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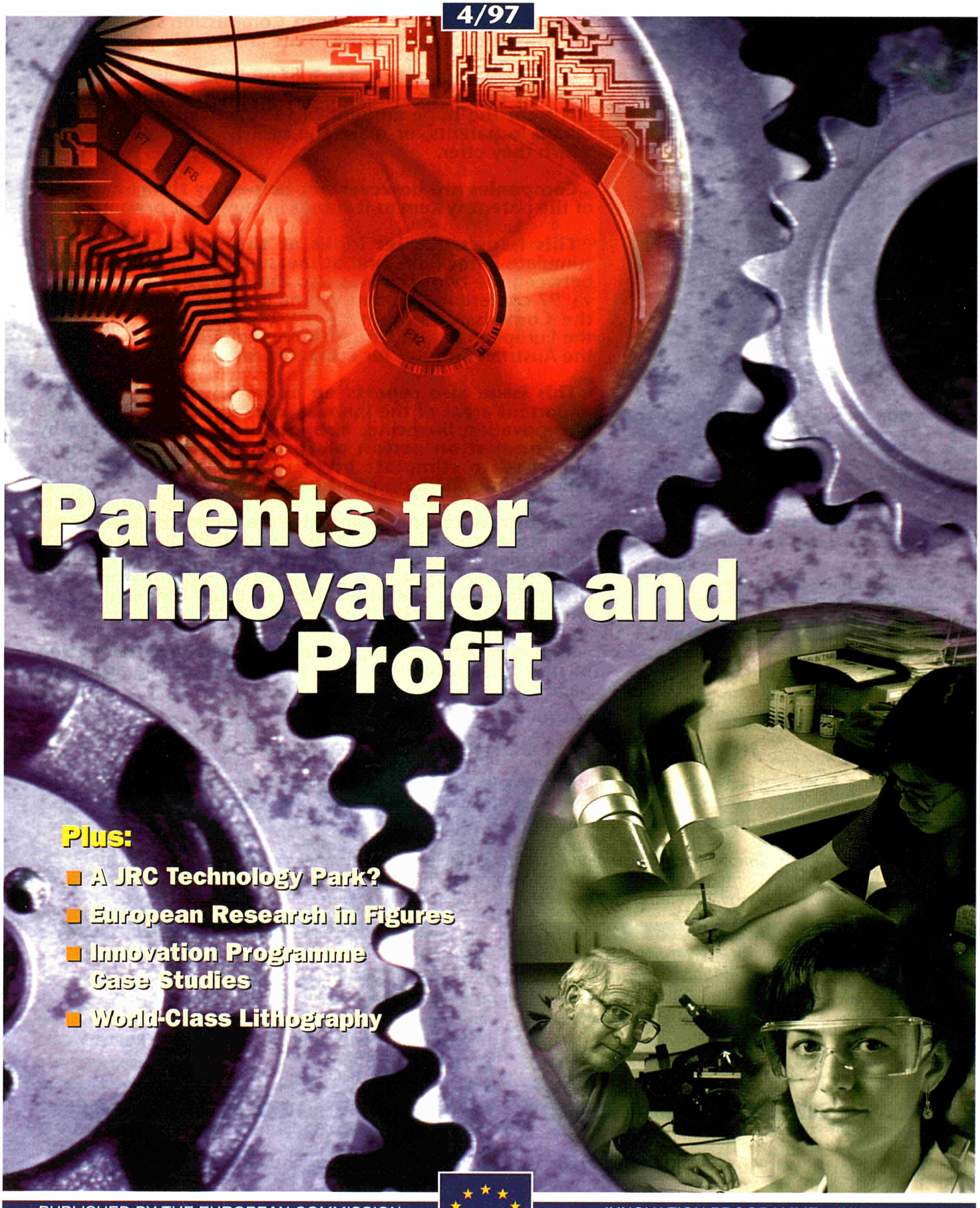

Patents for Innovation and Profit

Plus:

- A JRC Technology Park?
- European Research in Figures
- Innovation Programme Case Studies
- World-Class Lithography

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INNOVATION PROGRAMME • JULY 1997

CONTENTS

IRCs: providing a complete assistance package, page 10.

Cover: European Service Network.

Making the Most of Patents

Europe is not making the best use of the patent system. It is identified in the European Commission's Action Plan for Innovation as one of the prime areas for improvement.

One major weakness is a lack of understanding of patents by many European companies. As a result they do not benefit from the huge amount of technical information contained in patents, or make the best use of the protection which they offer.

Companies are however not helped by the complexity of the patent system as it stands in Europe at present.

This issue's dossier looks at the ways patents can stimulate innovation, and at measures to improve the link between the two. This was also the subject of the Patinnova '97 conference, held in Vienna in May and organised by the Commission's Innovation Programme together with the European Patent Office, the Austrian Patent Office, and the Austrian Ministry for Economic Affairs.

This issue also reports on activities in several other important areas of the Innovation Programme. In the area of innovation financing, also identified as a vital area by the innovation action plan, a new scheme is being launched to stimulate investment in young, technologically-innovative companies (see page 11).

The introduction of innovative management techniques for smaller companies is being supported by two innovation projects reported on page 8. One is designed to help small companies identify the computer system which best fits their needs, the other aims to bring 'benchmarking' within the reach of small companies.

Management techniques to assist in the introduction of new technologies are also the subject of the article on page 12. ■

INNOVATION & TECHNOLOGY TRANSFER

The European Commission's Innovation Programme is under the responsibility of Edith Cresson, Member of the Commission responsible for Research, Innovation, Education, Training and Youth.

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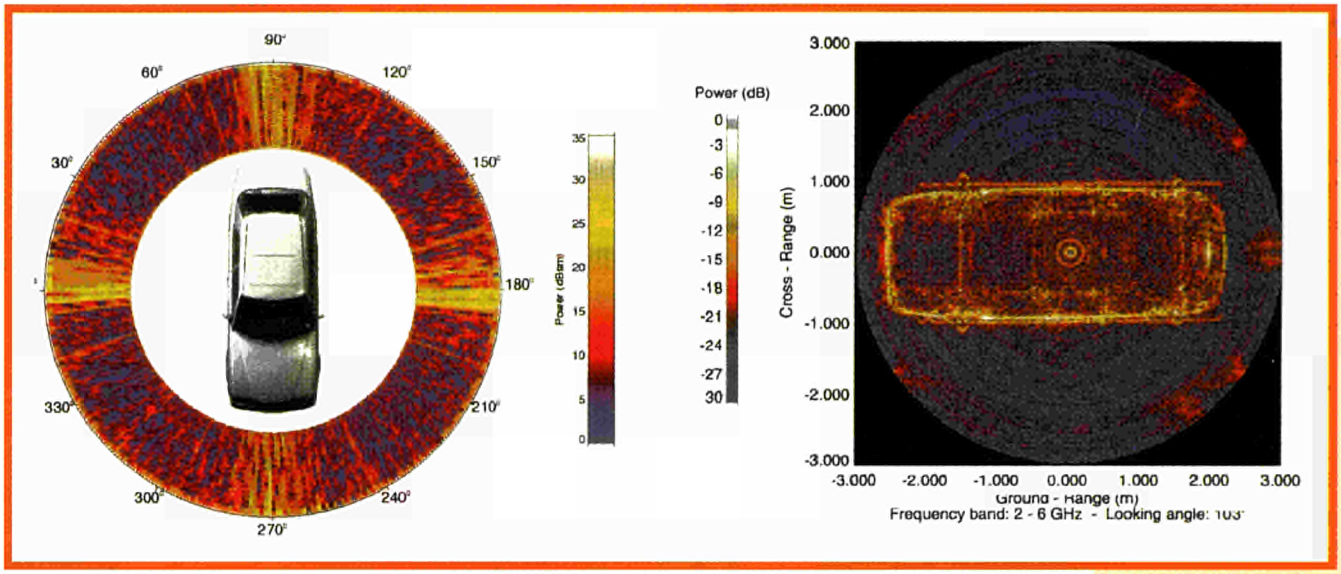
JOINT RESEARCH CENTRE

A JRC Technology Park?

The Commission is currently examining the feasibility of creating a new initiative to make the Joint Research Centre's expertise more accessible to European industry.



The JRC's European Microwave Signature Laboratory is helping several European car makers develop intelligent cruise control by making radar cross section (RCS) measurements of their vehicles. Pictured: RCS data of a Mercedes limousine (left) gives its radar visibility in real traffic situations, while a 2D radar image is obtained (right) from RCS data measured over 360°.

The EC's own research organisation - the Joint Research Centre (JRC, see the Dossier of edition 5/95) - is a unique feature in Europe's research landscape. It has many world-class experimental facilities that European countries would not have been able to fund individually. Its research teams are multi-disciplinary and solution-oriented in nature, and are involved in hundreds of Europe-wide collaborative research projects. Finally, it is neutral, independent and international in outlook.

In short, it may prove the ideal environment for a new European initiative. Located within the JRC's main site in Ispra, northern Italy, its major goal would be to give industry throughout the EU Member States access to the JRC's expertise and facilities. R&D collaborations could be carried out through a variety of means, such as contractual work, mixed team projects, sharing access to large installations and even joint ventures.

It could also host prototyping projects for SMEs which do not have the necessary infrastructure themselves, facilitate 'partner search' for European research projects, network with other research centres and technology parks, and serve as a European example for good practices in technology transfer and innovation.

Feasibility Study

The feasibility study, a joint initiative of Commissioners Cresson and Bangemann, is focusing on, among other issues:

- **industrial potential and technical assets:** the site's key technological competences and facilities are being assessed, particularly the large installations (the European Microwave Signature Laboratory, the European Laboratory for Structural Assessment, etc.).
- **technology transfer aspects:** different strategies for overcoming the site's distance from most European regions are being assessed, including the concept of a 'virtual' technology transfer initiative based on advanced information and communication technologies. The implications for the present organisational structures, staff incentives and intellectual property rights rules are being examined.
- **private finance:** the potential for attracting private investors to fund potential spin-off companies and invest in exploiting the JRC's research is being investigated.

The study is being carried out by a range of Commission services as well as external consultants. Interviews are being conducted with industrial companies throughout Europe to gauge the level of interest from the private sector and to analyse the services and structures necessary to develop commercial expertise, notably in the context of commercialising licenses stemming from JRC research.

The results will be presented after the summer, with a final decision likely before the end of the year.

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▶ SURVEY

European Research: Vital Statistics

The Commission's research programmes collect large amounts of information from project co-ordinators, and further R&D statistics are gathered directly by EUROSTAT. Why is all this data needed? How is it used? And what does it show?

If statistical data is to repay the effort expended on its collection, surveys must be designed to furnish answers to specific types of question. The Commission's research statistics are primarily intended to meet the needs of policy-makers, whose concerns include:

- trends in research activity, by region and sector;
- comparisons with research activity in the US, Japan and other third countries;
- impact of EC research programmes;
- relationships between R&D and industrial performance and prospects.

Such questions are also highly relevant to the R&D community, if only because a thorough understanding of the environment in which policy is framed is an invaluable aid to the preparation of bids for research funding.

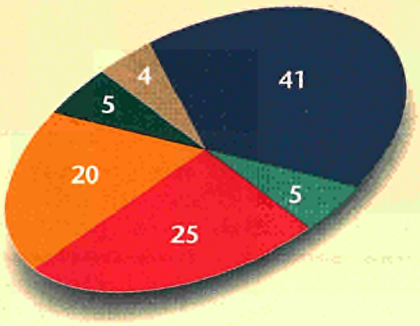
EUROSTAT: Statistics in Focus

EUROSTAT, the European Communities' Statistical Office, has traditionally studied two measures of research activity — allocations of financial and human resources and, since 1989, patent applications. Regular updates of R&D statistics are published in EUROSTAT's *Statistics in Focus* series. Full survey results are also released each year in the three-language volume *Research & Development: Annual Statistics*.

Key points from the 1996 yearbook include:

- Around 117 billion ECU was spent on R&D in the European Union in 1993. This was 1.99% of GDP, well below the corresponding figures for the US (2.66%) and Japan (2.94%).
- Germany, France and the UK were responsible for over 70% of the total, but there was wide variation between regions.
- Around capital cities, R&D expenditure as a proportion of GDP often approached or exceeded 3%, while in many remote regions it was under 1.5%.
- The business sector (some of it government-funded) accounted for almost two thirds of total R&D expenditure.
- In 1994 governments allocated 54 billion ECU to R&D, and the Commission a further 2 billion. This was 2.5% less than in 1993, and provisional data suggests a further decline in 1995.
- R&D-related employment in 1995 was nearly 2.1 million, a slight increase on 1993, and around 1.2% of the total EU labour force.
- European patent applications fell sharply from a 1990 peak of 32,000, but have recovered steadily to just under 31,000 in 1994.
- Germany accounted for 42% of 1994 patent applications, but Portugal, Spain and Ireland, starting from low bases, recorded the highest rates of growth between 1989 and 1994.

1. Expenditure on innovation by category



R&D
Market research
Pilot production
Product design
Patents
Other

(source: EUROSTAT/CIS)

The European Union's industrial performance is also reviewed each year in an annual *Panorama of EU Industry*, produced by DG III (Industry) with the support of EUROSTAT. Printed and CD-ROM versions of the 1997 edition, which includes a new chapter on the Information Society, were published in April.

Community Innovation Survey

Technological innovation and *SME participation in R&D* are two areas which are of particular concern both to policy-makers and to members of the research community itself, but about which there was until recently little evidence. Data on innovation is now available from the Innovation Programme's European Innovation Monitoring System (EIMS), particularly its first pan-European Community Innovation Survey (CIS1).

CIS1 was designed to produce a more qualitative account of European innovation, determining linkages between innovation and R&D expenditure and offering a more reliable indicator of future European competitiveness than R&D spend or

patent application rates alone. Undertaken in 1993 by Member States in collaboration with the Innovation Programme, it used common questions to gather comparable data from 40,000 enterprises.

The resulting database is unique in the world. It will provide valuable support for efforts to improve conditions for innovation in Europe. Analysis of the data has shown that:

- 50% of European companies describe themselves as innovative, having either developed or introduced a new product or process;
- 65% of these have engaged directly in R&D activities (others innovate without R&D effort, for example by introducing new equipment);
- Non-R&D costs represent 59% of total expenditure on innovation (see figure 1). Among large companies, non-R&D costs amount to only 50% of the total;
- On average, innovations introduced in the past three years account for one third of turnover. In the most innovative sectors — computers, communications and other electronic equipment — the figure is over 50%, in others as low as 15%;
- Financial considerations — risk, lack of appropriate finance, high costs, and long pay-back periods — constitute the greatest barriers to innovation;
- Other significant barriers include lack of research capacity, resistance to technical change, and intellectual property rights issues.

Further CIS1 findings were published in the second 1996 issue (1996-2) of EUROSTAT's *Statistics in Focus* series, and the full results are available on CD-ROM.

A second survey is planned for 1997. The Commission is aware of the burden which surveys impose on managers, but hopes for a more even regional response rate to CIS2. The new data will provide the basis for a European innovation benchmarking service, benefiting individual companies in all sectors.

SME Participation

SMEs are responsible for 65% of sales turnover in the European Union, 66% of jobs, and over 80% of job creation. Their capacity to innovate is therefore of crucial relevance to Europe's future economic performance.

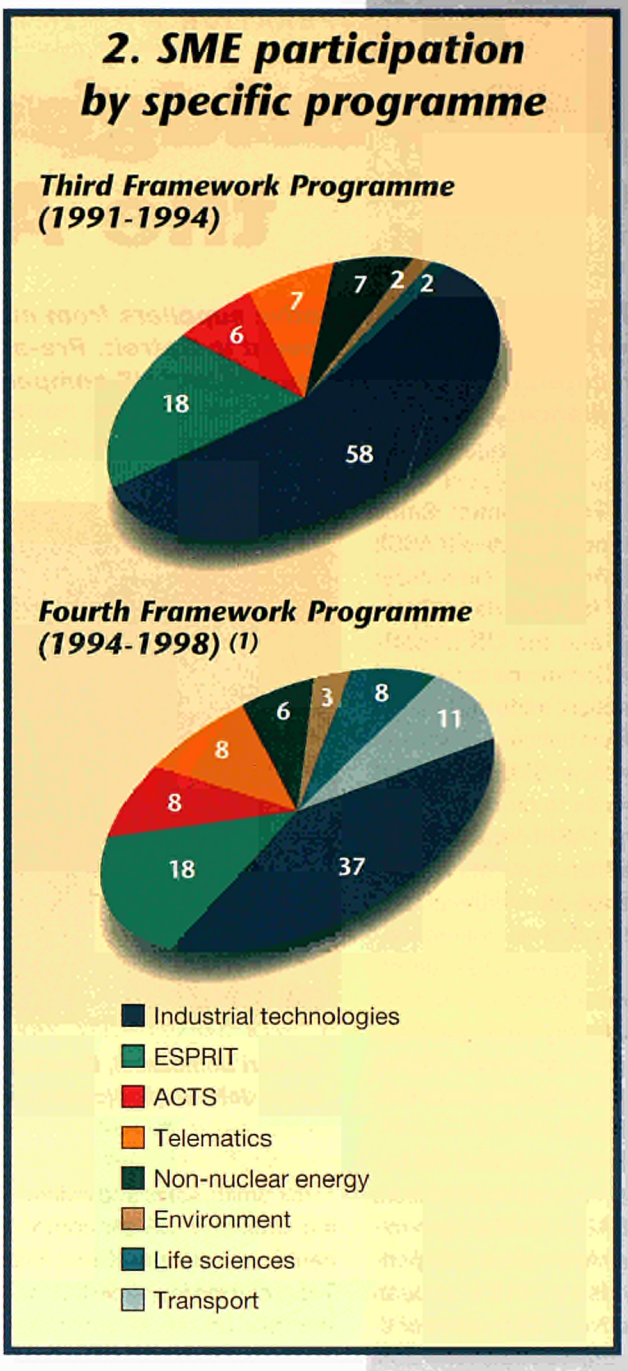
Special Technology Stimulation Measures for SMEs (TSME) were introduced as part of the Fourth Framework Programme, to facilitate the participation of SMEs in each of the specific research programmes, either as technology developers or, through CRAFT projects, as technology users. At the same time, an SME Coordination Unit was established in DG XII (Science, Research and Development) as a single contact point for all submissions.

> *"The resulting [CIS] database is unique in the world."*

The Unit has recently published a booklet on SME participation in the Fourth Framework Programme, which reveals that:

- 5,439 SMEs participated in the first two years (1994-96), compared with the 6,276 who took part during the entire 1991-94 period.
- SME participation was more evenly spread across the specific programmes (see figure 2).
- TSME accounts for 30% of all SME participation.
- Exploratory Awards raised the approval rate for SMEs' collaborative research proposals from 28% to 41%.
- 60% of the SMEs participating through TSME had fewer than 50 employees, and 75% were first-time participants. □

2. SME participation by specific programme



(1) Including Exploratory Award participants

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▶ INTERNATIONAL COOPERATION

SMEs Bridge the Atlantic

Earlier this year, 120 automotive suppliers from nine Member States visited the world's largest industry event in Detroit. Pre-arranged meetings between carefully matched European and US companies will lead to vital strategic alliances.

The Transatlantic Small Business Initiative (TASBI) was launched in November 1996 by the European Commission and the US Department of Commerce to facilitate co-operation, trade and investment flows between European and American SMEs. Designed in response to proposals from industry, TASBI organises sectoral partnering events in order to stimulate commercial alliances and exchanges of technological expertise, and is developing data resources to help SMEs identify business partners and research the trading environment on the other side of the Atlantic.

February's mission to the Society of Automotive Engineers Expo (SAE97) in Michigan followed a highly successful partnering visit by 118 European automotive industry enterprises and organisations to SAE96. 80% of those visitors said the mission had helped them to identify new business opportunities. Sixty took part in 200 bilateral meetings with US companies, and over three-quarters of these continued the dialogue after the initial meeting.

Ranieri Bombassei, Director of DG XXIII/B (left) and Michigan's Governor John Engler (centre), visiting the European Village at SAE97.

Detroit 1997

This year, 141 European automotive suppliers and trade bodies made the trip, supported and co-ordinated by DG XXIII (Enterprise Policy). They exhibited in a European Village and took part in a number of highly effective meetings with matched US counterparts.

Rex Smith, sales and marketing director of US car components manufacturer ComCorp Technologies Inc, reported that the pre-arranged meetings were his most productive in 20 years of visiting the SAE fair. ComCorp will pursue links with companies in Spain, Germany and the UK, and is already discussing the possibility of joint work with an Italian company. "We use the same performance tests, so there is considerable potential for the exchange of know-how," Mr Smith said. "This could only have happened as the result of expert matching. Without it, we would have had no reason to open a dialogue."

The European visitors were just as delighted with the match-making service, though some had initial doubts about the suggested partners, according to Gary Krause of the Michigan Jobs Commission. "They studied the background information on these companies and could not see what they had in common. But when we persuaded them to hold the meetings anyway, these were almost always worthwhile. One Italian company is in the process of establishing a Michigan office as a direct result of contacts made at SAE."

Future Missions

In April, the Department of Commerce arranged a return visit to the Netherlands, Belgium and Italy by 20 US companies, organising a total of nearly 350 meetings during the trip.

Plans for a high profile European Pavilion at SAE98, with a focus on specific sub-sectors, are already in hand. Similar missions to the US by SMEs from other sectors are also under consideration. In due course, European SMEs will be able to access on-line support for their own efforts to prepare for transatlantic partnership, via a TASBI Web site. □

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▶ CALLS FOR PROPOSALS

Innovation Projects and Regional Initiatives

The Innovation Programme published a Call for innovation projects on June 17, and was planning a Call for regional innovation actions in September as this edition went to press.

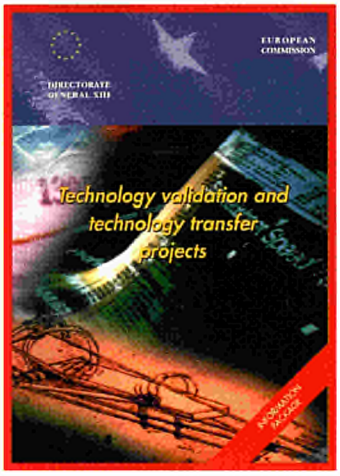
The Call for innovation projects (also known as technology validation and transfer projects, see following pages) is the Programme's third such Call. The main priorities are:

- to encourage the spread of generic technologies to new regions and sectors of activity;
- to support the transfer of technologies likely to improve access to international markets, especially for new technology-based firms;
- to foster links between companies and research institutions and to support proactive approaches to intellectual property rights.

As in earlier Calls, the Commission will fund up to 75% of the costs of a *definition phase*, allowing partners to develop a detailed workplan, and 50% of the allowable costs of the subsequent *implementation phase*, up to a maximum of 1 MECU.

Projects must, as before, address a clear technology demand, and must involve representative end-users. Innovation and an integral transnational dimension will again form key selection criteria, but proposals under this Call must also include an outline demonstration both of technical feasibility and of financial viability.

Eligibility and selection criteria are clearly defined, and will be strictly applied. Projects must aim to test or transfer a new technology, rather than to develop one, and they must be able to show that the resources to do so are available.



With a budget of around 20 MECU — just over half that of the last call — competition for funding is expected to be intense. A full information pack, including a streamlined application form, is available on the Innovation Programme Home Page.

Regional Initiatives

As *Innovation & Technology Transfer* went to press the Innovation Programme was planning a new Call for regional innovation-oriented projects for publication on September 15. The main focus will be on **RITTS (Regional Innovation and Technology Transfer Strategies and Infrastructures)**, which help regional policy makers and development organisations employ consultants - chosen from an approved list - to develop and implement strategies to improve the regional innovation and technology transfer infrastructure and policies.

Around one in four of Europe's regions has already participated in either a RITTS project or a **Regional Innovation Strategies (RIS)** exercise(1), creating a useful pool of expertise and experience. This experience will be disseminated around Europe through **Accompanying Measures**, which also form a part of this Call.

Moreover, this experience has shown that in many cases these projects identify regional problems which the concerned region cannot solve alone, although the know-how does exist elsewhere in Europe. Therefore this Call will also fund **Trans-Regional Projects** to help regions work together in tackling some of the common problems they face in implementing innovation support measures identified as useful by previous RITTS or RIS projects.

Further information will become available closer to the date of publication.

(1) RIS, funded by DG XVI (Regional Policy), help define regional technological plans within the framework of the Structural Funds. While they are not part of the September Call, they are carried out in close coordination with RITTS. See edition 6/96.

The Innovation Programme In Brief

The Innovation Programme implements the Third of the four Activities of the Fourth Framework Programme (1994-1998). Run by DG XIII/D, the Innovation Programme encourages the exchange of research information and the absorption of new technologies by European companies.

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► INNOVATION PROJECTS

Making Time for SMEs

Smaller companies often fail to benefit from new management techniques, simply because they lack the time to apply them. Two innovation projects are developing new methodologies - for IT system selection and performance benchmarking - specifically tailored to the needs of SMEs.

The SELECT-IT methodology was tested and refined in, among other environments, the shopfloor of Irish company Gentec Electronics.

Just like their larger competitors, SMEs must adopt the latest computer technologies if they are to keep pace with changing demand in today's rapidly evolving markets. Advanced systems for the support of design, production and logistics are now critical, even for smaller manufacturers.

But SMEs are less likely to have the specialist skills needed to identify the software most appropriate to their needs, and often lack the resources to 'ride out' a system selection error. Investment in unsuitable computer systems has pushed many out of business altogether - and the fear of such a disaster prevents many more from investing in the technology they need.

Quick Decision

Funded as an Accompanying Measure under the Innovation Programme, the SELECT-IT project will adapt a management tool which was designed by an earlier SPRINT project (1) to help SMEs specify and select computer systems suited to their strategic needs. The project is led by AMT Ireland, a Shannon-based technology consultancy.

"We became involved during the latter part of the SPRINT project," says AMT's Denis Kearney, "and helped two Irish SMEs to apply its checklist methodology. The results were excellent, but in its current form the method was too time-consuming for widespread use. Managers in small companies are unwilling to invest precious time in lengthy decision-making procedures. They want quick results."

Working with its UK development partner KAJ, and technology transfer agents in Greece and Portugal, as well as a number of the SMEs which piloted the original methodology, AMT will refine the software selection process so that it can be completed in just six days. Its output will be a specification that can be matched against the software available in the marketplace. But Mr Kearney hopes that users will gain something even more valuable -an improved understanding of their own businesses.

Mission Critical

"We want SMEs to focus on the critical competences of the software," says Kearney. "Can it be fully integrated with their existing systems? Can it comfortably handle the volume of transactions they anticipate in the coming years? They have to avoid being dazzled by the superficially impressive features described in the sales literature. Our method offers a systematic framework for decision-making, helping them to identify and prioritise the factors which should determine their choice."

An intensive survey of a sample group of SMEs will allow the partners to identify ten key software areas. These are expected to include CAD-CAM, production planning and control, quality control and, for companies involved in bespoke contract work, project management. Generic checklists of critical parameters for each type of software will be built into a computer application which the consultant partners will use in their work with specific clients, tailoring it to individual company circumstances.

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(1) SPRINT was one of the forerunners of today's Innovation Programme.

To demonstrate the method's linguistic and cultural transferability, the application will be translated and tested by the Greek and Portuguese partners. It will be promoted throughout the European network of Innovation Relay Centres by the UK's Midlands IRC, and the partners expect to licence it to practitioners across Europe.

Affordable Benchmarking

A second innovation project, BETTI, also aims to bring a valuable but time-consuming management tool within the reach of SMEs. In this case the tool is benchmarking, and the intended users are SMEs engaged in small-volume batch production. Target sectors include mechanical engineering, fabrication, and instrument-making.

Benchmarking involves detailed comparison of a company's performance with that of the best in the sector. Offering users concrete and achievable targets for improving indicators such as added value per employee, product throughput time, and percentage of orders delivered on time, the value of the technique is now widely accepted (2).

But according to Maurits Verweij of Dutch consultant Berenschot, which leads the project, the benefits of benchmarking are not yet available to most SMEs, especially in manufacturing industry. "Existing procedures are too expensive and too slow," he says. "For a small company it is also much harder to find comparable enterprises against which to assess performance, so results are less reliable."

BETTI aims to develop a procedure which will take up only five days of a manager's time. A further four days of consultancy input will be required to carry out the testing and to support the interpretation of results.

Precision Comparisons

What really sets BETTI apart from conventional benchmarking, however, is the way in which it selects the reference companies with which a client firm is to be compared. Berenschot and its partners are building a unique database containing detailed information about the performance of individual companies. The BETTI procedure does not just assess a company's performance as measured by key performance indicators. It also takes into account a number of the factors which characterise it, including its size, the complexity of its product, and the way in which it controls production.

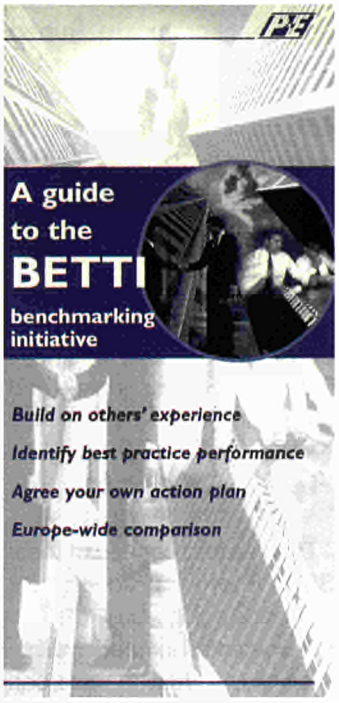
Analysis of the data already gathered has identified factors closely correlated with particular performance indicators. In general, for example, the difficulties which companies experience in meeting their delivery deadlines increase in line with the number of steps in their production processes.

"Consideration of the factors which characterise a small company allows us to develop an individual best practice profile from directly comparable examples in the database," Mr Verweij explains. "When we are assessing a client's performance in meeting its orders on time, we can compare it with other companies with similar product complexity. That allows us to suggest targets for improvement which are both more precise and more appropriate than those offered by conventional benchmarking schemes."

By the end of 1997, BETTI will have benchmarked 100 SMEs in nine Member States. Each will receive a profile of its production strengths and weaknesses, and a clear indication of the areas in which improvements can be realised.

Data from each pilot company, and subsequently from each paying client, will be added to the BETTI database. Each will therefore contribute to the growing accuracy and power of the benchmarking procedure. In this sense, BETTI represents a large-scale collaboration between European SMEs. Though they may never have heard of one another, they are helping to build a series of European production performance standards from which all can benefit. □

(2) See 'Benchmarking European Industry', edition 1/97



By the end of 1997, BETTI will have benchmarked 100 SMEs in nine Member States.

► INNOVATION RELAY CENTRE

A Complete Package

The Innovation Relay Centre network has helped a Dutch SME assemble the technical, financial and organisational expertise necessary to commercialise their revolutionary space heaters.

Dutch consultants MHP (Marketing High-tech Projects) provide transnational technology transfer services in the Maas-Rijn region on behalf of IRC Netherlands (1). Chosen for its strong cross-border contacts, in the first 10 months of its contract MHP helped 29 Dutch SMEs to forge links with German research institutes, particularly in the Aachen region.

But helping transfer technologies, according to Hubert Grooten of MHP, is just part of the package. "The aim is to enable companies to convert innovation into real business success. This is business engineering - it involves not just technology transfer but also market research, human resource development, innovation management, business planning, winning finance and much more."

Heat and Art

The recent success of local SME Energy Products BV serves as a good example. Using a patented infrared system, their 'Multi Heat' panels can heat a building using half the energy of standard electrical systems.

The ultra-slim panels are maintenance-free and come in various size and power ranges. They are composed of successive layers of insulating material, heat-reflective aluminium, and a unique opto-electrical semiconductor compound. As an added bonus, the side facing into the room can be covered with a decorative ceramic coating which will soon be able to carry full-colour images, opening up the possibility of heating a living-room with a Rembrandt print.

Frans van den Heuvel explains that the concept was born in the mid-1980s. "We got in touch with MHP in May last year through the Relay Centre because we needed more industrial and financial muscle," he says. "MHP performed a market survey and introduced us to the European Centre for Mechatronics and the Institut für Kunststoffverarbeitung, both based across the border in Aachen."

Joint Venture

MHP also helped the company tap the technical know-how of glass manufacturer Scheuten. This led to Energy Products forming a joint venture with Scheuten and regional finance house LIOF to commercialise the product at the end of 1996. "LIOF are doing more than simply supplying finance - they are helping the company adopt innovation management techniques such as employee training," Grooten adds. "They also funded a worldwide literature search on the likely impact of the new product on human health."

Mr van den Heuvel is confident that the new joint venture will win significant market share. "It's not only a very comfortable heating system, the energy efficiency makes it ideal for meeting environmental objectives," he points out. "We're currently piloting store heating in partnership with Albert Heijn (Ahold), the Netherlands' largest grocery chain, and have designed dedicated Multi-Heat panels for a major manufacturer of modular building units, used for portable offices and homes. We're also selling a lot for bathrooms, even though we're not even targeting the household market yet. We'll probably have to hire more people to cope with demand after the summer."

Other applications look bound to follow. The National Applied Research Centre (TNO), for example, is currently testing the system for high temperature applications. Initial results using it as a cooking grill operating at over 400°C look promising. □

(1) See the Dossier on the Innovation Relay Centres in issue 3/97.

Energy Products' wall-hung room heater.

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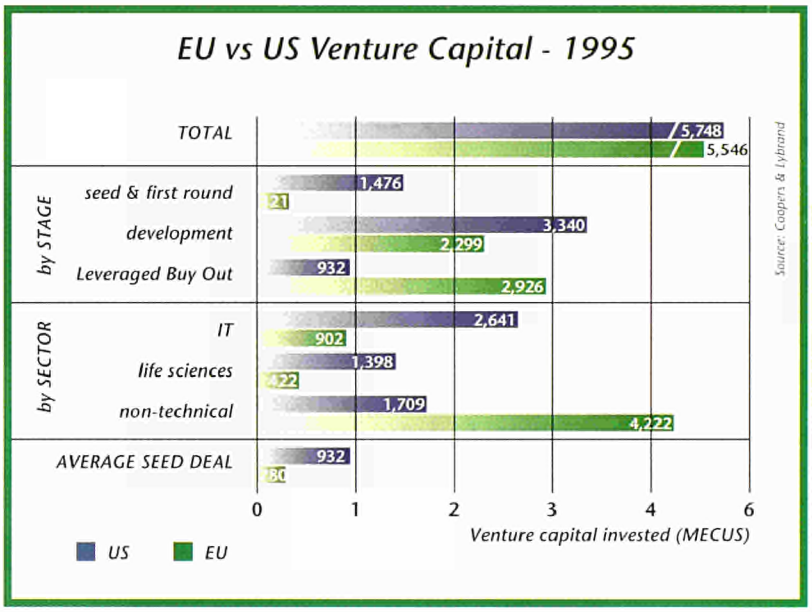
Capital for Exploiting Research Results

The Innovation Programme, in collaboration with the European Investment Fund (EIF), has launched a scheme to increase investment in young, innovative companies. One of the aims is to help participants in EC-funded projects to turn research results into marketable products.



In 1995, European venture capital investment in high-tech companies was less than a third that in the US, although the total invested was similar on both sides of the Atlantic.

The First Action Plan for Innovation in Europe (1) recognises that improved access to equity capital is needed to unlock the innovation and job creation potential of Europe's RTD community. Innovative European companies have, to date, found it significantly harder to secure financial backing than their US competitors.

In 1995, for example, European venture capitalists invested overall almost as much as their US counterparts (see graph). But US investments in high-tech enterprises were more than three times greater, and in young companies nearly five times greater than in Europe.

The Commission has identified a number of barriers to investment in high-growth, technology-driven businesses. These include the high costs of initial appraisal and on-going management and support. The lack of a strong European tradition of technology-oriented venture capital investment is itself an obstacle. Venture capitalists and entrepreneurs alike are unfamiliar with one another's needs, strengths, concerns and ways of working.

Making Investment Easier

The I-TEC (Innovation and Technology Equity Capital) pilot scheme, launched in July, sets out to lower these barriers by directly supporting the development of cost-effective appraisal and management procedures. In the longer term, the scheme is intended to build a body of experience in the financing of early stage, innovative technology ventures, and to help create an environment conducive to this kind of investment.

The EIF, meanwhile, will invest up to 75 MECU in venture capital funds across the Union during the next two years to lever the investment of new private capital. Funds selected for participation in the I-TEC scheme must devote at least 25% of the new money to young, technology-led projects, especially those which exploit Community funded RTD and those in less favoured regions. I-TEC will contribute up to 0.5 MECU per fund towards the appraisal and management costs associated with this type of investment.

(1) See Special Edition of December 1996.

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► INNOVATION MANAGEMENT TECHNIQUES

The Intelligent Use of Technology

Companies can improve their long-term prospects by using appropriate Innovation Management Techniques (IMTs) to secure the smooth introduction and integration of strategic new technologies. SMEs in particular can benefit, but choosing the right technique is crucial.

Confirmation of the effectiveness of IMTs comes in a report published by the European Innovation Monitoring System (EIMS). *Innovation management tools: a review of selected methodologies* takes a detailed look at the techniques used by consultants and advisors helping SMEs to manage innovation.

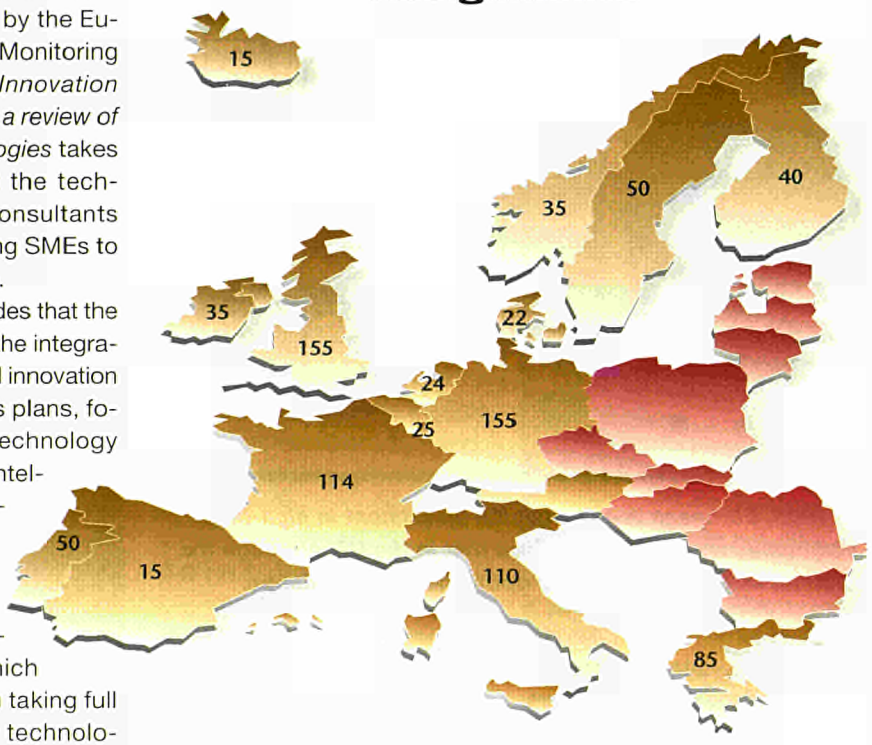
The report concludes that the best IMTs support the integration of technological innovation into wider business plans, focusing not on technology alone, but on 'the intelligent use of technology'.

IMTs promote a holistic view of innovation, highlighting the factors which prevent a firm from taking full advantage of new technologies, new market opportunities, and new ways of working. They should help companies to align business strategies with technological competences and challenges, and to ensure that the introduction of new technology is consistent with strategic goals.

Most of the companies which have used IMTs believe that they produce a faster and more comprehensive analysis than would otherwise have been possible. But the report warns that different types of enterprise are likely to need different tools. To be effective, support for innovation must take account of both internal circumstances and the external competitive and market environment. SMEs in particular should be very cautious about using tools designed for larger firms.

The report also identifies a number of gaps in the present IMT toolbox. While many IMTs deal with general strategy and with process and product development, few address organisational, human resource, or environmental issues. And few emphasise employee participation, despite evidence of its value.

Innovation Consultancy Assignments



The 29 projects will between them involve consultancy assignments to as many as 930 SMEs around Europe (including 181 currently under negotiation). The lessons learnt will then be disseminated to many more.

29 Projects Under Way

Meanwhile, 29 IMT-oriented projects co-funded by the Innovation Programme were launched at the beginning of 1997. The projects explore a variety of approaches, reflecting the diversity of companies' needs and capacities in relation to the adoption of new technologies.

Activities are of two distinct types. 23 projects, operating at national and regional levels, will develop specific tools and support private consultants and public agencies in promoting the use of IMTs. The remaining six will focus on transnational exchanges of knowledge and practice in the promotion and application of IMTs.

Over 900 SMEs will be helped directly by innovation consultancies undertaken within the projects, and many more will benefit from the dissemination of the methods and approaches which they develop. But the most effective channels for the spread of new ideas, both among SMEs and among the consultants who serve them, are often provided by existing networks. Many of the projects hope to stimulate a cascade of IMT good practice by training primary groups of consultants and business managers. □

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Patents for Innovation and Profit

High costs and a lack of awareness mean that European companies are failing to make best use of the patent system. New proposals from the European Commission will make patents cheaper, more accessible and more widely understood

Things are looking up for patents in Europe. After forty years of waiting, European inventors may soon be able to take advantage of a true 'EU patent' that should cut the cost of protecting intellectual property rights (IPR) while encouraging the free flow of technical information.

The need for patent unification is clear, according to Professor Joseph Straus of the Max Planck Institute for foreign and international patent, copyright and competition law in Munich. "We cannot afford a single market without a single patent system. If we are able to accept a single currency, we cannot tolerate 15 national patents in Europe," he told delegates at Patinnova, an international conference held last May in Vienna by the Innovation Programme.

"The existing patent system is complex and lacks co-ordination," agrees Paul Waterschoot, Director of the European Commission's DG XV-E (IPR legalislation). He points out that the Commission is now reacting to the needs of patent users, who are becoming increasingly vocal about the need for change.

Two documents - last year's Action Plan for Innovation (see the December 1996 special edition) and a forthcoming Green Paper on patents - form the basis of changes that will breathe new life into the dormant Community Patent (see 'A Plethora of Patents'), should slash the costs of patenting and provide easier access to the technical information locked up in patents.

"... the failure to understand patents and all the many ways they can be used is costing European industry millions of ECU every year."

Heinz Zourek, Deputy Director-General of DG XV (Internal Market and Financial Services).

I. Keys to Innovation

The current emphasis on innovation as a source of industrial competitiveness, and hence prosperity, makes patents a natural focus - patents, after all, are inherently about innovation.

Yet according to recent studies undertaken by the European Patent Office (EPO), only 59,000 companies in Europe have made any use of the patent system in the last five years; a further 111,000 innovative companies are estimated to be in a position to benefit from the patent system but fail to do

Context

A Plethora of Patents

■ **The European patent** was born from the 1977 European Patent Convention (EPC), and allows an inventor to file a single patent application (in English, French or German) to obtain protection in all 18 EPC signatory countries (more from Eastern Europe are on the way.)

The European patent is effectively a bundle of national patents: one for each Member State in which protection is claimed. An inventor can apply for a European patent through the European Patent Office (EPO). Once the EPO grants a patent the competence for administering it is transferred to each national patent office.

■ **The Community patent** is a long-awaited and never realised policy goal: a single patent which covers the entire European Union. A Community Patent Convention of 1973 was finally adopted in 1989, but has since only been ratified by seven Member States and is now moribund.

so. In fact, it is estimated that billions of ECUs are wasted every year in Europe on re-inventing and re-developing existing ideas because of lack of information.

Most people recognise that large, high-tech companies need patents and other intellectual property protection to safeguard their investment in research and development. Less widely appreciated is the fact that smaller companies and low-tech business can also benefit from patent protection.

A case in point is Irish company Kleerex International, which uses clear acrylic sheet to make racks for displaying retail products such as magazines and sweets. "Acrylic products of this kind used to be made by craft-based, localised industries, in short production runs. There was little investment in R&D and new designs were quickly copied by competitors," says company founder and licensing director Frank Carroll.

Carroll designed an innovative flat-pack modular construction system that could be manufactured at low cost yet gave a product that was more versatile and performed better than those of his competitors. When starting up the company in 1987 he realised that without patent protection his inventions would be widely copied, and is grateful to the financial support he received from the Irish Institute of Research and Standards. "If they had not covered the cost of patents on our first two products we would not have been able to afford protection," he says.

Successful Irish SME Kleerex needed public support to protect their innovative display system designs because "... patents remain too expensive and do not give enough protection to small firms that cannot afford lengthy court cases."

> *"... around 80 per cent of all publicly-available technical information is published in patent documentation - and often nowhere else."*

Since then the company has developed new products and expanded to the point where it now has 20,000 installed systems in the UK, as well as products made under licence in the USA and Australia. Carroll has plenty of criticism of the patent system: he thinks that patents remain too expensive and do not give enough protection to small firms that cannot afford lengthy court cases. Nevertheless, he acknowledges that his success has depended heavily on a willingness to take patents seriously.

Market Intelligence

But if patents are important as a way to protect hard-earned R&D results, they are equally significant as a source of technical information. An often-quoted figure is that around 80 per cent of all publicly-available technical information is published in patent documentation - and often nowhere else. Of this information, around 90 per cent can be used directly by people other than the respective patent holders; only the remaining 10 per cent is protected by valid patents.

Saving time and money: a QUICK SCAN report during the definition phase of an Innovation Project led by Trumpf Maschinen Austria showed that the laser-based optical measuring system they proposed for their sheet metal machines (*pictured*) had already been developed elsewhere. They elected to develop mechanical systems instead.

One company that appreciates the value of patents as an information source is Austrian farm equipment manufacturer Schauer Maschinenfabrik. This medium-sized firm, employing 220 people, makes automated animal feeding systems based on what managing director Gerhard Vogl refers to as "mid-technology". It's a fast-moving field, he explains, and the company relies on patents to stay abreast of the activities of its five main competitors as well as to protect its inventions.

Since 1985 Schauer has applied for 33 patents. Of these three are still at

Innovation Programme Services

Adding Value to Innovative Projects

The Innovation Programme's QUICK SCAN service has shown that patent information can reduce duplication of R&D and save public money.

The Innovation Programme's 1995 Call for Proposals for technology validation and technology transfer projects (see pages 7-9) resulted in 100 project proposals being granted funding for their first, feasibility phases. All of these projects were offered the QUICK SCAN service, where the European Patent Office's search division at The Hague checked the patent literature to see if the proposals were as novel as they claimed to be, and to learn more about the potential market.

The aim is to help identify relevant future technological trends, alert the proposers to any similar work already performed elsewhere, provide useful information on targeting products and services, and so on. It is a particularly useful service to the SMEs behind the proposed projects - small European companies are more ignorant of patents than their counterparts in Japan and the USA, and two-thirds of the SMEs generating inventions have no access to the patent system whatsoever.

Expert Analysis

The contractors received copies of the EPO's search report and all related documents, plus guidelines on how to proceed, for example by establishing an intellectual property rights (IPR) strategy.

Of the 100 proposals, 87 contained enough concrete technical detail to be suitable for patent searching. The searches showed that 30 of these were truly novel; in the remaining 57 cases the EPO questioned the novelty of the whole project or parts of it. As a result, three of the projects changed direction significantly or were abandoned. Twelve more projects changed their IPR strategy as a result of the QUICK SCAN search. Five of these applied for a patent or registered trademark and the other seven thought it worthwhile to contact a patent lawyer.

Compared to the total budget of the projects action line, the 'savings' as a result of QUICK SCAN are estimated to be around 3-5%. The cost of the QUICK SCANs, however, was only 0.15%.

Innovation* à la Tarantino: *a nine minute video has been produced to explain novelty searches, patent strategy and the QUICK SCAN service. It is available in five languages (EN, FR, DE, IT and ES) and in both PAL and VHS formats.

Market Intelligence

The project also succeeded in raising awareness of the market information available in patents. A questionnaire sent to all the participants was answered by 47 of them, and revealed that 50 per cent gained a better insight into the competitive situation as a result of QUICK SCAN. Three projects were able to identify new market opportunities, and three others found possible opportunities to license their technology. Other consortia discovered technologies that might be available for licence, or learned of interesting technologies in the form of abandoned patent applications or lapsed patents.

The Innovation Programme is continuing to offer QUICK SCAN to new project consortia, although in future the service will probably not be free, as it is at present. The Commission also has plans to including the regional dimension by allowing Innovation Relay Centres to take part in the QUICK SCAN process.

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■ **QUICK SCAN video: G. Haesen**

the application stage and seven were not granted. Of the remainder, 16 are still in force and seven were dropped from the company's portfolio because they had been superceded. "Patents give us important protection and are a weapon in the battle for market share," says Vogl. Patents cost the company around 43,000 ECU annually, or 11 per cent of Schauer's R&D budget.

Schauer Maschinenfabrik uses patents both to protect their inventions and keep abreast of its five main competitors.

II. Towards a Community Patent

Since the benefits of patents are clear, why do so few European firms, especially SMEs, use the existing patent system? According to the delegates at the Patinnova conference, the main problems are excessive costs, overlap between national and European procedures, the need to file patents in foreign languages, slow administration and poor access to published patents.

Probably the most apparent problem with the current system is cost. Patent costs are not always easy to compare, because they are made up of several different components payable at different stages during the lifetime of the patent. Nevertheless, there is no doubt that European patents are far more expensive than those from America or Japan.

A typical European patent giving protection in eight Member States costs DM 36,000, Professor Straus told Patinnova delegates — and this does not include mandatory translation costs. A US patent, by comparison, costs around DM 3,000. Japanese patents cost only DM 2,200 each, though this figure is somewhat misleading because Japanese patents tend to be smaller in scope than their western counterparts.

The total cost includes the fees charged by the EPO and national patent offices, patent attorneys' charges and translation costs. The EPO is currently in the process of cutting its fees by around 20 per cent, but many users think this is still too expensive. "I welcome the cut in EPO fees but it's still not enough," said Frank Carroll of Kleerex.

If the EPO's costs are still too high at least its customers are getting a service that is generally acknowledged to be highly professional. Translation costs, on the other hand, come in for even more criticism because they account for around 40 per cent of the cost of a patent and yet are often considered next to useless. At the moment a European patent must be translated into the language of every country in which protection is claimed. "Translations are hardly ever used," notes Renate Remandas, Vice-President of the EPO, "and as the number of Member States grows from 18 to 30 the cost of translation will rise in proportion."

Translation is a political problem too. This is not so much because each coun-

Innovation Programme Services

IPR Helpdesk

The Innovation Programme has firm plans for a combined Web site and telephone helpline to provide patent information.

The need for the IPR Helpdesk was identified in the First Action Plan for Innovation in Europe. The Innovation Programme initially intends the service to become the Commission's intellectual property hotline for protecting EU research results, but it could go on to become a valuable resource for all issues relating to research exploitation and IPR issues, including project planning.

The IPR Helpdesk Web site, which will be open to everyone, will be backed up by a telephone helpline reserved for organisations taking part in EU-funded research projects. Neither the Web site nor the helpline will seek to replace professional advice from lawyers or patent agents.

The Web site will provide:

- useful information on R&D planning, technical co-operation, and protecting and exploiting results;
- information on important IPR activities in the Member States, with contact points;
- bibliographies and links to other Web sites dealing with IPR matters;
- a forum for feedback and discussion, possibly with areas reserved for EU project participants.

After a preliminary feasibility study a Call for Tenders could take place later this year, so the IPR Helpdesk could be in operation by the spring of 1998. The annual budget provided by the Innovation Programme should be of the order of 2 MECU.

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Innovation Programme Services

Specialised IPR Training

Seminars on handling IPR are being developed for participants in EC R&D projects.

The seminars were originally developed for European Commission officials and scientific officers monitoring the EC's R&D projects. The seminar covers all aspects of IPR, from the initial reservation of property rights to the licensing process. Special attention is paid to the IPR aspects of the EC's model contracts for cost reimbursement, project management and partner cooperation, while case study and role-play sessions have been developed to help illustrate the main points.

The seminar is an initiative of the Commission's in-house Coordination Group for Dissemination and Exploitation, DG IX (Personnel) and the Innovation Programme, which now intends making similar seminars available free of charge to R&D project participants. Three different 1.5 day seminars are planned - the general seminar, plus two specialised seminars on biotechnology and information/communication technologies.

While it remains to be seen whether these seminars can be funded under the Fourth Framework Programme, the Innovation Programme is confident that they will become available under the Fifth, which gets underway next year.

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try wants patent documentation to be available in its own language - Patinnova, in fact, showed that there is wide support for filing patents in a small subset of the official Community languages - but because translation costs discourage companies from filing in less industrialised countries or in eastern Europe.

At the conference Jan Galama, patents and licensing director of Philips International in the Netherlands, admitted that costs forced his company to be "very selective" about where to file European patents, and that this could result in some countries becoming "patent-poor". This discourages investment because companies are reluctant to manufacture goods in countries where they do not hold patents to prevent copying.

Dual System Overlap

These and other problems all stem from today's 'dual system' arrangements. While inventors can apply for a European patent through either the EPO or a national patent office, in reality patent applications are split equally between these two routes. In fact, more than 90% of applications filed by EU nationals are based on a previous national application.

In addition, while 'the EPO route' can grant patent protection in up to 18 countries, legal challenges against the patent can be heard in each country. If some are successful, the supposedly European patent ends up recognised in some countries but not in others. This is hardly conducive to the smooth functioning of the Internal Market. The need to work with many different patent offices also increases costs and slows down the patent granting process in other ways, and makes accessing patent literature more difficult.

> *"... there is no doubt that European patents are far more expensive than those from America or Japan."*

The Innovation Action Plan recognised that the coexistence of national and European patents, and the failure of the Community patent to come into force, are responsible for many of these problems. To put matters right it promised a Green Paper on the Community patent and related issues.

New Green Paper

This Green Paper is likely to be published as this edition went to press. Consultation will take place during the rest of the year, with a political agenda taking shape in the first few months of 1998. The Paper's main point is that the Community patent must be created, and that it must be less expensive and more efficient than the current system.

Costs can be reduced in two ways. To begin with, the amount requiring translation must be reduced. The draft Green Paper proposes two possibilities - the production of high quality abstracts, which will be the only text requiring translation; and the 'compacted document' solution, where the patent is reduced to around 20 pages with the help of the patent examiner.

A second aspect to reducing costs relates to the problem of enforcement. Today's patents may provide protection to small, innovative companies in theory, but if they do not have the financial resources to go to the courts then in practical terms the protection is worthless. One possibility floated by the Green Paper is the establishment of a sort of insurance fund which will help finance SMEs' legal battles in enforcing their rights.

Another issue, of course, is the proce-

dure for both granting and challenging patents, which was one of the main stumbling blocks for the original Community patent. Could a single judge in any country overturn a Community patent across all of the EU? The Commission would like to see both granting and legal challenge procedures centralised, using the European Patent Office and the European Court of Justice. Whether this will be achieved remains to be seen.

Finally, the Green Paper will also address the harmonisation of the EU's national systems, tackling issues such as employees' rights to their inventions and the protection of software, which cannot currently be patented as such.

The changes the Commission has in mind will require determination and a formidable degree of co-operation between the EU's Member States. The consensus on these issues at Patinnova was impressive, especially since many of those present were patent lawyers and other specialists with vested interests in the existing system.

Translating this consensus into action will be worth the effort. Patents throughout Europe will be simpler and cheaper to administer and free from today's legal uncertainties. Patent documentation may be more easily available, further stimulating innovation. In short, the Commission is planning a European patent system that is truly competitive with those of the USA and Japan. □

> "... in 1994, industry spent about 2 billion ECU in Europe on legal or out-of-court proceedings to protect patents"

Accessing Patent Information

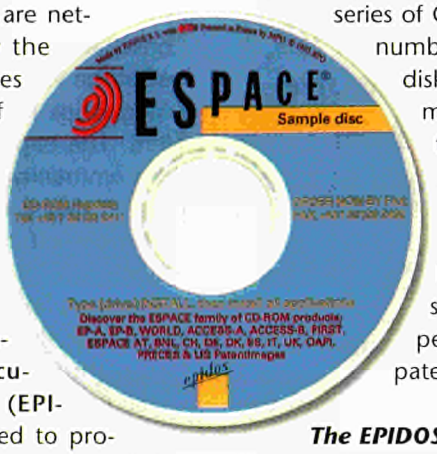
The **PATLIB network** is composed of around 130 offices across the 18 Member States of the European Patent Organisation. Each node in the network is a national or regional patent library or information centre and has qualified staff on hand to offer advice.

The various offices are networked together by the national patent offices with the assistance of the European Patent Office (EPO), from which an address list of PATLIB centres can be obtained. The EPO's **European Patent Information and Documentation Systems (EPIDOS)** office is devoted to producing and disseminating patent information products. For information on granting and appealing against European patents, however, contact the EPO's main office.

The two EPIDOS-INPADOC databases are the largest patent databases in the world in terms of both the countries and time span covered. One, known as PFS, deals with all patent documents applied for in 65 patent offices worldwide, receiving 25,000 new documents each week. The other, PRS, deals with the legal status of patents - whether they are in force or not - in 22 patent offices, and is growing at around 40,000 documents a week.

Other databases include the Register of European Patents, which provides detailed information on all European and Euro-PCT patent applications in English, French and German.

EPIDOS supplies this and other information both on-line (although not via the WWW) and through the ESPACE series of CD-ROMs. The latter numbers several hundred disks in total, although many users need only the 3-disk ESPACE-ACCESS A series, which gives access to searchable bibliographic and abstract data for European or international patent applications.



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ESPRIT

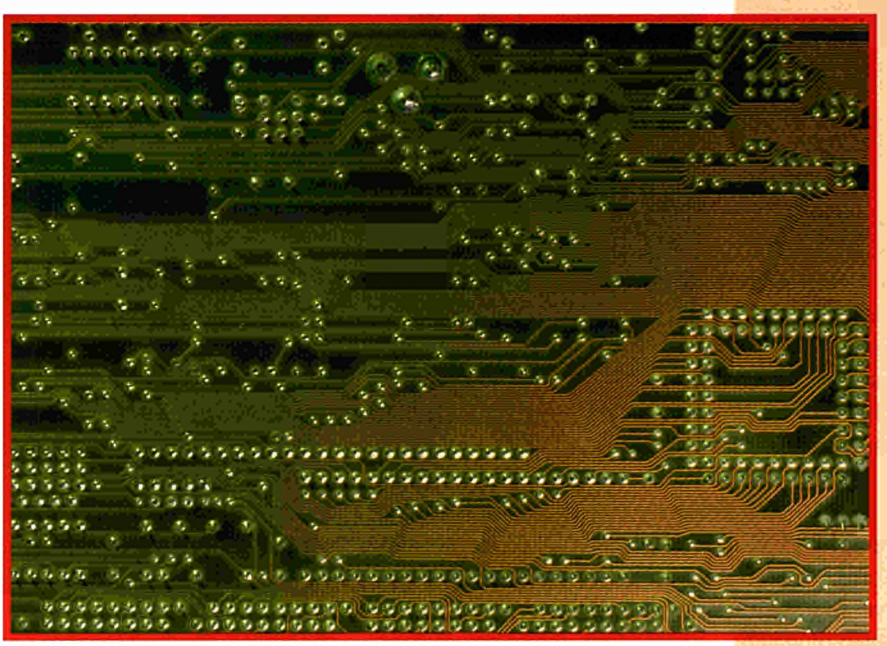
World-Beating Lithography

ASM Lithography's new 'step and scan' system for high throughput 0.22 micron semiconductor production is on the point of shipping. Developed in a series of ESPRIT projects, it could take the Dutch company to second place in a strategically important global market.

Twenty years ago, reducing the size of the circuits etched on a silicon chip allowed manufacturers to miniaturise computers and other electronic devices. Today, progressive reduction in the size of chip features is driven by economics. The greater the number of functions squeezed into each square inch of silicon, the more chips can be made from a single wafer, and the cheaper - and, of course, faster - each chip becomes.

The pace of size reduction is determined by advances in photolithography, the technology used to print circuits onto silicon wafers. Equipment manufacturers are now developing shorter wavelength laser sources, new lens materials and new imaging techniques in order to reach the 0.18 micron resolutions needed for mass production of 1 gigabit memory chips and super-fast microprocessors.

"Photolithography is *the* strategic technology in the semiconductor industry," confirms Dr Steve Wittekoek of ASM Lithography, the Dutch company which is leading Europe's efforts in this area. "All the other key technologies depend on it."



The circuits of a computer chip are printed onto the silicon using the photolithographic process. ESPRIT projects have been central in ensuring a European presence in this strategically vital technology.

Company Growth

ASML was founded by Philips in 1984 to commercialise the photolithography equipment it had developed for its own use in-house. ASML went public in 1995, with Philips retaining a near quarter stake in the company and remaining a key customer. The links between the two therefore remain strong.

"The arrangement offers ASML the best of both worlds," says Dr Wittekoek. "Access to Philips' research and development resources has enabled us to take on larger competitors. But independence gives us flexibility and allows us to respond rapidly to information and ideas absorbed from our customers."

Since 1990, ASML has achieved year on year sales growth of 50%, giving it a 1996 turnover of $800m. It has a 19% share of the global market - 28% outside Japan. Already larger than any US competitor, it is currently challenging Canon for the number two position behind market leader Nikon.

Strategic Support

ASML's success is obviously of great strategic importance to Europe. EC funding has been critical to this success, according to Dr Wittekoek. "The rate of technological change in this industry is enormous. Each new system has to offer customers clear advantages in terms of productivity, reliability, flexibility, and overall cost of ownership. But it is also imperative that we bring it to market ahead of competing systems. ESPRIT funding has enabled ASML to make an early start on each development cycle, helping us to catch up with our competitors."

ASML has benefited from two sources of R&D funding. While production machines have been developed within the

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framework of the EUREKA JESSI project, the more risky early research has in each case been supported by ESPRIT.

Dr Wittekoek sees ASML's experience as a prime example of the positive impact of European support for R&D that is clearly oriented to market needs. "Similar projects are supported by the Japanese and US governments," he says. "Market forces alone simply cannot stimulate the huge collaborative effort required."

Zeiss DUV projection lens being mounted in an ASML wafer stepper.

Fantastically Complex

A photolithography system integrates a number of complex components, including a light source, a reduction lens, alignment sub-systems, and wafer-handling robotics. This sophisticated machine is known as a wafer stepper because it makes an exposure of a circuit pattern on the wafer, and then 'steps' to the next area. The process is repeated until the surface has been covered to form an array of dies, each of which will become a separate chip.

The first ESPRIT project ran from 1988 to 1991, and led to the development of a 248 nanometre wavelength Deep UV (DUV) wafer stepper. "ASML already had successful 365nm i-line steppers on the market," says Steve Wittekoek. "But we could see that higher resolutions could only be achieved by moving to shorter wavelengths, and we knew this would require a huge development effort."

The project established a successful formula for collaboration with a core group of partners, including both sub-system suppliers such as lens-maker Carl Zeiss and laser manufacturer Lambda Physik, and integrated circuit (IC) makers such as Philips, IBM Europe, and SGS Thomson.

Several DUV steppers were developed, and the latest is now making a real market breakthrough. "I-line systems still provide manufacturing capacity for the less demanding circuit layers," Dr Wittekoek says. "But if you are building a new fabrication plant for 0.25 micron features or below, then you will invest in DUV systems, at least for the high-resolution layers. This will be a very important product for ASML."

> *"Components and sub-systems have to work together perfectly. You simply cannot achieve that without corresponding co-operation between the organisations which make them."*

Scanning Photolithography

By 1995 it was clear that existing stepper technology would soon be unable to meet IC-makers' demands for larger image field sizes and finer resolutions. The size and cost of the necessary lenses made it attractive to explore an alternative approach. Scanning photolithography builds up circuit patterns by moving the reticle and the wafer at high speed through a much smaller image field, permitting the use of smaller, cheaper lenses.

ASML's step and scan system was announced in February 1997 and the first machine is about to be delivered. Capable of 0.22 micron processing at throughputs of 96 200 mm wafers per hour, the system offers high productivity and extremely low operating costs.

ASML is currently engaged on a new ESPRIT project, ELLIPSE, which aims to develop a first 193nm step and scan system by 1998, followed by a full production tool in the year 2000. Completely new optics will be needed, and improved quartz and calcium fluoride materials are being researched by partners Heraeus and Schott respectively. Dr Wittekoek predicts that by the year 2004 the system will be capable of delivering the 0.13 micron feature size needed for 4 gigabit chips.

Cross-sectoral collaboration of the kind which has brought ASML such success will, he believes, become even more essential. "These are large systems, operating to extraordinarily fine tolerances," he says. "Components and sub-systems have to work together perfectly. You simply cannot achieve that without corresponding co-operation between the organisations which make them." □

► BRITE-EURAM

Surgical Scans: A Solid Approach

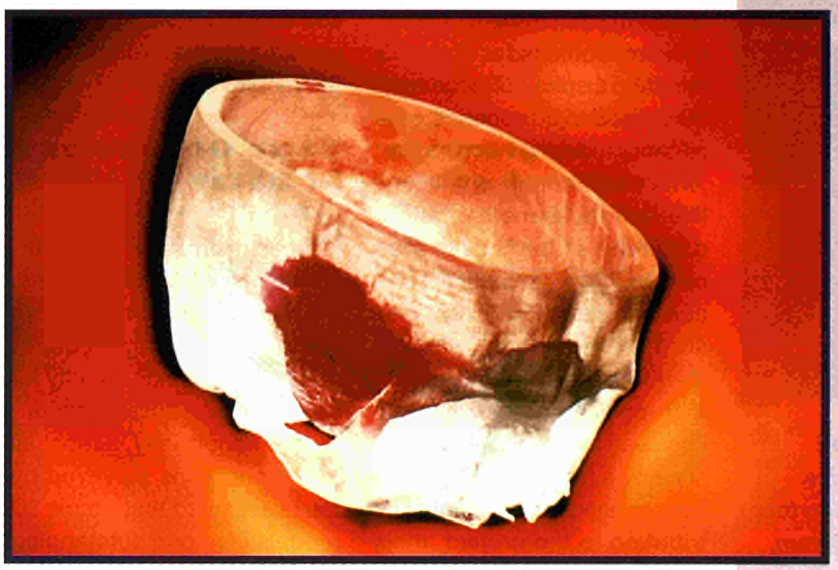
The PHIDIAS project brought together an SME, a university research group and two of Europe's largest companies to adapt the latest 'rapid prototyping' technologies from manufacturing to surgery.

3D medical imaging systems, such as Computerised Tomogaphie (CT) scanners, have been allowing surgeons to 'see' inside their patients and plan appropriate treatments since the 1970s. For surgeons planning complex operations, however, a solid model of their patients' organs and bones would offer many advantages over the images displayed on the scanners' computer screens.

Today, for example, inserting a knee implant involves opening up the knee and selecting the 'best fit' implant from one of five standard sizes and shapes. Solid models of the knee would allow surgeons to design each implant for each patient, ensuring a perfect fit and improving the implant's lifetime and effectiveness enormously.

The technology would also make scan data easier to interpret, ensuring that the surgeons are better informed on what they will see on the operating table. Having a model to work with also improves communication within the medical team and between doctor and patient, and allows the surgeons the luxury of a 'dry run' before many operations.

Until recently, unfortunately, there was no way of creating such models. In the late 1980s, however, manufacturing industry commercialised rapid prototyping, a new technique with intriguing possibilities. The BRITE-EURAM project PHIDIAS was launched to adapt rapid prototyping to surgical applications.



Surgeons can now have highly accurate models of their patients' internal organs, colour-coded to differentiate tissue types, just a few hours after performing CT or MR scans.

Rapid Prototyping

Manufacturers had always either carved their design models out of solid blocks ('milling') or made them by hand. Rapid prototyping (RP), by contrast, builds models upwards, layer by layer. There are several techniques - one, for example, involves laying down a series of carefully cut pieces of paper - and all translate computer-generated 3D images into solid objects in a few hours.

The technique can, unlike milling, create objects with internal spaces - such as the sinus cavities in a human skull. The Belgian SME Materialise NV, recognising the potential for medical applications, bought a stereo photolithography RP system in 1990. The machine essentially builds each layer of the model from a resin which is 'cured', or solidified, by a laser.

Materialise launched PHIDIAS in 1993 with Siemens Medical Systems, Europe's largest producer of medical scanners, Zeneca, a world supplier of resins, and the interdisciplinary medical imaging research group of the Katholieke Universiteit Leuven (KUL), Belgium's largest and oldest university.

One of the first steps was to find out what surgeons wanted from the models, so the KUL surveyed 30 surgeons from Europe and the USA. As expected, while some requirements were universal (non-toxic resins, reasonable accuracy, hardness), different specialists had different demands - dental surgeons need sub-millimetre accuracy, for example, while emergency spinal or skull surgery often requires the models within 12 hours.

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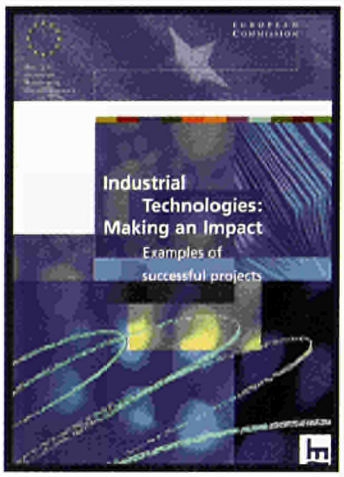

The recently published 'Industrial Technologies: Making an Impact' describes 50 successful Brite-Euram, SMT (Standards, Measurement and Testing) and ECSC (Steel) research projects. 13.5 ECU. Catalogue No: CG-NA-17-750-EN-C.

Sophisticated Software

The project structure was straightforward, with one partner responsible for each stage of the process. Siemens focused on data quality, as solid models require much higher resolution and accuracy than normal scans. They concentrated on 'spiral CT' imaging, where the CT scanner is moved continuously around the patient in a spiral pattern. Unlike normal scans, which require the patient to lie motionless for up to 20 minutes, a spiral CT scan only takes around 30 seconds, significantly reducing inaccuracies.

The disadvantage is that, unlike normal scans, spiral CT data have to be heavily processed into a series of 2D images, each representing a thin slice of the patient. Siemens therefore developed a suite of high-power algorithms which improved the resolution of each slice by a factor of 100. Apart from making an essential contribution to the project, their work has improved their entire product range and resulted in two new patent applications.

Meanwhile, Materialise NV, which coordinated the project and is now marketing the results, developed interpolation software to fill in the gaps between each slice, producing the smooth curves required for medical models. The interpolation software can handle all varieties of scanning equipment, although spiral CT produces the best results.

Materialise also developed the software for the Medical Modelling Workstation. This equipment takes the data, displays it to the radiologist and surgeon, helps them select the objects (such as bones, muscles and organs) they want produced and prepares the data for the rapid prototyping machine.

Dedicated software was developed so that if the surgeons selected just one data point - representing a fragment of the lower jaw, for example - the workstation could identify all the data points representing the entire jaw. In this way the surgeons can select whatever they want modelled in a few minutes, rather than laboriously specifying hundreds of data points manually.

Another problem is that many body parts are shaped so that they cannot stand upright as they are being created within the rapid prototyping machine. The partners therefore wrote software to help the users add special support structures into the model.

Extra Dimensions of Data

Zeneca, naturally, contributed the resins. As for Siemens, the new application set them some challenging requirements, such as non-toxicity for use in surgical environments.

More importantly, almost all of the surgeons surveyed by the KUL agreed that simple 3D models face one outstanding problem: unlike medical scanner screens, which display bone, cartilage and other tissue types using different colours, models cannot show the difference between tissue types. For a surgeon planning to remove a bone tumour from the surrounding bone, for example, this distinction is literally a matter of life and death.

But how to add colour to the models? Zeneca solved this problem by studying resins that can be *coloured*, as well as cured, by laser beams. The resulting 'Stereocol' resin becomes a transparent solid when cured at normal laser beam intensity, and goes a darker red as beam intensity increases. In this way different organs, or tumours can be shown in shades of red throughout the transparent model.

The PHIDIAS Network

Overall, the three companies have applied for at least seven patents between them as a result of their work. KUL also played a key role, validating the technology by providing more than 20 surgeons with experimental models for almost 50 different patients. The surgeons rated the models as Not Useful (6% of the time), Useful (33%), Very Useful (40%) and Essential (21%).

Materialise and its partners have therefore developed, tested and patented a new technology which looks set to radically improve complex surgery. Materialise has already opened a sales office in the USA and increased its size from five to 40 employees. Their CT Modeller System is used by 40 different groups that use or produce medical models worldwide.

The next step is the PHIDIAS Network, a Brite-Euram Thematic Network(1) to bring the technology to a wide number of potential users and research institutes around Europe. The exploratory phase of the project was successful, and the partners are optimistic the 1.9 MECU implementation phase will be approved in the next few months.

The planned network will have almost 40 partners, including Materialise and twelve other companies, a large number of hospitals and several universities and research institutes. All of these partners are conducting research in the medical modelling field - the network will bring this research together and also carry out a much larger validation study of the PHIDIAS technology's impact on surgery. □

(1) See Innovation & Technology Transfer, edition 6/96.

EIMS Reports

The Innovation Programme's European Innovation Monitoring Service (EIMS) has recently published three reports.
Executive summaries of all three reports will soon appear on the Innovation Programme's WWW site (http:// www.cordis.lu/innovation/home.html), while paper copies may be obtained from the EIMS (free of charge):

■ Innovation and employment in Italy
"The impact of innovation on employment - Alternative interpretations and results of the Italian Community Innovation Survey" assesses the impact of technological change on employment in Italy, based on data from the Innovation Programme's Community Innovation Survey.
It compares alternative views concerning the impact of innovation on employment, and analyses different economic approaches to technological unemployment. In particular, it looks at the neo-classical approach, in which the market is expected to lead to full employment, as opposed to the non-orthodox approach, which emphasises the importance of demand management policies.
The report discusses the effects of compensation effects on both the supply side and the demand side.
The report suggests that the direct effects of innovation on Italian firms have not been beneficial to employment, although the positive performance of small innovative firms has been encouraging. However, these small innovative firms represent a minority of small firms overall.

■ Innovation in Europe's pharmaceutical industry EIMS Report No 32
"Europe's pharmaceutical industry - an innovation profile" was written on behalf of the Commission by researchers from the University of Sussex's Science Policy Research Unit.
According to the research, the USA is the strongest player in the industry, with significant exports and the largest share of the 50 top-selling drugs. In Europe, the UK is the strongest country, while Germany has declined. Both France and Italy have strong R&D performance but are not responsible for any of the top-selling drugs.
The report looks at a number of measurements of innovation in the sector, such as R&D spending, patents granted, and the number of drugs in the top-50 sellers. It suggests that measures of R&D spending and patenting are inaccurate representations of innovation, since much R&D spending goes on duplicating the work of other companies, while much patenting is defensive. Measuring the numbers of top-selling drugs is possibly the best indicator, but this tends to measure past innovation rather than current. The report also suggests that European firms have been slow in incorporating biotechnology into their drug development.
The researchers note the need for the European research base to receive continued support, and for encouragement to companies to exploit it at a European level. These measures should be complemented by a European rather than national regulatory system, the reinforcement of the Single Market, and the easing of restrictions on venture capital financing.

■ Innovation in the European food and beverages industry EIMS Report No. 35
The report, prepared for the European Commission by the University of Aalborg (Denmark), reveals that, despite its low-tech reputation, product and process innovation in the industry over the past twenty years or so has been radical. A strong relationship is found between innovation and profitability, with the most innovative firms persistently showing the highest levels of profitability and least susceptibility to risk through critical phases of the business cycle.
The study concludes that although Western Europe has fared reasonably well in patenting in food and food-related areas, Western Europe's broad disadvantages in areas such as biotechnology, electronics and instrumentation could become stumbling blocks. It also concludes that although food processing does have some inherent advantages for disseminating industrialisation across countries, in recent times these benefits have been reaped more by the medium-sized countries of Western Europe than by the smallest and most disadvantaged. The study indicates that the gaps are larger still in terms of implementing new technologies.
The study concludes that a shift towards the demand side is needed in policy making at all levels. The focus needs to shift from knowledge creation to knowledge diffusion, but also from upstream to downstream in terms of the knowledge creation itself.

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■ INNOVATION PROJECTS: THE DEFINITION PHASE
ISBN 92-827-9714-7.
The Innovation Programme's (English only) "Guidebook for the project definition phase" serves as a planning aid for the Innovation Programme's technology validation and technology transfer projects (also known as innovation projects, see pages 7-9).
The Guidebook focuses on the definition phase of the project, which is aimed at verifying the technical and economic viability of the project and drawing up detailed plans for implementation and financing. Projects which successfully complete the definition phase may then move on to the main implementation phase. The definition phase work is intended to help proposers to structure their project, find additional partners, verify the IPR through the QUICK SCAN facility (see Dossier, this issue) and reduce the risks associated with implementation.
Participants in innovation projects may obtain the Guidebook free of charge from the Innovation Programme.

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■ OPET NEWS: PROMOTING ENERGY TECHNOLOGIES
The OPET Network (Organisations for the Promotion of Energy Technologies) has launched a new newsletter, designed to keep members and users updated on developments and activities in Community energy policy.
OPET News, will be published every six weeks by the OPET Coordination Unit. The first issue follows up the re-launch of the OPET Network last January 1997, when the network became a collaboration between the Innovation and Non-Nuclear Energy (JOULE/THERMIE) Programmes.
OPET aims to assist the dissemination of appropriate energy technologies to reduce consumption of non-sustainable energies. Members of the network work directly with market actors in their region, raising awareness of new technologies, and promoting technology transfer, innovation, exploitation of research results and collaboration between researchers and industry.

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POLLUTEC'97 Technology Transfer Days 30 September - 3 October, Villepinte, France

The Innovation Relay Centre Paris-Ile de France is organising three Technology Transfer Days within the framework of POLLUTEC'97, the thirteenth international exhibition for environmental equipment, technology and services for industry and local authorities.
Businesses and research centres participating in these Days will have the opportunity to meet with 100 French and other European SMEs and industries with technology offers or demands in the environmental sector. Pre-arranged meetings of approximately 45 minutes will take place throughout the three days of the event. Technical and legal assistance will be provided by experts in the field.
The Days are being organised in collaboration with the ARIST Rhône-Alpes Innovation Relay Centre and ADEME (Agence de l'Environnement et de la Maîtrise de l'Energie). Several Innovation Relay Centres from Belgium, Germany, Italy, the Netherlands and the United Kingdom will also be participating.
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Venture Capital for SMEs 23 October, Mulhouse, France

Companies from over 15 different countries are expected to attend the Second International Forum for the Development of SMEs, which is being organised by ICNA (International Consultant Networking Association), SODIV (Venture Capital Organisation) and LINKS (a consultancy firm), in collaboration with the CIAL Bank, X Roads and DG XXIII of the European Commission.
It will cover how venture capital works, its drawbacks, how to set up projects and how and why to call on venture capital companies. The main objective of the forum is to offer a realistic and practical view of venture capital to help projects find funding.
Participants will also have the opportunity to:
- Meet potential project partners;
- Discuss projects with venture capital organisations;
- Seek advice and support from financial and administrative organisations;
- Present their projects or finance strategies.

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NOTE

If specific contact information for obtaining a publication is not supplied, refer to the 'Quick Reference Guide' (1/97). Publications are free unless otherwise stated.

EITC 97 Convergence: Creating the future 24-26 November,Brussels

EITC 97, the European Information Technologies Conference and Exhibition, is organised by the European Commission, DG III (Industry), within the framework of the ESPRIT programme.
The theme will be "Convergence: Creating the future". The conference will look at the convergence of industries such as telecommunications, broadcasting, IT and publishing. Issues to be covered include:
- the intensive research into and trials of new interactive services, such as interactive TV and Internet trading;
- the growing numbers of cross-sectoral alliances thus created; the resulting pressure for adapting the regulatory framework;
- the nature of the content disseminated through on-line services, as well as publishing and access rights to new media.

The conference's keynote speech will be given by Nicholas Negroponte, director of the Massachusetts Institute of Technology's Media Lab.
A number of parallel workshops and forums will cover topics such as research networks, multimedia content, mobility and electronic commerce. In addition, the "Access to Finance" sessions will introduce IT innovators looking for venture capital to the markets through a range of workshops and presentations. There will also be an Investment Forum, by invitation, to introduce venture capitalists to selected high-tech SMEs.
The final day will include a presentation of the Commission's plans for the "Information Society Technologies" programme under the Fifth RTD Framework Programme. There will also be an exhibition of a selection of products developed in ESPRIT projects, and the 1997 European IT Prizes, to be presented by the President of the European Commission, Jacques Santer. The finalists' entries will also be on display in the exhibition throughout the conference.

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CD-AJ-97-004-EN-C

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