phase.

In 1997, the co-operation programme was revised again to encompass projects of common interest, such as the development of the on-line *esp@cenet* service (see main text). Such projects receive 100% funding under the framework of the co-operation programmes. Current national projects include improving the dissemination of patent information, and patent awareness promotion and training programmes.



Equipping national patent offices with CD-ROM jukeboxes (and now, 'DVD' jukeboxes) has greatly improved and speeded up their access to patent information.

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•••

3. The Spirit of the Law

Litigation, as well as patent-granting procedures, must be made more affordable if the European patent system is to be truly effective.

Much attention has recently been focused on the cost of filing European patent applications, though the last few years have seen a steady reduction in the EPO's procedural costs.

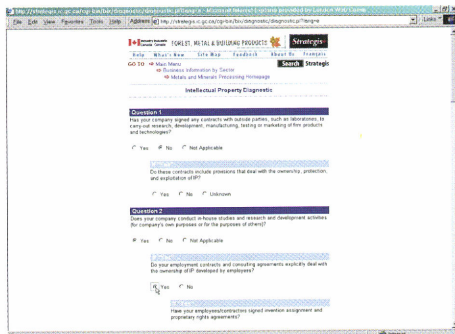
On average, translation of patent documents into the official language of each designated Member State still accounts for 40% of the total cost to the applicant. To some, this seems a small price to pay for access to a multilingual market of 375 million consumers. But many in industry now view it as an unnecessary burden, and pleaded at Patinnova for English to be adopted as the sole language of European patenting.

Defenceless

But one of the largest elements in the overall cost of protecting IP is still litigation. It is now widely accepted that the high costs of defending patent rights against infringement in court constitute the principal barrier to wider use of the patent system by European SMEs and research institutions. And as Liliane Meyers, the EPO's Principal Director for Patent Information, pointed out at Patinnova, they could be dramatically reduced by harmonisation of court procedures across the EU.



At Patinnova '99, 380 leading patent professionals had the opportunity to influence EU policy at a critical juncture for the European patent system.



Canada's web-based IP diagnostic tool introduces patent issues to SMEs in terms they understand.

The present system, in which the same patent is subject to multiple national jurisdictions, each with its own procedural rules and often handing down conflicting judgements, is slow, complex and costly.

In the opinion of many Patinnova delegates, a common European patent court should be established, operated by expert lay judges. Mrs Palacio's personal view is that the mini-

imum requirement is for a common Court of Appeal. "If constitutional reform is needed, so be it," she told the conference.

Insurance policy

A second option, proposed by John Keen of UK insurer Seer Ltd, is a European scheme of patent litigation insurance. In the past, he said, insurance policies had been too expensive, and had only been used by applicants with reason to fear litigation. High claim rates had forced insurers to raise premiums still further.

Now, the Danish, Swedish and French governments are jointly proposing a scheme in which all applicants would be required to pay a modest premium for limited cover against the cost of court procedures, as a way of lowering a major barrier to innovation. "The costs of litigation are so high that, without insurance, many SMEs are unwilling to defend their patents against infringement," Keen said. The possibility of public subsidy for such a scheme was also discussed.

In response, Erik Nooteboom of the Commission's Internal Market Directorate-General announced that a conference on patent litigation insurance would be held in Brussels early in 2000, and that a working group would be established to examine the feasibility of a Europe-wide insurance scheme. ●

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Sprinting into the Information Society

IST 99, held in Helsinki in November, re-emphasised Europe's commitment to transforming itself rapidly into an Information Society. Over 3,500 visitors attended the three-day event, which included an exhibition of 80 Community research projects.

Immediately prior to the event, the European Council's Information Society Technologies (IST) Committee approved funding of €500 million for 168 large projects in the Fifth Research Framework Programme (FP5). The second call for FP5 IST projects has opened (but closes on 17 January), and the new work programme for 2000 is now available⁽¹⁾.

In his opening speech, Erkki Liikanen, European Commissioner for Enterprise and Information Society, stressed the need to address issues at the European level. "It is only by pooling our resources and devising a common strategy that we can create an inclusive Information Society and ensure Europe does not fall behind. The stakes are high, as the Information Society holds the key to our future – jobs, growth and quality of life." He also empha-



Left to right: Riitta Uosukainen, Speaker of the Finnish Parliament, the three 1999 European IST Grand Prize Winners – C. Fahråus (C-Technologies), Karin Bjuvel (Effnet) and J. Ehrensård (CyPak) – Sir Derek Roberts and Erkki Liikanen, European Commissioner for Innovation and the Information Society.

sised the importance of SMEs: "The communications revolution is not for giants only – the Internet-driven world is creating new niche markets for small, innovative start-ups."

Technical and legal platform

The European Commission plays a central role, supporting technological development through the IST programme and ensuring a favourable legal environment for business and consumers.

In the last 15 years, European collaborative research has made a significant contribution to the development of user-friendly information and communication technologies and applications. It led, for example, to the global success of GSM and the development of a common standard for digital broadcasting in Europe. Now, integration of mobile communications and digital TV with the Internet for e-commerce is the Commission's strategic priority.

Full liberalisation of the EU

telecommunications market in 1998 has brought falling charges, diversification of tariffs, and improvements in the quality of service. This will do much to stimulate future economic growth, but the Commission recognises that the EU framework needs further adjustment to reflect new technological and market developments.

The 1999 Telecoms Review Communication, adopted by the Commission in early November, should lead to legislative proposals early in 2000. Key areas of concern include cheaper Internet access, consistent rules for communications infrastructures and simpler regulatory procedures.

The Commission is also planning a new 'eEurope' initiative, (due to have been presented at the Helsinki summit in December 1999). Its objective is to bring all European citizens, companies and administrations on-line as soon as possible. It will focus on improving Internet access, promoting 'digital literacy', stimulating venture capital and encouraging the public sector to take fuller advantage of digital technologies.

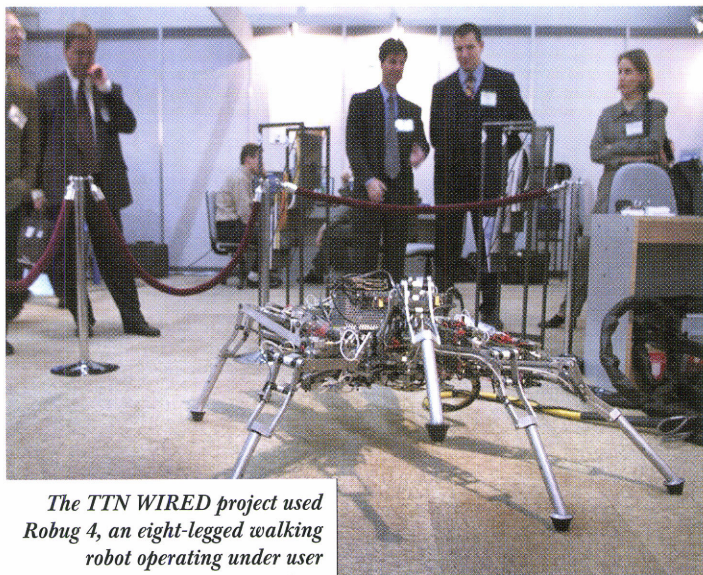
Innovation the Key

The Commission promotes IST take-up through the Information Society DG's Information Society Activity Centre (ISAC)⁽²⁾. "Our main function is to assess where we are, what still needs to be done and what instruments are required," explains Jörg Wenzel,

In the Money

Over 40 of Europe's most promising high-tech companies presented their strategic and financial plans to 250 leading international investors and advisers in the European Investment Forum, which ran in parallel with IST 99. These businesses are seeking over €200 million in capital for a range of ventures – more than half involving the Internet or electronic commerce.

The Forum was organised by a consortium that includes Europe Unlimited, IP Strategies, the Federation of European High-Tech SMEs and IESE. Promoted by the European Commission's IST programme, the Forum is part of a series of six-monthly events. The next will take place in Berlin on 10 and 11 April 2000.



The TTN WIRED project used Robug 4, an eight-legged walking robot operating under user directions, to demonstrate how HPCN (high performance computing and networking) technologies can lead to cheaper, smarter robots with increased flexibility and robustness.

ISAC's principal adviser. "We certainly need to do more to bring SMEs on board. For example, only 10% of SMEs have their own home page."

The establishment of 'innovation cells' within each FP5 research programme, to act as a contact points for SMEs and oth-

ers wishing to make use of research results, is an important advance.

The IST programme's 'innovation cell', set up under FP4, also fulfils a wider international role. "As part of the programme's International Cooperation activities, we work with third countries

to promote standardisation and technology transfer," explains José Cotta, Head of Unit for international aspects of the programme. "On the innovation side, we are concerned with socio-economic as well as the technical inputs to innovation as a means of improving quality of life."

Cotta sees his innovation group as the interface between IST and other parts of FP5 programmes – in particular, the horizontal Innovation and SMEs programme. And he believes it has an important role in stimulating innovation by encouraging the dissemination of project results – for example through the Prosoma service⁽³⁾ set up under FP4 to provide potential users with information about new technologies emerging from EU research. ●

(1) The new work programme is available at <http://www.cordis.lu/ist>

(2) The Information Society Promotion Office, part of ISAC, is at <http://www.ispo.cec.be/>

(3) See 'A Stronger Research Distribution Chain', edition 6/98. The Prosoma service is available at <http://www.prosoma.lu/>

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Pay as you go

Broadband Internet access can markedly improve competitiveness. However, the cost of broadband communication has often denied SMEs access to its benefits.

The BOURBON (BrOadband Urban Rural Based Open Networks) project, supported by FP4's Advanced Communications Technologies and Services (ACTS) programme, set out to offer SMEs affordable access to scalable networks using the 155 MB/s ATM (asynchronous transfer) protocol, to stimulate their full involvement in Europe's Information Society.

BOURBON was coordinated by Lake Communications in Ireland and involved partners from nine EU countries, with trials carried out at some 20 SMEs. Finnish SME trials were organised by the Helsinki Telephone Company (HPY) and have already revolutionised production in the Finnish media industry. Material for printing is now

assembled and supplied for publication in digital form rather than as films – dramatically speeding up the process. Similar advances have been made in the Irish engineering sector.

The participatory development process, involving both the telecommunications company and the SME user, was key to this success. "Service development is simple when you are dealing with one major customer," points out HPY Research Director Aimo Maanavilja. But a diversity of needs demands more complex solutions. "We

really have to understand each customer's business processes," he emphasises.

Service development consisted of proposing an innovative solution, obtaining customer validation, refining the service offer – and the price – and trying again. The process has led to the development of a series of generic platforms applicable to specific sectors, such as multimedia. Here, the goal is 'price per use', enabling agencies and reproduction houses to charge communications costs on a specific job in the same way that they have calculated film costs in the past.

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Untangling the Web for Small Firms

Neither the legislative nor the technological framework for e-commerce is fully developed yet. However, an Esprit project has shown that small European companies can realise substantial savings today by conducting business-to-business trade over the Internet, using existing technologies.

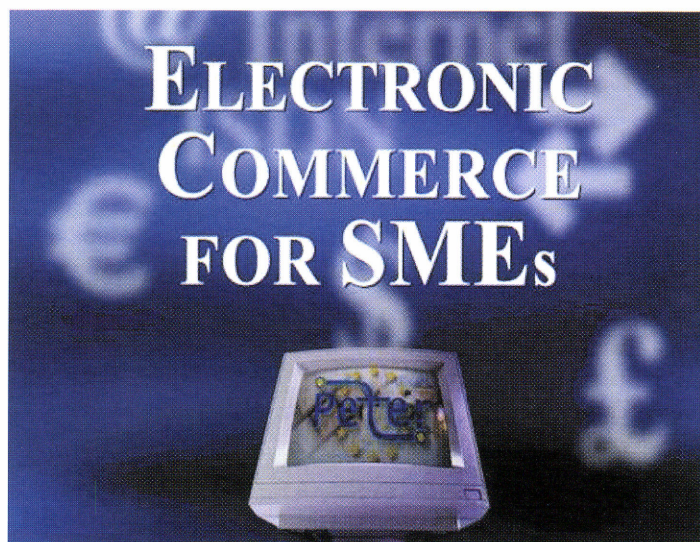
Consumer acceptance of electronic commerce is growing faster than Internet usage itself. Each day, tens of thousands of new customers place orders with on-line shops like Amazon, paying by credit card via a connection to a secure server.

Business transactions are more complex. Commercially sensitive customer data demands a higher level of security, and the sums involved are larger, so payment systems must be able to handle the transfer of funds between banks. Small and medium-sized enterprises (SMEs) have much to gain from e-commerce, since it allows them to compete with large corporations on equal terms. But most lack the technical resources to develop their own solutions.

E-valuation

"Peter⁽¹⁾ set out to evaluate, integrate and test existing technologies, creating a toolbox of all the elements needed by SMEs to establish secure on-line sales channels cost-effectively: product catalogue, order processing and payment," says project coordinator Jens Koblin of German telecommunications company Teles.

The two-year project, which ended in October 1999, involved seven partners in five countries – companies of various sizes already developing their own on-line shops. Five of them each



worked with three or four client SMEs with little experience of e-commerce, to increase their understanding of the technical and legal issues, clarify their specific requirements, and build pilot e-stores for each of them using software modules from the Peter toolbox.

"We originally focused on products such as software and multimedia content which can be delivered electronically, and where the security of the seller's intellectual property rights (IPR) is as important as that of customer data," explains Koblin. "But no reliable mechanism for protecting the IPR of digital goods is yet available."

Instead, the project prepared the ground for rapid take-up of such technology by the pilot SMEs, through awareness-raising

training. This material is now available to other SMEs in the form of guidelines⁽²⁾ which introduce the commercial and IPR issues and explain the technical requirements for e-commerce. A second set, now being prepared, will outline the current legal position in each Member State, pending implementation of the draft EU Directives on copyright and electronic commerce.

"Harmonisation will simplify things," says Koblin. "But people do not want to wait. They want to open their on-line shops now."

You can bank on it

Payment mechanisms presented the other major challenge. "There is still no universal standard for secure electronic payment," Koblin explains. "On-line transactions between companies in the same country are no problem. But differences between national banking systems meant that we had to develop a different solution in each country, in collaboration with a clearing bank, so that firms in different Member States could do business over the Internet." This experience will lead to a European benchmark for electronic payment systems, also included in the Peter guidelines.

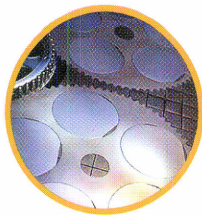
At a practical level, each of the project's partners is continuing to upgrade the pilot stores, integrating new technology as it becomes available. ●

(1) Esprit project 25326 – Pilot for electronic marketing and trading in European small and medium-sized enterprises.

(2) Available free from the project website.

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Research Grinds Away at Chip Costs

The cost of processing silicon for the manufacture of microelectronic chips is under attack. A research group at the Fraunhofer Institute of Production Technology (IPT) at Aachen in Germany is working on the next generation of machines for processing silicon.

With silicon wafers getting larger all the time, Fraunhofer IPT researchers and industrial partners in Finland, Austria and Germany are attempting to improve surface processing techniques. The companies involved in the Brite-Euram Bestwafer project⁽¹⁾ include manufacturers of the machinery for processing silicon and the wafer makers which use their equipment.

IPT project engineer Dietmar Pähler believes that new processing techniques could help to revive Europe's wafer industry. "In the 1960s, European manufacturers played a key role in the development of the semiconductor market. The main technologies were developed here. But today, it is Japan and the United States who call the shots," he says.

Wafer thin

Bestwafer is developing a new method for machining semiconductor wafers before they reach the companies that turn them into electronic devices. The fabrication of microelectronic integrated circuits starts with the growth of very pure crystals of silicon in the form of large rods. These are then sliced into wafers just 600 and 800 micrometres thick. Wafer makers are represented in the project consortium by the Finnish company Okmetic.

Each wafer goes through dozens of steps in order to build the tiny transistors and diodes that make up the chips, along

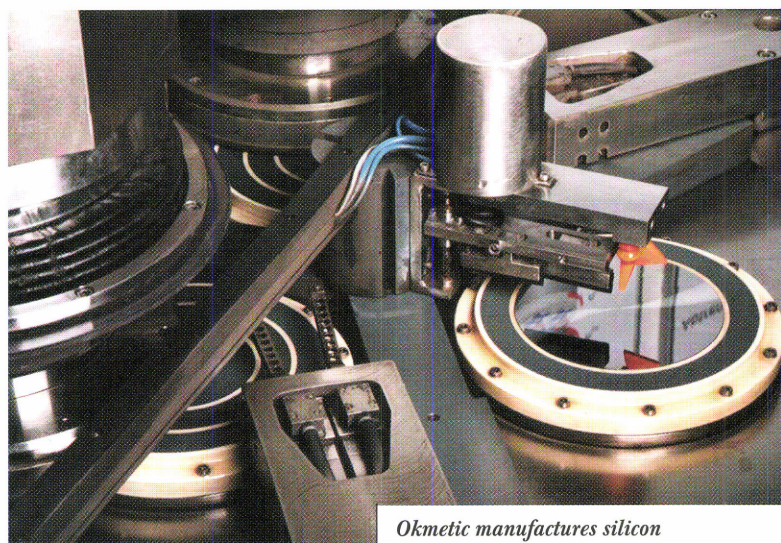
with the circuits which connect them. A wafer may contain hundreds of such chips, each typically 0.5cm by 0.5cm and containing 10 million elements or more. The final steps involve dicing up the wafer and packaging the individual chips.

The number of chips on each wafer has a critical impact on productivity, and the industry has used progressively larger crystal rods. In the early days, these yielded wafers of just 50mm in diameter. Today, chip production at plants like Okmetic's usually starts with 200mm wafers. The next generation on the market will be 300mm wafers. These will yield twice as many chips, but large wafers present formidable machining problems.

Slicing each wafer from a rod leaves a rough surface which must be smoothed in a series of lapping and polishing processes. "This is extremely expensive, accounting for nearly 40% of the total manufacturing cost of the wafer," explains Pähler.

Smooth as glass

Lapping produces a smooth surface by compressing the wafer between two rotating discs, in an emulsion containing ultra-fine crystal grains. But it is a dirty process, requiring a number of separate steps to clean away the slurry. "It is hard to control precisely, and difficult to automate. And it is just too slow because, of course, time is money," says Pähler.



Okmetic manufactures silicon wafers for highly integrated chips. Bestwafer technology will help the company to achieve the very fine tolerances necessary.

Very flat, damage-free wafer surfaces can only be achieved with extensive polishing. Bestwafer's goal is to limit the depth of the disturbed surface layer to less than one micrometre. "We hope to achieve surfaces much smoother than conventional lapping methods can produce, and to do so reliably and economically," Pähler explains.

The consortium plans to reduce the number and complexity of the stages in the surface treatment of wafers. Grinding equipment from a second industrial partner, the German machinery maker G&N of Erlangen, has replaced lapping. This employs an abrasive wheel to remove material from the surface. By changing the characteristics of the wheel, grinding can gradually improve the finish of the surface.

Pähler believes that as well as saving costs, grinding will produce a better surface. "A lapped wafer has a satin finish," he says. "If you look at our first test results, the ground wafer is almost like a mirror."

Reinventing the wheel

The key to Bestwafer is in the grinding wheels, which will be produced by another consortium member, the specialist Austrian manufacturer Tyrolit. The development of grinding wheels which do not need constant attention to maintain the right



degree of sharpness is a central element of the research project.

Wafer grinding is a two-stage process. It begins with a coarse grinding wheel which removes material rapidly, but causes damage beneath the surface of the wafer. The finishing stage uses a finer wheel to remove this damaged layer.

Just over 12 months into the three-year project, the results of the first experiments are promising, according to Pähler. Over the next two years the partners will

concentrate on further improvements to eliminate some of the subsequent process steps. At present, wafer makers have to put lapped surfaces through a series of mechanical and chemical etching processes. "We may be able to eliminate etching altogether," says Pähler.

By reducing the number of production steps, the partners hope that their grinding techniques will cut wafer manufacturing costs by around 25%. This would give Europe's wafer

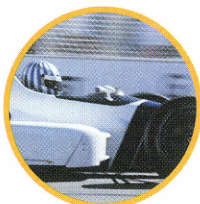
suppliers a chance to win back some of the ground that they have lost over the past quarter of a century. ●

(1) *Brite-Euram project BRPR980633 - Development of a new grinding technique towards damage-free machining of silicon wafers (Bestwafer).*

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11TH EU CONTEST FOR YOUNG SCIENTISTS



Michael Schumacher's Leg

Sophisticated simulation software developed by two German schoolboys could be used to improve the safety of Formula 1 racing cars, or to speed the calculation of motion in computer animations.

Sebastian Gschwender and Michael Rödel began work on their innovative technology as 16 year-olds, when a teacher suggested the finite-element method as a topic for a computer science project.

"It is a mathematical technique for approximating complex behaviour, which can be applied to problems of motion and deformation," Gschwender explains. He and Rödel used it as the 'engine' of a powerful tool for simulating mechanical events. After winning a local competition at the end of 1998, their FinoPro project also won at state and national levels, and was recently awarded a €3,000 second prize in the 11th European Union Contest for Young Scientists.

"We continued to refine the software at each stage," Gschwender says. "Winning was great. But the real reward was the satisfaction of finding our own solutions to a complex set of problems"

The art of self-defence

The annual contest is organised as part of FP5's Improving Human Potential programme. The 80 finalists who met in Thessaloniki, Greece, for the judging and awards last September were the best of 30,000 science students who had taken part in 35 national competitions.

They also heard a lively presentation on the basics of patenting

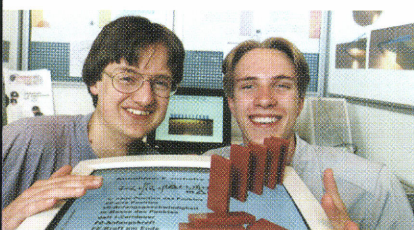
and licensing by an expert from the European Patent Office⁽¹⁾, whose vice-president, Paul Kyriakides, was one of the jurors. "It is important that scientists are aware of intellectual property issues from an early age," says Graham Blythe of the Directorate-General for Research. ●

(1) See also this edition's dossier article on intellectual property, starting on page 12.

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Sebastian Gschwender (right) and Michael Rödel hope to find financial backing to develop their prize-winning FinoPro technology as a commercial product.

FP5 model contract IPR booklet

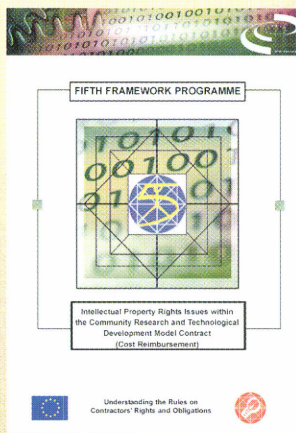
The Innovation and SMEs programme's IPR-Helpdesk has launched a new booklet covering intellectual property rights (IPR) issues relating to the model contract for the Fifth Research Framework Programme (FP5).

Designed for existing research contractors as well as those preparing proposals for projects under FP5, the booklet gives an overview of the model cost reimbursement contract. It explains the rules, rights and obligations related to IPR and the dissemination and use of research results set out in the contract.

Copies of the English edition are available free of charge, and the full text can be downloaded from the IPR-Helpdesk homepage. French and German editions will be available shortly.

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Available Studies on Innovation Management Techniques

The Innovation Management Techniques (IMT) action line of the Innovation programme of the Fourth Research Framework Programme aimed to strengthen the capacity of national and regional bodies to promote the use of IMTs by small and medium-sized enterprises. An updated list of 13 studies and methodological reviews on innovation management produced in the framework of these activities is available on-line.

Contact:

<http://www.cordis.lu/imt/src/p-study.htm>

Veille Technologique – Guide des Bonnes Pratiques en PME/PMI

ISBN 2-9599776-0-2; €10 (FR)

Technology watch – encompassing the systematic monitoring of the competitive, technological and legislative environment in which a company operates – is more and more a prerequisite for survival in today's rapidly changing markets. This short, practical booklet – written in French, with key sections summarised in English and Spanish – offers small and medium-sized enterprises (SMEs) an easily accessible overview of the theory and practice of technology watch. Produced

by the Innovation project, Reveil, the booklet offers ten commandments for the simple implementation of efficient technology watch procedures, supported by case studies of good practice drawn from companies in France, Spain and Luxembourg.

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Innovation in Urban Transport

ATS 1,000 (€ 255)

The proceedings of a November 1998 conference on innovation in urban transport have been published. Jointly organised by the European Commission and the Austrian Ministry of Transport, the conference focused on innovative solutions emerging from research undertaken within the Fourth Research Framework Programme. Findings were assessed from the point of view of their practical applicability and political feasibility in order to transfer expertise between research, policy-makers and practitioners. Specific topics included benchmarking, sustainable travel, new transport technologies and services, urban transport and quality of life, transport pricing, and transport telematics.

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Note

Publications are free unless otherwise stated. If specific contact information for obtaining a publication is not supplied, and there is a price listed in euros, then the publication can be purchased from the sales and subscription office in your country of the Office for Official Publications of the European Communities (EUR-OP). Addresses can be found in most EU publications, on the WWW (<http://eur-op.eu.int/general/en/s-ad.htm>) and by contacting EUR-OP (fax: +352 2929 42759).

Nuclides 2000 (CD-ROM)

EUR 18737 EN; ISBN 92-828-6512-6; € 260

Radionuclides are widely used in agriculture, medicine, industry and research. The chart of nuclides is an indispensable tool, but paper versions are awkward and slow to use. The software package published on this CD-ROM overcomes this problem for the first time, not only presenting the basic data on radionuclides, but automatically carrying out all the calculations needed to obtain the required information. It was developed by the Institute for Transuranium Elements (ITU) of the European Commission's Joint Research Centre (JRC) with the support of the Innovation and SMEs programme, in a Competitive Support Action.

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CEO Newsletter

The quarterly newsletter of the Joint Research Centre's Centre for Earth Observation (CEO) provides an overview of its most recent activities. The latest issue presents recent developments in the European Environmental Information Services (EEIS) project, launched in 1998, which aims to bridge the gap between the environment and earth observation user communities. It also gives details of the Satweb project for secure on-line exchange of earth observation data via the web, and outlines the ENVIP-Nature project, which aims to develop a standard set of criteria, indicators and methods for the use of earth observation data and geographic information systems to view the European landscape.

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World Sustainable Energy Day

9-10 March, Wels (Austria)

Designed as a forum for the presentation of sustainable energy solutions and the establishment of new partnerships, this international event will showcase outstanding projects and initiatives from around the world, as well as providing information about major European policy developments. The Energy Globe Award 2000 – for energy efficiency and renewable energy projects in the fields of housing, industry, transport and public services – will be presented as part of the conference programme.

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 http://www.esv.or.at

Water Technologies – brokerage event

29-30 March 2000, Vienna (Austria)

The Water Technologies brokerage event is being held in parallel with the international conference 'Water' and the exhibition 'Aqua-therm'. The staging of these three events in parallel will offer participants the opportunity to examine the subject of water from various angles during their visit to Vienna. The aim of the event is to facilitate and encourage collaboration between technology suppliers and users in the fields of drinking water, water treatment, waste-water management, management of water resources, and project financing. The organisers aim to stage an event where SMEs, industrialists, universities

and research institutes from eastern and western Europe can showcase their technologies and develop new and important partnerships. A catalogue detailing all technology offers, requests and partner searches will be published and disseminated throughout Europe to interested parties.

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European Business Summit – Innovation and Creativity

9-11 June, Brussels (Belgium)

Organised by the European employers confederation (UNICE) and the European Commission, this high-level summit meeting will bring together around 1,500 senior political and industrial decision-makers. In open debate and parallel workshops, delegates will address an issue of strategic importance to both private and public sectors: how to develop within the European Union a culture of innovation and a spirit of entrepreneurship, as a source of economic growth. Designed to establish dialogue as the basis for concrete action, the event will also explain the role of the EU Institutions in creating synergies between Europe's governments and industry.

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Eco-efficiency 2000 – towards sustainable economic growth

19-21 June, Malmö (Sweden)

This business-oriented event offers a specialised arena and market place for scientists, professionals and business people working in the field of eco-efficiency. The first day will challenge top scientists, CEOs, officials and politicians to demonstrate how to achieve sustainable development – socially, economically and technically. Days two and three will be devoted to seminars on research and good practice, covering research findings and applied techniques, methods, policies and system solutions. There will also be an exhibition.

Contact:

http://www.nutek.se/information/
 ecoefficiency2000

Functional electrical stimulation and motor systems

21-24 June, Aalborg (Denmark)

The sixth conference on neural prostheses, focusing on motor systems, aims to bring together the various disciplines involved in the field of restoration of motor and sensory functions of individuals with motor disabilities. Sponsored by the EU's Improving Human Potential programme, student awards aim to attract high-quality papers and posters from young scientists in particular.

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