



EUROPEAN  
COMMISSION

Community research

# Co-operative Research projects for SMEs Volume 3



HORIZONTAL ACTIVITIES INVOLVING SMEs

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017819	BIO-HYDROGEN	Development of Biogas Reformer for Production of Hydrogen for PEM Fuel Cells
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512887	RAP-EAT	An Ultra Efficient, Low Cost, Biocatalytic Material For Use In Rapid Oil Spill Treatment Applications (Inland And Coastal) To Dramatically Improve Bioremediation Efficiencies And Protect High Risk Receptors Through Pathway Activation
513134	RASPED	Reverberating Abrasive Single-use Piezo Electric Driven Device
513035	Reward	Research On Energy, Water And Chemical Agent Reduction In Commercial Dishwashers
16357	SCREENS	New Method Of Video Transfer And Control Functions For Training In Computer Classroom And For Audiovisual Applications
017788	SEFUCO	High Performance Self-lubricated Multifunctional Coating For Demanding Industrial Applications
5901	SILVERCROSS	Mass Production Of Silver Halide Recording Material For Full Colour Holographic Applications
508283	S-SCIL	Development And Testing Of New Standards For Sorption Measurement And Characterisation Of Ionic Liquids
17683	U-CREATE	Creative Authoring Tools For Edutainment Applications
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# DESTINATION MANAGEMENT GOES MOBILE

Aladdin

*“There will be a substantial mobile marketplace for leisure and business services in the destination area.”*

European SMEs in the tourism and travel industry are facing serious challenges from large international companies. Optimised tour transfer setups, tailored offerings, the handling of last-minute changes to hotel bookings, etc. are key issues for incoming agencies. They have to deal with the growing trends of mixed individual or group travel combined with highly volatile business processes, which have become increasingly complex and expensive.

Incoming tour operators, tourist offices, restaurants, leisure parks or conference organisers are typical SMEs that are expected to provide multiple services to the same customer — the traveller — in a cost-efficient yet attractive way. Due to the rapid growth of mobile terminals such as smartphones and handheld computers, there will also be a substantial, untapped mobile market for leisure and business services. However, different device types make it nearly unaffordable for service SMEs at the destination to participate in this new mobile market.

## Open market

The Aladdin project brings together project partner SMEs and research organisations from six European countries with complementary skills and experience to help SMEs get their foot in the mobile market door. The aim is to develop a mobile destination system that combines both the provision of a mobile incoming tour operator workspace (B2B) and a mobile content and service management system for destinations (B2C).

The Aladdin system — a new concept for a mobile service and information platform for destinations — will provide incoming tour operators with an optimised and cost-efficient mobile workspace. This system will support their business processes and allow small incoming tour operators to compete with larger ones. It will also allow SMEs at the destination to offer their services and content to potential customers in an attractive and easily accessible manner. Aladdin will consider different usage scenarios, keeping in mind the varied preferences of holiday and traveller types. The so far nonexistent competition in the area of mobile applications for tour guides opens up a promising new market of completely new standards.

## Towards mobile travel business

The Aladdin consortium aims to intensify international cooperation between SMEs and universities, thereby enabling SMEs to benefit directly from the project's outcome. Focussing on the tourism and travel market, Aladdin aims to provide an innovative mobile service and information platform to small-to-medium sized travel organisations. This platform will increase their business opportunities and allow for the sustainable enhancement of their competitiveness. Tour guides at the destination will be efficiently supported in their daily work, thanks to the Aladdin mobile application system.

Furthermore, Aladdin will encourage local SMEs to contribute content and services to a mobile business marketplace at the destination. The means will be in place to create new, easy-to-use and flexible marketing channels for destination services and information. Research partners participating in the Aladdin project will contribute with scientific and technological research in order to improve their own expertise in an innovative, practical and tourist-related context. In turn, travellers will benefit from a broad choice of location-based, tailor-made mobile information and services during their stay.

Through its continuous process of innovation and technical adaptation, the Aladdin project will make a useful contribution to the competitiveness of the European tourism and travel market, home to some of the most popular tourist destinations in the world.



*"The so far non-existent competition in the area of mobile applications for tour guides opens a promising market for a new standard."*

## Project title

Mobile Destination Management for SMEs (Aladdin)

## Contract number

017566

## Duration

24 months

## Global project costs

€1 800 768

## EC contribution

€1 299 200

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## Participants

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*“A concentration of only a few cells of noxious microalgae per litre can have harmful effects.”*

Toxin-producing microalgae are responsible for serious environmental, economic and public health catastrophes, and have been throughout history. For example, an outbreak of *Chattonella antiqua* killed \$500 million worth of caged fish in Japan, and in 1981 over 5000 people suffered from diarrhetic shellfish poisoning in Spain. Today, fish farms remain at risk of toxin contamination and the problem is aggravated by the effects of human economic activity, such as the use of pesticides and fertilisers in farming. These compounds, which contain phosphates and nitrates, are ferried to the sea by rivers, where microalgae growth is stimulated, resulting in blooms. Fish farms are often located in coastal areas where rivers carrying sewage pollutants or agricultural fertilisers reach the sea.

This recurrent toxic phenomenon has made it necessary to devise a cost-effective and simple-to-use device for detecting toxic algae. ALGADEC is developing what will be the first commercially available biological sensor, capable of rapidly detecting the presence of specific harmful algal species before they develop into harmful blooms (HABs). The device will enable aquatic farmers to check for the presence of toxic algae in their waters at an early stage, and to take the proper preventive measures to avoid contamination and the economic losses associated with it. Plentiful catches aside, the ALGADEC biosensor is expected to reduce the health risk for humans who eat farm-raised fish and shellfish and even those who collect shellfish themselves, due to the fact that notices warning not to collect can be posted earlier.

### Good vs bad algae

Phytoplankton, composed of microorganisms such as algae, form the basis of most aquatic food chains. Algae can be quite beneficial to humans for nutritional purposes and in cosmetics, or for the production of dyes and even biodiesel, hydrogen and natural oils. However, there are about 100 recognised microalgal species that are toxin-producing.

These noxious algae do have severe effects on the environment and humans. A concentration of only a few cells of noxious microalgae per litre can trigger very harmful side effects. If farm-raised fish and shellfish feed on toxic algae, they can become infected and potentially contaminate consumers. The resulting health impacts can be devastating, ranging from digestive disorders to amnesia, or even death. People can also be affected by swimming in infected waters.

The economic repercussions of algae contamination can be far-reaching. Not only is fish production affected, through stock destruction and consumer mistrust, but there are also ramifications for the tourism sector. Tourists will naturally avoid those destinations where algal blooms are present, as some blooms cause skin and lung irritations.

### Contamination alert

Currently, there is no product commercially available allowing for *in situ* detection of specific harmful algae. The legal

requirement by governments to monitor for toxic algae is by identifying exact species with optical microscopy. This technology has many limitations. For instance, it can only be performed by specialised operators and requires a very lengthy procedure. This morphological observation relies on comparing toxic and non-toxic algae, which can be physically very similar, making them difficult to distinguish. This technique is often complemented by the use of mouse-assays for the detection of toxins in water, a method that raises ethical questions.

In order to overcome the difficulties caused by the visual observation of algae, ALGADEC suggests a new approach, based on a molecular study of algae. The procedure involves DNA testing, giving it the ability to detect noxious algae that undergo hybridisations or genetic evolutions. The developed ALGADEC device will be portable and highly sensitive, and will contain an electromechanical sensor and a multi-probe chip, designed to obtain tailor-made sensors for each species. It will also contain a fluidic cell and warming chamber, controlled by specific software, to achieve a reliable automated detection system.

The ALGADEC biosensor is expected to become an important mechanism widely used by fish-farmers, monitoring agencies and tourist administrations. Its ease of use, rapidity and reliability, not to mention its portability, make it the perfect tool for the detection of dangerous algal contaminations. Early contamination detection is key for the adoption of measures aimed at preventing economic losses and ensuring human health protection, and ALGADEC will make that possible.



*“Currently, there is no commercially available product allowing for in situ detection of specific harmful algae.”*

## Project title

Development of an rRNA-Biosensor for the Detection of Toxic Algae (ALGADEC)

## Contract number

508435

## Duration

29 months

## Global project costs

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## EC contribution

€591 216

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*“Changing to a hydrogen society, one has to ask firstly the question: Where does your hydrogen come from? This should be mainly from renewable sources, otherwise you just waste energy for the hydrogen conversion.”*

With soaring oil costs and increased concerns over pollution and global warming, more and more people and companies are turning to alternative sources of energy. On the other hand, air pollution in urban agglomerations is caused by combustion of fossil fuels mainly by vehicles. The usage of a clean fuel, i.e. hydrogen produced from renewable sources, such as biogas, is able to solve both problems, since the hydrogen used in a fuel cell produces only water as exhaust gas. BIO-HYDROGEN is a project aiming at the development of a biogas reformer unit for the production of hydrogen for fuel cells.

BIO-HYDROGEN will provide a stable and cost-effective reforming unit for the production of hydrogen using biogas from waste, landfills, water treatment and agricultural products. The project will convert biogas, produced by the fermentation of organic matter and containing mainly methane ( $\text{CH}_4$ ) and carbon dioxide ( $\text{CO}_2$ ), into hydrogen ( $\text{H}_2$ ). Biogas is a clean and renewable energy source, which can be produced on almost every farm or waste treatment plant with an increasing market share.

### Making the most of biogas

Biogas can easily be produced, since any decomposing biological material can be converted to produce gas. In order to convert methane into hydrogen, BIO-HYDROGEN will develop a new reformer with improved efficiency, which in time will contribute to widespread hydrogen production. The project participants are also aiming at the implementation of a cost-effective biogas cleaning unit adapted to the requirements of the reformer. The cleaning unit will use biofilters for the removal of sulphur and siloxanes from biogas, which are harmful for the reformer catalysts.

A reformer is a device used for the production of hydrogen from hydrocarbons. This technology is being developed as a means to provide hydrogen for proton exchange membrane fuel cells, used in either stationary or portable applications. Using the reformed gas as fuel for cars, the gas has to be reduced to pure hydrogen and compressed. Indeed, the cleaner the fuel and the greater the pressure, the greater the energy it will deliver.

### On-site testing

The goal is to create a filter suitable for the treatment of up to 1  $\text{m}^3/\text{h}$  of biogas. In the early phases of the project, commercially available gas catalysts were tested for stability, performance and durability. The RTD project partners played a crucial role in the development of prototype installations (both reformer and biofilter) by simulating and modelling all possible scenarios and conditions, while SMEs contributed to the construction of the prototypes.

The researchers tested the selected catalysts' effect on methane and other biogases in state-of-the-art natural

gas steam reformers. Results demonstrated that natural gas steam reformers could be used for reforming biogases containing only methane and  $\text{CO}_2$ . The siloxane biofilter was also tested under different conditions for optimisation. The project identified relevant bacteria and acquired evidence of quantitative biodegradation, leading to a flow rate of 1  $\text{m}^3/\text{h}$  biogas, consistent with the prediction frame set out by BIO-HYDROGEN.

With the developed biogas reformer prototype, a capacity of 6kW of hydrogen can be produced; such a reformer was installed in Spain for endurance tests under real-life conditions, at an existing biogas plant. Participants hope that the new biogas reformer will contribute to the sustainability and wider acceptance of hydrogen production, as it requires limited investment and low running costs.

The use of biogas as a source of hydrogen for fuel cells is an environmentally friendly solution to the problems of energy production and waste disposal. The final results of BIO-HYDROGEN are expected in the second half of 2007, when all the information regarding the innovative biogas reformer will be widely disseminated to ensure its greatest possible exploitation.





*“Biogas is a highly flexible and renewable energy source with the potential of being produced in almost every farm or waste treatment plant.”*

## Project title

Development of Biogas Reformer for Production of Hydrogen for PEM Fuel Cells (BIO-HYDROGEN)

## Contract number

017819

## Duration

24 months

## Global project costs

€1 370 237

## EC contribution

€846 235

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*“... although fully- grown trees can offer shelter to many animals, young trees need to be protected against animals ... which can accidentally destroy them.”*

The fight against global warming is a battle on two fronts: the prevention of its causes and the limitation of its effects. Each year, hundreds of thousands of people are affected by natural disasters, many of which are a direct consequence of the unprecedented concentration of carbon dioxide (CO<sub>2</sub>) in the atmosphere. It is this gas that scientists acknowledge as one of the main triggers of global warming, which causes extreme flooding and severe drought periods in areas previously unaffected. The Bio-shelter project, which involves 8 SMEs and RTD performers, has developed a degradable tree shelter, used by foresters to protect young trees in afforested woodlands, where trees are being replanted to absorb CO<sub>2</sub> levels.

Afforestation is an excellent contribution to the environment. The process involves planting trees to restore forests, or even to create new ones, which are able to capture CO<sub>2</sub> emitted by industries and oil-burning cars. Trees produce oxygen and can also be used as timber for construction and furniture. Furthermore, they contribute to biodiversity by housing and protecting many animals and other plants.

Although fully-grown trees offer shelter to many animals, young trees need to be protected against animals, such as insects, rabbits and cervidae which can accidentally destroy them. Bio-shelter's new biodegradable tree shelter, which is now finding its way into the market, is designed to provide protection for these trees.

### A clean solution for the environment

Young trees are more vulnerable to external factors, such as animals and weather, but they are also able to absorb nearly 25% more CO<sub>2</sub> than adult trees. It is, therefore, especially important to protect them.

The Bio-shelter consortium focused on the development of a biodegradable tree shelter that is made of natural and biodegradable fibres, to protect growing trees. To achieve efficient and ecological tree protection, the team combined hemp with a specially developed polymer blend and created a tubular shelter.

Hemp has been known and used for a variety of applications, like fabrics, clothing, paper, ropes and nets. These natural fibres were combined with a polymer that breaks away and degrades into the soil, making the tree shelter 100% biodegradable. Another interesting aspect of this polymer is the fact that its degradation can be programmed: the mixture can be adjusted for degradation according to what is needed.

As a result, the currently used plastic shelters will become a thing of the past. Foresters will no longer need to remove old shelters once the trees have grown strong enough to survive and thrive without protection. The eradication of this lengthy and labour intensive phase is accompanied by a reduction in the amount of plastic being disposed of in overfilled landfills. Furthermore, the end of plastic shelter production means that less oil will be used in the preparation of tree shelters. This biodegradable tree shelter therefore provides an environmentally sound alternative to current plastic tree shelters.

### A stake in the market

The shelter is currently available as a one-size product but the product range will increase relatively easily. The tube is placed around a small tree and shelters it from its environment. It is kept in place with a stake, which also allows the tube to be moved up and down, in case weed treatments need to be applied at the trunk base. As the tree grows, additional tubes can be added on top.

In Europe, the potential market for tree shelters is valued at EUR 100 million. Moreover, the biodegradable shelter is made of a mixture of materials that can find other applications in horticulture, such as grow bags that can be buried and left in cultivated fields or gardens. The project participants expect the technique to improve the competitiveness of the forestry sector. The team also hopes to create over 800 new jobs in the domestic sales market within 5 years.

Afforestation is not only a means of exploiting the potential offered by trees in terms of economic prospects; it is also a suitable way of limiting the effects of global warming. Bio-shelter will successfully contribute to the afforestation efforts, initially in Europe and eventually worldwide.



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*“The biodegradable tree shelter therefore provides an environmentally-sound alternative to current plastic tree shelters.”*

## Project title

A Novel, Innovative and Sustainable Technique for the Manufacture of Biodegradable Tree Shelters with a Known Life (BIO-SHELTER)

## Contract number

513116

## Duration

24 months

## Global project costs

€930 270

## EC contribution

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# WHO SAID RAIL AND ROAD COULDN'T BE (KEPT) QUIET?

*"Essential improvements are to be achieved on the ... innovative design of noise barriers."*

CALM-TRACKS  
AND ROUTES

The word 'noise' is derived from the Latin word 'nausea', meaning seasickness. Noise is among the most pervasive pollutants today and can originate from many sources. It negatively affects human health and well-being. Problems related to noise include hearing loss, stress, high blood pressure, sleep loss, distraction and lost productivity, and a general reduction in the quality of life. It is therefore all the more important to try to reduce this nuisance, in order to improve people's lives, which is exactly what the 'Calm-Tracks and Routes' project aims to do.

Cars have only been present since the beginning of the 20th century, but people have been dealing with road noise for thousands of years. In ancient Rome they were bothered by the clinkety-clank of iron wheels on cobblestone pavements, and in 17th century England people complained about the rumble made by wagons with iron-tyred wheels as they drove over granite block streets. Nowadays, complaints about road noise come from people who live close to the busy highways that take us from place to place.

## Taking on land-transport generated noise

The 'Calm-Tracks and Routes' project takes on one of the most common sources of noise pollution, i.e. that produced by human transport activity. The project aims at achieving noise reduction indirectly. Rather than making trains and vehicles quieter (something that has already been widely achieved), 'Calm-Tracks and Routes' wishes to modify the infrastructure used by transport. Essential improvements are to be achieved on the shielding performance, acoustic quality, psycho-acoustic performance and innovative design of noise barriers.

All this research originated in the decision made by the European Parliament and the European Council to establish new standards of tolerance vis-à-vis traffic noise, implying a reduction in decibels (dB). To meet these improved environmental standards, more effective noise barriers are requested, using better noise abatement technologies, new absorptive materials, higher sound screens and the possible use of tunnels.

## Expert solutions by well-established partners

Based on the already acquired know-how and experiences of its participants in the field of noise reduction, the 'Calm-Tracks and Routes' project is intended to help consolidate scientific evidence and research in the field of refraction edge performance (absorption and interference). The design and construction should offer the best cost-benefit products to the market.

The initial step will be to specify soundscapes (friendly, healthy noise) as the result of noise shielding, found and measured behind barriers, and then to gain information about its effects on people. These soundscapes should then serve as benchmarks for digital simulation, design and material quality. Static and dynamic calculations will then determine construction and design concepts for future prototypes.

Another of the project's objectives will be to reduce the cost of high quality noise-abatement systems through intelligent production, innovative construction, and the reduction of maintenance and life cycle costs.

The project is about to present the first results of its work. When published, these results should be met with great interest by the infrastructure industry and by affected populations in general. Indeed, with potential noise reductions of up to 6dB, 'Calm-Tracks and Routes' will be a valuable instrument for the implementation of current and future noise regulations.



*“Design and construction should offer best cost-benefit products to the market.”*

## Project title

Innovation of Noise Barriers: Improved Noise Abatement for Motorways and Railway Tracks (CALM-TRACKS AND ROUTES)

## Contract number

17609

## Duration

24 months

## Global project costs

€1 658 473

## EC contribution

€1 004 015

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# ONCE A LOBSTER, NOW MEDICINE

## CHITOSANPEROS

*“Chitosan is commonly known as a dietary supplement working wonders for weight loss.”*

Obesity is, quite literally, a heavy burden to bear and sufferers are often prepared to try any trick to lose weight. There are many diets and exercise regimes that claim to be effective, but there is no miraculous solution for losing weight. Or is there? For years, chitosan has been hailed as the holy grail of weight loss dietary supplements. However, high costs and poor results have motivated the Chitosanperos project to investigate new forms and formulations for more effective chitosan supplements.

Chitosan is a derivative of chitin, found on the exoskeleton of crustaceans such as lobster and shrimps. The shells of these crustaceans are ground into a powder which, in turn, is submitted to a chemical reaction (deacetylation) that gives the powder its ‘fat-soaking power’. Indeed, the chitosan powder is said to be able to bind with fat molecules.

During the course of the Chitosanperos project, the eight team members focused their research efforts on developing formulations that promote joint regeneration and prevent and treat diseases of the digestive tract. Advances in scientific knowledge — for example, the most efficient delivery methods for chitosan — could lead to the launch of new Chitosan-based products, opening new markets for European biomedical SMEs.

### The chitosan miracle

Chitosan is commonly known as a dietary supplement which works wonders for weight loss. There is little scientific evidence that chitosan tablets help people lose a lot of weight very quickly, but there is no doubt that they do facilitate digestion of fibre. However, there are other possible applications for chitosan. For example, the substance is already used as a plant growth enhancer and as protection against fungi. It is also used as part of filtration systems for wine and water, and as a remover of oils and dangerous metals from the surface of water. Recently, an innovative chitosan-treated bandage was developed that proved to clot bullet wounds faster than any other treatment.

For the Chitosanperos team, the efficiency of currently available chitosan tablets for weight loss can greatly be improved. The team applied techniques frequently used in the food industry (i.e. spray-drying) to obtain more efficient, soluble and porous chitosan forms.

The project participants focused their resources on medical applications, especially digestive illnesses, which are associated with an increase in chronic diseases, such as diabetes and Crohn’s disease, in Europe and in most developed countries. The team improved the formulation of chitosan tablets for weight control and hypercholesterolemia (high cholesterol levels). Chitosanperos also studied the possibility of using chitosan as a carrier for specific drugs in the treatment

of ulcerative colitis. Finally, new formulations were developed for the prevention of celiac disease, and for replacing wheat in foods for celiac sufferers who have trouble digesting gluten contained in wheat.

### Pivotal role of SMEs

By developing new treatments for conditions leading to chronic diseases, the quality of life in European society can be substantially improved. New cures and preventative methods also lead to a reduction in health costs as the number of affected people diminishes.

From a commercial point of view, new chitosan formulations, new dietary foods for celiac patients and new drug carriers for colitis sufferers, open potential new markets. European SMEs can make better use of chitin resources, most of which go to waste at present, and stimulate retail price reductions at the same time. Eventually, chitosan producers may have economic benefits that far exceed the costs of the project.

The scientific advances achieved by Chitosanperos can place the participating SMEs as leaders in the chitosan dietary and biomedical market. The input of European SMEs was crucial for the development of new products, which can only improve the quality of life for patients suffering from diseases of the digestive tract.





*“The scientific advances can place European SMEs in a privileged position to become leaders in the chitosan dietary and biomedical market.”*

## Project title

New Chitosan Formulations for the Prevention and Treatment of Diseases and Sysfunctions of the Digestive Tract (Hypercholesterolemia, Overweight, Ulcerative Colitis and Celiac Disease) (CHITOSANPEROS)

## Contract number

508421

## Duration

24 months

## Global project costs

€764 000

## EC contribution

€382 000

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# BROADENING THE SCOPE OF CORROSION MANAGEMENT

CORRLOG

*“The particularity of the sensors under development by the consortium is that they allow for online and real time monitoring of the corrosion.”*

Annual corrosion causes massive damage to modern infrastructures and engenders financial losses up to 50 times higher than those caused by fires. This is the case, for example, when the foundations of a brand new building are not adequately protected, and, in time, heavy repairs become necessary. This substantial amount (5% of GDP in some countries) could be radically reduced if corrosion monitoring became a common procedure. The CORRLOG project is developing automated sensors to detect corrosion at the early stages of its development in a simple yet very effective way.

The six partners involved in this project are working towards finding a monitoring system that is so effective and easy to use that it can be employed in broad number of situations, where corrosion prevention is crucial. To date, corrosion monitoring has been performed by expert-conducted surveys which are costly and unable to provide immediate indications of corrosion advancement.

## Real time monitoring

The ultimate goal of the CORRLOG project is to introduce corrosion sensors as process monitoring tools to provide information on corrosivity of environments on diverse structures, such as buildings, pipelines, valuable objects, etc. The particularity of the sensors under development, allows for the online monitoring of corrosion in real time, enabling operators to take immediate countermeasures to stop it, thus reducing the cost of heavy repairs or replacement of corroded structures.

An important objective for CORRLOG participants is to develop accurate and reliable sensors for all uses, that perform efficiently in all environments. The sensors will perform both indoors and outdoors and will even be able to detect corrosion in underwater structures. However, efficiency is not the sole driver of innovation in this project: developers are also working on ways of optimising the accessibility of data for users. They are minimising the need for interpretation of data and simplifying the communication between the sensor device and the end user. The simplification process will enable a faster understanding of the corrosion problems affecting the monitored structures.

## High technology and simplicity

Corrosion detection surveys are expensive specialist-controlled operations, which CORRLOG aims to simplify by creating a high-tech device that can also be used by untrained personnel. The project aims at developing corrosion detection sensors that can be used in such industries as electronics, oil and gas, civil engineering, transports, pollution detection and cultural heritage management.

The project has five innovative objectives, from creating highly sensitive and reactive sensors, to introducing sensors and accompanying measuring devices that are battery driven and easy to handle. It also aims at designing simple devices that are user friendly, requiring no special skills on the part of the end users. The devices will incorporate a GSM-reading based remote control and be able to detect localised corrosion.

CORRLOG will use electrical resistance as the starting point of its innovation process. The recent development of this technology has paved the way for its use in real time monitoring devices. The time needed for the corrosion detection has been reduced to just hours or even a few minutes, thanks to improved means of temperature compensation and resistance measuring.

Extensive testing by end users has already been scheduled, involving museums interested in protecting works of art from corrosion, and SMEs wanting to adjust sensor and software specifications to their customers' requirements.



# Co-operative Research Volume 3

*“Corrosion detection surveys are expensive specialist operations, which CORRLOG aims to simplify by creating a high-tech device that can be used by unqualified personnel.”*

## Project title

Automated Corrosion Sensors as Online Real Time Process Control Tools (CORRLOG)

## Contract number

18207

## Duration

24 months

## Global project costs

€979 240

## EC contribution

€507 368

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6. Metricorr APS (DK)



*“The technology developed by the DeSol consortium uses the sun as the only energy source, but without the inconvenience of former projects.”*

The Mediterranean hosts Europe's most favoured holiday destinations. But these destinations are often located in areas where there is a natural lack of drinking water. With the number of visitors expected to double by 2025, the scarcity of drinking water represents a massive economic and environmental threat for the whole Mediterranean region. The only way to tackle this problem is desalination, but current methods are neither cost efficient nor environmentally friendly. Therefore, there is an urgent need to develop a technology that would fulfill both criteria. As the name suggests, the DeSol project will rely exclusively on solar energy to achieve this strategic goal.

The main necessity for approximately 140 000 European SMEs in the Mediterranean tourism sector is to provide their guests with fresh and drinkable water. The excessive draft of ground water leads to a negative balance in the water cycle. Moreover, sea water infiltrates into the ground water and leads to the over-salting of its residual water resources. As a result, both sea and ground water need to be desalinated. The technologies available today are, however, expensive and have a high energy consumption, which makes them unsuited to SMEs. The DeSol consortium includes seven technological partners and a major vacation resort operator from Europe. The goal is to support an important economic area in the south of Europe and to respond to the environmental threats that come along with it.

## Away from compromises

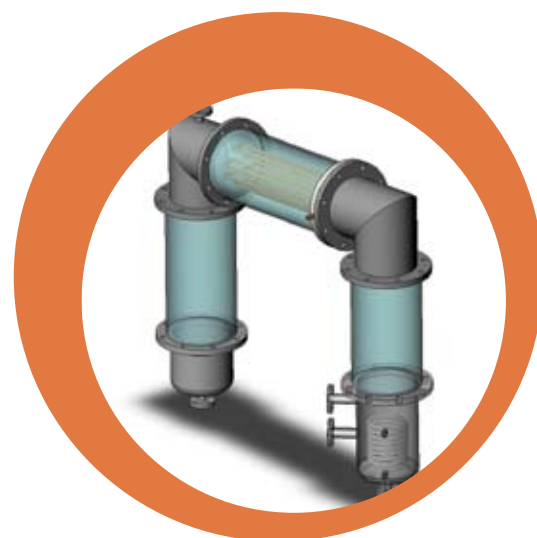
Currently, there are two commercially available processes for desalination. Reverse osmosis (RO) is the process of pushing a solution through a filter that traps the solute on one side and allows the pure solvent to flow to the other side. The other method is evaporation using a thermal process. While the required electric energy for RO is very high, the thermal processes have, in addition, very high heat consumption, depending on the plant size and the technique used. Today's desalination methods are also raising environmental concerns. Holiday facilities lack reliable power supplies because they are usually located far from power plants. Consequently, power supplies are produced locally or onsite by diesel or gas power units with low efficiency, but a high CO<sub>2</sub> emission rate.

Some research has been conducted to produce drinking water from sea water by exclusively using thermal solar energy, but so far, none of the systems have entered the market successfully. The technology developed by the DeSol consortium uses the sun as the only energy source, but without the inconvenience of existing technologies. Indeed, the project partners have designed a system that will have no capacity limitation. Furthermore, it will be affordable and totally reliable in operation. High energy efficiency can be achieved by using low temperatures. This is made possible with a vacuum distillation process using gravitation to generate the vacuum instead of using a vacuum pump. Efficiency will be further optimised by an internal energy recovery system. Control and adjustment of the DeSol system have been designed for reliability and ease

of use. Furthermore, the system is expected to require little maintenance and to have a long life. Finally, flexible adaptation to low or high capacities will be made possible, thanks to a modular design. Instead of heat from thermal solar collectors, waste heat from photovoltaic solar panels, for example, can also be used, providing the DeSol technology with an unprecedented flexibility.

## Towards a real alternative

During the first 12 months, it was already possible to conclude that the DeSol technology is able to desalinate sea or brackish water with high energy efficiency. Laboratory experiments have already demonstrated an efficiency of 80% to 85% without insulation or energy recovery. It is expected that the efficiency will further be improved during the project, in order to reach 90% to 95%. The system will provide households, campsites, hotels, bungalow resorts or neighbourhoods with an environmentally friendly water supply. As it will do so independently from grid electricity or fossil fuels, this technology will be ideally suited for decentralised water production in small and medium-sized facilities.



## Project title

Low-Cost Low-Energy Technology to Desalinate Water into Potable Water (DeSol)

## Contract number

17928

## Duration

24 months

## Global project costs

€1 018 484

## EC contribution

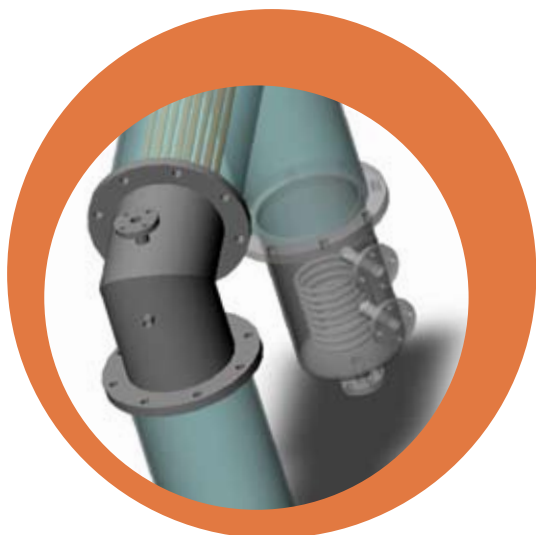
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# SMART ROBOTS FOR A PERFECT PAINT JOB

ECO<sup>2</sup>PAINTER

*“Painting robots developed by the ECO<sup>2</sup>Painter consortium will automatically adapt to new products, with downtimes near zero.”*

Intense global competition is challenging Europe’s SME-led manufacturing industry. New business models have been developed to counter these challenges, which focus primarily on adding value through production rather than competing by reducing costs.

To be able to competitively provide good quality as well as throughput and price, industrial automation is imperative for Europe. Moreover, in order to support the new value-adding production paradigms, automation must evolve from the economy of scale to truly adaptive production. Novel adaptive robotic systems are therefore needed. One such system is the ECO<sup>2</sup>Painter system, designed for industrial painting processes.

The European manufacturing industry is responsible for 40% of value creation and for 34% of all jobs in the EU Member States. Yet this backbone of our economy is facing increasing competition from low wage countries. In order to respond to this trend, production must be both value-adding and adaptive. Automation and robotics have to support these new paradigms. In addition, they should support the transition from a mass production industry towards a more competitive one that will be knowledge-based as well as customer- and service-oriented.

## A crucial boost

The necessity for the ECO<sup>2</sup>Painter project has risen from the significant disadvantages of current automatic painting systems, which offer very little adaptation flexibility. The consortium focuses on a software and control technology that automatically programmes painting robots. This implies 3D sensing, embedded simulation, automated process, motion planning, and code generation.

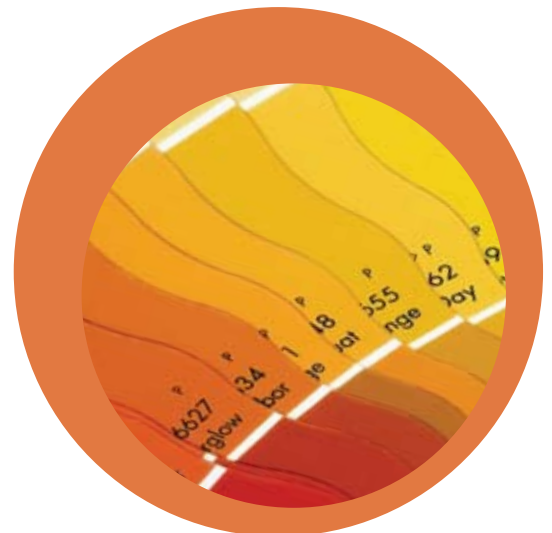
Painting robots developed by the project team will automatically adapt to new products, with downtimes near zero. These features are highly important to European SMEs, which are often suppliers or small volume producers that would benefit greatly, if they could produce even extremely small batches of very high quality and low cost on demand. In addition, a new technology able to efficiently customise and to rapidly and smoothly launch new products, would considerably speed up the product innovation cycle. Maximum output with minimal input is a paradigm that is particularly beneficial to industrial companies with limited resources.

## Painting is believing

To date, industrial robots have been executing fixed programs with very restricted sensory compensation for small pose deviations. In addition, programs’ executable paths have to be kept collision-free. For every change in the product or environment, the executable program of the robot must be adapted. Currently, this can only be done manually, which is time consuming. The ECO<sup>2</sup>Painter strategy follows a completely new paradigm: basically, there is no robotic program. Instead, the robots programme themselves for each new product, quickly enough to keep pace with production speed — ‘quickly enough’ may be an understatement, as ‘auto-programming’ is actually a hundred times faster than human programming.

The project is expected to provide important breakthroughs in the fields of active 3D sensing and part recognition, ‘closed loop’ process and motion planning, including motion simulation and adaptation. Interfaces will be suitable for use by non-robotic experts, and an improved paint stroke scheduling will increase overall painting efficiency.

Compared to what is currently considered state-of-the-art, the main advantage of the cutting-edge system will be its ability to paint products or unique goods in even very small batches — which has so far not been possible. This, paired with high quality and unprecedented speed, make the ECO<sup>2</sup>Painter highly innovative.



*“The ECO2Painter strategy follows a completely new paradigm: basically, there is no robotic programme.”*

## Project title

Economical and Ecological High Quality Painting at Highly Scalable Batch Sizes (ECO2PAINTER)

## Contract number:

17809

## Duration

24 months

## Global project costs

€1 383 249

## EC contribution

€808 701

## Contact Person

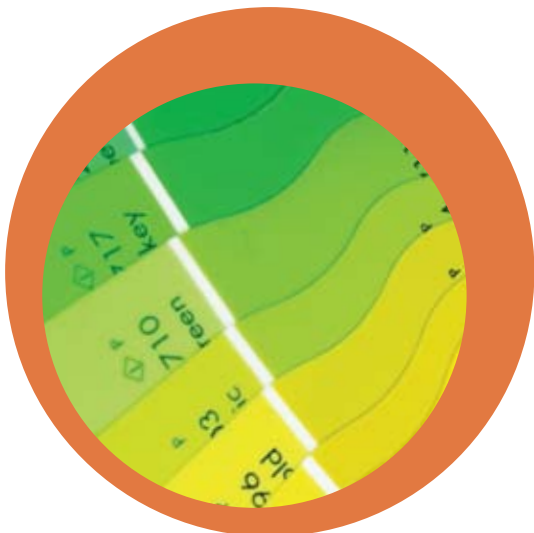
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*“The unique structure of carbon nanotubes makes them stronger than diamonds.”*

Irrespective of type or size, all electric devices generate superfluous electromagnetic radiation. Electromagnetic radiation is a natural consequence of the normal operation of electric circuits. However, when various circuits are clustered together, their radiation disrupts the effective operation of the other circuits around them. In order to limit the effects of such interference and noise, electromagnetic interference shielding (EMI shielding) is necessary. The Emishield project aims to develop an easy-to-mount cable seal system that is electromagnetically compatible (EMC) with electric circuits.

Current solutions for EMI shielding gaskets and seals are expensive, and passable at best. Currently, cable shields are made of rubber integrated with metal shielding coatings. This configuration limits design possibilities and relies on copper, silver and ferrite particles, which are among the most significant metal pollutants today. Novel techniques are therefore required for the development of new shielding materials and systems that can be easily implemented in electrical installations and electronic devices.

The Emishield project team builds on the experience of eight SMEs and RTD performers, to create a low-cost system with increased performance and a negligible impact on the environment. They are focusing their research efforts on a new carbon-based filler material, expected to be the next breakthrough in EMI shielding technology.

### The strength to resist

The goal of the project is to develop a new gasket and seal system that will be able to maintain its effectiveness against EMI, even under the most extreme working conditions. The filler material under development is made of carbon nanotubes, which are graphite cylinders with walls one-atom-thick, suitable for a variety of electronic applications thanks to their high conductivity.

Emishield is researching both single-wall carbon nanotubes (SWNT) and multi-wall nano tubes (MWNT), in an effort to determine which is most likely to meet the needs of end users and see widespread market uptake.

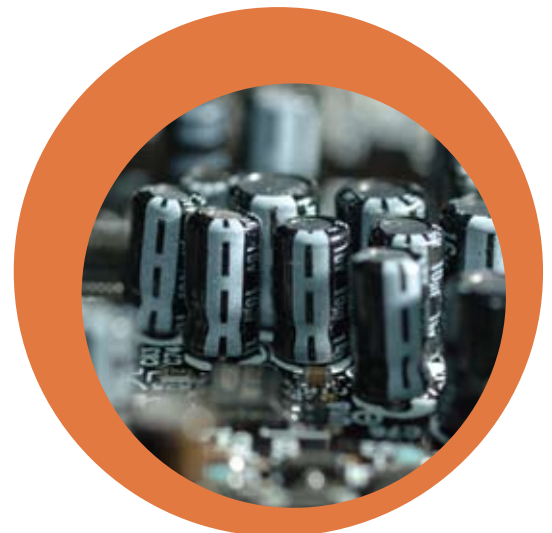
One of the many distinct characteristics carbon nanotubes bring to the table, is their strength. The unique structure of carbon nanotubes makes them even stronger than diamonds. Nevertheless, for Emishield's purpose and that of the electronic market at large, further scientific advances need to be made, to improve the flexibility of carbon, while at the same time maintaining its singular conductivity and strength.

### Nano investment, maximum performance

The EMI shielding system proposed by this project represents substantial benefits to European SMEs in spite its relative low cost. The choice of carbon, the innovative double-percolation concept and the 2D-film geometry in the works, simplify the overall production chain and reduce the costs of shielding cables. With the carefully designed Emishield technology, the lengthy process of coating and painting metal reinforced rubber seals is eliminated as the carbon filler is more compatible with rubber, rendering mixing easier. The simplification of the production process reduces costs, and hence can give SMEs a critical edge in the market.

The new technology also carries significant environmental benefits. Dangerous metals are replaced by carbon which can easily be disposed of. Consequently, it will be easier for SMEs to comply with European legislation on electronic waste, i.e. the Waste Electrical Equipment (WEEE) Directive and the Restriction on Hazardous Substances (RoHS) Programme, again representing an potential economic benefit of the project.

The research undertaken by Emishield will bring important advances to carbon nanotechnology and develop new applications for nanotubes. For the SMEs involved in the project, the development of a new gasket and seal system will give them an important competitive advantage over their rivals.





*"The Emishield film will be a universal and cost-efficient shielding material."*

## Project title

A Novel Gasket and Seal System used for EMI Shielding using Double Percolation of Carbon Nanotube Technology to Improve Safety, Profitability and Productivity for SMEs (EMISHIELD)

## Contract number

18164

## Duration

24 months

## Global project costs

€857 946

## EC contribution

€444 313

## Contact Person

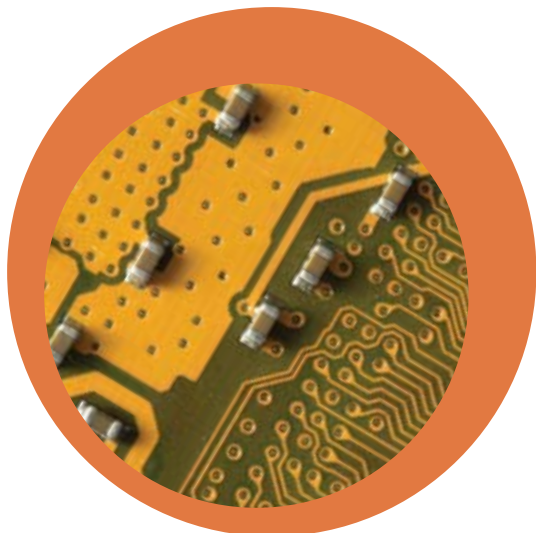
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8. CRIF - Wallonie (BE)



*“The forstINNO project fills a gap in the current set of forest machines, providing new tools for the updating of the forestry sector in central Europe.”*

Heavy trees and sensitive soils don't make a good combination, particularly when outdated machines are used for logging in the rough central European forests. The forstINNO project aims at improving the forestry techniques used in central Europe by developing new ecologically compatible and highly productive methods of timber harvesting. This development work entails the construction of new machinery, adapted to the region's ecological and social conditions.

The scientific partners of the forstINNO project have conducted technical surveys to identify the principal characteristics of central European forests. Their study included information related to soil sciences, climatology and biology, but also information regarding property, infrastructure, and wage levels and incomes in rural areas.

## Tailoring machines to central European forests

The project determined that machines needed to be improved in order to be able to deal with hardwood (i.e. broad-leaved trees) and to harvest multiple and crooked stems. The machines also had to be adapted for delimbing bushy trees, but perhaps more importantly, for transporting heavy trees on very sensitive soils and on permanent skid roads. Skid roads are tracks generated through driving on the forest floor; they are positioned transversally every five feet. Moreover, the enhanced performance of these machines had to remain cost-effective while complying with European standards for mobile working places.

With the specifications of the central European forests at the centre of their attention, the forstINNO partners decided to develop two new harvester heads and one skidder. (A skidder is a type of heavy vehicle used for pulling cut trees out of a forest.) The participants focused on creating harvester heads for broad-leaved trees with small dimensions, uneven shapes and different stem conditions, with diameters of approximately 40 cm dbh (diameter at breast height). The other harvester head is being prepared for bushy stems with rough branches of up to 50 cm dbh.

The project is also developing a skidder with a long crane and strong winch, to cut and move long heavy trees without damaging the surrounding environment. The new skidder will improve the driver's working environment by reducing noise and vibrations.

A further tool being created is a dGPS-sensor (differentiated Global Positioning System) for the documentation and control of new, permanent skid roads. The use of permanent skid roads is expected to contribute to the protection of sensitive soils.

## A solution for every problem

All prototypes are now nearing completion and are being prepared for testing in the field. The team is satisfied with the initial results, but more work is needed on some prototypes, although no obstacles are expected that risk endangering the project's outcome. For example, the main components of a 6-wheel drive log-carrying skidder have been developed but another larger, heavier skidder is needed to transport big logs, particularly in countries such as Austria, France and Germany.

All new working methods will be thoroughly tested, and compared with their traditional counterparts, in order to evaluate the results. The testing phase and the punctual modification of prototypes will continue until May 2007 in France, Germany, Hungary, Lithuania, Poland and the United Kingdom.

The project will also produce a map of forest technological sites and best practice, which will identify specific requirements and support the development of future technical solutions. This advisory role will be a continuation of the suggestions already made by forstINNO participants, with regard to industrial machinery for forests and forestry workers, in terms of economy, ecology and social needs.

The forstINNO project fills a gap in the current range of forest machines, providing innovative tools for the new challenges faced by the forestry sector in central Europe. The project will find important solutions for every question faced by forestry professionals, and in so doing will help to improve EU competitiveness.



*“The project will find important solutions for every question, which will improve the competitiveness of the EU.”*

## Project title

Development of an Ecologically Compatible, Highly Productive Method of Timber Harvesting For Central European Forestry (FORSTINNO)

## Contract number

512681

## Duration

24 months

## Global project costs

€1 828 924

## EC contribution

€1 081 958

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# INTELLIGENT MATERIALS FOR THE SHOE INDUSTRY

INNORUBBER

*“... an optimised production process leading to a competitiveness increase for European shoemakers.”*

Cutting production costs in the European shoe industry is an essential element in the competition against manufacturing countries with significantly lower labour costs (e.g. the Far East, Latin America, and Eastern Europe). Innorubber's aim was to develop new rubber compounds for outsoles and adhesives, that would reduce — and eventually avoid — the need for surface preparation of soling materials prior to bonding. The simplification of this essential phase of shoe manufacturing will allow for the reduction of both production time and costs, for European shoe manufacturers.

## Pros and cons of surface treatment

Currently, the surface preparation of outsoles prior to adhesive bonding is a crucial part of the production process. An unsuitable treatment can result in unsticking problems during the use or storage of shoes. Subsequently, poor quality can lead to customers' complaints, returns and refunds of products. To avoid major financial losses for European companies, it has become a major challenge to solve the problems related to the bonding of rubber compound materials.

Adhesive bonding can only be performed after costly and lengthy chemical and mechanical surface preparations. These treatments help to eliminate pollutants and substances capable of forming weak layers of material. They also enhance chemical and mechanical adhesion by increasing the surface area. An enlarged surface area improves the adhesion of materials by increasing the number of contact points. The quality of surface bonding can be further increased by developing materials with more surface energy, (i.e. the ability to establish stronger and more resistant contact points between different layers of material), and also by improving the wettability of compounds.

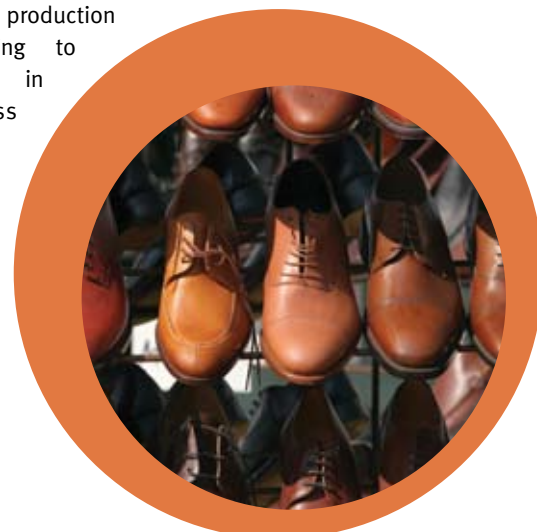
The whole surface treatment phase, although beneficial for the quality of bonding, is also expensive and time-consuming, and can be dangerous for workers, especially when working with chemically treated rubber material (e.g. by halogenations). The reduction of chemical preparation of surfaces will have a direct impact on the health of workers and on the environment in general.

## The solution: “multifunctional” materials

Innorubber, which involved partners from Greece, Spain and Italy, set out to create new rubber compounds and adhesives that would reduce the need for surface treatments. The new products, called intelligent-multifunctional materials, were created using three different techniques: the use of additives to improve the quality of the finished products and to obtain low surface energy rubbers (formulation); the improvement of common materials' adhesion to rubber substrates (polymer blending); and the introduction of pre-activated reactive sites in the polymer's molecules to make them more compatible with other materials in the adhesive joint (functionalisation).

Research on modifications was carried out on elastomeric materials and adhesives in order to pre-activate their reactivity, allow bonding, and to obtain good adhesion parameters according to European standards (CEN TC309 and CEN TC193). The modifications did not affect the final physical and mechanical properties of the soles.

As a result, new rubber compound/adhesive systems have been created. Not only do these new systems comply with footwear requirements, but they can also be obtained using conventional manufacturing processes with little adjustments and, in most cases, without having to rely on chemical and mechanical treatments. Their properties are similar to those of conventional materials, but they make for an optimised production process, leading to an increase in competitiveness for European shoemakers.



*“The advantages of the elimination of surface treatment are obvious as there is an important reduction of production time and costs, which implies less labour cost and thus the improvement of the competitiveness of European footwear companies.”*

## Project title

Intelligent and Multifunctional Rubber Compounds/Adhesives for the Shoe Industry (INNORUBBER)

## Contract number

508157

## Duration

24 months

## Global project costs

€922 588

## EC contribution

€536 204

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8. CF. S.R.L (IT)
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*“The IWAPIL project should be able to dramatically improve the environmental performance of decentralised wastewater plants all over Europe.”*

Due to the toughening of environmental legislation in the near future, many currently operating wastewater treatment-systems will no longer be acceptable. Improved environmentally friendly standards will demand a significant increase in their efficiency. Stricter regulations will especially target those areas that are particularly ecologically sensitive, used for drinking water abstraction, or for bathing waters. They will therefore cause major constraints for decentralised areas with little technical infrastructure and know-how. The IWAPIL project is set to address this problem with an innovative, compact solution.

According to the framework for Community action in the field of water policy, defined by Directive 2000/60/EC, Member States are required to establish maximum annual averages for the release of certain pollutants. This applies particularly to those with an unfavourable influence on oxygen balance.

Such stricter environmental laws governing the purity of drinking water threaten to render existing wastewater treatment plants obsolete. Rising environmental demands will mean that many of them, particularly in remote and isolated areas, will not meet formal recycling or treatment standards established by the EU. This will be an acute problem for tourist interests such as hotels, camping sites and picturesque communities off the beaten path. These resorts run the risk of losing income due to the failure of treatment systems to cope with rising seasonal demands. Indeed, drinking and bathing water quality is essential in ensuring that tourists return year after year.

## Clean water

The aim of the IWAPIL project is to develop and test a membrane bioreactor (MBR) for use in remote communities. The IWAPIL system is based on a newly developed membrane and membrane module (PURON®-membranes and module) that will allow end users to overcome most of the problems that currently make MBRs unsuitable for remote usage where no skilled operators are present. The innovative characteristics of the new membrane and membrane module will enable a low-maintenance and extremely efficient wastewater system to be exploited, in areas where this is not currently feasible. Its effluent can even be reused for related applications, such as irrigation and toilet flushing purposes, as it is totally germ-free.

## Intact resources

Thanks to its reasonable energy consumption, low membrane replacement rate and reduced use of cleaning chemicals, the IWAPIL system will be able to compete with existing systems for use in isolated locations. This should allow much more efficient depuration rates than existing decentralised plants. Moreover, the IWAPIL system will meet the strictest of current and future green regulations. All this will be achieved with a highly automated, minimum-maintenance system that can be operated by laypersons.

The IWAPIL project should be able to dramatically improve the environmental performance of decentralised wastewater plants all over Europe, not only by saving significant amounts of water through reuse, but also thanks to a substantial reduction of sludge (waste). The European tourism sector in remote areas particularly stands to benefit from the effective conservation of water resources. Since the new decentralised MBR systems and their components will have to be produced and installed, the project should also promote the creation of new jobs in the European wastewater sector.

The PURON® membrane system is the first system in this field solely developed by Europeans, with competing MBR systems offered by Canadian and Japanese companies. Consequently, the outcomes of the IWAPIL project are also expected to boost the competitiveness of the European membrane sector for wastewater applications.





## Project title

Innovative Wastewater Treatment Applications for Isolated Locations (IWAPIL)

## Contract number

508144

## Duration

24 months

## Global project costs

€855 244

## EC contribution

€509 966

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*“The need for an efficient recycling technique is stronger than ever.”*

With pollution and global warming continuously making their way to the top of political agendas, more and more companies are looking for new recycling techniques to ‘save the world’. L-FIRE is a project studying new possibilities for the recycling of long fibres, such as ropes, and particularly optical fibre cables (OFC), for which there is currently no viable recycling method. The participants in this project expect to put an end to the dumping and burning of tons of OFC.

OFC are complex products, with a variety of compositions and particular characteristics. The need for an efficient recycling technique is stronger than ever: telecom companies started using OFC in the 1980s, and the cables are reaching the end of their thirty-year life span. As they are replaced by newer and better performance OFC, old cables are dumped or burned, but numerous European countries are banning such practices. To avoid pollution and the long-term negative effects of incineration, an eco-friendly recycling method is needed for the recovery of aramid fibres, metals and plastics used in OFC.

L-FIRE pools together the knowledge of six European SMEs, two RTD centres and a large industrial company, with extended competence in OFC technologies and recycling. Now nearing completion, the project is developing a reversed processing technique to replace the inappropriate burning and shredding used to date.

### The birth of a new recycling technique

Current processing of outdated OFCs is very limited. Cables are dumped or burned, without any re-use of their components. The only existing processing method is mechanical shredding which isolates its components, but the very nature of OFC prevents this technique from being efficient. OFC contains optical fibreglass, polyethylene, gels, aramid fibres and, in the cases of the older cables, aluminium or steel. In the process of shredding and size-reduction, the cable is cut and the different components isolated, but the aramid strength prohibits durable cutting and the gel sticks to the small pieces of material, resulting in a useless blend of chunks.

The L-FIRE consortium follows a different route: instead of being cut (as is done for other types of cables with traditional shredding), the OFC is ‘broken down’, in a process mirroring the layering-up building process. The cable is stripped of its different component layers, from the outer plastic jacket to the inner fibre core. As a result, the different materials are recycled and gels are no longer an important issue in the separation process.

### Closing the OFC life-cycle-loop

The L-FIRE method has the potential for economic viability, as to date, most of the replaced OFC are still waiting to be processed.

The ineffectiveness of shredding and dumping, and the costs of burning, opens up encouraging prospects for L-FIRE. The establishment of the new methods can have positive effects on the recycling of OFC and also pave the way to the recycling of other long fibres, such as ropes. By stopping incineration, recycling SMEs can recover recyclable materials from OFC, while at the same time avoiding incineration costs, that are currently at EUR 50 to EUR 350 per ton. The L-FIRE results could strengthen the position of many companies and create up to 5 000 jobs in Europe.

The L-FIRE initiative is developing a new recycling method at a time when market prospects are at their highest. There is a strong need for such a method and the solution proposed by project participants will satisfy the demands of the European recycling industry in terms of costs and efficiency. Furthermore, the project will have positive long-term environmental effects, by reducing the need for incinerations and encouraging the recycling of plastics and long fibres.



# Co-operative Research Volume 3

*“The ineffectiveness of shredding and dumping, and the costs of burning, open up encouraging prospects for L-FIRE.”*

## Project title

Long Fibre Recycling (L-FIRE)

## Contract number

513091

## Duration

30 months

## Global project costs

€1 842 989

## EC contribution

€954 495

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10. Velox (D)



# A PERFECT FINDING FOR EUROPEAN FOUNDRIES

MAGNET

*“Magnetic moulding is environmentally-friendly, cost-competitive and suitable for the production of high quality parts with very complex shapes in a large range of sizes and materials.”*

Magnetic moulding technology is an innovative process with great potential for increasing the competitiveness of foundries. The initial development of magnetic moulding took place in Europe more than 30 years ago, at the same time as the so called ‘lost foam’ casting process. However, magnetic moulding never achieved the same level of industrial development as the lost foam process. Based on the research results of recent years, the MAGNET project was set up to develop the magnetic moulding technology up to the industrialisation stage.

The MAGNET project drew seven European SMEs, one large company and two European RTD performers together with the main objective of bringing the magnetic moulding process to industrial maturity. The project has been completed recently, showing promising results that could prove beneficial to both the competitiveness and the working conditions of European foundries.

## Progress through tradition

Magnetic moulding can be considered as a variant of the traditional lost foam process. In this foundry process, an expendable pattern is surrounded by a mould constituted of metallic particles that are bonded together by the action of an induced magnetic field. Once the cast metal has solidified, the magnetic field is interrupted so that the mould collapses by itself. The metal part is recovered and the particles can be reused in the subsequent castings. The main technological advantages provided by this system are the acceleration of the casting solidification, and the increase in the mould cohesion. These two factors have a direct positive effect on all mechanical properties, dimensional tolerances, design flexibility and costs of the process.

Environmentally friendly and cost-competitive, the magnetic moulding process is suitable for producing high quality parts with very complex shapes in a large range of sizes and materials. The components produced do not need any parting lines, and the metallurgical and mechanical properties obtained are better than those achieved by other casting processes. This is due to a fine grain structure resulting from a fast solidification achieved with the use of metallic particles to form the mould. Magnetic moulding can substitute for components presently produced by lost foam, lost wax or gravity and sand casting processes, and for additional, more complex components severely limited by these technologies. It can also be used to design new components that take advantage of its specific characteristics.

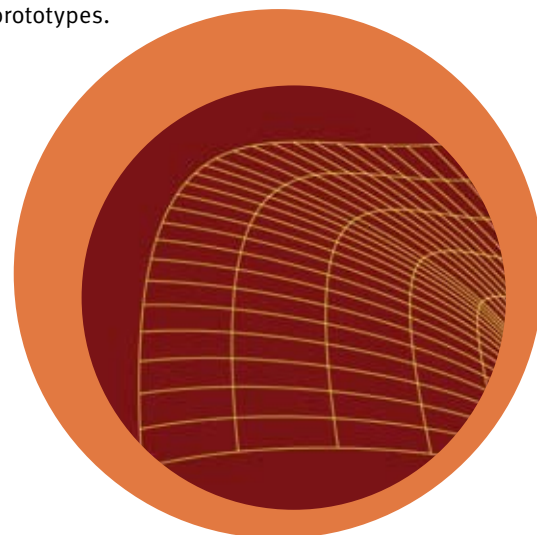
## Improved features for complex casting

The potential impact of this technology is considerable. It will enable European casting foundries — especially those using sand casting, lost wax and lost foam technology — to offer complex shaped parts with high metallurgical quality through

a knowledge-based foundry process. High added value of the parts, low investments in new equipment, reusable moulds and low energy requirements, integration of functions, and a wide range of casting materials are further benefits of this technology. Besides, it is ideally suited for the automotive and aeronautical markets.

Overall, the results achieved have been very positive. The suitability of the magnetic moulding process for producing both ferrous and non-ferrous complex castings plus added improved features, has been confirmed. The use of steel shots and a magnetic field in the castings has generated a decrease in grain size for both ferrous and non-ferrous materials, and an increase in the rigidity of the mould. Furthermore, both parameters can now be easily adjusted to suit the specific needs of each application. The higher solidification rates that can be obtained with the metallic steel shots in comparison to the sand moulds lead to a decrease in solidification time and grain size. Improvements of around 10% to 20% in the stress yield have been recorded. The improved rigidity of the mould entails a larger flexibility in the design of the component, as well as of the feeding and filling systems.

Industrial companies involved in the project have begun to exploit the results commercially. In addition, the automotive industry has shown a great interest in this technology and there have already been negotiations for casting some new industrial prototypes.



*“The potential impact of this technology is large as it will enable European casting foundries to offer complex shaped parts with high metallurgical quality.”*

## Project title

Innovative Casting Process for the Improvement of the Competitiveness and Working Conditions of the European Foundries (MAGNET)

## Contract number

512745

## Duration

24 months

## Global project costs

€1 061 082

## EC contribution

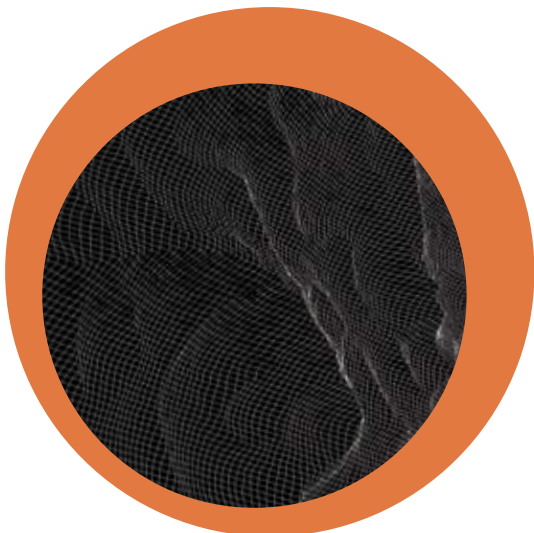
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# BIG CHANGES IN THE INDUSTRY OF THE SMALL

MEMS-pie

*“The integration of piezoelectric materials into silicon-based microsystems is a key enabling technology for a wide range of future products.”*

Piezoelectric materials have the unique ability to transform electrical energy directly into mechanical motion or, conversely, to transform movement or vibration into electrical signals. Current knowledge on the integration of piezoelectric materials into silicon-based microsystems is largely limited to laboratories, but it is a key enabling technology for a wide range of future products such as sensors and micropumps. The MEMS-pie project tested these materials extensively, in order to develop validated procedures for the integration of piezoelectric thin films into micro-electromechanical systems (MEMS), on an industrial scale.

## Wafers and sandwiches

MEMS-pie developed piezoelectric technology as an alternative to the customary techniques for MEMS actuation and sensing: electrostatic, piezoresistive and thermal effect. These techniques are impractical, in that they are unable to fulfil the combined requirements of force, speed and energy efficiency demanded by industry, to develop new types of sensors and actuators.

The MEMS-pie project team developed robust and flexible fabrication routes for piezoelectric films, using two of the most popular materials in the sector: aluminium nitride (AlN) and lead zirconate titanate (PZT). The project participants then focused on the integration of the thin films into silicon-based MEMS. This method involves sandwiching a thin film of piezoelectric material between metal electrodes. Following this, when a voltage or oscillating signal is applied, it provokes a change in the dimensions of the film. This movement is transferred to a microstructure in the MEMS device. The microstructure can have different shapes: cantilevers, plates, bridges or fixed membranes.

MEMS-pie created a special set-up to automatically pole and test the different devices at wafer level. The setup allowed for efficient recording of ferroelectric hysteresis, fatigue behaviour and impedance sweeps.

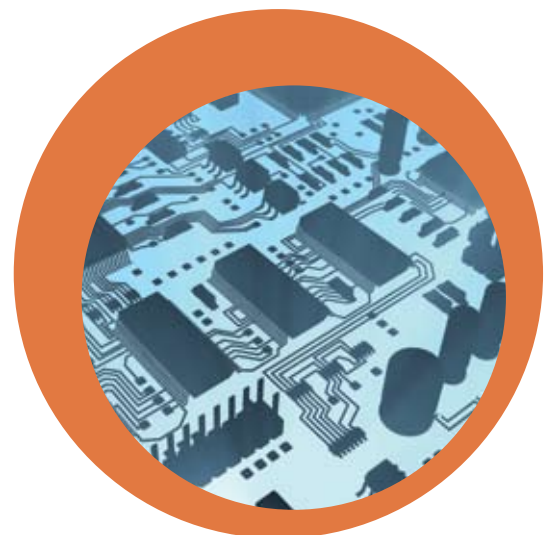
In the course of the project, MEMS-pie participants also developed a new method for measuring piezoelectric performance of thin films. Furthermore, they successfully managed to integrate the new piezoelectric films into sensors and actuators, thus paving the way for industrial production of piezoelectric MEMS.

## Slow start, strong prospects

The performance results obtained during MEMS-pie in research laboratories are now on the verge of being reproduced on an industrial scale. To start with, the validated production routes for thin films will form the basis for a new foundry service, which one of the project's three RTD partners will offer to its customers. This service will be a low-cost production option, particularly suitable for SMEs lacking the resources to build their own production lines.

It is likely that the first commercial MEMS devices will be used for small-scale applications, where only a few thousand devices are made. These devices may be ultrasonic imaging transducers, pressure and flow sensors, accelerometers, micromotors and micropumps, among others. The production of such items in foundry laboratories, using existing procedures, should be possible in the near future.

The development of innovative production methods contributes to the improvement of standards in the MEMS field. Perhaps more importantly, new product development will not only reinforce the competitiveness of the five SMEs involved in the project, but will also subsequently affect the entire European MEMS sector.



*“The performances obtained during MEMS-pie in research laboratories are now on the verge of being reproduced on an industrial scale.”*

## Project title

Integration of Piezoelectric Thin Films in Micro-Electromechanical Systems (MEMS-pie)

## Contract number

508219

## Duration

28 months

## Global project costs

€1 996 300

## EC contribution

€1 258 310

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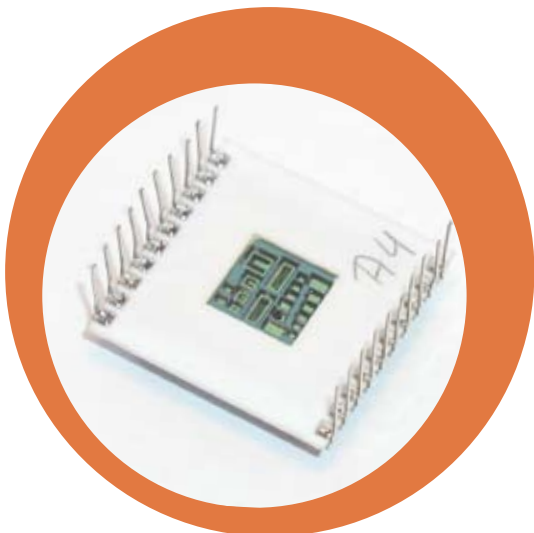
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7. Sonitor Technologies AS (NO)
8. Hök Instrument





*“The final test kit has a very high sensitivity to mycotoxins, due to the outstanding performance of Mycoplex antibodies.”*

The Mycoplex project, which set out with the aim of developing an innovative immuno-PCR assay for the detection and quantification of toxins in complex matrices such as coffee and milk, has reached a successful conclusion. Specifically, the project participants have created a low-price, user-friendly test kit, allowing for the rapid analysis and detection of both Ochratoxin A (OTA) and Aflatoxin M<sub>1</sub> (AFM<sub>1</sub>). The Mycoplex consortium expects the test kit to be on the market in 2008.

### The targets

The Mycoplex project fills a major gap in mycotoxin detection research — and its market — by developing a device that is inexpensive, user-friendly for untrained personnel, and fast as well as accurate in detecting OTA and AFM<sub>1</sub>.

OTA is a mycotoxin that occurs naturally in plant products such as cereals, coffee, wine, beer and spices. OTA is produced by fungi similar to *Penicillium* that have been proven to possess carcinogenic, nephrotoxic, immunotoxic and possibly neurotoxic properties. OTA has also been linked to nephropathy, a condition affecting kidneys.

AFM<sub>1</sub> is produced when ruminants ingest contaminated feed. It is then excreted in milk and may contaminate other dairy products such as cheese and yogurt, which represent an important risk for frequent consumers, particularly infants and young children. Aflatoxins are produced by several types of the *Aspergillus* fungus and can have sub-acute and chronic effects in humans, such as liver cancer, chronic hepatitis, jaundice and cirrhosis.

The successfully developed test device will have a significant impact on the European food industry as it allows for a quick and effective analysis of mycotoxins at very low levels of occurrence, even below those prescribed by the EU. Two European Commission regulations limit the maximal concentration of AFM<sub>1</sub> and OTA; however, Mycoplex's test could contribute to even further reductions, thanks to the advanced technical standards developed by the SME consortium.

### More results, less effort

The test kit is based on the widely used analytical method known as ELISA (enzyme linked immunosorbent assay). Mycoplex tested and selected the anti-OTA and anti-AFM<sub>1</sub> antibodies that provide the best results. During the project, different pathways were explored. For example, the consortium initially focused on immuno-PCR as a detection technology, combining ELISA with Polymerase Chain Reaction. However, this technology required expensive equipment that proved cost prohibitive.

In simplified terms, the process requires that the test kit is well coated with a protein-mycotoxin conjugate. The sample that

needs to be tested is collected and placed, after a quick and easy sample extraction procedure, inside the well. The next step is to wash the well. In a non-infected sample, the antibodies bind to the conjugate; if the sample is infected, the resulting substrate will contain unbound antibodies.

The test device has a very high sensitivity, due to the outstanding performance of Mycoplex antibodies. It allows users to determine the mycotoxin concentration in under 90 minutes, with a low error ratio and reliable results. The exact quantitative evaluation of concentration is possible with the additional use of an ELISA reader. For end users not requiring the precision of quantitative tests, the kit offers the option of replacing the absorbance reading with a colour scale. Colour scales indicate the approximate amount of toxins, and are also faster and easier to use. It is important to note that when the kit is offered for sale, it will include the solutions and materials necessary for both types of analysis.

With regard to the commercial prospects opened up by the fast, easy-to-use and inexpensive test kit, the SMEs involved in the consortium expect to make the most of Mycoplex's results, by securing a large share of the mycotoxin detection market.





## Project title

Development of Innovative Immuno-PCR Assay for the Detection and Quantification of Ochratoxin and Aflatoxin in Complex Matrices (Milk, Coffee) (MYCOPLEX)

## Contract number

513145

## Duration

24 months

## Global project costs

€926 447

## EC contribution

€553 059

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8. ISEAO technologies (UK)



# CUTTING EDGE, NOT CUTTING GLASS

*“The objective was to validate a new internal engraving process for transparent materials, and to open new markets.”*

NAGINELS

Laser marking is a key manufacturing technique used for product identification, traceability and anti-counterfeiting. For transparent materials such as glass or plastic, current laser technologies using Yttrium aluminium garnet (YAG) do not meet industrial requirements. To date, a laboratory laser technology using Titan-Sapphire (Ti:Sa) crystals has shown promising results in its capacity to engrave materials with femtosecond pulses (a femtosecond is equivalent to one billionth of one millionth of a second). However, this technology faces major industrialisation challenges, especially in terms of speed, reliability and price. But thanks to a group of European SMEs, an alternative solution is now available.

A consortium of four SMEs active in decorative, anti-counterfeiting and normative marking, teamed up with two SMEs acting as RTD performers, as well as with two research centres specialising in non-linear light/matter interactions and femtosecond micromachining. The objective was to validate a new internal engraving process for transparent materials and also to open up new markets. This process would use a new type of high repetition rate femto laser — cheap and reliable, with the potential to be integrated into an industrial system.

## Smooth and innovative

The Naginels project aimed at creating a new laser system for non-aggressive internal engraving for traceability and decorative applications. Common laser techniques (such as CO<sub>2</sub> or UV lasers) are only effective for surface engraving, which remains too aggressive for the product's sub-layers. Nanosecond lasers allow for inside engraving, but create microcracks which may decrease the integrity of the product. The new technology developed by Naginels was designed to overcome these issues.

This technology will be applied mainly in the fragrance, beverage, pharmaceutical, and automotive industries. However, during the project phase, it was subject to a number of constraints. For instance, particular attention was required, so as to avoid creating any microcracks that might alter the product. Re-reading technologies needed to be simplified. The codes had to be miniaturised while simultaneously retaining a high level of information. Finally, the new technology had to enable new, innovative decoration techniques.

## Rainbow effect

The new laser systems can subsurface engrave any transparent material, such as glass or plastic bottles used for medicines or perfumes. The characters are nearly invisible, but under certain lighting conditions they are displayed with a rainbow effect, which renders them legible. The Naginels project uses high technology lasers that can be focused at different depths, specifically within the glass containers. The Naginels Passport Mark (NPM) does not affect the physical properties of the glass containers in any way. In addition, since the mark is virtually invisible, it does not affect the appearance of the product.

Developing industrial quality YAG lasers and exploring the potential of femto lasers within a cost effective system will comprise state-of-the-art technology. End users will have the ability to generate complex decorative designs, which make copying extremely difficult, create high resolution invisible codes linked with anti-counterfeiting signatures, and produce indelible normative marking.

Talks are currently in progress with various companies, with the intention of setting up pilot programmes. The new technology was demonstrated at “Glasstec 2006” in Düsseldorf (24 to 28 October 2006). A patent has been filed on the technology, and a new company managed by the Naginels Consortium will be created to continue its validation.



# Co-operative Research Volume 3

*“Developing industrial quality of YAG lasers and exploring the potentia of femto lasers ... will comprise state of the art technology.”*

## Project title

Non-Aggressive Internal Engraving Laser System (NAGINELS)

## Contract number

512931

## Duration

24months

## Global project costs

€1 359 965

## EC contribution

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# SINGLE INPUT, DOUBLE OUTPUT, TRIPLE IMPACT

PROBIO

*“The PROBIO initiative focused on cellulose, a common material in plant cell walls, which also happens to be the most abundant form of living terrestrial biomass.”*

The primary structural component of any green plant is cellulose. Not only is cellulose the most abundant and renewable biopolymer, but also the most widespread energy source in the world. Cellulose-containing materials can be used to produce biogas or fertilisers for agricultural purposes. The goal of the PROBIO project was to develop a technology that would satisfy both energy and agricultural usage, relying on two cellulose-rich materials, i.e. wood and straw.

In the context of energy production, biomass refers to living and recently living biological material, which can be used as fuel or for industrial production. The PROBIO initiative has focused on cellulose, a common material in plant cell walls, which also happens to be the most abundant form of living terrestrial biomass. Cellulose is a valuable source of renewable energy that can be almost greenhouse gas neutral or better. In areas with plenty of farmland, it can play an important role by serving as chief supplier of heat and electricity. Using wood and straw as their main materials, the project team aimed at reaping another benefit from bioenergy generation; PROBIO technology would produce fertilisers at the same time as it produced biogas.

## The method of metamorphosis

Cellulose-containing materials can be converted into glucose-containing materials with the aid of enzymes. During this procedure, glucose is transformed into methane. At the same time, a gas originates and leaves the process, with no impact on the bacteria. This biogas, consisting mainly of methane and carbon dioxide, is an approved fuel for use as lean gas to run combined heat and power plants (CHP). The plant prototype developed by the PROBIO consortium had to be able to produce this gas on an industrial scale, while adding another process. At its heart is the pre-treatment unit, which allows it to convert biomass material with a high-energy content into soluble substances for the biogas process. As far as the processing technology for the development of fertilisers is concerned, it can be operated outside the biogas process, which increases the throughput. While the technology deployed mainly applies to cellulose from straw and wood, research into new materials will allow for a wider range of biological energy sources.

## Optimising biogas production

The PROBIO plant prototype has successfully concluded the project. Its performance, biogas quantity and quality, as well as its usability for CHP have resulted in keen interest from several companies. Due to its simplicity, the process is perfectly suited to the agro-industrial sector. The technology developed makes it possible to optimise biogas production significantly. Indeed, unlike existing methods, the developed plant entails process-control in a such way that maximum energy can be

obtained depending on the input material. Likewise, maximum energy conversion can be achieved, or both variants can be combined depending on operating conditions. The modularity of the PROBIO system allows for custom-built biogas plants using similar components that can be adapted to specific applications. Furthermore, the technology used makes it possible to produce the biogas plants in series. The subsequent reduction in production costs will have a positive effect on price levels. Future biogas reactors will be developed and built on the basis of the PROBIO prototype: thanks to their excellent cost/performance ratio, they will be highly competitive and marketable. The industry's interest in the PROBIO prototype is correspondingly high.

Beyond the market perspective, the PROBIO technology will provide an alternative energy production method that will have a positive impact on the fields of environment, energy and economy. Increased uses of renewable materials, reduction of carbon dioxide emission or limited SO<sub>2</sub> and NO<sub>x</sub> emissions are only some examples of the ecological potential of the project. The use of cellulose-containing materials, such as wood and straw, means less dependence on finite fossil fuels as well as a sustainable production of energy.

Last but not least, in a time when small and mid-sized farms often have to struggle to survive, the possibility of selling fertilisers can be seen as a good opportunity to generate additional income and strengthen business continuity.



*“Beyond the market perspective, the PROBIO technology will provide an alternative energy production method that will have a positive impact on the fields of environment, energy and economy.”*

## Project title

Production of Biogas and Fertilisers out of Wood and Straw (PROBIO)

## Contract number

508174

## Duration

24 months

## Global project costs

€656 615

## EC contribution

€440 149

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# A MODULAR APPROACH TO WATER TREATMENT

PURILEACH

*“To assure a safe and efficient water treatment of landfills, there is a need to develop new effective and inexpensive methods based on both microbial and non-microbial leverage.”*

European countries use landfill as a disposal method for 60% of their municipal and hazardous waste. One of the main problems associated with this method is the leakage of potentially toxic liquids into soil and groundwater. Biological and chemical wastewater treatment units separately do not achieve high removal efficiency because a microbial population is not able to survive in such a contaminated environment. To assure a safe and efficient water treatment of landfills, there is a need to develop new effective and inexpensive methods based on both microbial and non-microbial leverage. The PURILEACH project was set up to develop such methods.

Historically, landfills are the oldest form of waste treatment, and up to now they have remained the most commonly used method of waste management. Yet, this method is showing serious limitations when it comes to retaining toxic substances. At the same time, current waste treatment facilities are proving to be more of a compromise than a secure solution. The key factors that must be considered in treatment facility design, include leachate character and loads as well as effluent discharge regulations and cost. To this end, and in order to create a solution that would be totally reliable, the PURILEACH project chose to focus its research effort on a modular solution. In addition, an integral operational system for wastewater analysis, including feedback for working regimes optimisation, was developed.

## Old problem, new solution

Leachate is the liquid produced when water percolates through any permeable material. It is generated by the aerobic and anaerobic decomposition of the landfill waste. Due to its nature, treatment of leachate is a complex task. A typical leachate is highly contaminated with ammonia, organic contaminants, halogenated hydrocarbons and heavy metals, as well as high concentrations of inorganic salts. Moreover, the wastewater profile changes from landfill to landfill as well as with containment time within the same landfill.

The novelty of the PURILEACH technology is its flexible modular approach, with ‘smart’ feedback allowing a selection of treatment regimes according to the varying wastewater composition and quantity. The on-site adaptive leachate treatment consists of specific technological modules with an integrated operational system for regime optimisation. Its ‘online’ system design is based on a decision-table and expert techniques for knowledge processing.

## Setting up a new standard

The PURILEACH consortium aims at launching the adaptable modular leachate treatment system onto the European market within 12 to 18 months. Within 3 to 5 years, the system should hold 10% of the European leachate treatment market. It is further expected to obtain a 50% reduction on material costs where PURILEACH technology is used, thanks to online control and dynamic optimisation of technological regimes. A similar reduction is expected for facility engineering, installation, and manufacturing.

All in all, the PURILEACH technology should increase the competitiveness of the SME partners through the development of a niche-market product. Furthermore, it will reduce landfill costs to society, mitigate environmental effects and local pollution of soil and groundwater from the discharge of untreated or inadequately treated leachate. Groundwater protection will preserve the environment and enhance the availability of natural resources.

The testing carried out during the PURILEACH project has shown an efficiency of chemical oxygen demand (COD) removal of 98%. Currently, no other technology can match this efficiency with comparable treatment costs.





*“The novelty of the PURILEACH technology is its flexible modular approach, with ‘smart’ feedback allowing a selection of treatment regimes according to the varying in wastewater composition and quantity.”*

## Project title

Modular Purification System for Heavily Polluted Leachate (PURILEACH)

## Contract number

508698

## Duration

24 months

## Global project costs

€763 768

## EC contribution

€412 117

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# RAP-EAT: MAKING BIOREMEDIATION WORK HARDER

RAP-EAT

*“Bioremediation is the process of returning an environment contaminated by oil or chemicals to its original condition, by using micro-organisms.”*

Oil and chemical spills constitute environmental ‘tragedies’; they wreak havoc in marine and land areas. Each year, there are approximately 50 000 spills in Europe alone, adversely contributing to nearly 1 000 000 known contaminated sites.

Approximately 350 European SMEs are dedicated to the remediation of hazardous material spills, but these SMEs face increasing competition from large international companies. The RAP-EAT project aims to introduce cost-effective and high performance bioremediation products to the growing land remediation market, which will improve the competitiveness of the European remediation sector.

The project consortium comprises SMEs and RTD performers with specialist knowledge of contaminated land and water remediation, environmental microbiology, process engineers and interested stakeholders affiliated to the oil products. The project participants propose the production of an ultra high-performance, low-cost biological catalyst, to increase the efficiency of oil spill remediation by up to 50%. This biostimulatory material would offer an attractive alternative to the long term use of engineered remedial technologies and other more expensive bioremedial technologies often used to remediate oil spills. In addition, the active ingredients of the product are derived from a co-product of the food industry, thereby offering an environmentally sustainable solution.

## Utilising nature’s cleaners: bioremediation

The natural environment harbours a wide variety of microorganisms that have ability to breakdown a variety of hydrocarbon compounds, including components of petroleum hydrocarbons, to harmless compounds. It is generally accepted that this ability of microorganisms, such as bacteria and fungi, can be utilized to our benefit to remove contaminants from the environment in order to remediate land or water; this is a process referred to as bioremediation. However, there are often limiting, time, design, contaminant type and nutrient factor constraints that have previously prevented this method of remediation being adopted on a large scale, particularly when traditional methods such as ‘dig and dump’ were traditionally considered a quicker solution. Increasing legislative and economic pressures to develop alternative strategies for the remediation of contaminated sites has led to bioremediation becoming an attractive remedial solution. Today, in Europe, the principal driver for exploring the use of bioremediation is the increasing cost incurred for sending contaminated waste to landfill, following the implementation of the EC Landfill Directive and subsequent enforcement of the regulations.

Bioremediation can be achieved *in situ*, in contrast to many current cleaning techniques which require the prior removal of hazardous materials for *ex situ* treatment in specifically designed plants. The removal process presupposes the pumping or digging of the polluted water or soil; this process is both costly and technically challenging. Consequently, the main advantage of *in situ* bioremediation processes is that they can

be employed without pumping or excavation; this is particularly useful for areas that are inaccessible.

## A new bio-remedial treatment

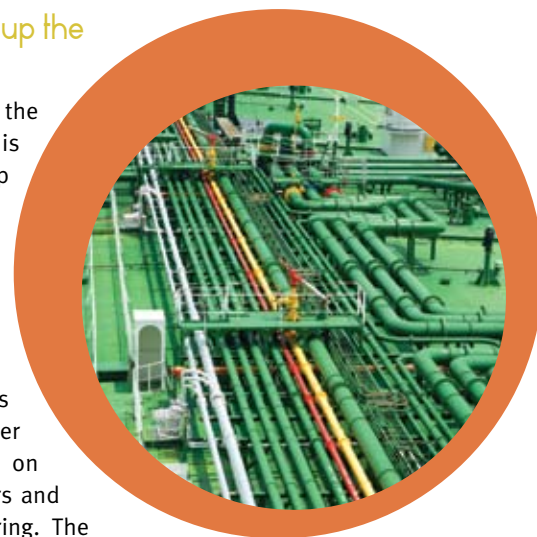
The RAP-EAT (RAPid trEATment) products will be designed for use in remediating recent or historical, domestic or industrial contaminated sites and spills affecting land or water bodies.

The RAP-EAT products have demonstrated an ability to stimulate and enhance the degradation of petroleum hydrocarbons. The products work by providing the microorganisms that are already present within the contaminated zone with suitable growth factors, enabling them to successfully degrade the petroleum hydrocarbons.

The RAP-EAT products will be available as a solid granular or liquid fast-release form, thereby allowing easy delivery of the product to all contaminated areas, including areas of land that are difficult to treat, rather than by expensive and extensive mechanical works. In addition, development of a novel formulation of the product will incorporate a protective coating that will only release the active ingredients on exposure to hydrocarbon contamination. The development of the coated product is aimed at preventing the migration of contaminants from one site to another.

## Cleaning-up the market

The aim of the project is to develop bioremediation solutions that are much easier to use than those currently available, whereby users will no longer need to rely on physical barriers and heavy engineering. The



level of remedial performance achieved will be superior to current biostimulatory amendments, the cost substantially lower and the entire cleaning process less time-consuming. Furthermore, the RAP-EAT system is not restricted exclusively to cleaning petroleum hydrocarbons, but may also be used for other important contaminants, such as PCBs (Polychlorinated biphenyls) and PAHs (Polycyclic aromatic hydrocarbons). Such compounds are often considered particularly resistant to biodegradation and cause particular concern due to their toxicity and evidence of carcinogenicity.

It is proposed that RAP-EAT technology will enter the land remediation market as soon as it is validated in the field. This market is particularly promising, growing at a rate of 6% per year across Europe. It is anticipated that the RAP-EAT remediation system will be used on a significant proportion of the estimated 1 000 000 contaminated sites that require EUR 100 billion worth of remediation.

The RAP-EAT research project proposes to develop a new bioremediation system offering improved performance, to rapidly treat oil spillages, in both marine and land environments. The new system has the potential to become an effective tool in ensuring the success of European land remediation SMEs against their global competitors.

## Project title

An Ultra Efficient, Low Cost, Biocatalytic Material for Use in RAPid Oil Spill TrEATment Applications (Inland and Coastal) to Dramatically Improve Bioremediation Efficiencies and Protect High Risk Receptors Through Pathway Activation (RAP-EAT)

## Contract number

512887

## Duration

24 months

## Global project costs

€1 450 187

## EC contribution

€751 369

*“... the RAP-EAT system is not restricted to cleaning petroleum oil only but it can also be used for other substances.”*

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7. Maxol Oil Limited (UK)
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10. Institute of Technology, Sligo (IRE)



# MAKING PROSTHETIC SURGERY EASIER TO BEAR

RASPED

*“During laboratory tests, the hollow rasp proved to be much more efficient than the solid broaches.”*

The theory of prosthetic surgery is quite simple, it is the replacement of a damaged joint or bone with an artificial material. However, the reality can sometimes be very different. In the case of hip prosthesis surgery, which affects mainly elderly people, femoral fractures and infections are common complications. In order to reduce these complications, RASPED developed a new single use cutting device for preparing femoral bones prior to implantation in a more effective way, with the added benefit of reduced contamination risks.

The RASPED (reverberating abrasive single use piezoelectric driven) device is in fact a hollow rasp device, which in time is expected to replace the currently used solid broaches. Gathering the expertise of ten SMEs and research centres involved in the medical industry, the RASPED project has developed a promising new technology with great benefits for prosthetic operations. It also makes the recovery from such interventions quicker and more comfortable.

## Solid arguments against broaching

A hip replacement operation requires the removal of bone from the acetabulum and the femur, in order for the replacement parts (usually a cup and a stem) to be fixed into position. More specifically, the stem is inserted into the intramedullar canal, and the hollow recess for the stem is made by impacting a solid broach against the bone. Although effective, this technique has a serious drawback since the repeated impacts needed can cause femoral fractures, resulting in post-operative complications. Another problem is that the solid broaches are reusable, and if sterilisation between different operations is not effective, cross-contamination of patient tissue can occur.

The RASPED consortium has developed a device, which solves these problems. The hollow rasp, manufactured in high carbon steel with pressed and ground teeth, is used in conjunction with a piezoceramic drive system. This makes for a better cutting of the bone and a better removal of bone fragments from the intramedullary canal. The femur also suffers fewer impacts and is less prone to fractures. Importantly, the hollow rasp is a single use device so there is no risk of cross-contamination.

During laboratory tests, the hollow rasp proved to be much more efficient than the solid broaches. Whereas the latter needed up to ten impacts to reach its maximum penetration, the hollow rasp needed only four. These results mean that, in a clinical situation, fracture risks would be greatly reduced.

## Clean cut potential

Based on the medical advantages highlighted during testing, the RASPED participants expect to see the newly developed tool being used in 10% of all European hip implementations by 2012. The positive results achieved by this project pave the way for a significant improvement in the comfort and safety of hip operations. According to the project team, the use of hollow rasps could reduce the number of femoral fractures by 60%, which means 7 000 people would be spared complications following surgery.

In practice, the low cost of the new technology will enhance the competitiveness and productivity of the SMEs involved in surgical equipment production. It will also impact on European healthcare systems, saving up to EUR 100 million per year in corrective interventions and treatments. Furthermore, developments from the RASPED project could also benefit other medical applications, such as dental prosthetics.

RASPED participants expect that the results of their work, conducted over two years, will contribute to making prosthetic surgery easier to live with for patients. The reality of such interventions will bring prosthetic operations closer to the ideal of ‘simple’ joint replacements, without stress and complications.



*“... the use of hollow rasps could reduce the number of femoral fractures by 60%, which means 7 000 people would be spared complications after surgery.”*

## Project title

Reverberating Abrasive Single-Use Piezo Electric Driven Device (RASPED)

## Contract number

513134

## Duration

27 months

## Global project costs

€1 418 316

## EC contribution

€734 479

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*“Overall, the challenge was to optimise the operational parameters of industrial dishwashers.”*

Industrial dishwashers consume an immense amount of energy, water and chemical agents. Each year, 2.6 terawatt-hours of electrical energy, 19 million cubic metres of drinking water, and 48 000 tons of detergents are used to clean dishes in hotels and canteens throughout Europe. Reducing the consumption levels of industrial dishwashers would therefore have a highly beneficial impact on the environment. Rising to the challenge, the REWARD initiative brought together European SMEs and IAGs, so as to develop a high-end system for water filtering and cleaning.

The goal of the REWARD project was to establish a new standard for industrial dishwashing, which would prove both efficient and environmentally friendly. The project involved three SMEs, two higher education institutes and a manufacturer of commercial dishwashers. The views of an end user with demanding hygienic standards were supplied by a public institution managing a student canteen. Overall, the challenge lay in optimising the operational parameters of industrial dishwashers.

## Progress through optimisation

Part of the REWARD project was dedicated to improving water filtering methods to the greatest attainable degree. Industrial dishwashers need about 360 litres of water per hour. Water must be heated to a temperature of 85°C, and mixed with aggressive detergents, in order for it to be used as a sterile cleaning agent. During the cleaning process, the same water is used for different cleaning steps. According to the project coordinator, Prof. Dr Thomas Rose, intermediate filtering may lower water consumption by 50%. The consumption of energy, mainly for the purpose of water heating, may be reduced in the same proportion. This would, on a large scale, translate into a lowering of CO<sub>2</sub> emission, by 820 000 tons per year in the EU.

Another project characteristic was the focus on the use of ozone for water cleaning and sanitising. Since ozone cleaning is a widely used, economical process for drinking water preparation, the project team wanted to exploit its saving potential for industrial dishwashing. In fact, the project partners expected a reduction of 50% to 70% in the use of chemical agents, by adapting and improving existing ozone cleaning techniques.

## Public places or private spheres

The REWARD water purification system is the main achievement of the project research and development activity. The modular system resembles a normal sewer pipe, but is characterised by a sophisticated flow system, that relies on the crossflow principle. Water is pressurised through micro-sized pores, and the dirt particles left behind are flushed back into the waste water tank. The clean water is used in the next rinse cycle of the machine. Following this, the cycle starts again: new cleansing takes place, using the machine's cleaned waste water. Thanks

to the performance of a new type of filter, this waste water attains drinking water quality. Pure, crystal clear water drips into a glass container, rendering visual control possible. This water is now in a sterile state, and available for the next rinse in the machine.

This innovative system developed by the REWARD consortium was tested under real-life conditions, and paired with an industrial dishwasher in a student canteen. The test run was not exclusively limited to the cleaning of waste water: leftovers of mashed potatoes, tomato sauce and eggs were also filtered. Thanks to their construction design structure, the pores of the system's microfilter remained unobstructed. Overall, the hygienic standard of dishes remained unaltered, and the tests proved to be successful. In fact, the initial target of reusing half of the dishwashing waste water to clean dishes, has been surpassed.

Further developments concerning mass production of the REWARD system are being encouraged. The demand for a resource-saving, efficient water cleaning system for industrial dishwashers is growing steadily. But the opportunities are not limited to industry — private households use similar, if smaller dishwashers, and face similar economical constraints and ecological challenges. Moreover, private households represent an even more dynamic and expanding market.





*“... the initial goal to reuse half of the dishwater waste water to clean dishes has been exceeded.”*

## Project title

Research on Energy, Water and Chemical Agent Reduction in Commercial Dishwashers (Reward)

## Contract number

513035

## Duration

30 months

## Global project costs

€1 741 124

## EC contribution

€1 139 352

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## Project website

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4. Studentenwerk Münster, Anstalt des öffentlichen Rechts (DE)
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# ENHANCING THE CLASSROOM EXPERIENCE

*"Students can follow a lesson on their own screens."*

## SCREENS

"Screens" is an innovative computer screen and audio transfer solution for computer classrooms, language labs, meeting rooms and other demanding audiovisual applications. The system will be controlled by an easy-to-use and stylish LCD panel containing programmable and localised soft keys and a keyboard. It will enable long distance digital video transfer and switching, audio transfer and audio conference, remote control of USB keyboard and mouse, and electronic voting.

Technological changes in e-learning and audiovisual technologies require European SMEs in these fields to innovate and develop their products accordingly in order to stay competitive. With this in mind, a public-private partnership of five European SMEs and three research organisations was initiated to develop a new audiovisual system. The "Screens" consortium will combine new generation flat panel screens, USB connectivity, intuitive user interfacing, and high frequency video transmission. One of the main applications of this technology is the educational network, as a cutting-edge training tool in a computer classroom.

### The classroom of the future

The most important function of the educational network is to transfer computer images from the instructor's to the students' screens. The advantage of this system over a data projector is that the students can see all the details of the instructed software in daylight, from anywhere in the classroom. The system also allows the instructor to follow students' progress from their own displays. To this end, the new digital standard for flat panel displays (DVI) provides a significantly improved image resolution and quality over the analogue display connector (VGA), which is becoming obsolete. However, the transfer distance allowed by DVI is specified to a maximum of 5 metres, which is insufficient for a typical classroom environment. One goal of the "Screens" project is therefore to increase the transfer distance of the digital video signal up to 20 metres. Using high quality cables with controlled propagation delays in conjunction with adaptive equaliser techniques, the targeted transfer distance has already been successfully achieved.

### Seamless integration

Another useful function of the educational network is that the instructors can take control of the keyboard and the mouse of the computer they have selected. This feature enables the instructors to guide a student when needed, from their own computer. This feature also enables a teacher to prepare software and files for all computers remotely before the lesson. In order to provide ease of use, reduced system costs and true Plug-and-Play convenience to end users (teachers, students, etc), a specific USB module has been developed.

Since all this technology should be easily accessible, the "Screens" consortium is developing an intuitive user interface panel to control the educational network. The user interface will feature small-size colour LCD displays with soft keys. It will easily support different European languages, which can be changed during the lesson. The Linux platform, an open source code operating system, has been selected to shorten time to market, reduce development costs and minimise runtime royalties. Another positive aspect of open source-based systems is their stability. The "Screens" technology will bring interaction between teachers and students to a new level. The computer classroom of the future might just as well become the only classroom of the future.



# Co-operative Research Volume 3

*“There is no picture decline in the next generation educational network, when a digital video is transferred.”*

## Project title

New Method of Video Transfer and Control Functions for Training in Computer Classroom and for Audiovisual Applications (SCREENS)

## Contract number

16357

## Duration

22 months

## Global project costs

€833 769

## EC contribution

€431 999

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6. Datim s.r.l. (IT)
7. Consorzio Roma Ricerche (IT)
8. Electro-Hill Oy & AS (FIN & EST)



*“Novel powder production techniques open possibilities for innovative powder compositions and tailored coating solutions.”*

The reliability of large industrial fields such as energy plants, process industry and transport are dependent on the functioning of critical components. In particular, safety critical components in heavy engineering, such as bearings, seals, shafts, barrels, rolls, etc. face material sticking problems. Conventional lubrication oils often cannot be used due to process environment, temperature or impurities. Self-lubricating, wear-resistant coatings are available, but only for specific applications. A broader solution is needed: this is why the SEFUCO project was set up.

The SEFUCO consortium is made up of two Research Performers and six SMEs from western and northern Europe with the aim to improve coating performance for demanding industrial applications. The goal of the project is to enhance the safety and reliable use of critical components. It will also prevent people from being exposed to hazardous waste due to chemical leaks caused by sticking and tribology problems. Tribology is the science and technology of friction, lubrication, and wear. In addition to powder production and thermal spraying, tribology represents one of the three technology areas of the Sefuco project.

## Sticky problem

Novel powder production techniques open possibilities for innovative powder compositions and tailored coating solutions. Meanwhile, thermal spray methods have been well established to produce wear -resistant coatings for components. For instance, a space organisation has been investigating the use of thermally sprayed (TS) coatings with the addition of solid lubricants (SL). Universities, institutes, automobile and electronic manufacturers have all conducted specific research on the same topic. However, tailored coatings including solid lubricants are not yet commercially available.

Thermal spray techniques are coating processes which involve spraying melted (or heated) materials onto a surface. The energy to heat the feedstock is supplied by either electrical (plasma or arc) or chemical means (combustion flame). Coating quality is usually assessed by measuring its porosity, oxide content, bond strength and surface roughness. Generally, the coating quality increases proportionally with particle velocities. The

heated materials are typically fed through an insulated tube to the sprayer, where they may be atomised before being expelled through a nozzle.

## Total control

The Sefuco consortium is optimising spray coating processes, especially HVOF (high velocity oxyfuel), for spraying powders containing solid lubricant materials, adapting them to different application environments. Furthermore, the consortium is undertaking tribological tests to determine tribological, wear and corrosion properties of the coatings containing solid lubricants. Controlling the whole manufacturing route from powder to coating allows for the tailoring of the coating composition according to each application.

One of the main achievements so far has been the successful creation of powder for thermal spraying, where three alloying elements were integrated into each powder particle. Innovative powder solutions consist of a hard carbide phase, metal matrix phase and solid lubricant additions, some of them alloyed in a nanostructured scale. Another achievement is the aforementioned optimisation of the thermal spraying process: the added solid lubricant does not decompose during the spraying process.

Tests of the tribological properties of these solid lubricants containing coatings will be continued, but the microstructural observations are already very promising.



# Co-operative Research Volume 3

*“Controlling the whole manufacturing route from powder to coating enables tailoring the composition of coating according to application.”*

## Project title

High Performance Self-Lubricated Multifunctional Coating for Demanding Industrial Applications (SEFUCO)

## Contract number

017788

## Duration

24 months

## Global project costs

€1 162 719

## EC contribution

€602 261

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# CROSSING THE BOUNDARIES OF HOLOGRAPHY

SILVERCROSS

*"Holography is a technology which has only fulfilled a fraction of its potential."*

Full colour holography is the most masterful imaging technology known to science. However, even though the technology dates from the 1960s, it has not seen many significant developments since. This may explain why the general public still regards holograms as mere novelty items, the exception perhaps being holograms found on bank notes or as security devices on credit cards. Holograms are defined as high resolution recordings of the interference pattern formed between a wave, scattered from an object or scene, and a reference wave. The result is a 3D image that is the exact copy of the original object wave. This impressive technology has, despite its huge potential, a crippling disadvantage: no commercially available material exists which is capable of recording high quality colour holograms. SILVERCROSS aims to develop the technology that will make such recordings possible.

## Perfection potential

Holograms can produce astonishing full colour 3D images of objects that are so realistic they can hardly be distinguished from real objects. Due to recent developments in other technology areas, holography has found a number of possible applications in fields ranging from advertising and medical 3D imaging applications to head-up displays in cars and illumination pipes in buildings. Nevertheless, up until now, holography has been a technology which has only achieved a fraction of its potential.

The quality of a hologram depends on a range of variables such as the stability of the recording arrangement, the coherence properties of the recording light, the processing of the exposed plate, the replay conditions, etc. All these variables are controllable and adjustable in the same way a photographer adjusts exposure time and lighting.

However, one element of holographic technology, the recording material, has not yet reached the technical standards required to be fully exploited in most sectors. In fact, to date, it has been very difficult to record high-quality full-colour holograms, because no substance or emulsion provides all the characteristics needed for perfect colour imaging.

## Scientific challenge

Addressing this challenge, the SILVERCROSS project combined the forces of a group of seven SMEs and RTD centres from five European countries, and aims at solving the recording material problem by developing a new nanoparticle (5-10 nm), high sensitivity ( $< 2 \text{ mJ cm}^{-2}$ ) low light-scattering, panchromatic silver halide emulsion, which can be used to produce quality, full-colour holograms.

Silver halide is the best emulsion available, compared to dichromated gelatins or photopolymers, but its grain size is still too large to be used for high-resolution full-colour holography. Once it is reduced to the requisite and uniform size, the project will optimise the emulsion to improve its light sensitivity. Finally, the project will produce a prototype emulsion-producing machine to test full-scale production.

If these materials can be produced on a large scale, it could represent a major advancement in the technological development of holography, and would open up whole new markets in the fields of art, cultural heritage, security and beyond. For instance, new three-dimensional imaging techniques such as 3D-TV could be developed.

The initial results have been extremely promising, even exceeding initial expectations. SILVERCROSS has developed and tested an improved silver halide emulsion and has started work on the improvement of its sensitivity. Once demonstration holograms are produced, the final stage of the project will be conducted and results disseminated through technology workshops and conferences.





# Co-operative Research Volume 3

*“The initial results have been extremely promising, and have exceeded expectations.”*

## Project title

Mass Production of Silver Halide Recording Material for Full Colour Holographic Applications (SILVERCROSS)

## Contract number

5901

## Duration

27 months

## Global project costs

€1 434 017

## EC contribution

€1 090 349

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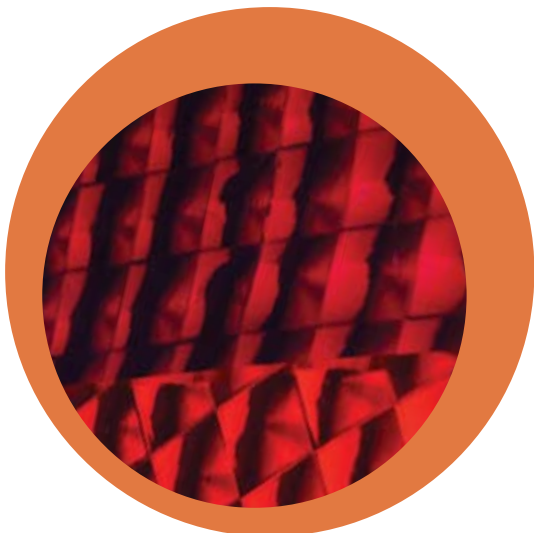
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4. The Holographic Image Studio LTD (UK)
5. Bulgarian Academy of Sciences CLOSPI-BAS (BG)
6. Université de Liège (BE)
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*“S-SCIL’s resulting methods and instruments are expected to become the new international standards for multigas sorption measurement on solids and ionic liquids.”*

Current sorption measurement techniques could soon take a major step forward. S-SCIL is developing and testing new sorption measurement standards for multigas applications. Although the technology is not yet available, it could bring enormous advantages for various kinds of chemical, pharmaceutical, environmental, food and energy processing. The project is investigating ways of adapting the standards for the investigation of pure and multigas processing based on ionic liquids.

Sorption is the mechanism of both absorption and adsorption, i.e. the effect of gases or liquids being incorporated into a material of a different state or adhering to the surface of another molecule. New S-SCIL standards will characterise the substances used to perform the process — porous solids, nanoparticles, polymers or liquids. The project will study the sorption mechanism in ionic liquids, which are salts with a relatively low melting point (below 100°C). Due to their non-volatility, these liquids are generally considered as having a low impact on the environment and human health, and are often recognised as solvents for ‘green’ chemistry.

## The next level

In order to achieve an accurate measurement of sorption in fluid mixtures and ionic liquids, the project team has developed and improved the currently available measuring instruments used for pure gases. The two methods further developed by S-SCIL are the dynamic analytical carrier gas method and gravimetry. In the first, sorption is determined by measuring the change in concentration of the adsorptive substance in an inert gas flow (the gas which carries the adsorptive substance through the measuring device). In the second method, sorption is determined by measuring the weight change of the adsorbing material by means of a highly accurate magnetic suspension balance.

The participants have already achieved significant results and made important findings during the first year of the project. For instance, new sorption measuring standards for gas mixtures have been successfully developed, both in steady atmospheres and in forced flow. Taking into consideration the demands by end users for new measurement tools, and the availability of materials and processes, the project evaluated different technical solutions. As a result, the first commercial instruments for sorption measurement in gas mixtures have been created.

S-SCIL participants also aim at evaluating and adapting these initial findings to the characterisation of ionic liquids and the processes based on these new kind of fluids. The final project objective will be to design and build a prototype for a commercial instrument for sorption measurements in a forced through flow of gas mixtures.

## Patents and property rights

The S-SCIL initiative has generated new exploitable products and measures, such as standards for volumetric and gravimetric measurements, high-pressure gas analysers and sorptometers. These findings will be commercialised and, in some cases, new patents will be filed. Furthermore, each participant will retain their property rights on all knowledge and processes brought to the project.

The project has the potential to achieve a major step forward in the field of sorption measurement. S-SCIL’s resulting methods and instruments are expected to become the new international standards for multigas sorption measurement on solids and ionic liquids. These new standards are of great value to scientific and industrial research and will create new opportunities for developing a wide range of innovative products.



*“As a result of the project, the first commercial instruments for sorption measurement in gas mixtures have been created.”*

## Project title

Development and Testing of New Standards for Sorption Measurement and Characterisation of Ionic Liquids (S-SCIL)

## Contract number

508283

## Duration

24 months

## Global project costs

€1 468 000

## EC contribution

€781 000

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6. JVS Engineering (DE)
7. Institut für Thermo- & Fluidodynamik, Ruhr Universität Bochum (DE)
8. Politecnico de Milano (IT)
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*“... Europe must assume a stronger position in the field of authoring tools.”*

Multimedia is a key word in the information society. But this technology is worthless without content, and content requires specific competences and instruments. Authoring tools are dedicated software solutions for interactive content creation. For SMEs dealing with content development, a powerful, graphical, beyond the state-of-the-art authoring tool is needed. No such software has existed until recently in the edutainment domain, but a solution has been developed: it's called U-Create.

Given that the major creative authoring tools are developed in North America, Europe must assure a stronger position in this domain. Three European SMEs in the field of edutainment (a form of entertainment, designed to educate as well as to amuse) joined efforts to create a tailor-made solution for SMEs taking part in content development. U-Create is an authoring tool for existing interactive technologies, which nowadays still require programming at code level. The project has two aims: first, to increase competitiveness of content developers by significantly shortening production time and effort; and second, to enable non-programmers to create content.

### Same budget, improved quality

The authoring tool innovates in three particular aspects. First, it relies on user-friendly visual programming to ease the work of content creators. Second, the Mixed-Reality technology makes it possible to establish a correspondence between real physical places and virtual ones. Finally, the latest advance in digital storytelling is used to guide content creators through a visual representation of the structure of their story.

Content creation is the most demanding task when producing multimedia. Yet customer budgets are often limited, so that content has to be shortened. U-Create will accelerate content creation significantly and allow for the production of more content in the same or less time. This will have a direct impact on global costs for both the content producer and the customer. With a constant cost approach, the authoring tool will allow for the creation of contents of higher quality within a reasonable budget.

### Reaching out to the global market

With U-Create, the project team's aim is to position European content developers on a global market. Market analysis shows that this market is ideally suited for SMEs. Starting with a niche approach of an authoring tool for edutainment applications, one could progressively extend it to several other application fields.

Many interactive authoring tools build the authoring part first and then progressively extend its experiencing capabilities. However, U-Create assists the creation of interactive contents

for advanced experiencing systems that already exist. In doing so, it faces the challenge of coping with all the features of the system and proposing a solution that conceptualises all these features into a single framework. U-Create will be an affordable, integrated solution that will make full use of process automation. Its ease of use will furthermore allow SMEs to subcontract or licence their content production.

The implication of end users was critical to the project. This is why, in addition to the end-user partner already involved in the consortium, U-Create established a dynamic and open organisation at the end of 2005. The U-Create Open Community gathered a broad range of end users interested in the project activities and results, i.e. the authoring tool. Members of this community had privileged access to the project, which allowed them to provide their experience. Some were offered to test the results achieved and to evaluate the prototype.

The goal of the U-Create project is not to deliver a finalised tool, but rather a prototype to be further developed and customised. From the established prototype at the end of the project (the end of 2006), it is expected to bring the tool to a commercial grade within one or two years of internal usage and improvements.



# Co-operative Research Volume 3

*“... the authoring tool will allow for the creation of contents of extremely high quality within a reasonable budget.”*

## Project title

Creative Authoring Tools for Edutainment Applications (U-CREATE)

## Contract number

17683

## Duration

18 months

## Global project costs

€1 654 118

## EC contribution

€1 130 862

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6. Zentrum für graphische Datenverarbeitung e.V. (DE)
7. Hadronet Ltd (HU)



*“Burglars who love false motion detection alarms will hate Waveshift.”*

Burglars who love false alarms from intruder detection equipment and who exploit the fact that some homes and companies are equipped with fake alarms, instead of working devices, will come to fear Waveshift. Crime figures show that there are over two million burglaries in Europe each year, with the associated costs to police, crime prevention companies and victims adding up to a total of EUR 3.3 billion. Believing that the most effective way to reduce burglaries is to develop new alarm systems, Waveshift project participants are developing a new microwave alarm with enhanced performance and lower costs.

The project team will focus on developing a super high frequency (SHF) non-contact detector, measuring mobility and speed. The team of nine participants will work in the context of new EU targets for the harmonisation of sensor frequency. Currently, most sensors work at a frequency in the 10 GHz range, but the new technology is smaller and can provide greater location accuracy. The EU encourages the switch to the 24GHz range for security systems, and Waveshift is aiming at improving the technology by reducing size and production costs for intruder alarm systems.

### From drafting page to prototype building

The first stage for Waveshift was to conduct theoretical studies into the characteristics needed for a new short range motion and movement direction unit. Once a viable detector was characterised, the RTD team, along with two of the SMEs in the project, elaborated the specifications required for the detector, bearing in mind the need for cost-effectiveness and easy production.

Waveshift is now in its second year, and most prototype components for the new SHF detector have been studied and produced. These include microwave micro-strip antennas, oscillators, mixers and couplers. These components offer a range of possibilities and configurations, and function at high performance levels in all test situations. For example, the oscillators achieve high levels of thermal stability, a key parameter influencing their performance.

The final element that remains to be developed for the new device is an adequate shielding enclosure. The housing is a crucial part of the system: it needs to ensure an optimal level of electromagnetic shielding, as well as protection for the detector's electronic components. If the components are not appropriately protected from physical and electromagnetic threats and the environment, the detector will not function reliably. Currently, two options are being studied as potential housing materials: plastic with built-in stainless steel fibres, and a magnesium and aluminium composite.

In the next few months, the consortium will assemble fully operational test detectors, exploring all the available configurations, in order to obtain the most cost-effective device

with optimum performance, which will then be developed into a commercially viable and available detector unit.

### Crime prevention SMEs

The main objective of Waveshift is to improve intruder alarm technology and develop a new product which will contribute to crime prevention. The new device will be launched in a market estimated at 60 million alarms. The 35 000 SMEs involved in the production, distribution, installation and maintenance of crime prevention devices will be among the beneficiaries of such a system.

However, crime prevention in general will be the main beneficiary of new safety systems. With the newly developed technology, the number of burglaries can legitimately be expected to decrease, resulting in less harm done to property owners — and increased peace of mind.





*“The main objective of Waveshift is to improve intruder alarm technology and develop a new product which will contribute to crime prevention.”*

## Project title

Development of a Novel Super High Frequency (SHF) Non-Contact Detector Unit for Mobility Detection and Speed Measurement (WAVESHIFT)

## Contract number

16927

## Duration

24 months

## Global project costs

€1 118 792

## EC contribution

€579 445

## Contact Person

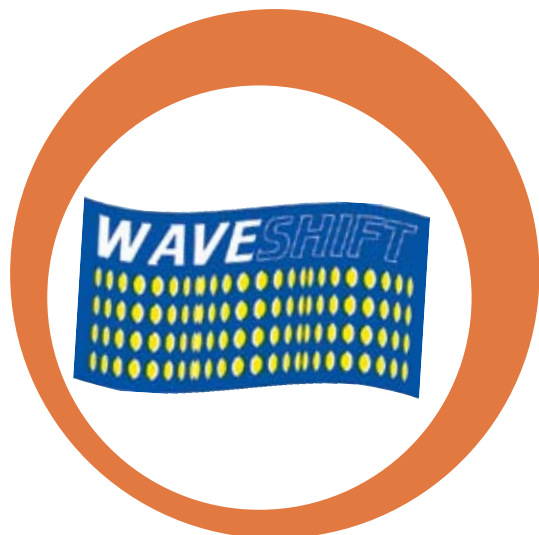
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*“A significant factor for the low annual production level of traditional wine vinegar is the lack of knowledge of the basic biotechnological process involved in vinegar production.”*

Up to now, traditional wine vinegar production has been a very lengthy process. This has become a problem for traditional vinegar producers due to high production costs, low profit margins and competition. Faster industrial methods that produce lower quality vinegar, but at significantly cheaper prices, are putting traditional producers at risk. Although there is strong consumer demand for high quality vinegars in Europe, the amount produced annually is low and the product expensive. The WINEGAR initiative has been set up to support traditional wine vinegar SMEs by developing a method that will shorten production time, while maintaining high quality standards.

Wine vinegar is produced by the fermentation of wine into acetic acid and other fermentation byproducts. The main reason why its production process is so time consuming is that acetic acid bacteria are obligate aerobes. Obligate aerobes are organisms that require oxygen for cellular respiration to obtain energy. Oxygen must be slowly fed into the process — this is a vital, but complex procedure. Until now, production times of ‘industrial’ wine vinegar have been reduced by forcing air to disperse through the wine, which converts the superficial transformation (aeration) into a ‘submerged’ development. However, the quality of the final product is lower than that produced by the slower traditional method, as there is a considerable loss of volatile compounds.

### Wood is where the traditional vinegar is

The WINEGAR consortium aims at combining the best of both worlds: faster production and traditional process. In this way, the taste and bouquet of high quality wine vinegar is even improved. A significant factor for the low annual production level of traditional wine vinegar is the lack of knowledge of the basic biotechnological process involved in vinegar production. Consequently, the WINEGAR project is to develop a method that will reduce the time needed for traditional vinegar production through an integrated approach, including research on the barrel wood and bacteria selection and control. So far, most of the wood used in the production of wine vinegar barrels has been oak, just like in wine production. However, oak allows very limited oxygen transfer. The project is therefore investigating the use of other woods which are more porous, and the effects of wood thickness on oxygen diffusion. Another goal of the project is to establish a collection of the different micro-organisms involved in the production (acetic acid bacteria), which will also be useful for follow-up work.

### Same quality, increased affordability

In term, the WINEGAR methodology is expected to reduce the production time of wine vinegar by 30% to 50%. This will imply an improved process control, reduction of production risks and substantial cost reduction. New barrel prototypes for vinegar production have already been developed and are likely to become a significant innovation for the vinegar sector. After appropriate analysis (microbiological, chemical and sensory), the new prototypes are being tested and will be commercially available by the end of the project. Another important aim of the project is the establishment of production standards. These will apply to the procedures for microbiological, chemical and sensory analysis of wine vinegars. At the end of the project these protocols will be presented to international standardising bodies for approval.

The measures undertaken by the WINEGAR project will have a positive effect on both the production volume and selling price of traditional European wine vinegar. The improved price/quality ratio will strengthen the competitiveness of European SMEs in this sector and offer more value for money to the consumer. Facing up to the increasing challenge of mass products, the WINEGAR project can be seen as a concrete step towards the preservation of a traditional European culinary product.



# Co-operative Research Volume 3

*“In term, the WINEGAR methodology is expected to reduce production time of traditional wine vinegar by 30% to 50%.”*

## Project title

Wood solutions to excessive acetification length in traditional vinegar production (WINEGAR)

## Contract number

17269

## Duration

30 months

## Global project costs

€1 376 934

## EC contribution

€1 136 616

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