

THE EUROPEAN ASSOCIATION OF
RESEARCH & TECHNOLOGY
ORGANISATIONS

**Impact
Delivered**

Foreword

From the President of EARTO



EARTO is publishing this collection of case studies of high-impact innovations at a critical and challenging moment in Europe's economic history. A moment in which everything is pointing to the need for Europe to drive economic and social progress by reinforcing its investment in research and innovation.

Against the backdrop of the fall-out from the financial crisis, many countries are facing fiscal retrenchment and tight budgets, yet also an urgent need to return to sustained economic growth in increasingly globalised and competitive markets. In response, the European Commission, with its proposals for an Innovation Union, is challenging us all to debate and create the next generation of European research and innovation programmes that will fuel this growth and competitiveness. These proposals require us to re-tool our policies. To target smart, sustainable and inclusive growth. And to focus on Europe's 'Grand Challenges': sustainable and secure energy supply, the environment, resource security, ageing populations and lifelong health and wellbeing. These challenges are also, of course, 'Grand Opportunities' for economic growth.

Rising to this challenge is about more than scientific excellence. It is about putting novel concepts to practical use. We have to help organisations do more than invent, we have to enable them to bring their ideas to life.

This is where our members, Europe's Research and Technology Organisations (RTOs), make a difference. Supporting innovation in both the public and private sectors, and particularly among small firms, is our overarching objective. That is what we were originally set up to do – in most cases half a century ago or more. And it is what we continue to do so successfully today.

Our heritage, our focus and our expertise mean we have much to contribute to the new Innovation Union policy.

For we play a central role in national innovation ecosystems, interlinking companies and universities, public agencies and civil society groups to develop technologies that feed directly into new goods, processes and services. More than this, we provide technology and market foresight and monitor social developments so that policymakers and businesses can make better decisions about future needs and market opportunities. We also run scientifically excellent strategic research programmes to develop the technologies we will need tomorrow. In all that we do, we work to create wealth and welfare for all. And critically, given today's economic climate, we help governments to maximise the return on their investment in research and innovation.

The case studies presented here highlight the contribution we are already making to the quality of life, health, sustainability and future of Europe. As you will see, sometimes our contributions are revolutionary, sometimes evolutionary. They are, however, always relevant to real-world needs and they always deliver maximum impact.

With my many RTO colleagues in EARTO, I look forward to the forthcoming policy discussion about shaping and implementing the Innovation Union. This is a challenge that Europe must – and can – rise to!

Erkki KM Leppävuori

President and CEO of VTT Technical Research Centre of Finland
President of EARTO

Introduction

Enabling innovation: delivering impact

Europe's Research and Technology Organisations (RTOs) exist to create real business growth and improved social welfare by helping companies and governments to harness innovation. By enabling firms to identify and access the technology and expertise they need to realise their product and service ideas, we're helping them make their mark in global markets. In the same way, we help governments design and deliver improved quality of life for citizens. In all that we do, we make a powerful, unique and vital contribution to Europe's economic growth, to tackling Grand Challenges and to achieving sustainability.

Innovating for wealth and wellbeing

As the case studies we feature here show, firms we work with have achieved outstanding success through innovation – even in the depths of recession. Success that has not only led to dynamic business growth but also to global leadership positions, as in the case of SonoWand's brain imaging innovation and St1's sustainable transport fuel. Then there's Fraunhofer's MP3 breakthrough, whose success is feeding millions of Euros back into its research into next-generation technologies.

The impact of our innovations extends far beyond wealth creation. Products we have enabled are improving the health and wellbeing of citizens and the quality of lives and environments. Just one innovation in this collection – a new kind of concentrator module – could massively transform the future of solar power.

The real life examples of our work that you'll read about in these pages are just the tip of the iceberg. Thousands more have been making a difference to our world for years.

Bringing people and resources together

Today, as we strive to help companies and entire countries deliver the full impact of innovation in a post-crisis economy, we must work smarter. We have always been innovative

problem solvers. We have always been effective players within open innovation networks. Now, resource restrictions demand that we develop new ways of bridging the gap between new scientific knowledge created by universities and the needs of industry and new ways of innovating to add value to products competing against cheaper alternatives.

The typical RTO business model is a mixed one combining public core funding, public competitive funding and enterprise income in roughly equal proportions.

Many policymakers across Europe already recognise the impact RTOs deliver and are aware that the distinctive role we play in helping to turn knowledge into innovation reflects our distinctive business model.

Typically, the RTO model combines roughly equal elements of public core funding,

public competitive funding and private sector income from services such as contract research. This funding mix is particularly important for helping small firms – the main generator of new jobs and innovative products – who cite the risks of innovation and poor access to finance as the two key obstacles to successful growth.

RTOs are immensely proud of their ability to inspire organisations to innovate to the next level, helping firms to get beyond the reach of their global competitors and governments to provide more and better welfare. We hope you are inspired by this insight into some of these innovations – and that you will look out for future issues of what is to be a regular series of case study collections.

RTOs – Impact Delivered!



Technology for a better world



Cleaner living



Transport productivity



Safer environments



Health for all



Digital entertainment



World-leading advance



Childhood health



Sustainable industry



Safer healthcare



Future energy



Health device advance



Sustainable transport



Smart healthcare



Quality of life



Sustainable development



Impact delivered

Air monitor measures up to climate change challenge

Laser-based air quality measurement technology developed by a French collaboration including EARTO member CEA enables, for the first time, the monitoring of both urban air quality and climate change with one compact system. Now in use in 22 countries, the Aerosol LiDAR played an important European role in April 2010 when it tracked the ash cloud created by the Icelandic volcanic eruption.

Remote sensing of particles in the atmosphere has traditionally relied on techniques such as tethered balloons, limited-scope LiDARs (Light Detection and Ranging technology) or laboratory LiDARs, which are expensive, non eye-safe and operable only by qualified scientists. The growing need for atmospheric information for measuring and forecasting air quality and changes in the climate system meant the time was right for a more accessible, cost-effective system capable of generating real time, high resolution data on all aerosol layers.

Rising to the challenge

A team of the Laboratory for Climate and Environment Sciences (from the French National Centre for Scientific Research (CNRS), CEA and Versailles-Saint Quentin University) and the SME Leosphere jointly developed a prototype for just such a next-generation system. The resulting Aerosol LiDAR counts and locates atmospheric dust in space, providing the optical characteristics of clouds and the thickness of the air layer that traps pollutants as far as 9.5 miles from earth, in real time and in 3D.

A temporary network of 10 Aerosol LiDARs was set up after the eruption of the Icelandic volcano Eyjafjöll in April 2010 and the subsequent closure of air space, to detect and communicate details of the resulting ash cloud across Western Europe.

Benefiting all of Europe

Four key features led to the LiDAR's substantial commercial success. The system's optical design extends its range from very low heights up to the

stratosphere. Its detection efficiency enables laser power use to be limited, which ensures operators' eye safety. It comes in the form of a stand-alone, low-maintenance system transportable by two people. And, finally, it can be networked for regional, national and international coverage, as Europe discovered to its benefit during the volcanic ash cloud incident.

Extending system applications

Six years on, the company founded to develop and commercialise the technology, Leosphere, has 56 employees, a range of products including wind LiDARs and 175 systems deployed worldwide. Leosphere continues to work with CEA: it is currently focusing on developments such as water vapour detection in the atmosphere.



• energie atomique • energies alternatives

CEA is the French Alternative Energies and Atomic Energy Commission, a leader in research, development and innovation comprising 10 research institutes and 16,000 research staff. It is involved in setting up collaborative projects with partners around the world focused on low-carbon energies, defence and security, information technologies and health technologies. In each of these areas CEA maintains a cross-disciplinary culture of engineers and researchers, building on the synergies between fundamental and technological research.
www.cea.fr

Traffic system makes ports more productive

A smart traffic optimisation system resulting from a multinational collaboration managed by EARTO member Pera significantly increases the productivity of the world's sea ports. By enhancing the safety of ships entering port, Optiport has already increased throughput in European ports by up to 10% and added value by as much as €3 billion a year.

For centuries, many ports have been unable to maximise their revenues by accommodating all sizes of ships, their restricted size and depth making them unsafe for larger vessels. Without accurate under keel clearance (UKC) calculations the risk of running aground was simply too great. The limitations of existing UKC calculations and the huge cost of electronic guidance equipment required for bigger ships presented a major barrier to increased port productivity. With ports contributing significantly to government funds – €23 billion in Europe for example - the economic potential of overcoming the problem was clear.

Navigating the route

Pera and a consortium of six European companies agreed that if a navigation system could be developed to improve the accuracy of UKC measurements from 50cm to 10cm, more ships could pass through the ports during a tide. If the system could also increase real-time ship movement forecasting and position accuracy, accidents and groundings in shallow waters would be reduced. This was precisely what the Optiport project set out to do – and exactly what it achieved.

Optiport increases port throughput by up to 10%, which in turn increases added value by as much as €3 billion a year.

Reaching the destination

With funding secured by Pera from the European Commission Framework Programme, the consortium members combined their expertise in marine equipment, navigation systems, sensors and aluminium and plastic extrusion to create a light, portable unit combining GPS receivers and motion sensors. Easy to use and precise in its display of a vessel's position, speed and predicted UKC, Optiport proved an instant success.



Reaping the rewards

Within months of the project's completion, 16 systems had been sold at around €25,000 each, a price competitive with other navigation systems offering lower performance. This early indication of a highly successful commercial exploitation opportunity is now being realised. Analysis suggests that the European market could be around 15,000 units of the product valued at €375 million, with the North American market estimated to be worth €500 million.



Pera is one of Europe's leading innovation and business

support organisations, with a presence in eight European countries. It inspires and enables clients to transform products, services, skills and business processes beyond their competitors' reach using tried and tested innovation techniques. It works in partnership with regional, national and EC government agencies to provide access to both public funding and over 10,000 scientists and engineers.
www.pera.com

Intelligent earplug removes danger of noise damage

An intelligent earplug developed by EARTO member SINTEF, QUIETPRO® protects and preserves the hearing of people who work continually in noisy surroundings and enables them to communicate normally with colleagues. Aimed originally at the military and security markets, the device's highly innovative design and technology is equally effective in any working environment where sound levels are high, from construction sites to offshore platforms.

Noise is a major problem in many civilian and military working environments. In addition to causing hearing damage, it's also a serious safety hazard due to impaired communications, tiredness, stress and reduced alertness. Noise-induced hearing loss is the most common reported occupational disease in the European Union. One in five European employees has to raise their voice to be heard for at least half the working day, and 7% suffer from work-related hearing difficulties .

Reducing noise levels

SINTEF developed the ground-breaking technology that led to QUIETPRO®, an award-winning intelligent earplug successfully commercialised by spin-off Nacre AS. The lightweight device not only protects the hearing but also incorporates wireless communication, allowing the wearer to hold a normal conversation whatever the sound level. Incorporating a mini-loudspeaker and both internal and external microphones, the earplug uses digital sound processing to filter out noise while still letting in speech, and automatically adjusts noise attenuation and communication signal levels.

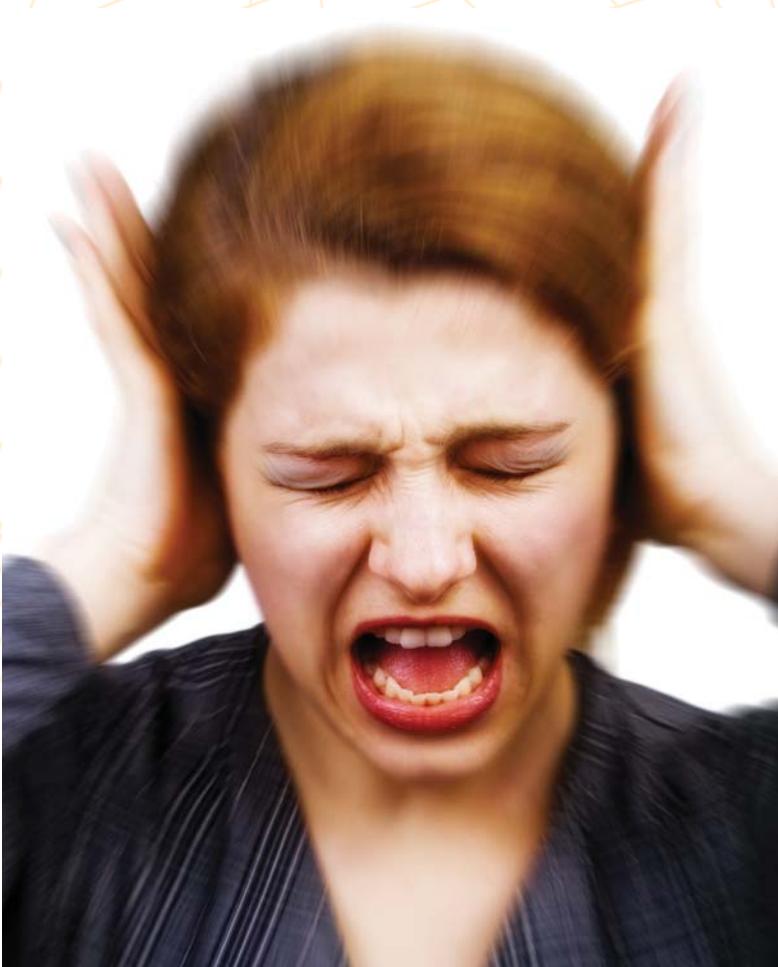
Effective in most environments

QUIETPRO® is compatible with helmets and protective masks and also functions as a hands-free terminal and can be used in conjunction with other communication systems, such as military radio units, intercoms and GSM telephones. The earplug functions equally well on a manufacturing production line, in an engine room onboard ship, on offshore platforms or in a military tank.

An expanding global market

To date, QUIETPRO® has won customers in Norway, Sweden, Denmark, France, the UK, Canada and the USA, and has been adopted by military forces all over the world, including the US Marines, NATO, the French Special Forces and the Royal Netherlands Armed Forces. SINTEF and Nacre are currently collaborating with Statoil to develop next generation technology for the offshore energy industry, and with BAE Systems, part of the Eurofighter Consortium, to adapt the technology to a fighter cockpit environment.

The QUIETPRO® Intelligent Hearing System has achieved the highest possible hearing protection rating from the renowned French-German Research Institute of Saint-Louis (ISL).



 **SINTEF** Sintef is the largest independent research organisation in Scandinavia. Every year it supports the development of around 2000 Norwegian and overseas companies through research and development activity in technology, the natural sciences, medicine and the social sciences. SINTEF has 2100 employees from more than 65 countries, working in offices in Trondheim, Oslo, Bergen, Stavanger, Tromsø, Hirtshals in Denmark, Houston Texas and Rio de Janeiro.
www.sintef.no

Stomach simulator creates alternative to animal testing

EARTO member TNO is behind the most sophisticated in vitro model of digestion ever developed. TNO's human digestion simulator provides the world's food and pharmaceutical industries with an ethical and economical alternative to animal testing at a time when regulatory and commercial pressures for rapid and reproducible results are increasing.

Animal testing still plays a significant role in the development of new drugs, foods and chemicals. Across Europe, over 12 million experiments using animals are performed each year. There is, however, a global goal to reduce, refine and replace animal testing by capitalising on new technologies that can carry out tests faster and cheaper. European directives such as REACH, which demands that 30,000 chemical substances be tested for human and environmental safety by 2020, makes realising this goal even more urgent.

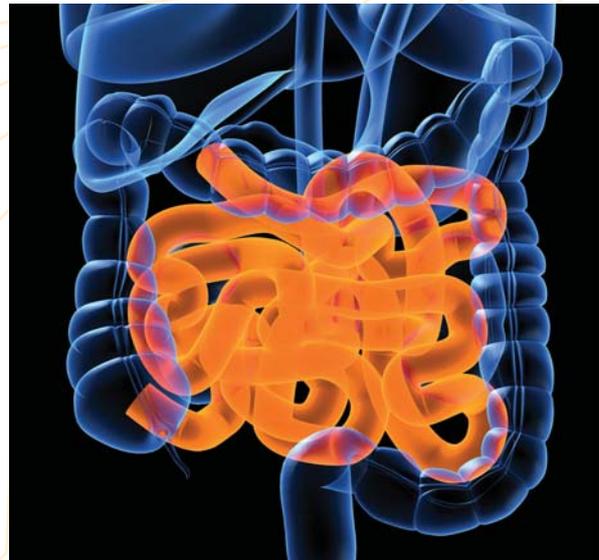
Creating a computerised gastrointestinal tract

Building on its experience in developing novel test methodologies that are predictive for humans, TNO invested years of research in its TNO Intestinal Model (TIM). This unique computerised artificial gastrointestinal system is a highly complex network of valves and compartments in which everything from body temperature to enzyme secretion can be regulated. It allows researchers to accurately reproduce the biological and physiological conditions of people and animals with and different ages, medical conditions and fasting and fed states. This also helps TNO meet the growing need for research into vulnerable groups, such as children and the elderly.

Answering scientists' questions

TIM not only offers scientists a time-saving, highly reliable way of assessing compounds as they pass through the digestive system, but also valuable flexibility. This flexibility allows scientists to implement a broad range of experimental strategies and work towards various research goals. TIM is the premier platform for in vitro

If all the tests on substances required by the new REACH regulations were carried out using animals, it is estimated that nine million laboratory animals would be involved and the total cost would amount to €1.3 billion. TIM has the potential to dramatically reduce these figures.



analysis of nutritional and functional foods. It is also proving an unrivalled tool for providing insights into the release, solubility and bioaccessibility of pharmaceuticals.

Achieving global renown

TIM's extensive global customer base includes both academic and industrial organisations including Rutgers University in the US, Danish bioscience specialist Chr. Hansen and top five pharmaceutical companies. Seventh Wave Laboratories, which obtained TIM systems to carry out preclinical drug development studies for its US clients, describes it as a 'valuable tool to solve our customers' specific needs in formulation development and pharmacokinetics.' Due to increasing market demand for validated in vitro systems and more acceptance by regulatory authorities, the number of studies conducted with TIM has been increasing 15% per year. As a result, in vitro tests are responsible for a significant percentage of TNO's total turnover for preclinical services.



TNO is the largest, independent innovation organisation in the Netherlands. TNO connects people and knowledge to create innovations that boost the sustainable competitive strength of industry and well-being of society. We do this by working in seven themes: Healthy Living, Industrial Innovation, Comprehensive Safety, Energy, Mobility, Built Environment and Information Society. TNO employs some 4,500 employees. www.tno.nl

mp3 technology rocks the music world

mp3 technology has changed the way people buy and listen to music – and the music industry itself. Invented, developed and marketed mainly by EARTO member Fraunhofer, the now-famous data format was designed to reduce audio file size, while retaining the sound quality of the original uncompressed recording. Today, earplugs are commonplace as people tune in to their favourite music everywhere they go.

Back in the late 1970s, however, when Prof. Dieter Seitzer first came up with the idea of high quality transmission of music over phone lines, he had no clue that his invention would cause such an upheaval in the music industry. Then

Seitzer was a scientist at the University of Erlangen-Nürnberg. Later he became the Director of the Fraunhofer Institute for Integrated Circuits IIS.

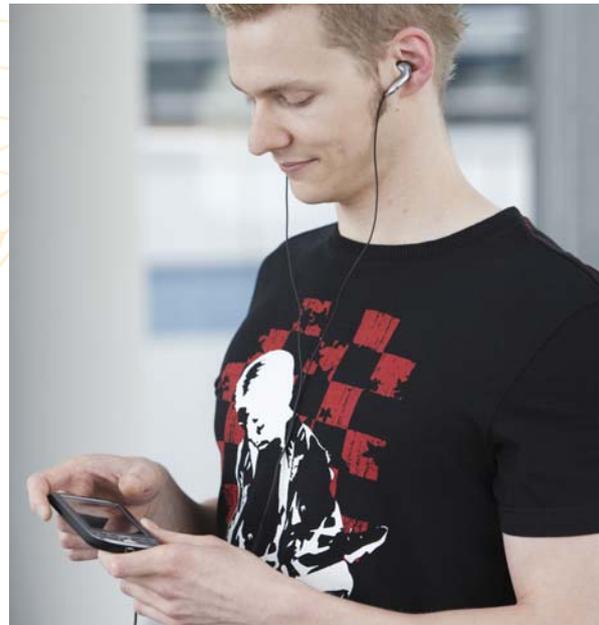
Achieving the impossible

Seitzer's first patent application for audio coding was rejected for being technically impossible; true at the time, but he and the project team were convinced they could find a way to compress musical

data, pack it into small data chunks and transmit it rapidly over data links. The challenge was – and still is – ensuring that the sound quality doesn't suffer during the data compression process. Their determination was rewarded when a patent was granted in 1989.

Convincing the sceptics

When the mp3 standard first came on the scene it received little interest from the electronic entertainment industry. Fraunhofer audio experts refused to give up, and with personal computers and access to the internet by now more widely available, the organisation started selling the software online. To begin with, the technology was used by radio broadcasters to send high quality audio data between studios via ISDN network, instead of using expensive dedicated lines. Collaboration with Micronas, formerly Intermetall, to develop the first decoder chip resulted in the first prototype mp3 player in 1994. The first portable playback device was launched the following year by German company Pontis. Microsoft became one of the first significant licence holders



in 1997, and in 1998 the era of portable mp3 players began – and the rest is history.

Investing in the future

Today, mp3 is the most widely used audio file format, compatible with mobile phones, car radios, DVD players and many other devices. Buying music online has become the norm. Fraunhofer annually collects tens of millions of euros in licensing revenue, which is used to develop new patents and know-how and next generation audio and multimedia technology. Guest scientists from around the world are working with Fraunhofer researchers and scientists from the University of Erlangen-Nürnberg in the joint collaboration project AudioLabs Erlangen to develop new multimedia technologies and applications and optimise sound quality.



Fraunhofer The **Fraunhofer-Gesellschaft** is the leading

organisation for applied research in Europe. Its research activities are conducted by 59 Fraunhofer Institutes at over 40 different locations throughout Germany. The Fraunhofer-Gesellschaft employs a staff of around 17,150, who work with an annual research budget totalling 1.6 billion euros. Roughly two thirds of this sum is generated through contract research on behalf of industry and publicly funded research projects. Branches in the USA and Asia serve to promote international cooperation. www.fraunhofer.de

Fraunhofer's groundbreaking mp3 technology has led to the creation of 9,000 jobs in Germany, and generates annual tax revenue amounting to at least €300 million.

Novel implant surface impacts healing rates and results of surgery

A breakthrough implant surface developed by a scientist from EARTO member SP in collaboration with Nobel Biocare is improving the healing rates and results of dental surgery for patients around the world and securing a significant share of the €2.2 billion a year implant market.



Fast healing and stability

TiUnite® hastens the osseointegration process, giving the surgical process greater predictability, which has a number of key benefits for both patients and dentists. Clinical results have shown that TiUnite® reduces the time of greatest risk, which occurs in the early healing phase immediately after surgery, significantly increases survival rates of implants placed in soft bone with low-load bearing capacity and secures long-term bone level stability.

Rapid sales results

From its launch in 2000, TiUnite® has been a huge sales success. Hundreds of thousands of patients across the globe have been successfully treated with implants with the TiUnite® surface. Implants with TiUnite® coatings are used in all major dental implant markets including, Europe, USA and Japan. The total dental implant market is estimated to have a value of about €2.2bn per year.

TiUnite® actively participates in its integration with human bone, improving primary implant stability immediately after surgery and helping to achieve secondary stability earlier compared to machined surfaces.

The success of dental implants depends on how quickly and effectively the implants are permanently integrated with surrounding soft tissue and bone. To improve on the performance of conventional implants with machined surfaces, a novel implant surface was sought which would interact with the biological environment to increase the predictability and speed of bone formation and implant stability.

Today, approximately every sixth dental implant sold around the world is a TiUnite® implant.

Unique surface solution

Nobel Biocare worked with an expert in materials technology and chemistry at SP and capitalised on the Institute's laboratories and advanced microscopy and spectroscopy instrumentation to develop, validate and commercialise the TiUnite® surface. Made from titanium oxide rendered into an osseoconductive ceramic biomaterial through spark anodisation, TiUnite® has a unique porous surface topography without sharp features.



SP Technical Research Institute of Sweden is a leading international research institute. We work closely with our customers to create value, delivering high-quality input in all parts of the innovation chain, and thus playing an important part in assisting the competitiveness of industry and its evolution towards sustainable development. SP concentrates on core areas such as of building and construction, electronics and ICT, energy and the environment, fire, risk and safety, food and biotechnology, mechanical engineering and automotive industry, measurement technology and wood technology. www.sp.se

Soya-based fabric cares for babies with dermatitis

A natural fabric designed specifically to prevent atopic dermatitis, was developed by a technology centre represented by EARTO member FEDIT and is soothing the skin of babies across Europe. Incorporating soya protein to preserve skin's moisture, it's the world's first material of this type to be incorporated into baby clothes which very quickly secured medical endorsement and strong sales.

In the last 50 years, the prevalence of atopic dermatitis in Europe has increased sevenfold. Today, up to 20% of babies and young children are affected at some point, suffering from dry, inflamed and itchy skin. While minimising exposure to heat, chemicals and detergents can improve the condition, there was an obvious opportunity to explore how fabrics in direct contact with skin could be enhanced to provide care and protection.



Applying science to skincare

After two years of research by Spain's Textile Technology Institute (AITEK) and the Mediterranean Dermatological Institute (IDM), involving input from paediatricians and dermatologists, the new product was released. Based on the ability of the amino acids in soya protein to stimulate the production of collagen in the skin, the new material aids the recovery and preservation of the skin's natural moisture balance.

Bringing benefits for babies

Launched in early 2010, with a range of baby bodysuits under the name Dermatek, the fabric offers significant advantages over traditional materials such as cotton. Its better breathability avoids the accumulation of perspiration which is a major cause of skin irritation. Its softness reduces irritation of dry, scaly skin and is durable without the use of chemical softeners, which can also irritate sensitive skin.

Improving outcomes

As a result of a highly successful sales and marketing strategy focused on the pharmaceutical sector, 50,000 units were sold in Spain within four months. Very quickly, Dermatek baby clothes expanded into Norway, Sweden, Denmark, Germany, France and Chile where, again, they are recommended by medical professionals such as midwives and paediatricians and sold in pharmacies.

One in five babies and young children in Europe suffer from atopic dermatitis of the kind this natural soya protein-based fabric is designed to soothe and prevent.



AITEK, is one of the Technology Centres associated to **Fedit**, the

Spanish Federation of Technology Centres. AITEK is a Technology Centre of textile and related companies whose main objective is to improve the sector's competitiveness. AITEK works in many different research areas including: plastic and metallic design and production technologies, rapid manufacturing, integrated intelligence systems and biomedical advanced materials. Fedit is the main private research, development and innovation agent in Spain. www.fedit.com

Tooling technique cuts waste, time and costs

An innovative tooling technique for component manufacturing, developed by Surface Generation with the support of EARTO member Pera, is producing big savings in lead times and production costs. By using a surface of movable pins rather than an entire solid mould insert, Reconfigurable Pin Tooling also gives users unprecedented design, volume and process flexibility.

Traditionally, making mould inserts for large or short-run components in particular has been a lengthy, expensive and wasteful process. Made out of solid steel blocks, with material cut away to create the required shape, these moulds present three distinct problems. They take ages to make, waste a huge amount of material and require large amounts of energy and process time to heat the tool when forming carbon composite components in a traditional autoclave or oven for instance.

Breakthrough idea

Tooling specialist Surface Generation saw a way to make the whole tooling and component forming process more cost effective and much less wasteful. The UK company's concept centred on the use of a hybrid subtractive and additive build strategy to selectively create only the front face of the tool against which the moulding is formed. The unique architecture of the tooling allows each pin to be individually heated and cooled, resulting in much shorter cycle times and considerably less energy usage when compared to autoclaves which are very inefficient. Floor to floor times of twelve minutes have been demonstrated for the forming of advanced thermoplastic materials when heated to 400°C and then cooled to ambient, a process which would normally take up to an hour or more.

Reconfigurable pin tooling processes reduce lead times and costs for large moulds by up to 90%.

To take its idea from the drawing board to the factory floor, Surface Generation sought the help of Pera, which secured funding of €640,000 through the European Commission's Framework Programme and managed the project.

Rapid results

Capable of producing plastic, metal and ceramic moulds, this tooling and process approach reduces the whole life costs for the manufacture of advanced components to a fraction of conventional processes. The new process technology enables users to make design changes rapidly, produce specification

prototypes cost-effectively, manufacture one-offs and reuse over 90% of the mould for future projects. Crucially, it reduces time to market for large components by up to 40%. Additionally and perhaps more significantly it can reduce the need for capital equipment, reduce process time and allow far more parts to be manufactured from the same tool at lower costs, achieving immediate increases in profitability.

Global market

Surface Generation has marketed its pin tooling technology in both Europe and the US. It is selling successfully in the aerospace composite tooling market, which is worth around €1 billion. Systems are now being used by major US and European companies for the development and manufacture of advanced composite components.



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Brain surgery imaging system saves lives

A ground-breaking medical imaging tool developed by researchers at EARTO member SINTEF in collaboration with neurosurgeons is helping to save lives all over the world. By giving surgeons a real time, three dimensional 'window' into the patient's brain SonoWand makes delicate brain surgery safer, with fewer complications and higher survival rates.

Conventional navigation systems for brain surgery use magnetic resonance (MR) or computerised tomography (CT) images which can be several days old and rapidly become out of date and unreliable as the operation progresses. For surgery inside the brain, where all parts have a function and patients can suffer serious injury if a mistake is made, the ideal would be high quality, continuously updated images to improve the surgeon's precision and the patient's safety.



Combining key technologies

SINTEF set about creating a system that would enable a surgeon to easily refresh their 'map' of the brain during surgery, taking just a few seconds to scan the brain and give high definition images of the tumour he is trying to remove. By integrating a neuronavigation system with an ultrasound scanner, a computer, an optical positioning system and innovative display modes to simplify image interpretation, it achieved its objective.

Over 5,000 patients around the world have benefited from the use of SonoWand.

Giving confidence and hope

The accuracy, speed and quality of SonoWand's images mean that surgeons can verify the progression of an operation at any time and remove brain tumours with greater precision than ever before. The system's navigation capabilities also enable the removal of a greater portion of a brain tumour through a smaller incision and give surgeons the confidence to operate on patients who would, in the past, have had no hope.



Expanding applications and markets

SonoWand is improving surgical outcomes for up to 1000 patients a year at 40 hospitals, including world-class centres of excellence such as the Karolinska Hospital in Stockholm and London's Charing Cross Hospital. It has recently been granted FDA clearance, which will open the door to the US market. The company is continuing to work with SINTEF to broaden the clinical application range of the technology within neurosurgery and also to expand into areas such as urology, breast surgery and abdominal treatment.



SINTEF

Sintef is the largest independent research

organisation in Scandinavia. Every year it supports the development of around 2000 Norwegian and overseas companies through research and development activity in technology, the natural sciences, medicine and the social sciences. SINTEF has 2100 employees from more than 65 countries, working in offices in Trondheim, Oslo, Bergen, Stavanger, Tromsø, Hirtshals in Denmark, Houston Texas and Rio de Janeiro.

www.sintef.no

Solar cell technology powers the future of renewable energy

Scientists at Fraunhofer in Germany have developed concentrator solar cells with almost double the efficiency levels of conventional silicon-based cells. By making it possible to optimise the use of almost the entire solar spectrum for energy production, the unique cells have established a new benchmark – and buoyant global sales.

Solar energy, a clean, silent, harmless and limitless source of power, is expected to play a crucial role in the energy mix of the 21st century. If it is to realise its full potential, however, solar cell technology must become more efficient and cost-effective. Concentrator solar cells enabling even more sunlight to be converted into electricity are believed to offer the best solution and researchers have been competing to develop versions with ever-greater degrees of efficiency.

Capitalising on emerging technology

Scientists at the Fraunhofer Institute for Solar Energy Systems (ISE) were convinced that a metamorphic triple-junction solar cell consisting of III-V compound semiconductors could challenge the existing efficiency record. By stacking multiple

top-quality solar cells on top of each other on a substrate of germanium, the team created a wafer-thin solar cell structure better adapted to the spectrum of wavelengths found in sunlight. In tests the technology achieved a record degree of efficiency of 41.1%.

Fast-tracking commercialisation

Originally engineered for use in space, the multi-junction cells were adapted to concentrator

technology for use on earth and commercialised by ISE spin-out Concentrix Solar under the brand name FLATCON. To facilitate the swift transfer of the technology from the laboratory to industry, a demonstration laboratory was built at



the ISE so that researchers could develop and test production processes for the construction and connection technology, module integration and quality control.

Achieving record efficiency

Currently in use around the world, including a solar park in Puertollano in Spain, the concentrator module achieves a degree of efficiency in excess of 29%. The researchers are continuing to collaborate with Europe's leading manufacturer of solar cells for space, Azur Space Solar Power, to develop the next-generation of modules containing even more efficient cells. It plans to bring these to market in 2011.

The Fraunhofer researchers responsible for the record-breaking concentrator technology received the 2010 Joseph von Fraunhofer Prize and the lead scientist also won the Foundation Louis D Award, the highest award in France for achievements in science.

 **Fraunhofer** The **Fraunhofer-Gesellschaft** is the leading organisation for applied research in Europe. Its research activities are conducted by 59 Fraunhofer Institutes at over 40 different locations throughout Germany. The Fraunhofer-Gesellschaft employs a staff of around 17,150, who work with an annual research budget totalling 1.6 billion euros. Roughly two thirds of this sum is generated through contract research on behalf of industry and publicly funded research projects. Branches in the USA and Asia serve to promote international cooperation. www.fraunhofer.de

Laser-based system set to revolutionise drug delivery

A new kind of needle-free drug delivery system, developed by Pantec Biosolutions with EARTO member CSEM, is set to transform the range of medications that can be delivered effectively and painlessly through the skin. The laser-based device, used with intraepidermal patch technology, is currently in clinical trials for IVF hormone therapy, a market with an estimated value of up to €1.6 billion.

'PLEASE Professional' received an 'honourable mention' at the Red Dot Awards: Product Design 2010, which recognises outstanding international product design.

During IVF treatment, women have to administer several hormones by self injection on a daily basis over the course of many weeks. Painless, easy-to-use drug delivery skin patches would be an ideal alternative, but the size and physiochemical nature of the hormones'

molecules prevent permeation of the epidermis. Pantec's goal was to find a way of enabling their permeation to reduce the pain and swelling, as well as the tedium, cost and infectious waste, of the current method.

Seeing the light

Working with CSEM as well as physicians, pharmaceutical companies and healthcare organisations, Pantec developed a laser-based skin poration technology which allows intraepidermal delivery of large and poorly-permeating molecules. PLEASE (Painless Laser Epidermal System) pre-treats the skin ready for drug delivery via a patch system, fine-tuning pore properties to the therapeutic need for a specific drug dose.

PLEASE will help 20% of all couples affected by this kind of infertility.

Extending applications

The system's dosing flexibility and compatibility with most patch systems, as well as its ease of use by patients and medical professionals without training, means that PLEASE can be used for a

diverse range of therapies in the home and clinic. As well as IVF – for which the device received its market clearance in March 2010 – applications being investigated include pain therapy, immunology and dermatology.



csem CSEM is a Swiss innovation centre specialising in micro and nanotechnology, nanomedicine, robotics, packaging and information technology. The centre creates a dynamic link between research and high-tech industry, and also collaborates with other innovation centres around Europe, to transform scientific and technological knowledge into elegant solutions for cutting-edge products and applications.
www.csem.ch

Bioethanol innovation makes a breakthrough for green fuel

A novel bioethanol production process developed by VTT Technical Research Centre of Finland, a member of EARTO, is being used to create the world's most sustainable transport fuel. Even more significantly, the waste-to-ethanol Etanolix process can be used wherever food is produced, making small-scale production economically viable and green fuel accessible on a local basis for the first time.

In the global fight against climate change, transport is a prime focus for action. Europe has set a target of 10% renewable energy in transport by 2020. Finland aspires to meet this target as early as 2015. Petrol substitute bioethanol can reduce CO₂ emissions by up to 80%, but progress has been hindered by concerns about the amount of arable land required to grow feedstock crops and the financial and carbon costs of transportation.

Rethinking the process

To overcome these problems, VTT developed a novel concept for a highly energy efficient, dispersed biofuels production process which produces ethanol from waste generated by bakeries and breweries in units located next to the feedstock source. A spin-off company, St1, was established which commercialised the Etanolix innovation, blending the resulting ethanol with petrol to make Finland's first domestic vehicle biofuel, Refuel RE85.

Reducing lifecycle emissions

Etanolix is a universal eco-friendly energy production concept with widespread global potential. Not only does it use a raw material that would otherwise be a waste problem and source of environmental emissions. It also dramatically reduces transportation needs and costs, opening up the opportunity for bioethanol production and distribution to be profitable and for bioethanol-based fuel to reach a mass market.

Awards success

- **European Business Awards for the Environment 2009** – First prize winner in the Product category with Refuel RE85
- **Environmental Innovation for Europe 2008** – Silver Award which cited the 'unique lifecycle emissions of the ethanol produced by Etanolix'
- **Chemical Industry Innovation Award 2008** – First prize awarded to Etanolix, described as an 'exemplary innovation'
- **INNOSUOMI 08** – First prize winner in Finland's national innovation awards, presented by Tarja Halonen, President of the Republic of Finland.

Driving forward fast

St1 currently has six bioethanol plants in Finland and plans to build more in Sweden and Poland. Refuel has hit the fuel pumps of three of its 650 petrol stations. The company has already introduced a new bioethanol production concept, Bionolix, which uses commercial and domestic biowaste as feedstock and is developing next-generation plants using packaging and straw. St1 is also working to develop Etanolix networks with local partners and to make Refuel available in other countries around the world.

'St1's ethanol production will represent around 2% of the total volume of petrol sold in Finland. Alone, it is enough to meet over half of the goals that the Ministry of Employment and Economy are thinking of setting in relation to the use of biofuel components in Finland'

Juha Kokko, St1

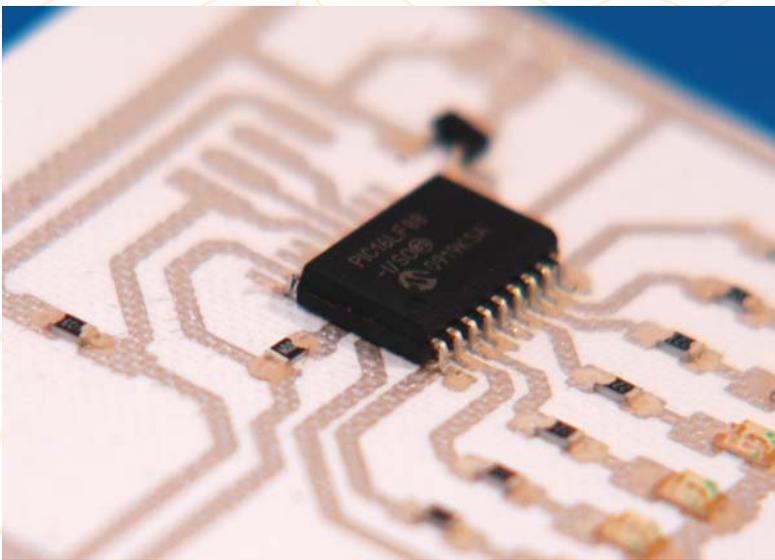


VTT Technical Research Centre of Finland is the biggest multi-technological

applied research organisation in Northern Europe. With its staff of 2,900, its unique research facilities and extensive global co-operation networks, it provides leading-edge technology solutions and innovation services. VTT works to enhance its customers' competitiveness and competence, creating the prerequisites for society's sustainable development, employment and wellbeing. www.vtt.fi

Controlled drug delivery with smart skin patch

Spanish firm Infinitec Activos and CETEMMSA, a technology centre represented by EARTO member FEDIT, have developed for the first time a smart skin patch that signals a step-change in the value and versatility of this form of treatment delivery. Capable of releasing active ingredients into the skin in a controlled way, the intelligent textile has the potential to revolutionise the administration of drugs and cosmetics.



Existing skin patches, used for the delivery of nicotine for example, rely on the uncontrolled release of their active ingredient. Once the patch is put on the skin, the nicotine simply starts to diffuse until it is all released. Until now, this lack of control over the quantity and timing of the ingredient's release has limited applications of this convenient and painless way of administering potent substances.

Addressing limiting factors

Infinitec Activos believed that a solution combining a smart nano-encapsulated peptides release system with integrated electronic controls could unlock the technology's potential. Working with seven collaborators including CETEMMSA, which prepared the textile-active material on which the nanoencapsulates are deposited, the company succeeded in developing a smart skin patch whose embedded ingredient is activated by heat from a programmable electric circuit.

Penetrating major markets

Having achieved its goal of creating a skin patch that allows the delivery of regular doses, the company first applied the technology to anti wrinkle, whitening and anti-ageing skin care products. It is expected to make a notable impact in the €226,000 million dermocosmetics market. The next-generation patch also has huge potential in the significantly bigger pharmaceutical industry, where it could be used and controlled by patients or even, in the future, remotely by healthcare professionals via a wireless system.

The smart skin patch is programmed to heat up via an electric circuit which stimulates the peptide-containing capsule to open and release some of its contents. When the signal ceases, the patch cools, the capsule closes and delivery of the drug or cosmetic stops.



CETEMMSA is one of the Technology Centres associated to

Fedit, the Spanish Federation of Technology Centres.

CETEMMSA has over 18 years' experience of applied research on smart materials and smart devices. CETEMMSA works in other research areas including: organic electronics, functional textile structures, RFID systems, automotive, security, protection, defence, health, sport and textiles. Fedit is the main private research, development and innovation agent in Spain.

www.fedit.com

Keeping a watch on the old and vulnerable

The Vivago Care watch, developed by Vivago with EARTO member VTT Technical Research Centre of Finland, is the world's first security device that automatically monitors a person's well-being 24 hours a day. The watch is already in use by tens of thousands of elderly and chronically sick people around the world, enabling them to live safely at home for longer.

As life expectancy rises and family life changes, more elderly people than ever are living on their own. Add to this the increase in chronic illness associated with ageing and there is clearly a need to find innovative ways of helping people to live independently by providing for their security and healthcare needs. Discreet, easy-to-use solutions which place no limit on users' activities and no demands on their input are the most highly prized.

Sensing an effective solution

Working with VTT, researchers at Vivago (originally known as IST International Security Technology), developed patented technology consisting of sensors and algorithms which allows body signals to be monitored and analysed automatically and continuously. The team incorporated this technology into a discreet wrist unit which adapts to the wearer's normal activity levels and sleep patterns and sends an alert to a carer if these change significantly.



Valuable and varied functionality

Designed to look like an ordinary watch so there is no stigma attached to wearing it, the Vivago Care watch is invaluable when the wearer has a fall, for instance, or is uncharacteristically immobile and also highlights body



changes indicative of the need for medical assistance. Fitted with a device interface, the watch can be used as an access control system, for wearers with dementia for example, as well as a security system for carers.

Capitalising on core technology

The Vivago Care watch, named the world's best telecare product in 2006, is now sold in Finland, Sweden, England, Ireland, Germany, France, Holland, Italy, Hungary and Japan. The company has gone on to capitalise on its patented BODYCARE technology to develop and market a range of advanced personal safety systems and wellbeing products.

The Vivago Care watch is already helping tens of thousands of users around the world.



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Planning tool builds the case for sustainable cities

An interactive planning tool developed by EARTO member TNO will help to improve the quality of life and sustainability of cities. By instantly calculating the impact of factors like traffic and noise on the built environment, the Urban Strategy system gives planners an opportunity to optimise their designs.

As part of its ambition to chart and promote the sustainability and quality of the built environment now and in the future, the Netherlands Environmental Assessment Agency (PBL) sought

Introduce a new office block into a city and the Urban Strategy system will show the impact of the building and its extra commuters on public transport services and traffic noise and pollution, achieving within seconds what used to take hours or even days.

a way of understanding the effects of interdependent factors such as air quality, proximity to facilities and services, noise, traffic and access to greenery when it came to planning and development. With these insights, individual designs and local, regional and national policies could be developed to maximise the quality of urban life.

Valuable pictures

The PBL called on TNO's expertise in the local environment to help with the task. TNO came up with high-tech modelling tool capable of giving a comprehensive and

interactive overview of the effect of a variety of decisive environmental factors on a habitat. Plans for a new neighbourhood can be developed, or the effects of various planning scenarios tested, their consequences on the quality of the environment determined and adjusted and the results shown almost immediately in 2D or 3D.

Informed decisions

This sophisticated decision-support tool enables work that normally takes weeks or even months to be done in a couple of days. It can also be used in interactive sessions that bring together the knowledge and insight of specialists from municipal authorities, developers, urban and planning consultants and housing associations.



PBL and TNO are continuing to work together to further develop the system – they are currently adding new environmental simulation modules and devising smart new applications. Other active users of the Urban Strategy tool are the City of Rotterdam and the Dutch Directorate-General for Public Works and Water Management.



TNO is the largest, independent innovation organisation in the Netherlands. TNO connects people and knowledge to create innovations that boost the sustainable competitive

strength of industry and well-being of society. We do this by working in seven themes: Healthy Living, Industrial Innovation, Comprehensive Safety, Energy, Mobility, Built Environment and Information Society. TNO employs some 4,500 employees. www.tno.nl

Research and technology organisations

- are specialised knowledge organisations dedicated to providing research and technology services in response to the major economic and social challenges and opportunities of our time.
- offer targeted basic and applied research; product and process technology development and knowledge transfer; access to advanced equipment and facilities; value-added technological information and consultancy; vocational training, laboratory, testing and certification services.
- work for and with governments, universities, firms both large and small, non-governmental organisations and others, in varying modes of engagement: collaborative multi-partner research, single-client contract work, branch-related collective research.

EARTO

- is the European trade association of the Research and Technology Organisations (RTOs), a non-profit organisation founded in 1999.
- promotes and defends the interests of its members towards European institutions and others, and offers them added-value services.
- groups over 350 Research and Technology Organisations with a combined staff of 150,000, an annual turnover of €15 billion, specialised equipment and facilities to a value of many € billions, and more than 100,000 customers annually.



EARTO

Rue Joseph II, 36-38
B-1000 Brussels
Tel: +322 502 86 98
Email: office@earto.eu
www.earto.eu

