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Special feature



Cultural heritage: preserving the past for the digital future

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Digital futures, physical pasts

These days we can walk with dinosaurs and take virtual tours through the ruins of Pompeii with just the hint of sulfur permeating the air. Science and technology are bringing the past to life with evermore sophisticated virtual reality applications.

Meanwhile, with web portals like the EU's Europeana (www.europeana.eu) culture buffs can get inspiration from the some 6 billion digital artefacts assembled from major collections across the Union.

We are witnessing a sense of shared cultural experience expressed through a host of collaborative research projects aimed at preserving Europe's cultural heritage through technology and digital preservation.

*Readers of this issue will learn that cultural heritage isn't what it used to be. We speak with members of a high-tech project which takes a whole new slant on film classics. Technology developed by the Cinespace consortium 'augments' reality, making a stroll through Europe's cultural landmarks a whole new experience. Imagine Audrey Hepburn approaching you at St Marks Square in Venice, a scene immortalised in the film *Roman Holiday*, and you get an idea of the directions of Europe's digital heritage in the not-too-distant future.*

Also in this issue, our biology and medicine section sets the record straight on creativity and schizophrenia. Research led by Sweden's Karolinska Institute provides thought-provoking evidence of links between the two in the human brain.

The top story in our energy and transport section charts the way forward to more efficient air traffic management with the aid of a four-dimensional (4D) virtual airspace management system developed by European researchers.

The impressive output of the 'Census of marine life' initiative, funded in part by the EU, gets top billing in our environment theme this issue. As the largest-ever collaboration in marine biology history, the Census has revealed at least 1 200 new species, and generated a massive 2 600 publications.

Our IT and telecommunications section supports our theme of the month, 'Cultural heritage: preserving the past for the digital future.' We showcase the results of the ISAAC project which has developed what it calls an 'open box for cultural tourism.' ISAAC harnesses the wealth of cultural knowledge (internet content and archive material) available to a city or destination and, using developments in Web 2.0 technology, invites contributions from the public (locals and tourists) to enrich and update the material.

Our lead story in the industrial technologies theme follows a friendly little autonomous robotic waste collection unit, called Dustbot, as it navigates its way round the narrow streets of Europe's medieval towns.

As usual, the events section in this issue offers a selection of upcoming conferences and gatherings in the field of research and technology.

*We look forward to receiving your feedback on this issue and on the research*eu publications in general. Send questions or suggestions to: research-eu-supplements@publications.europa.eu*

The editorial team



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Thank you to Maria Teresa Linaza and Gorka Diez for their contribution to the 'special' dossier in this issue



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Creativity and schizophrenia use similar brain canals

Researchers at the Karolinska Institutet in Sweden have discovered that the brains of healthy, highly creative people are similar to that of schizophrenic patients in some aspects: in both cases, the dopamine system is involved. The results have been published in the Public Library of Science (PLOS) ONE journal.

Schizophrenia is a serious mental illness that is characterised by social malfunction and a range of psychotic symptoms such as hallucinations, or inarticulate and disorganised thoughts. According to a 2005 global scientific survey by Sukanta Saha and colleagues, about 4 in 1 000 people are affected by schizophrenia worldwide. This is far below the widespread 1 % estimate.

Some believe that a number of remarkable artists and scientists owe their strong, unique creative minds to schizophrenia. For instance, some psychologists cite Dutch painter Vincent Van Gogh or US mathematician and economist John Nash as likely schizophrenia sufferers. Therefore, several teams of psychiatrists and neurologists are interested in exploring the link between schizophrenia and high creativity.

Using a number of psychological tests, the Swedish team identified a group of 13 healthy, highly creative people. These tests help measure creativity or 'divergent thinking', i.e. a free-flowing generation of ideas. A person is considered creative if she

can give novel, meaningful responses to open-ended questions, as opposed to trivial or bizarre answers. The researchers then studied these creative brains, in particular by using imaging techniques such as positron emission tomography (PET) scans, which allow scientists to follow up specific molecules in live patients.

In this study, the researchers focused on the dopamine system, which is known to be linked with psychotic symptoms. Dopamine is a neurotransmitter, a chemical naturally produced by the body that passes on messages between neurons. It is involved in many brain functions such as cognition, learning, or reward and punishment. To understand the role of the dopamine system in their experimental group, neurologists measured the density of so-called Dopamine-2 (D2) receptors in zones of the brain that are specifically known to be linked to schizophrenia.

The study showed that the more creative the person is, the less D2 receptors can be found in their thalamus (i.e. less dopamine molecules can bind to the neurons in this brain area). 'Schizophrenic patients are also known to have low D2 density in this part of the brain,' explains co-author Dr Fredrik Ullén, a researcher at Karolinska Institutet's Department of Women's and Children's Health.

This striking similarity offers a single explanation to how healthy, highly creative people find links between different ideas to solve a problem, and how patients with mental illness make unusual or bizarre associations.

The thalamus serves as a kind of brain filter; it sieves out a signal before it reaches the brain cortex, the seat of rational thinking processes. 'Fewer D2 receptors in the thalamus probably mean a lower degree of signal filtering, and thus a higher flow of information from the thalamus,' says Dr Ullén. In other words: 'Thinking outside the box might be facilitated by having a somewhat less intact box.'

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Frequent acronyms

ERA European research area
 FP5/6/7 Fifth/Sixth/Seventh Framework Programme of the European Community for research, technological development and demonstration activities

ICT information and communication technologies
 IST information society technologies
 R & D research and development
 SMEs small and medium-sized enterprises

From model to man, multi-scale modelling in healthcare

The COAST project, which aimed to help scientists and researchers achieve a better understanding of a serious coronary heart condition, has opened the door to multi-scaling modelling across a whole range of disciplines. The project's work is feeding into the valuable work of the 'Virtual physiological human' (VPH) community.

Plaque build-up in the coronary artery could mean that the heart is not getting enough oxygen, and that there is a risk of a blocked artery, which could lead to a heart attack.

The standard procedure for addressing this condition is angioplasty, which involves mechanically widening a narrowed or obstructed blood vessel. Doctors then crack this plaque open in order to restore blood flow, though the cleared artery is often not strong enough to remain open without some support. A stent is therefore inserted, which basically sits in the artery, ensuring it is kept open.

The patient then has a wound inside the artery that needs time to heal. In most cases tissue will grow around the stent and the patient will be able to lead a healthy life. However, in about 10 % of such cases, things go wrong when unwanted tissue forms inside the artery.

This condition is called in-stent restenosis (ISR): the development of neointimal tissue which has the potential to block the

artery. Once this happens, follow-up treatment may be required.

Addressing this problem was the driving force for the project 'Complex automata simulation' (COAST), an EU-funded project to build a framework for multi-scale, multi-science simulations.

The goal of the project was not to improve medical care per se, but rather to develop a complex automaton (CxA) capable of simulating and synthesising complex mathematical models at a wide range of scales, from 'molecule to man.'

'The COAST project is about multi-scale modelling or MSM,' says Alfons Hoekstra, professor of computational science at the University of Amsterdam and coordinator of the COAST project.

'About 10 years ago, we realised that in science, biology and healthcare, we are used to studying systems at a certain scale, say at a certain magnification of our microscopes. We zoom in to see organs, tissues,

cells and try and understand our bodies at separate scales. Since the unravelling of the human genome, we've been able to analyse from the molecular level up to the level of man; these are complex processes that happen at different scales,' he explains.

Better understanding of ISR — and ultimately finding a better treatment — was used as an example of a challenging multi-scale biomedical application to validate whether a framework for multi-scale, multi-science simulations is achievable. 'This whole COAST project is being driven by ISR,' says Mr Hoekstra. 'It is a very challenging application. It involves all the different variants of multi-scale couplings you can think of.'

To study exactly how the body works, you could try to simulate every cell in the body, and all proteins in the cells, to find out what happens. The problem is that no computer in the world is capable of achieving this goal. Therefore, one solution is to treat things at a coarser scale, say in bigger blocks. But then researchers would not get all the information they need to analyse a process.

The idea behind COAST was to do both: create large-scale and small-scale simulations running at the same time and somehow couple them. Achieving this has been the core of the EU-funded project.

So while COAST had a specific objective relating to ISR, it also attempted to answer the broader question of whether a model can be used to simulate a number of parts of the body and enable interdisciplinary cooperation.

Using some muscle

In order to deal with all these multi-scale couplings, the project team developed a computational tool called 'Multiscale coupling library and environment' (Muscle) for the simulation of multi-scale models. And in order to study ISR, the team identified and constructed individual single-scale models of the biological and physical sub-processes involved. Muscle then integrated these complex interactions according to their distinct temporal and spatial scales.

'On all these MSMs, you usually have single-scale models available,' says Mr Hoekstra. 'They are just there. You



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want to glue them together, and Muscle provides that glue. The scale separation map then provides a pictorial demonstration to help biologists organise their knowledge and by organising all this, COAST also becomes a qualitative modelling tool.'

Muscle is also an open source project, and is available for researchers to use. The framework developed by the COAST project was used to try and learn more about ISR. 'Our simulations now allow us to test hypotheses related to simple questions, such as "why does ISR start, and why does it stop?"', says Mr Hoekstra. This hypothesis testing will then inform the biologists to conduct new experiments. Such simulation-guided experimentation should then lead to a deeper understanding of ISR.

The virtual physiological human

The focus by COAST on ISR feeds in to a much broader research target: the development of a virtual physiological human (VPH) model. This concept is currently receiving lots of ICT funding, and a large network of excellence has already been developed. With the help of EU funding, Europe has developed a very strong VPH community.

The VPH is a methodological and technological framework that will enable collaborative investigation of the human body as a single complex system. The VPH will be made up of integrated computer models of the mechanical, physical and biochemical functions of a living human body.

'The whole VPH vision is very challenging from an ICT perspective,' says Mr Hoekstra. 'This is where ISR fits in — as one VPH application. The VPH community is pushing these ideas along. I believe VPH is part of this "health for ICT vision", and we're starting to see a merging of these groups.'

Mr Hoekstra reckons there are about 15 or so EU-funded VPH projects currently active. 'There is lots of interest in this, creating models to understand human physiology and improve human health,' he says. 'It can be summed up in two phrases: from molecule to man, or from DNA to disease.'

It is within the VPH community that the groundwork laid by COAST can now best be exploited. This is where real uptake in ICT research has been occurring. 'The point is that the models have been validated,' says Mr Hoekstra. 'COAST has ended, but there are follow-up projects.'

The "Medical devices design in cardiovascular applications" (Meddica) project, for example, is about improving medical devices: artificial heart valves, stents, etc.'

The future

Mr Hoekstra believes that the COAST project has got researchers to the point where they can really begin to make a difference in multi-scale modelling and applications in human health.

'It is now time to broaden the application to other systems, not just coronary,' he says. 'COAST was not discussed with companies, but Meddica will be. We are in a position now to team up with companies and discuss our findings. Previously, we weren't quite there.'

A new project, due to start in October 2010, with completion scheduled for 2013, aims to find the best computers on which to run multi-scale models, using paradigms developed by COAST. It will involve coupling computers throughout Europe, and tying together disparate disciplines such as fusion researchers, those working with nanomaterials, hydrologists, and the VPH.

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Flower power determines win or lose verdict

New research has revealed that the so-called Flower (Fwe) protein has the power to mark weak cells for eradication, allowing fitter cells to remain and flourish. Fwe, a cell membrane protein present in multicellular animals, has authority during cell competition to deem some cells 'winners' and others 'losers.' Results from the study, which was partly funded by the European Research Council (ERC), are published in the journal Developmental Cell.

The research conducted by the team of seven scientists from the Spanish National Cancer Centre (CNIO) in Madrid provides further insight into the process of cell competition. It may even contribute to the way we treat diseases that involve cell fitness imbalances such as cancer.

'We were interested in investigating how cells of fly wing imaginal discs distinguish winners from losers during cell competition,' explained CNIO's Dr Eduardo Moreno, who received an ERC Starting Grant in 2007 of almost EUR 1 million for the 'Genetic and Genomic Study of Cell Competition in *Drosophila*' (Super-competitors) project. These grants allow

emerging scientists with a proven track record to consolidate their own research team and conduct independent research in Europe. When a cell develops, it compares its metabolic rates with surrounding cells.

Consequently, those cells better able to adapt, proliferate at the expense of the less fit. This cell competition process was first described in the larval structures, called imaginal discs, which help produce wings and other body parts of fruit flies in 1975. Since the discovery of cell competition, other genes have been linked to cell competition (dMyc, the *Drosophila* homolog of the proto-oncogene c-Myc, is among the best studied).

For their study, Dr Moreno and his CNIO team used a genomic approach and combined it with functional assays to try to identify the genes expressed in the early stages of cell competition. As a result, they discovered that three different forms of Fwe act as cellular 'tags' that contribute to the decision-making of whether a cell wins or loses.

One particular Fwe tag has the power to not only label cells as losers but is responsible for activating their elimination by apoptosis (cell death). They also found that Fwe is necessary in cell competition, but does not play a role in general cell growth and survival.

'Taken together, our results suggest that Fwe isoforms [different forms of the same protein] generate the scaffold that is required and sufficient to label cells as winners and losers during competitive interactions among cells,' concluded Dr Moreno.



In their paper, the authors note that the extracellular 'code' of the Fwe isoforms 'may have biomedical implications beyond cell competition because imbalances in cell fitness appear during ageing, cancer formation, and metastasis.'

Cell competition may be a way to guarantee that only the best remain to contribute to the organism's growth and well-being. The role that Fwe performs in cell competition makes it an attractive focus for future study. One potential new avenue of research would be to explore the function of cell competition in isolation from other signals that control tissue growth.

Dr Moreno's team involved in this study includes Christa Rhiner, Jesus M. Lopez-Gay, Davide Soldini, Sergio Casas-Tinto, Francisco A. Martin, and Luis Lombardia.

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What are the symptoms of male menopause?

EU-funded scientists have identified the symptoms behind late-onset hypogonadism or 'male menopause', a rare condition that affects 2 % of men. Nine symptoms were linked for the first time to low testosterone production, the key factor in male menopause.

The seven-year study was part of the 'European male ageing study' (EMAS) project, which received over EUR 6 million under the 'Quality of life and management of living resources' thematic programme of the EU's Fifth Framework Programme (FP5). The findings, which are published in the *New England Journal of Medicine*, are expected to better gauge the need for male testosterone therapy.

For the study, scientists from Belgium, Spain, Estonia, Italy, Hungary, Poland, Sweden, Finland and the UK interviewed a total of 3 369 men aged between 40 and 79 years from all 8 countries. They asked specific questions about their sexual, physical and psychological health, and measured their testosterone levels.

Of the 32 candidate symptoms posed by the team, only 9 were in fact associated with low levels of testosterone. The scientists identified three sexual symptoms as being the most important: less incidence of morning erection; less incidence of sexual thoughts; and erectile dysfunction.

Although a patient may show signs of other non-sexual symptoms, a diagnosis of male menopause requires a low testosterone level and the presence of all three sexual symptoms. These findings are expected to help physicians better assess the condition and the need for treatment, particularly male testosterone therapy.

The lead author of the study, Professor Fred Wu from the University of Manchester in the UK, said that the findings show that testosterone treatment may only be useful in a relatively small number of cases where androgen deficiency is suspected, 'since many candidate symptoms of classic hypogonadism were not associated with decreased testosterone levels in older men.'

The scientists also identified three physical symptoms: inability to engage in vigorous activity (e.g. run or lift heavy objects); inability to walk more than one kilometre; and inability to bend, kneel or stoop. The remaining three symptoms



were identified as psychological: energy loss; sadness; and fatigue. But the link to low testosterone levels for these six symptoms was found to be weaker than the sexual symptoms.

Other symptoms commonly thought to be linked to late-onset hypogonadism, such as sleeping pattern changes, bad concentration, and feelings of low self-worth, were discounted by the team as not being testosterone related.

The team also identified the testosterone thresholds below which specific symptoms become increasingly common. But the scientists warn that differences in testosterone levels between

symptomatic and non-symptomatic men were marginal.

'The long list of non-specific symptoms that have a potential association with testosterone deficiency makes it difficult to establish a clear diagnosis of late-onset hypogonadism. This situation is further complicated when you consider that even the most specific sexual symptoms of androgen deficiency were relatively common among men with normal testosterone levels,' explained Professor Wu.

He added that in order to increase the probability of correctly diagnosing late-onset hypogonadism it was important to specify the presence of all three sexual

symptoms of the nine testosterone-related symptoms that were identified in the study, together with low testosterone. 'The application of these new criteria should guard against the excessive diagnosis of hypogonadism and curb the unwise use of testosterone therapy in older men,' concluded Professor Wu.

Male menopause is often linked to obesity and poor health. Since 1999, the prescription of male testosterone therapy has increased fourfold in the US (a statistic that is not replicated anywhere else in the world).

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EU researchers create virtual lab to treat HIV

EU researchers have developed a virtual laboratory to help doctors around the world match drugs to patients and to make treatments for HIV, the virus that causes AIDS, and other infectious diseases more effective.

EU support for the research came from the 'Virtual laboratory for decision support in viral diseases treatment' (Virolab) project, which received EUR 3.3 million from the 'Information society technologies' (IST) thematic area of the Sixth Framework Programme (FP6).

The Virolab, scheduled to be online before the end of 2010, uses the latest advances in machine learning, data mining, grid computing, modelling and simulation to turn the content of millions of scientific journal articles, databases and patients' medical histories into knowledge that can effectively be used to treat disease.

Up to seven hospitals are already using the virtual laboratory to provide personalised treatment to HIV patients, and it is attracting widespread interest as a potent decision-support tool for doctors.

'Virolab finds new pathways for treatment by integrating different kinds of data, from genetic information and molecular interactions within the body, measured in nanoseconds, up to sociological interactions on the epidemiological level spanning years of disease progression,' explained Professor Peter Sloot, a computational scientist at the University of Amsterdam in the Netherlands, and the coordinator of Virolab.

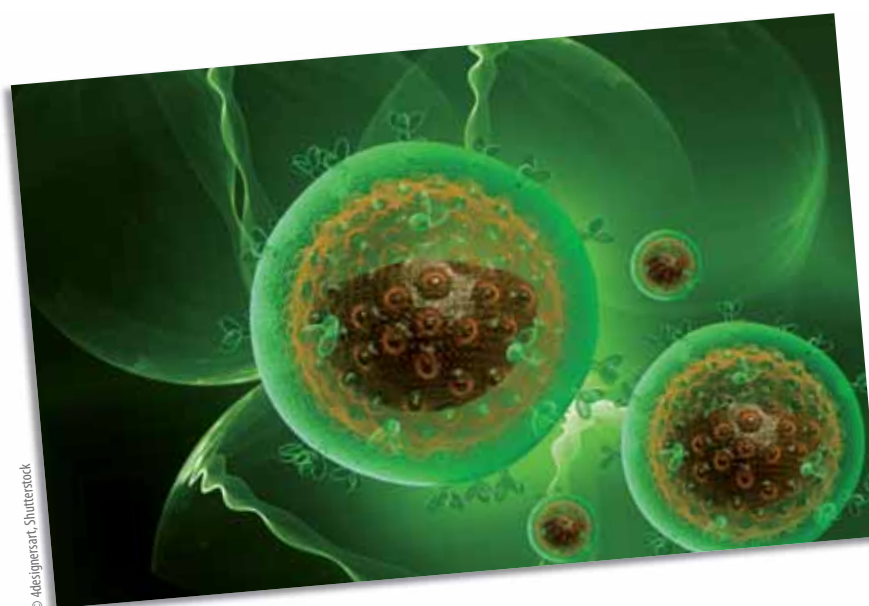
HIV, like other viruses, poses great challenges because it frequently mutates and can quickly become resistant to drugs. Doctors therefore need to know which medications are likely to be effective in slowing the progression of the disease, taking into account the strain of the virus, the patient's own medical history, genetic information and even sociological factors.

'It's like a lock and key,' said Prof Sloot. 'Drugs are keys made to fit certain locks, which are part of the viruses. If the locks change then the key no longer

fits — and each lock is different for each patient. That is why we need personalised medicine.'

The system continuously crawls grid-connected databases of virological, immunological, clinical, genetic and experimental data, extracts information from scientific journal articles and draws on other sources of information. This data is then processed to give it machine-readable semantic meaning and analysed to produce models of the likely effects of different drugs on a given patient.

Each medication is then ranked according to its predicted effectiveness in light of the patient's personal medical history, and the information delivered via a simple-to-use web interface.



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The system records every step it and the doctor take to find the right drug for a patient, and allows cases of other patients living a few streets or even thousands of kilometres (km) away to be compared. Moreover, it can generate models simulating the likely spread and progression of different mutations of viruses based not only on medical data but also on sociological information.

'Say a government has EUR 500 million to spend on HIV research and wants to know whether they should focus on funding the development of new drugs

or on preventive measures, we can give them an answer as to what would be more effective,' Prof Sloot pointed out.

He said the project's focus on HIV was driven by the scale and importance of the AIDS epidemic and by the wealth of information about the disease. HIV drug resistance is one of the few areas in medicine where genetic information has been widely used for a considerable number of years.

Prof Sloot and other Virolab partners are now looking at how the programme

could be used to create personalised drug rankings to improve the treatment of people suffering from other diseases. This research is being carried out via 'Computing real-world phenomena with dynamically changing complex networks' (Dynamets), an EU-funded project looking at drug dynamics in people infected with the H1N1 flu virus and co-infections, in addition to drug-resistant HIV. Support for Dynamets stands at EUR 2.41 million.

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Scientists reveal dolphins' diplomatic social behavior

Scientists from the Bottlenose Dolphin Research Institute (BDRI) on the island of Sardinia off the coast of Italy have published the most complete repertoire ever of sounds made by bottlenose dolphins (Tursiops truncatus).

The study shows how the mammals use whistles and burst-pulsed sounds to communicate and maintain their position in their community's social hierarchy. The research results appear in the book *Dolphins: Anatomy, behaviour and threats* by Nova Science Publishers.

Bottlenose dolphins are an extremely vocal mammalian species, but until now scientists believed whistles were the main sounds made by them. They were also largely unaware of the importance and use of burst-pulsed sounds. This latest long-term study, which is based on acoustic recordings and behavioural observations from the surface and underwater off the coast of Sardinia, reveals how both sets of sounds are vital to the social life of these marine mammals.

Spanish scientist Bruno Díaz, lead author of the study and a researcher at the BDRI, along with co-author Paraguayan scientist J Andrea Bernal Shirai, found that the Sardinian common bottlenose dolphin, like other dolphin populations, has a vocal repertoire consisting of 14 audibly distinct social signals that differ from each other in their acoustical structure and duration. The scientists noted that the creature's 'communication sounds ranged from soft and melodic sounds to harder, almost harsh sounds, with wildly differing durations ranging from the most

diminutive twitters to the long and most extravagant screeches and yelps.'

Dr Díaz said this vast range of sounds indicated a complex vocal repertoire in which the tonal whistle sounds — those which are most melodious — are used by dolphins, in particular mothers and their offspring, to stay in contact with each other and to coordinate hunting strategies. He pointed out that the study also produced evidence to show that 'stereotyped or signature whistle patterns were used to call calves back to within visual range of the assumed mother.'

Meanwhile, the burst-pulsed sounds, which are more complex and varied than the whistles, are used 'to avoid physical aggression in situations of high excitement, such as when they are competing for the same piece of food, for example,' explained Dr Díaz.

Bottlenose dolphins make longer burst-pulsed sounds when they are hunting and at times of high aggression, and make it possible for each individual to maintain its position in the pod's social hierarchy, he said, adding that the dolphins emit these strident sounds, for example, when in the presence of other individuals moving towards the same prey, forcing the least dominant mammal to quickly move away in order to avoid confrontation.

The researchers found that the vocal emissions increased 'especially in those activities involving excited depredation or socialising, confirming that activity and social signals production were related.' Moreover, 'the fact that a positive relation was observed between group size and the production of social signals, confirms that dolphin vocalisations are used for communicative and social purposes,' they said.

Dr Díaz and Dr Shirai suggested that in one respect at least, the dolphin appears to be rather more sophisticated than human beings. 'The surprising thing about these sounds is that they have a high level of uni-directionality, unlike human sounds,' the Spanish scientist commented. 'One dolphin can send a sound to another that it sees as a competitor, and this one clearly knows it is being addressed.'

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Hungarian scientists discover island-hopping dinosaur

Archaeologists in Hungary have discovered the remains of a small-horned dinosaur that was previously thought to live only in North America and Asia. Members of the Hungarian Academy of Sciences (MTA) believe that the ceratopsian made its way to Hungary from Asia by island-hopping across the ancient Tethys Ocean to reach what now constitutes Europe.

The new discovery, presented in the journal *Nature*, is being heralded as highly significant and has prompted calls for a re-examination of the biogeography of time.

The fossils of the herbivore dinosaur, which is believed to have measured around 150 centimetres (cm) in length and weighed 25-30 kilograms (kg) and boasted a small horn and a mouth resembling a parrot-beak, were found last summer by MTA archaeologist Attila Ősi in Iharkút in the Bakony mountains in western Hungary.

Scientists have long assumed that *ceratopsians*, or horned dinosaurs, occupied only the North American and Asian sides of the supercontinent Laurasia, and not the Europe section in the middle. When the supercontinent split in the Late Cretaceous, palaeontologists assumed the fauna had split too — generally they have not found much overlap between the inhabitants of Europe and its former supercontinent brethren.

However, Dr Ősi's find seems to undermine this theory as he detailed last month in *Nature* in an article co-authored with Richard Butler, Humboldt Foundation Research Fellow at the *Bayerische Staatssammlung für Paläontologie und Geologie* (Bavarian State Collection for Palaeontology and Geology), in Germany, and David Weishampel from the Center for Functional Anatomy and Evolution at the Johns Hopkins University, US.

They insisted that the remains of the newly found ceratopsian — named *Ajkaceratops kozmai* after Ajka, Dr Ősi's hometown, and as a tribute to Hungarian geologist Karoly Kozma — rendered the idea that the creatures were geographically limited to Asia and western North America 'overly simplified' and said the theory now 'requires reassessment.'

The researchers pointed out that the discovery of the 85-million-year-old fossil 'unambiguously demonstrates that *ceratopsians* occupied Late Cretaceous Europe' and added that 'when considered with the recent discovery of possible *leptoceratopsid* teeth from Sweden', the species 'may have reached Europe on at least two independent occasions.' The apparent discovery in 2006 of isolated *leptoceratopsid* teeth in the Kristianstad Basin, southern Sweden were heralded as representing the first record of horned dinosaurs from Europe.

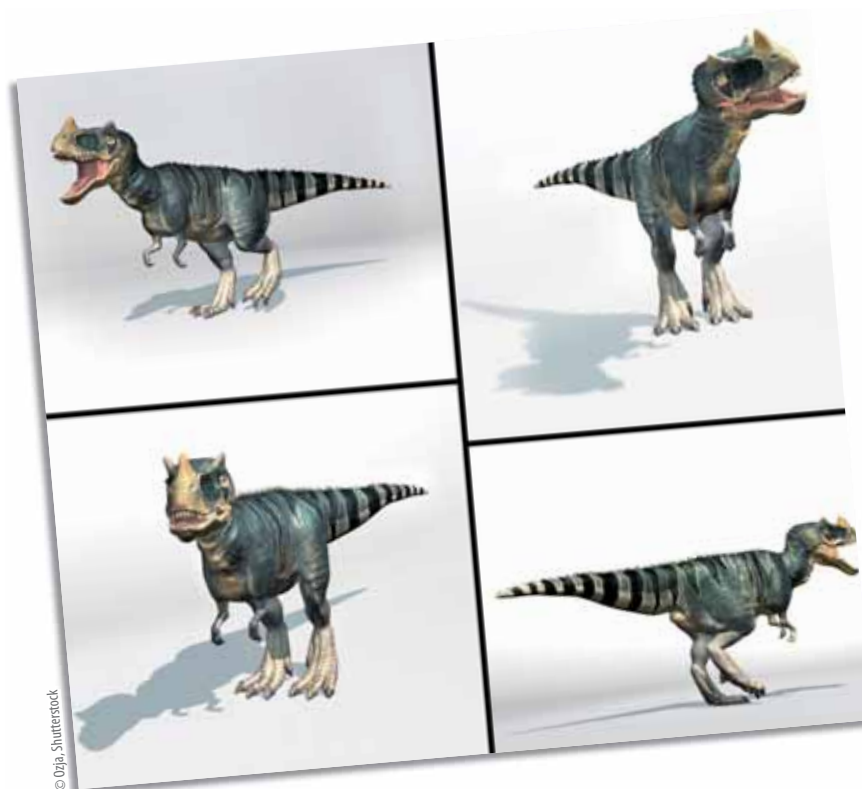
Dr Ősi and colleagues believe that *Ajkaceratops kozmai* most probably made its way to Hungary from Asia by island hopping, crossing an archipelago that now represents Europe.

'The presence of a *ceratopsian* in the western Tethyan archipelago probably results from an early Late Cretaceous dispersal event from Asia, possibly by island-hopping across the Tethys Ocean,' the authors write. 'This dispersal would have been facilitated by subduction of the Tethys Ocean along the southern Asiatic margin with resultant insular island arches in this region. *Ajkaceratops kozmai* thus adds new complexity to our understanding of Late Cretaceous dinosaur faunas and demonstrates the need for re-evaluation of current biogeographical hypotheses.'

MTA Chairman Jozsef Palinkas agreed that the findings called for a rethink about the migration routes and living areas of land-dwelling vertebrate of the Late Cretaceous.

Dr Ősi's name first grabbed the headlines 10 years ago, when he unearthed a small, intriguing looking piece of bone during a geological research session at Iharkút. It later turned out he was holding the first dinosaur fossil ever found in Hungary, according to the MTA.

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<http://ec.europa.eu/research/infocentre> > search > 16873



How do plants grow?

Plants play a crucial role in the life of all living creatures, especially in ours. As well as supplying the planet with oxygen, their use as food, bio-fuels, medicines and construction materials, make them irreplaceable. However, we know very little about their internal processes.

Researchers of the Bioengineering Institute at the Universidad Miguel Hernández de Elche (UMH) in Alicante, Spain are now on the case. They are part of the EU-funded project, Agron-omics⁽¹⁾ which is trying to discover the genes responsible for vegetal growth, directly related to the productivity of crops. Lecturer José Luis Micol Molina and Professor María Rosa Ponce Molet lead the UMH team made up by Professor José Manuel Pérez Pérez and postdoctoral researchers Silvia Rubio Díaz and Rafael Muñoz Viana.

Researchers the world over are working on ways to improve crop plants. One model species, in particular, has caught the attention of the international community — the *Arabidopsis thaliana*. Despite having no direct commercial value, the international community is keen to extrapolate data and findings from the study of *Arabidopsis thaliana* towards other, more commercially, viable species. However, 'despite the fact that this species was the first plant whose genome was fully sequenced, we do not know how many of its genes act and are coordinated', explains Dr Micol Molina, head researcher of the Genetics Unit of the Bioengineering Institute.

The Agron-omics consortium decided to first start identifying the *Arabidopsis thaliana* genes related to growth and then look into their functions. Later they plan to construct mathematical models to explain the interactions between these genes. The project is unique because of its global scale and claims to be the largest of its kind with around 140 dedicated researchers. All hope to genetically modify the plants with the aim of making them larger and therefore more economically profitable.

Dissecting leaves

Although the partners are interested in the overall cellular growth of the plant, they also focused on the largest organ — the leaf. It was initially believed at the beginning of the project that about 1 000 genes were involved in the control of leaf growth. 'There are genes that modulate the size of the cells and others that modulate the number of cells. We are studying the latter because, in theory, if we modify the genes in charge of the process of cellular division to achieve that the cells divide more times, the plant will show greater growth,' says Dr Molina, adding that researchers focused on one concrete group.

The Spanish researchers drew up a list of genes that, once damaged, stunt the foliar development of the plant. Dr Molina's team approached the foliar development study using both classic genetics and inverse genetics.

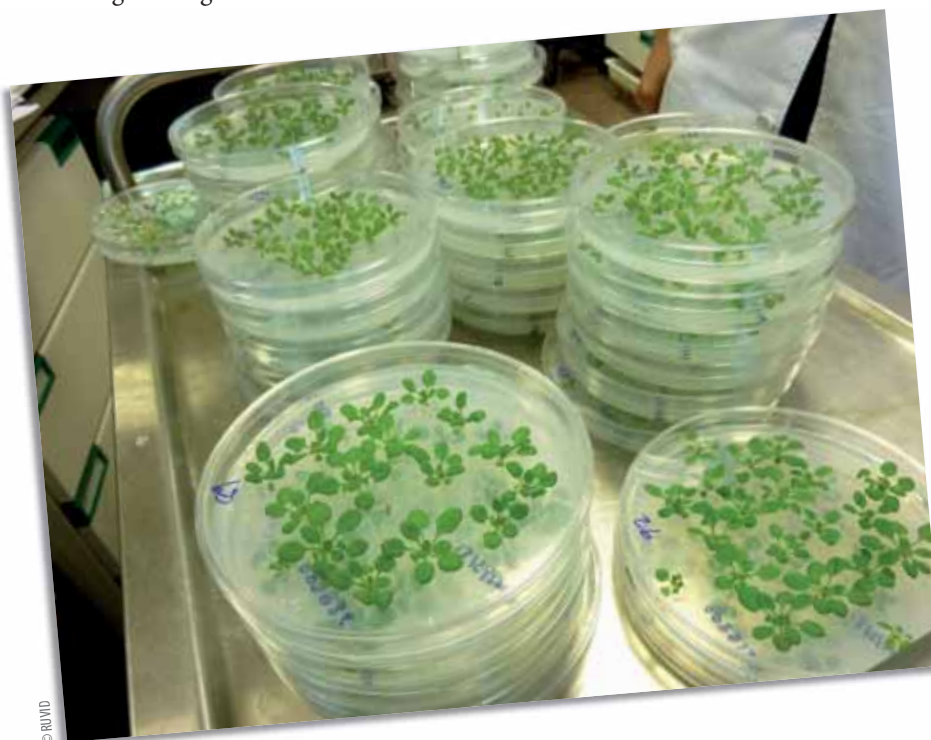
Following the classic research method, they deliberately damaged genes at random by exposing examples of *Arabidopsis thaliana* to a substance that modifies their DNA. The modified DNA is then transmitted to the next generation. They are now studying the collection of mutants at the UMH laboratory. These mutants have a below normal growth rate. The aim is to identify the gene responsible for dwarfism and then characterise its function. Once a gene necessary for growth is identified, the next step is to increase its activity through molecular techniques. Alternatively, they can look for natural variants of this gene whose activity is greater than normal.

The other research method to identify genes that affect the development of the leaf is through inverse genetics. As the genome of the *Arabidopsis thaliana* is fully sequenced, it is possible to eliminate the genes of this plant one by one in order to find the phenotype. Scientists are therefore also able to deduce the function of each gene. In Elche, for instance, they are studying the collection of dozens of thousands of mutant plants obtained by the Salk Institute of California.

Growing up

A more profound understanding of the molecular components driving growth in the cells of a developing *Arabidopsis* leaf required using novel high-throughput (HTP) techniques to analysis cell-level resolution. The researchers also employed more advanced profiling techniques and then developed software tools enabling data integration and biological system modelling.

The in-depth analysis of molecular cell components should provide the basis for new applications that could one day yield greater output of crops. The end result, could according to Agron-omics, not only increase food stuffs but also advance bio-fuel initiatives.



The five-and-a-half-year project received EUR 12 million in funding from the European Commission's Sixth Framework Programme (FP6). It is the second-highest grant awarded by the Commission in the area of biotechnology and the molecular biology of plants, according to the team.

The project is coordinated from the Biotechnology Institute of Flanders in Ghent, Belgium. Other elite research centres in Germany, France, Switzerland

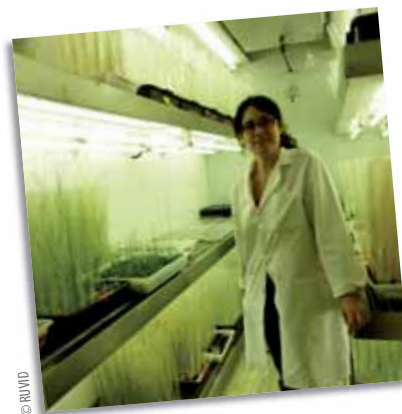
and the United Kingdom are also taking part, as well as the Dutch company Plant Research International and the Belgian company Maia Scientific.

(1) 'Arabidopsis growth network integrating omics technologies.'

Funded under the FP6 thematic area 'Life sciences, genomics and biotechnology for health'.

Promoted through the Network of Valencian Universities for the promotion of Research, Development and Innovation.

<http://ruvid.webs.upv.es/inforuvid/index.php?edi=2109&con=1942&sec=3> (original version in Spanish)



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Loosening up tumour cells could stop their proliferation

Cancer cells are very good at proliferating, but they're not very good at dividing neatly into two new cells. A team of researchers at the German Cancer Research Centre in Heidelberg has investigated this weakness in depth. They found that the tension of the protein fibres involved in cell division is a key feature that allows cancer cells to thrive. The results were published in the journal Science Translational Medicine.

During cell division, a normal cell divides neatly along one axis, on a bipolar scaffolding structure. For the division to go on correctly, the cell has two copies of an organising structure called centrosome. Protein fibres form from the two centrosomes, and pull each of the two sets of chromosomes to one pole. Seen under the microscope, these fibres have the shape of a spindle.

Cancer cells, however, often have more than two centrosomes, so the spindle fibres cannot organise properly and take a multipolar shape instead. Such malformed spindles distribute the chromosomes unevenly among the daughter cells, which cannot survive. Some cancer cells have found a way around this: they group several spindles together into two clusters so the cells can go on to divide properly and become thriving tumours.

Professor Alwin Krämer, head of a clinical cooperation unit at the German Cancer Research Centre and Heidelberg University Hospitals, believes this trick is an underrated Achilles' heel of cancer cells. His team investigated this weakness in detail to identify the proteins necessary for cancer cells to form such clusters. These proteins could be targets for new drugs — if the cells can't form clusters with their extra centrosomes anymore, they'll divide anarchically and die.

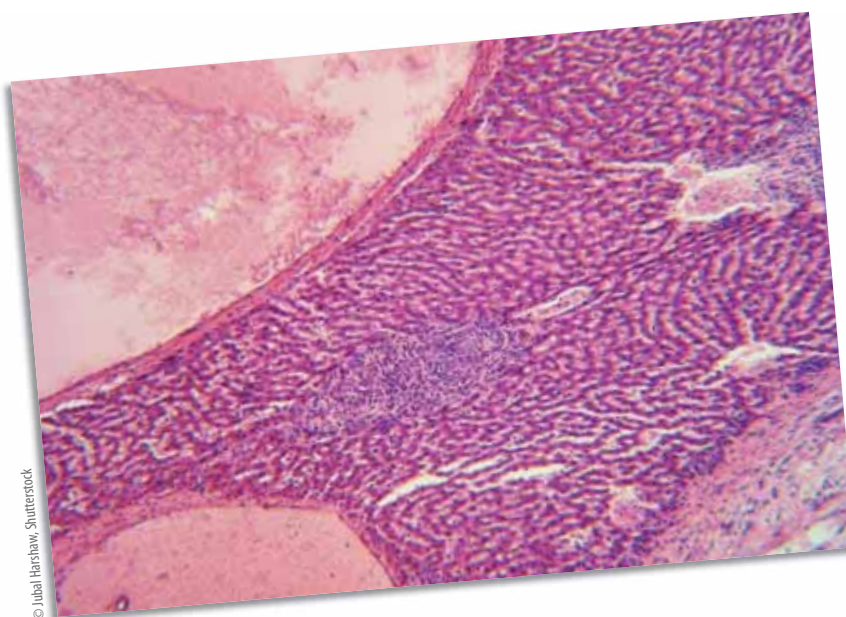
The scientists screened all the genes of a carcinoma cell line; they switched off each of the 21 000 genes 1 by 1, and looked under the microscope to determine which cells had more than the usual two spindle poles during cell division. They identified a series of 82 genes involved in the formation of extra centrosomes. Many of them are involved in attaching chromosomes to the cell's scaffold. In particular, the team believes that the spindle's tension is a necessary feature to bundle centrosomes. Only tightly stretched spindle fibres will place centrosomes close enough to each other for clusters to form. A whole

range of proteins are responsible for this tension; if their genes are switched off, the fibres' tension disappears, and cancer cells cannot divide properly.

Scientists have known about cancer cells' extra centrosomes for about a century now, but there remain many questions about how this affects cell division and the survival of tumour cells. These findings suggest that some existing cancer drugs are efficient precisely because they interfere with spindle tension in tumour cells with extra centrosomes. Further down the line, this research could help develop more targeted cancer drugs. 'Such a therapy would hit the cancer very specifically, because only tumour cells have extra centrosomes and depend on the survival trick of clustering,' explained study leader and co-author Alwin Krämer from the German Cancer Research Centre.

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ENERGY AND TRANSPORT

Blue sky thinking for European air traffic control

The 'Single European sky' initiative seeks to integrate Europe's national air traffic management systems into a seamless European whole in order to handle the ever-increasing volumes of traffic safely and efficiently. An EU-backed project brought a useful fourth dimension to airspace management systems. The results are promising to a sector under heavy pressure.

The 2010 eruption of the Eyjafjallajökull volcano in Iceland, which spewed ash to heights in excess of 9 km and paralysed Europe's air systems, drove home to millions of Europeans the critical importance of air travel in the 21st century.

In fact, in the space of a single decade, partly propelled by the emergence of budget airlines, air traffic over Europe has grown by more than 50%. Europe now has close to 8.5 million flights per year and up to 28 000 flights on the busiest days. To cope with this, airspace capacity has increased by 80% since 1990.

Nevertheless, there has been a sharp rise in flight delays which costs airlines between EUR 1.3 and EUR 1.9 billion a year, not to mention the wider economic costs for other economic operators. The delays are due to a combination of factors: insufficient capacity of the air traffic control (ATC) system, adverse weather, problems of airports or within airline operations.

Most projections forecast a continuing increase in air traffic, and Eurocontrol, the European organisation for the safety of air

navigation, expects that today's level of air traffic will have doubled by 2020. It predicts that current air traffic management systems (ATMs), with ongoing improvements, should be able to handle this increased load until the middle of the next decade. After that, more radical measures are called for in order to avoid serious congestion.

In order to handle this increasing traffic in a safe and efficient fashion, the EU launched, in 2001, its 'Single European sky' initiative which should lay the foundations of a unified European ATM. The technological and operational dimension of the initiative is known as the 'Single European sky ATM research' (SESAR) programme which aims to develop a modernised air traffic management system for Europe. This future system will ensure the safety and fluidity of air transport over the next three decades.

New models of cooperation

As the volume of air traffic skyrockets, air traffic controllers need to be able to base their decisions on an accurate and realistic picture — with split-second accuracy — of the situation in the air and on the ground, not only within their own airspace but also elsewhere in Europe with local implications. Given the fast pace of their jobs, they need to be able to do this through a system that is intuitive and straightforward to manage.

The project '4D virtual airspace management system' (AD4) sought to enhance the way European ATM systems cooperate with one another by developing virtual three-dimensional traffic control systems that work effectively in real time and make use of varied geo-related data, such as terrain, weather, positioning (satellite and radar), flight plans, etc. The project investigated the application and benefits of three-dimensional displays and interactive technologies in order to determine the qualities required to produce an effective 3D information visualisation environment for air traffic controllers.

Virtual reality in real time

AD4 uses a distributed 3D virtual reality (VR) system, called D3 (D-cube), which facilitates real-time visual representation and manipulation of ATM data, both in open space (particularly in the aircraft approach phase) and at the airport level. It is not only capable of 3D visualisation but also of 3D navigation, either using a conventional mouse or a special three-dimensional mouse which offers six degrees of freedom.

These semi-immersive 3D displays offer a 'global vision' of the traffic flows that an air traffic controller has to organise. The



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system allows users to interact rapidly and dynamically with the scenes represented: for example, an air traffic controller can zoom in on certain spots of traffic, perform rotations and translations of the scenes, interact with 3D and 4D widgets and controls, as well as gain easy access to different points of views on the traffic flows.

The system makes use of VR techniques to provide an environment within which the air traffic controller can observe and monitor a large number of aircraft over a wide area, while being kept constantly up-to-date on a broad range of complex factors about their planned routes which may have ramifications for flight path planning. Furthermore, the air traffic controller can use interactive 3D methods to select and reroute flights in real time. The project partners also constructed robust IT infrastructure which not only integrated 3D technologies and ATM components, but also employed model-driven architecture.

Successful demo

A demonstrator of the AD4 system — which included real interfaces and actual data from a traffic centre and simulation environments — was designed and implemented in a collaborative effort between partners from five European countries (Belgium, Germany, Spain, Italy and the United Kingdom) which drew on experts in ATM systems and VR developers.

The demonstrator was extensively evaluated by air traffic controllers which helped to identify the safety and efficiency gains of the AD4 system. These derive from the enhanced understanding and clarity of perception that 3D displays and/or 3D representations on 2D displays, combined with enhanced information presentation, can provide to controllers in both the approach and tower sectors.

Through this successful demo, the AD4 project has highlighted the possible exploitation of 3D virtual reality technologies in the ATC context in a manner that enhances human-machine interactions through a powerful and user-friendly interface. Furthermore, the project promoted interoperability among heterogeneous components and systems which has led to the development of an open platform for 3D representations and interactions in the ATC domain.

On the policy front, AD4 can contribute to a number of the goals of the 'European Single sky' initiative, namely it can help boost safety levels and bring down costs. 'AD4's combined 3D/2D displays can improve the controller's local situation awareness, that is awareness of specific situations involving a limited portion of the airspace while preserving global situation awareness. This heightened awareness enhances safety significantly,' says Antonio Monteleone, the technical coordinator of the AD4 project.

'Regarding the concept of 4D trajectory management envisioned by SESAR, the "Single European sky's" ATM research programme, AD4 can help controllers in planning and controlling "4D trajectory" exchanged among aircraft and control centres,' adds Mr Monteleone. 'For example, it can display and manipulate, via proper 3D widgets, 4D constraints that aircraft have to respect at different stages of their flight plans.'

The next step for AD4 is to further explore 4D trajectory visual planning/control capabilities, as well as to develop further combination and coordination between 3D displays and conventional 2D radar displays in order to exploit advantages deriving from both of them.

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World records for EU-funded fuel cell-powered aircraft

A hydrogen fuel cell-powered aircraft developed by the 'ENFICA-FC' project has completed a number of successful test flights out of Reggio Emilia airport in Italy, establishing new speed and endurance records for electrically powered class C aeroplanes.

The European Union is a strong supporter of research towards greener, safer and more efficient air transport systems, including the 'more electric' and 'all electric' aircraft. The primary advantages of electric technologies in aviation include low emissions and low noise, particularly important for commuter airplanes that usually take-off and land in urban areas.

Other advantages include lower chance of mechanical failure, such as that caused by

volcanic ash, and lower risk of explosion or fire in the event of a collision. Until now, the main disadvantages of electric aircraft have been decreased range and weight penalties.

A new aviation milestone

The goal of the ENFICA-FC project, including 10 partners from across the EU, has been to demonstrate manned flight in an electric aircraft using fuel cells as a main power supply. Over three years, it has worked to design, develop and install a fuel cell-based power system in a Czech-built ultra-light aircraft.

The aircraft, called Rapid 200-FC, completed its maiden flight on 20 May 2010, using a completely electrical hybrid power system, comprising a 20kW PEM fuel cell and a 20 kW Li-Po battery. Test pilot Marco Locatelli carried out a first aero-mechanical take-off, followed by an eleven-minute test flight for investigations of the flight envelope.

Level flight was attained at 700 ft and 130 km/h on a partial fuel cell power setting. Further flight tests were carried out on 26 and 27 May 2010, during which RAPID 200-FC established a new world speed record of 135 km/h for electrically powered class C aeroplanes (four consecutive runs over a 3 km course, as per FAI Sporting Code).

According to Locatelli, the aircraft showed positive handling qualities and satisfactory engine performance. Higher speeds of 145-150 km/h were measured for tens of seconds during free flight. The plane also broke the endurance record of 45 minutes.

Good news for aviation and for citizens

ENFICA-FC project coordinator Giulio Romeo of the Politecnico di Torino says RAPID 200 FC is one of the first aeroplanes in Europe and in the world to be fuelled by hydrogen. Project partners consider its successful first flights as a major step forward in the introduction of clean energy in aeronautics.

European Commission officials say the ability of low-noise electrically powered commuter airplanes to take-off and land on airfields with strict noise abatement regulations in urban areas and near population centres will allow the use of these airfields late at night, when noise abatement regulations are more stringent. This, in turn, will contribute to the more efficient and sustainable use of the aviation system capacity.

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Submarine robots learn teamwork

New technology developed by European researchers will allow autonomous underwater vehicles to work together as a team. It increases the scope of submarine applications for autonomous vehicles. Even better, the technology can be retrofitted.

One could reasonably argue that the ocean floor is composed primarily of surprise. Surprise is the most common finding when scientists investigate some unexplored portion of the sea bed. And the ocean is 90 % unexplored.

We know more about the surface of the moon than we do of the watery depths. The most advanced alien life form so

far encountered by humanity — a species using chemosynthesis, an entirely new metabolic process to create energy, cells and life — was found by Professor Colleen Cavanaugh at a hydrothermal vent in the ocean deep just 30 years ago.

Studying the deep ocean floor like this is cumbersome, expensive and dangerous. The majority of exploration efforts have

to employ an autonomous unmanned vehicle (AUV), which works without control cables.

But many AUVs are specialised, they cannot travel far alone and they can only provide a narrow range of data. Moreover, there are few AUVs and the unexplored kilometres of ocean are many.

Underwater robots?

The work of one European project, however, has the potential to dramatically increase the range and functionality of the world's AUV fleet. The GREX⁽¹⁾ project sought to develop appropriate networking technologies

and software to have coordinated missions with heterogeneous AUVs acting as a team.

There are many advantages. For a start, multiple AUVs can map a larger area in one sweep, performing a sort of synchronised swimming thanks to some very clever software developed by GREX.

What is more, the formation benefits from the sum of its sensing equipment, making the AUVs potentially much more versatile and capable of getting both a greater variety of data at a higher granularity in one pass.

GREX's results have the potential to extend the range of underwater exploration. Coordinated AUVs can daisy-chain the control signal from one to the other, so they can stretch out, bouncing the control signal from the mother ship to the networked submarines, over many kilometres.

'Underwater communication between vehicles is a very difficult area,' explains Michael Jarowinsky of MC Marketing Consulting, a partner of the GREX project. 'You have no link, so these vehicles are totally autonomous.'

Until now, there have been only solo AUVs out there.

Coordinating multiple AUVs requires sophisticated software. Seawater is a difficult medium for linking up submarine robots and bandwidth is very limited, which affects the quality and range of the signal — measured in the hundreds of metres.

'So we did not work with individual vehicles, we sought to create a "GREX" box that incorporates communications... tied into the vehicle controls. This can be simply added to existing vehicles, dramatically increasing their functionality,' notes Mr Jarowinsky.

There is high demand for this kind of functionality and the number of potential applications is enormous, from studying hydrothermal vents and their rich, alien ecosystems to making new discoveries in biology, geology, magnetism and any number of other studies.

'We focused on scientific applications in the GREX project. We were interested in fish data for fisheries research, a very important area. We aimed at marine map-

ping and also the study of hydrothermal vents,' Mr Jarowinsky reveals.

'Scientific applications are an important area for submarine exploration and it requires adaptable software that can be applied to many different tasks. It was useful to prove the technology.'

The sophistication of the GREX technology is amply demonstrated by the hydrothermal vent application. Methane escaping from the vent creates a plume that degrades slowly, and a formation of submarines can 'track' concentrations to follow the plume to its source.

This requires the AUVs to move almost as a single, distributed vehicle, honing in on the highest concentrations of methane. It is analogous to the slow and graceful yaw of a space shuttle as it docks with the International Space Station.

However, Mr Jarowinsky points out that there are many other potential commercial applications that were not studied by the GREX project.

Commercial applications

The oil industry uses remotely operated unmanned vehicles controlled by cable (ROVs), which require a supply ship, for the inspection of offshore pipelines. It costs tens of thousands of euros a day to rent the supply ship. Longer-range AUVs equipped with a GREX box could provide huge savings. There are many other, long-term applications, such as ocean mining.

In the meantime, GREX has created a platform for the coordination of AUVs.

This platform has been successfully tested in a series of sea trials. The research results will be disseminated and exploited in three phases. The first, short-term, phase is publishing the research results and informing the submarine exploration community.

In the second phase, SeeByte, one of the project's partners, plans to market the control software and graphical user interface for managing AUV schools. And in three or four years the project coordinator, ATLAS Elektronik, aims to start offering a complete system, including the GREX box, software and installation and training.

'The marine exploration community is very conservative, and they have to know that a system works, that it is reliable. It takes time to completely prove a technology like this,' stresses Joerg Kalwa from ATLAS Elektronik.

GREX was a research project, but the partners will develop a further proposal for a commercial project to take the results from GREX and apply them to commercial problems, perhaps also looking at fundamental technical constraints of the marine environment, like modem technology.

The GREX project received funding from the ICT strand of the Sixth Framework Programme for research.

(1) 'Coordination and control of cooperating heterogeneous unmanned systems in uncertain environments.'

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=91356>



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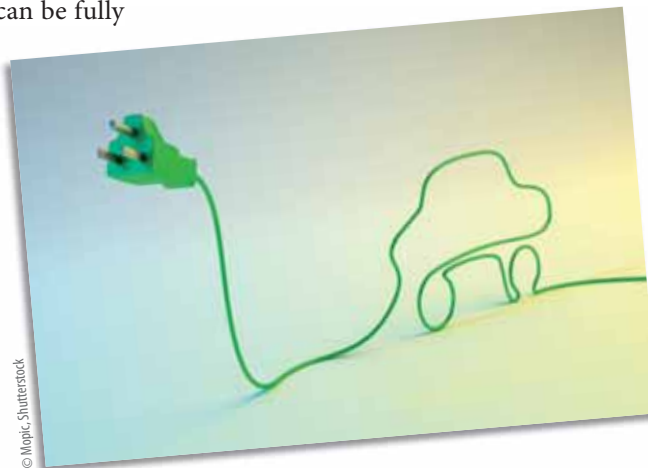
Hybrid powertrains deliver

Major progress has been made towards more reliable and cost efficient high density power electronics for fuel cell and internal combustion engine hybrid electric vehicle powertrains.

The use of fuel cells (FC) is expected to be the wave of the future, bringing forth an environmentally-friendly alternative to fossil fuels. Before this can be fully realised, however, more advances in fuel cell technology are needed.

The HOPE⁽¹⁾ project addressed high density power electronics, a key technology concerning energy supply in the automotive industry with tremendous energy saving potential. The particular emphasis of the research was on high density power

electronics for FC and ICE (internal combustion engine) hybrid electric vehicle powertrains.



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The main goals concerned cost reduction, meeting reliability requirements and reducing volume and weight. Key parameters from industrial application specifications such as OEMs (Original equipment manufacturers) were considered.

Through testing the integrated technologies, lower costs and higher reliability were achieved. These indicators bring good news for more competitive European products as well as for the environment.

(1) 'High density power electronics for FC- and ICE-hybrid electric vehicle powertrains.'

Funded under the FP6 programme Sustdev (Sustainable development, global change and ecosystems).

Collaboration sought: further research or development support.

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Top ten concerns for rail investors

Creating a harmonious rail freight network throughout Europe requires considerable investment. Researchers have focused on one important source of finance — private investors — to identify their concerns about putting their hands into their pockets for a unified European freight rail system.

Shifting the emphasis away from freight road haulage to rail makes sense ecologically and financially. However, the present rail system falls short in many respects as it is not integrated and standardised throughout this already vast, and still expanding, European Union.

The finance required to upgrade and revamp this fragmented rail network can come from the two sources — government, where pressing social needs must

be balanced, and, or private investors. The 'Implementing change in the European railway system' (Reorient) project focused on outlining the ten criteria most important to investors when considering if they will receive a competitive return on their money compared with other financial opportunities.

A conceptual framework previously devised from successful US and European rail systems was used to develop the top ten reference points. These were then compiled with information gleaned from experts at grass roots level from railway officials, reputable railway periodicals and individual rail reports.

General rules for investment applied such as an adequate risk-return ratio when an increased risk is accompanied by a correspondingly higher return. Whether

the projected traffic and revenue was adequate for the amount of capital invested was another issue.

The other factors tended to be more rail-specific. Questions were asked about network effects. For example, individual corridors running from north to south-east Europe should be complementary to one another.

For any service involved in carrying, whether people travelling with airlines or goods, viability of operations is dependent on whether there is full capacity both ways. Expensive infrastructure also has an impact. General rolling stock or the wheeled vehicles can be used so can be redeployed should they become redundant or obsolete to the service.

Being aware of investors' requirements will no doubt help the seamless unification of the EU's railways. Once potential investment problems are identified, managers and other stakeholders can implement appropriate strategies to encourage crucial cash injections from the private sector.

Funded under the FP6 programme Sustdev (Sustainable development, global change and ecosystems).

Collaboration sought: further research or development support.

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Smart vehicle communications improve road safety

In the future, cars stuck in traffic or on slippery roads will be able to communicate with other vehicles and road operators. In a bid to cut down on traffic jams and road accidents, the priority of the 'eSafety observatory' (Escope) project was to bring the benefits of eSafety to all road users.

The road system network envisaged by the eSafety initiative will promote the use of ICT to ensure smarter, safer and cleaner road transport. And it comes not a moment too soon.

Europeans already spend a quarter of their driving time in traffic jams and it will get much worse before it gets better. More importantly, every year, nearly 40 000 people are killed in road accidents in the European Union and more than a 1.5 million injured. The 'road toll' statistics can be overwhelming, and may even obscure the fact that each case is a personal tragedy.

As part of the effort to accelerate the development, roll-out and use of vehicle safety systems, the European Commission funded the establishment of the 'eSafety observatory' (eScope). Its aim was to strengthen and harmonise the activities of the automotive industry working on the introduction of 'co-operative' systems for smart vehicle communications.



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These intelligent systems which enable vehicles to communicate with each other and road infrastructure operators are based on wireless technology. Warning other drivers of adverse road conditions or of a crash which has just happened are just two examples of how this technology can contribute to reduce road accidents and traffic jams.

The Escope project partners worked with high-level advisers and experts as well as industry representatives from across Europe to follow the progress made on yet another eSafety solution. The pan-European in-vehicle emergency

call, eCall is a system by which, after an accident, a car can automatically call the rescue services and transmit location data, reducing the response time.

In principle, the technology is available. But there are legal, budgetary and co-ordination problems to overcome before it can be implemented in all Member States. Discussions carried out during the Escope project made clear that although the problems differ between Member States, together they delay its implementation.

In 2006, Escope organised the launch of the 'Intelligent car initiative' at which several technologies were showcased in front of decision-makers. It also created a publicly accessible database on eSafety systems and comprehensive reports on the progress of activities contributing to the achievements of the eSafety objectives.

The first decisive steps towards meeting the European goal of road accidents seem to have been made. Still, the investment in smart vehicle communication systems by the automotive industry will need to be met by public funding in essential roadside infrastructure. Only then will the lives of European drivers be safer.

Funded under the FP6 programme IST
(Information society technologies).

Collaboration sought: further research or development support.
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On the road to reducing accidents

Rising traffic volumes are posing increasing demands on a driver's attention. The EU-funded project Prevent⁽¹⁾ concentrated on accelerating the use of intelligent systems which will assist with driving and enhance road safety for all road users.

It won't be long before cars start communicating with each other and with the traffic environment. Car safety systems will monitor drivers and warn them of dangers ahead, preventing crashes and intervening if necessary. This would mean fewer car accidents and less work for 'guardian angels.'

But new technology has to pass stringent practicability tests before it can be applied safely on the roads. Furthermore, the tran-

sition period can be years, if not decades, if the purchase price of necessary equipment is high. The Prevent project focused on innovative active safety technologies and tried to speed up their deployment on European roads.

For this purpose, researchers combined forces with European automotive industry players such as DaimlerChrysler, Audi and BMW, as well as automotive suppliers.

They developed, tested and evaluated a wide range of crash prevention technologies based on the use of sensors and communications devices.

These include adaptive cruise control helping drivers maintain sufficient distance between neighbouring cars, and electronic stability control, which prevents skidding. Such onboard technologies are all examples of advanced driver assistance systems (ADAS), as they offer an extra set of eyes and ears for a driver.

Over the last decade, advances in information and communications technologies (ICT) have further widened the scope for ADAS. The Prevent project brought Europe's research



efforts to develop ICT-based automotive safety systems under a single umbrella.

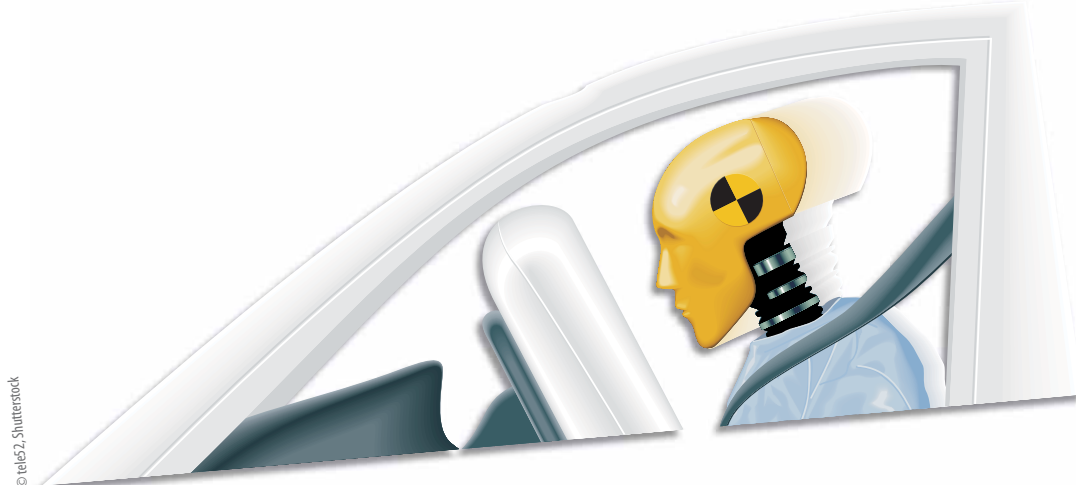
To boost the uptake of ADAS and help manufacturers navigate the complex legal aspects coming with these technologies, a European 'code of practice' was drawn up. The Prevent project also devoted efforts to raise awareness among consumers and decision-makers of the

potential benefits and availability of ICT-based solutions.

In a bid to communicate with the public, the Prevent project held the Icar event in September 2007, a successful exhibition of the latest results of European ICT research for smarter and safer cars. It aimed at the public to promote the

full range of ICT-based technologies for road vehicles, including driver assistance systems and cooperative systems.

'The EU must spread this good news among consumers and continue to put pressure on stakeholders to ensure Europeans benefit from these winning technologies sooner rather than later,' said Viviane Reding, former European Commissioner for the Information Society and Media, at the Icar event.



(1) 'Preventive and active safety applications contribute to the road safety goals on European roads.'
Funded under the FP6 programme IST (Information society technologies).
Collaboration sought: further research or development support.
<http://cordis.europa.eu/marketplace> > search > offers > 5526

New technology for multi-tasking motorcycle officers

A motorcycle police officer on an urgent call faces huge information processing and decision-making demands. A new European research project aims to prevent potentially dangerous information overload.

A motorcycle police officer on the roll could serve as a case study of the challenges of multi-tasking under high stress and high information-processing demands.

The EU-funded research project 'Multi-modal and multi-sensor zero-distraction interaction interface for two wheel vehicles on the move' (Moveon) set out to apply state-of-the-art information technology to help motorcycle officers carry out their work more safely, efficiently and effectively.

'Because of the limitations of the devices they carry with them today, officers often don't perform to the maximum they can,' says Elias Kalapanidas, technical manager for Moveon. The project set out to make ordinary operational procedures, like changing a communication channel, quicker and easier, and to maximise the information that an

officer can send and receive without being distracted or having to stop the motorcycle, he says.

Based on a thorough examination of real-life conditions and on requirements identified by police officers, Pininfarina Italy (a member of the consortium) designed a special-purpose helmet that was virtually tested by computational fluid dynamics (CFD) analysis using their experience on car manufacturing and physical wind tunnel studies.

This challenge helped Pininfarina to consolidate a new methodology on aero-acoustic calculation. A Moveon prototype has already been field tested in the UK. Mr Kalapanidas is now working with the consortium's other commercial partners to develop products for use worldwide, not just by police organisations but also by fire fighters and other emergency responders.

Assessing and avoiding information overload

The Moveon researchers realised that simply funnelling more information to motorcycle officers — for example via a heads-up GPS display or a sleeve-mounted touch screen — might not help them manage their missions more efficiently.

Even very valuable information relayed at the wrong moment could create a dangerous distraction or overload the officer. In response, the researchers set out to monitor an officer's moment-by-moment information processing capacities, assess situational demands, and provide information accordingly.

They accomplished that in part by building a set of sensors into the officer's jacket to monitor key body functions such as heart rate, respiration and blood oxygen levels.

Combining that biometric information with the officer's recent interactions and with data about driving conditions such as speed, acceleration, the tilt of the motorcycle, and proximity to an intersection allows the Moveon processor to estimate the officer's stress level and

current ability to process visual, auditory and tactile information.

'We've developed an algorithm that sums up all that information, estimates the overall cognitive load on the driver and the demands being placed on the visual, acoustic and tactile channels,' says Mr Kalapanidas. 'Based on that, we can select the best channel available at that time.'

If the system decides that any further information would overload the officer, it temporarily stops the communication.

'When the overall cognitive load passes a threshold, we cut off all information and let the user devote full attention to driving the motorcycle,' says Mr Kalapanidas. 'When the load settles back below the threshold, the information flow starts up again.'

As an example, an officer careening around a corner in hot pursuit of a speeding vehicle will not be distracted by a GPS update or by a request for a description of the suspect.

Enhanced multi-modal control

A speeding motorcycle is a notoriously noisy environment. Despite that, the researchers were determined to provide officers with effective voice control of the Moveon information interfaces. That required them to develop an enhanced speech recognition system which could identify an officer's voice commands amidst a welter of noise.

'Our requirements were not for a huge vocabulary,' says Mr Kalapanidas, 'but for a very robust speech recognition algorithm, one that could extract speech from the many, many noises coming from the environment and the motorcycle itself.'

By coupling that robust speech recognition algorithm with advanced noise suppression and signal enhancement systems, says Mr Kalapanidas, they were able to build a reliable voice command system.

Knowing that there would still be situations when voice commands would not work, the researchers provided officers with an independent control mode through touch. Officers can manage the Moveon system through a joystick mounted on the motorcycle handlebar and through a touch screen built into the sleeve of their jacket.

'These devices complement each other,' says Mr Kalapanidas, 'and allow us to achieve a very robust command input.'

Police officers in the field are out of necessity very demanding users. Recognising that, the Moveon team put their system through several rounds of trials with the help of the West Midlands Police in the UK. Feedback from the officers allowed the researchers to refine both the IT and the ergonomic aspects of the system to the point of winning acceptance from experienced motorcycle officers scrutinising it under realistic conditions.

What's it like to use the Moveon jacket, helmet and other controls under real-life conditions?

'Despite the helmet's camera, microphone and LEDs, its look and feel is much like that of any helmet,' says Mr Kalapanidas. 'It feels comfortable.'

The jacket is a bit heavy because it includes the system's CPU, he says. 'It feels like a heavy protective garment.'

The difference, Mr Kalapanidas says, is that the system comes to life when the officer switches it on. 'You don't feel like an individual separated from the operation,' he says. 'You feel connected, part of what's going on.'

The Moveon project received funding from the Sixth Framework Programme for research. Mr Kalapanidas is confident that the prototype they've developed will lead to commercial products that will prove useful to police and other public safety professionals worldwide.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&id=91429>



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Another milestone for marine science's greatest endeavour

As the largest ever collaboration in marine biology history, research under the 'Census of marine life' initiative, funded in part by the EU, has resulted in the discovery of at least 1 200 new species, and generated more than 2 600 publications.

The latest in a long list of achievements is a species inventory of distribution and diversity in 25 key ocean areas. The inventory is part of a collection of articles published in *Public Library of Science* (PLOS) *ONE* journal.

Support for the work came from two projects funded under the EU's Seventh Framework Programme (FP7): Ecofun⁽¹⁾, which received more than EUR 212 000 from the People specific programme; and Hermione⁽²⁾ with EUR 8 million from the Environment theme.

Between 2000 and 2010, more than 2 700 scientists from over 80 countries contributed to some 538 marine expeditions under 'Census of marine life'. The inventory represents a remarkable combination of research findings from the last 10 years but also information that has been in the public domain for centuries.

It is a historic roll call of species from 25 key biologically representative regions on Earth that will help set a baseline for measuring future changes.

Dr Patricia Miloslavich, senior scientist of the 'Census of marine life' and leader of the regional studies, said: 'To create this baseline, the 'Census of marine life' explored new areas and ecosystems, discovering new species and records of species in new places.'

The total number of species in the 25 areas ranges from 2 600 to 33 000. Crustaceans top the inventory list, comprising about one fifth of all species, while only 2% of the species comprise whales, sea lions, seals, turtles and other vertebrates. But for every known species, the 'Census of marine life' scientists believe that more than four new species are still waiting to be discovered.

In their paper, the authors explain that although scientists have discovered almost 2 million species and that great knowledge gains have been made, 'this knowledge may distract attention from the estimated four fifths of species on Earth that remain unknown to science, many of them inhabiting our oceans.'

The lead author of the collection summary, Dr Mark Costello, explained there were two reasons why the inventory was so urgent. The first is due to our impaired ability to discover and describe new species because of dwindling expertise in taxonomy. The second is due to the major declines in the numbers of marine species as a result of human activities.

In fact, human-related activities, such as overfishing and pollution, have been identified in 'Census of marine life' studies as among the main threats to marine life. Emerging threats to marine life include water temperature increases and acidification of sea water. Dr Miloslavich added that there is a sense of urgency to increase our knowledge of unknown biodiversity, 'before much of it is lost without even being discovered.'

'The census has made a tremendous contribution by bringing order to chaos. This previously scattered information is now all reviewed, analysed and presented in a collection of papers at an open access journal,' concluded Dr Miloslavich.

The inventory's 25 ocean areas include Alaska (US), Antarctica, Atlantic Europe, Australia, Baltic, Brazil shelves, Canada Arctic, California (US), Canada Eastern, Canada Western, Caribbean, China, Gulf of Mexico, Hawaii, Humboldt Current, Japan, Mediterranean, New Zealand, Patagonian Shelf, South America Tropical West Atlantic, South Africa, South Korea, Tropical East Pacific, Northeast US, and Southeast US.

The *PLOS ONE* landmark collection of papers was compiled by 13 committees and over 360 scientists. The papers are available to any interest member of the public.

(1) 'Analysis of biodiversity changes on structural and functional properties of marine ecosystems under cumulative human stressors.'

(2) 'Hotspot ecosystem research and man's impact on European seas.'

Promoted through the Research Information Centre.
<http://ec.europa.eu/research/infocentre> > search > 17653



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EU-funded conservation halts decline of threatened Maltese shearwaters

EU-funded conservation work has halted the decline of the yelkouan shearwaters, one of Europe's most threatened bird species on the Rdum tal-Madonna peninsula in Malta.

EU support for the research came from the LIFE 'Nature programme' that provides funding for projects contributing to the EU birds and habitats directives. The programme provided 50 % of the research's funding to the tune of nearly EUR 500 000.

The yelkouan shearwaters have been steadily declining in the Mediterranean for many years. In 2008, the species was upgraded to 'near threatened' in the International Union for Conservation of Nature (IUCN) Red List and is listed under annexe 1 of the EU birds directive, meaning they are subject to special conservation measures.

The Maltese Islands are home to approximately 10 % of the world's population of yelkouan shearwaters, but several colonies, including that at Rdum tal-Madonna, have decreased at an alarming rate in the last 25 years because suitable nesting sites have been disturbed or destroyed.

Scientists claim that the four-year project, Malta's largest conservation initiative, has stopped the population decline and improved the population trend of the species by around 10 %. The project focused on eliminating a number of threats for the Shearwaters, carrying out scientific research to discover more about the lifecycle of the species and increasing awareness about the birds through an information campaign.

According to the team, led by the non-governmental organisation (NGO) BirdLife Malta, the major threats for the shearwaters are loud noise and bright lights caused by shipping and boating activity and rat predation. Thanks to the project, Transport Malta, the island's maritime authority, has taken measures to prevent boats from carrying out such activities, while a professional

rat eradication programme was started in 2006 to decrease the rat population sustained by litter left in the area.

Other threats for the shearwater colony include camping and other recreational activities, urban encroachment, by catch due to fishing, dumping, illegal hunting and ferreting used in rabbit hunting, said the project partners, adding that all these threats have been systematically reduced in the past four years.

This has been achieved by working closely with local fishermen to find out how fishing might be affecting the birds and subsequently introducing measures to prevent birds from being accidentally caught. Likewise, the armed forces of Malta has patrolled the sea throughout the project to ensure that birds are not shot or otherwise affected by activities from boats, and camping, which generates noise, and that vegetation damage and rubbish has been phased out in key areas.

The project has undoubtedly been a success and will be used to set standards for the management of similar sites around Malta. But this does not mean that

the colony at Rdum tal-Madonna can now be left to fend for itself. EU Life Yelkouan Shearwater project manager Nicholas Barbara insisted that the continuation of research and conservation actions are crucial to secure the site as a safe haven for yelkouan shearwaters.

Because of the shearwaters Rdum tal-Madonna has been identified as a globally important bird area (IBA) by Birdlife International and as a special protection area (SPA) under the EU birds directive and a special area of conservation (SAC) under the EU habitats directive, and is part of the Natura 2000 series of European protected sites.

In addition to the shearwaters, the site is important for the cory's shearwater, the blue rock thrush and the spectacled warbler. Short-toed larks breed on the site and wintering birds include the black redstart. It is also home to various types of garrigue vegetation, including wild thyme, Mediterranean heath and Maltese spurge, and a number of orchid species.

The Malta Environment and Planning Authority (MEPA) and the bank HSBC also supported the project with financial contributions.

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When the law works against our natural habitats

Transport requirements are often in direct conflict with environmental policy. An EU project has revealed an unacceptable gap between conservation and the development of our waterways and port facilities.

Improving relevant activities and know-how in Europe's precious marine environments is crucial to protect natural habitats and surface waters. The 'Maritime transport coordination platform' (MTCP) project examined European competitiveness and safe and efficient operations involving maritime transport.

The project conducted a study which teased apart the problems associated with the implementation of EU environmental law as regards the protection of natural habitats and surface waters in the arena of port-related plans, projects and activities. Several main findings

have shed light on what remains to be accomplished and resolved.

Environmental policy law is in potential conflict with that relating to transport, waterways and port services. It is evident that there is major difficulty in conforming to relevant environmental requirements. National and EU transport policy objectives may be in jeopardy.

Legal difficulties such as major delays to waterway and port-related projects have had a negative economic and environmental impact. The cause of such poor conditions is due to the geographical overlap of natural habitats and prospective waterway and port development as well as uncertainty related to certain directives.

Awareness of the legal clash between environment and development is important for future policymakers. As Europe is on the verge of a major shake-up in its transport system, timing of this important study may remove the threat from aquatic habitats.

Funded under the FP6 programme Sustdev
(Sustainable development, global change and ecosystems).
Collaboration sought: further research or development support.
<http://cordis.europa.eu/marketplace> > search > offers > 5502

See also page 39 '**Towards streamlined ship monitoring and data transfer**'



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Best ways to collect urban waste

The 'Best urban freight solutions II' (Bestufs II) project identified and disseminated information about possible bottlenecks and best practice for transporting freight around Europe's towns and cities. The consortium continued the success of the Bestufs thematic network and comprised freight transport experts, user groups and transport operators.

Project partners drew up a series of recommendations following an analysis of best practice. These included using a range of different approaches for transporting waste in urban areas rather than applying a single solution. In addition, spatial planning and waste transport planning should cooperate to determine the best locations for landfills and incinerators.

The investigation highlighted the need for local authorities hiring waste disposal contractors to ensure that environmental impacts are kept to a minimum. It was also suggested that Member States should

make national and regional government work together with private operators to develop sustainable solutions.

Promoting the use of environment-friendly vehicles (EFVs) and equipment was another priority. The most effective way is to target operators who possess a large fleet of vehicles, thereby quickly and simply reducing a major negative impact. Studies also revealed that the greatest improvement can be achieved through the use of compressed natural gas (CNG) fuel.

Electric vehicles, however, are most effective when operated in a small built-up area such as a historical city centre.

High-tech control and enforcement schemes for freight transport are best



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suited for large heavily built-up areas, but a manually operated system is more cost-effective in small urban centres. However, it is important for both schemes that all stake-holders are correctly informed so that they can gain a proper understanding of new initiatives right from the start.

Any scheme that seeks to restrict city access is doomed to failure if it does not

take into consideration the needs of its users. If they are engaged during the early planning stages the chance of success for an access restriction scheme is much greater. Therefore, a carefully thought out public information campaign is vital to the scheme's success.

Recommendations by the Beststufs II project can not only reduce the impact

of freight transport on the environment, they can also improve the quality of life for urban dwellers. Faster deliveries will also help boost business, increase employment and benefit Europe's economy.

Funded under the FP6 programme Sustdev
(Sustainable development, global change and ecosystems).
Collaboration sought: further research or development support.
<http://cordis.europa.eu/marketplace> > search > offers > 5490

See also page 40 'Europe's first mobile robotic bin-on-call'

Ten out of ten for European transport

Upgrading and revamping European transport system is an exciting prospect. The Heatco⁽¹⁾ project has devised a set of harmonised guidelines to make sure the effects of this massive investment into Europe's future has optimum benefits for its citizens.

Accidents, pollution, noise and congestion are all compelling reasons why unsustainable development in transport must be replaced. Its successor will be a seamless trans-European network (TEN) held together with sustainable guidelines in step with each other. So far, the existing guidelines, although going in the right direction, are fragmented and inconsistent so the European transport system resembles a completed jigsaw puzzle — together but with obvious divisions.

The aim of the Heatco project was to first complete an analysis of the national assessment practice in all Member States. Seemingly straightforward to eliminate individual national frameworks and replace them with a unified approach, the Heatco project partners were aware that vested interests of stakeholders, although legitimate, may be counterproductive. To avoid conflict of interest, a cyclical approach was proposed incorporating meetings with provision for different options if the need arise.

The pros and cons of multi-criteria analysis (MCA) and cost benefit analysis (CBA) were weighed against each other. The overall winner was MCA as it can take into account a much wider range of project impacts than CBA, derived from welfare economics only. The researchers also decided in favour of using local

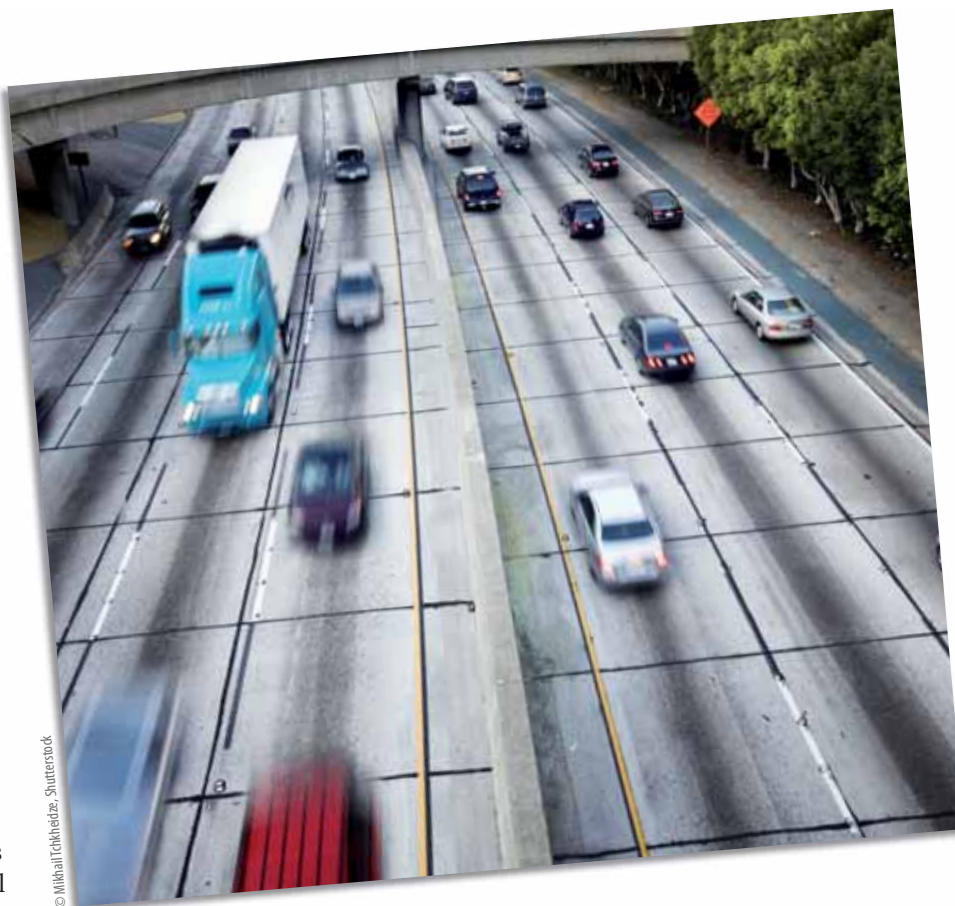
values for prices in the analysis wherever possible although EU-wide values have transparency.

Recommendations by Heatco representatives were comprehensive to say the least. For every project under review, a 'do-something' was compared with a 'do-nothing' scenario. The value of any project was to be made using the present net value. A default evaluation period of 40 years lent the project analysis a long-term element.

Advantages of a harmonised approach include transparency, time saved for decision makers and less boundaries. For commercial interests, distribution networks will be streamlined and simplified. At citizen level, reduction of accidents, traffic congestion, and noise promise a better quality of life.

(1)'Developing harmonised European approaches for transport costing and project assessment.'

Funded under the FP6 activity 'Research for policy support'.
Collaboration sought: further research or development support.
<http://cordis.europa.eu/marketplace> > search > offers > 5496



Car versus plane: travel and the climate change debate

Which is worse for global warming: travelling by car or by plane? According to the results of an EU-funded study, car travel increases global temperatures more than an air travel for the same journey but only in the long term. Travelling by plane, on the other hand, adversely affects short-lived warming processes at high altitudes.

The findings are part of the 'Quantifying the climate impact of global and European transport systems' (Quantify) project, which was funded EUR 8.39 million under the 'Sustainable development, global change and ecosystems' thematic area of the Sixth Framework Programme (FP6).

Published in the journal *Environmental Science & Technology*, the results are part of an ambitious research programme that incorporated the expertise of 41 participants and 6 associated members from 17 European countries as well as China, India and the US. Together, their work under Quantify focused on the impact of air, sea and land traffic (of both the European and global transport systems) on the climate, with particular reference to the effects of greenhouse gases, emissions of ozone precursors and particles, contrails and ship tracks. The ultimate

goal was to provide forecasts and other policy-relevant advice to governments and international bodies.

For the researchers involved in the current study, it was the first time a particular series of climate chemistry models were used to compare the climate effects resulting from different modes of global transport. Importantly, in addition to carbon dioxide (CO₂), the study considered the effects of all gases (both long- and short-lived), aerosols and cloud effects.

The team found that in the long run driving a car, on average, increases global temperatures more than if you were to make the same long-distance journey by air. However, for the first few years after the journey, travel by air increases global temperatures four times more than car travel.

The lead author of the study, Dr Jens Borken-Kleefeld from the International Institute for Applied Systems Analysis in Austria, explained that since planes fly at high altitudes, their impact on ozone and clouds is short lived but disproportionately high. The researchers are uncertain of the exact magnitude but believe the net effect is a strong (albeit short-term) temperature increase.

Car travel emits more CO₂ than air travel per passenger kilometre. As CO₂ remains in the atmosphere longer than the other gases, cars have a more harmful impact on climate change in the long term,' Dr Borken-Kleefeld explained.

The team of researchers from Austria and Norway also found that transporting goods by plane will increase global temperatures up to 35 times more than moving the same goods in a lorry over the same distance. Rather surprisingly, in the long run shipping exerts 25 times less warming, and even cools in shorter periods.

'Ships contribute to global warming through CO₂, ozone and soot. Currently they also emit relatively large amounts of sulphur dioxide which forms sulphate particles in the atmosphere. Those particles cool the planet by reflecting solar radiation back into space,' explained co-author Dr Jan Fuglestad from the Centre for International Climate and Environmental Research (CICERO) in Norway.

Dr Fuglestad added that in the first few decades after a shipment, the cooling effect more than offsets the warming. Since huge volumes of goods are traded by ship, international trade actually counteracts some of the temperature increases triggered by global passenger travel. He warned, however, that 'in the long term all means of motorised transport add to global warming.'

The Quantify project ran from March 2005 to February 2010. Other achievements include the emission inventory database, a summer school, a series of international conferences, and web portal eLearning activities.



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<http://ec.europa.eu/research/infocentre> > search > 17633

Reducing the noise of jet engines

Our modern way of life has become more and more reliant on air travel, but this comes with a price as our peace and quiet is shattered by the roar of jet engines. Fortunately, the problem of excessive aircraft noise has been addressed by the EU-funded 'Computation of coaxial Jet noise' (COJEN) project.

Researchers developed tools that enabled the aerospace industry to study and improve techniques for reducing the level of noise emitted by aeroplanes. The project built on the success of the previous 'Jet exhaust aerodynamics and noise' (JEAN) project, designing quieter aircraft and promoting Europe's aeronautics industry in the global market place.

Project partners identified and improved computational fluid dynamics (CFD) techniques for optimising jet

flow from coaxial nozzles with random geometry. Most methods currently used for noise prediction are based on data-bases of experimental results. However,



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these are of limited use for determining new noise reduction technologies. The COJEN project faced this challenge by developing techniques for predicting the turbulence characteristics of jet nozzles, which are associated with the generation of noise.

By designing quieter aircraft Europe's aircraft industry has responded to the public's demand for more environment friendly aircraft. Furthermore, the COJEN project helped the aeronautics industry to compete in the global marketplace by developing new products more quickly and cheaply.

Funded under the FP6 thematic area

'Aeronautics and space'.

Collaboration sought: further research or development support.

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High cycle standards for Europe

Cycling is good for health and the environment and should be encouraged by the local authority. Exactly how is another matter but an EU-funded project has become the acknowledged quality standard, helping Europe to become a cleaner, fitter, quieter continent.

In the face of rising pollution from fossil fuels and an increase in many countries in cardiovascular disease and diabetes, 'four wheels bad, two wheels good' seems to be an appropriate motto. When municipalities decide to implement this philosophy, they can contact the 'Bicycle policy audit' (BYPAD) project for a guaranteed source of advice.

BYPAD's credentials could not be more impressive. Established some 10 years ago, it has evolved with the increase in use of bicycles in European cities. Basically, it evaluates local and regional cycling policy and the improvement of its quality.

In its last guise, BYPAD platform, the aim was to enlarge the BYPAD network to an expanding Europe to all regions, not only urban areas and cities. For this purpose, project partners adapted the BYPAD method of auditing. New auditors have also been recruited and trained specially.

BYPAD tailors its tools to fit the customer. Manuals and questionnaires have been developed for small- and medium-sized

towns as well as regions. No less than 17 languages are catered for in 21 EU countries.

Web-based services are extensive, interactive and are linked with other sites with Europe's health in mind. An online tool makes it possible to fill in the BYPAD questionnaire online. Europe's main portal on mobility, European Local Transport Information Service (ELTIS) is fed good practice cycle tips by the BYPAD database.

The hard copy and spoken word have not been neglected either. Articles, conferences and interviews make sure valuable information on good cycling is distributed. There is also a publication, *Cycling the European Approach* which gives the lowdown on the history of BYPAD.

The high standards and holistic approach make BYPAD the natural choice for any organisation needing help with its cycling policy. Little wonder then it's become the European quality standard for cycling policy.

Funded under the Steer strand of the EU programme IEE

(Intelligent Energy-Europe).

Collaboration sought: further research or development support.

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Cultural tourism in your 'hood

European tourist destinations must find ways to unlock the potential of cultural tourism, for visitors and citizens alike. Today, modernising information and communications technology (ICT) is only part of the solution to delivering better tourist services, say European researchers. Innovation and a commitment to promoting and preserving cultural heritage by a wider range of stakeholders, including local residents, is the key.

Europe is the world's leading international tourist destination with some 500 million arrivals each year (53% of the total). Its cultural cities and heritage are a major drawcard for international and domestic tourists alike. But this popularity introduces a fresh set of challenges.

Tourism and city authorities are scrambling to keep up with visitors' growing demand for more sophisticated, joined-up tourism experiences, starting online before the trip and ending with user contributions — i.e. posting pictures and advice on various social networking media sites — after the trip.

Destinations must find ways to unlock the potential of cultural tourism, for visitors and citizens alike, while protecting the most popular heritage sites from over-visitation. And new ways need to be found to inspire greater interest and engagement in cultural heritage and its preservation.

A recently finished European consortium of researchers and cultural tourism stakeholders may have a solution. It has developed a suite of 'Integrated e-services for advanced access to heritage in cultural tourist destinations' (ISAAC), or what ISAAC's coordinator Krassimira Paskaleva-Shapira of Manchester Business School, calls an 'open box for cultural tourism.'

The project partners developed a unique user-centred web platform which acts as both a distributed repository of 'intelligent cultural heritage content' and as a service-oriented software architecture for customising the way content is presented and accessed by users.

The ISAAC platform harnesses the wealth of cultural knowledge already at the city's disposal in the form of current internet content and archive material and, using developments in Web 2.0 technology, invites contributions from the public (locals and tourists) to enrich and update the material. Combined, these sources help to extend the range of cultural tourism assets, which could also take the pressure off the most popular sites featured in guidebooks.

The project partners have also demonstrated a reliable way of integrating the inputs and interests of a range of different stakeholders, from tourism and city authorities to tourist service providers, local residents and the tourists themselves. The platform has been successfully implemented in Amsterdam, Genoa and Leipzig, and has growing support at the grass-roots level in the cities.

'Residents are posting their own stories, pictures and information about heritage sites and cultural events in their

neighbourhood, which can attract outside interest as well,' explains Dr Paskaleva-Shapira. 'This is creating a unique mingling between local residents and tourists, for a richer experience of the expected and unexpected culture in a destination — museums, little-known festivals, public art, traditions, boutiques, etc.

'Our integrated portal and e-services make the visitor sense, feel, think about, act on and relate to cultural heritage, not just passively look at it. It's about promoting experiential selling points and to give a sense of locality and meaning to local heritage.'

Tourism opens doors

According to Leipzig's Office of Urban Regeneration and Residential Development, which put the ISAAC project's tools through their paces, they were 'clearly... a door opener for more advanced use of e-services and for e-governance within the City's administration and beyond.'

Tourism, the Leipzig partners said, generates valuable 'foot-fall' — measuring the number of people entering a shop or public space — for existing cultural facilities, retail outlets and related services. It generates new uses for disused buildings and facilities, and it helps to stabilise local economies and attract investment, supports built structure and heritage projects, and bolsters the external image of certain quarters.

The Commune in Genoa had a similar assessment of the worth of cultural tourism to the city and the contribution of ISAAC towards re-packaging its overall tourism offer from an 'old industrial port city to a new, young and lively touristic [sic] city.' ISAAC helped the authorities create a whole new outlook with a new portal, new vision and backed by sophisticated IT tools for promoting the city and deploying services, such as interactive maps, new public-private partnerships and a greater stake in the Web 2.0 social networking phenomena.

Genoa's interactive maps bring the city's many UNESCO castles and sites to life with 'clickable' facts, pictures and stories. 'You can get the whole "back story" of who lived there, what they meant to the city, their traditions, likes, what they ate, and more,' says Dr Paskaleva-Shapira.

Tourism innovation checklist

The results of ISAAC's innovation checklist show, for example, that Amsterdam is advanced in both technological and non-technological innovation aimed at cultural tourism. Leipzig, the results show, invested the most in non-technological aspects, and all three trial cities engaged in new forms of in-



house alliances or reorganisation of internal processes and teams to reach their cultural tourism goals.

'Actually, ISAAC's results show that modernising ICTs is not sufficient to transform service delivery in cultural heritage tourism,' notes Dr Paskaleva-Shapira. 'Changing the way government organisations work and transforming government-stakeholder relationships can dramatically unlock the potential for better and richer e-services [in this field].'

ISAAC discovered that it was as important to embrace a new way of thinking and identify opportunities for innovation, both technological and non-technological. This could mean better use of e-services and better coordination between heritage groups, tourism marketers and national tourism organisations to find hidden cultural treasures in the destination.

It uses services like personalised itineraries and geo-location to find off-the-beaten-track sites in what becomes 'a journey in urban heritage.' And this can be planned before a visitor even books a hotel 'With ISAAC's services, they can see if the hotel is located in a "meaningful neighbourhood", and then chart an itinerary to enjoy the surroundings, which makes the trip-planning easier, more enjoyable but also a learning experience,' the coordinator confirms.

A visit to 'I amsterdam', the virtual portal inspired by ISAAC's approach and tools, is a good place to start to understand the power of simple, joined-up tourism information. An 'active' city map is the centrepiece with a range of 'virtual tours', stories and itinerary options. Click the 'Journey through the Golden Age' and the map instantly displays an ideal route to take in cultural artefacts in the city which match this period in Dutch history.

Virtual visitors can delve further by clicking on the individual geo-locations. A popup offers photos, 360o tours, and descriptions and stories about the site. For instance, your reporter learned that the first wife of the painter Rembrandt was buried in the Oude Kerk (Old Church) of Amsterdam in 1642. His daughter Cornelia was baptised there in 1654. The church is now an exhibition space. A subsequent 'physical' visit to the church is then brought to life knowing the famous painter's personal connection to the building. And with Web 2.0 functionality integrated in the website — as planned in the Genoa case — the visitor's own experiences (music, pictures, stories, and multimedia com-

binations, etc.) become part of the information package, not unlike user contributions to TripAdvisor.

Tangible results

The project delivered an integrated and customisable ICT platform for e-heritage destinations, and populated it with accessible e-services and an e-toolkit to aid strategic decision-making in this sector. It also came up with a new governance framework and tool for managing cultural tourism e-services in urban destinations, notably ISAAC's e-governance website in Genoa. And it introduced the idea of 'interpretive strategies' which through narrative and story help the trial cities position or brand their e-heritage destinations.

The ISAAC team, made up of 14 partners in 5 countries, offer many other tips and e-tools (technological and non-technological) which can be read on their up-to-date website. Other cities are also invited to join the ISAAC movement.

The ISAAC team has successfully presented the project at several headline events, including the last e-Challenges in Turkey. 'ISAAC's platform and services have received a lot of interest from different communities and e-commerce providers,' confirms the coordinator. Discussions are being held with MFG Baden-Württemberg mbH, the Public Innovation Agency for IT and Media in this region of Germany, on how to implement all or part of the project's platform or e-services.

ISAAC partners are also not ruling out future collaboration with another EU-funded project, Imageo, which combines smart-phone technology with mapping and geo-location applications that bring tourist snaps to life. The phone finds web matches for the image in the phone's display and tells the user what he or she is looking at in real time.

ISAAC delivered on many fronts, providing the means to transform a growing tourism sector into a well-managed, linked-up package of information, innovation tools, e-services and experiences (fun and learning) that really help to put e-heritage destinations on the map.

The ISAAC project received research funding under the EU's Sixth Framework Programme. The Institute of Technology Assessment and System Analysis of the Karlsruhe Institute of Technology coordinated the project.



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INTERVIEW

It's culture but not as we know it: *research*eu results supplement* talks with the people at Cinespace

Cinespace, an EU-funded project, developed a novel device that will help preserve one of Europe's greatest and most fragile assets — our culture. Only recently was it discovered that most of Europe's silent films were lost; withered away in industry, humid archives and backrooms. Film, old and new, provides insight into the vast diversity of languages and customs Europe has to offer. To keep the past and present alive, we must look forward to a digital future where cultural artefacts, like film, are preserved.

This is why *research*eu results supplement* decided to talk to Cinespace. We found out about their unique multi-media platform which promises not only to help keep Europe's cultural heritage from being lost to posterity, but also promote it. Both Dr Maria Teresa Linaza (ML) and Mr Gorka Diez (GD) from Cinespace were kind enough to share their thoughts and insights into their innovative project.

Ms Linaza, who is the Cinespace project technical coordinator, has a PhD in industrial engineering from the University of Navarra. She was also a member of the R & D team in the electronic and communications department of the CEIT research centre in San Sebastian, Spain. She taught and participated in training activities at the University of Navarra and was associate professor at the University of the Basque Country. She is also the author of several publications and has given a series of lectures on arts and new technologies in the field of cultural heritage. She currently works at Vicomtech.

Mr Diez, Cinespace project coordinator, obtained his law degree from the University of the Basque Country in 1997. He graduated in European and international law from the Université Catholique de Louvain, Belgium in 1998. From 1999 to 2007, he worked as European projects manager in Fundación ONCE mainly in the management, control and monitoring of the activities carried out within the 'Action programme to combat discrimination' (2001-06), and also as an assistant for European affairs and external

relations in the General Secretariat for Foreign Affairs of the Basque government. He joined the European projects department of Fomento de San Sebastián in 2007 and has been in charge of the coordination of the Cinespace project as well as developing and coordinating other European programmes.

• *Films are a rich facet of Europe's cultural heritage. And yet only recently it was discovered that most of Europe's early silent films have been lost. How does your project contribute to preserving this heritage, past and present, for future generations?*

[GD] The Cinespace consortium believes that films are unquestionably part of our cultural heritage. As stated by UNESCO, the documentary heritage in libraries and their archives constitute a major part of the collective memory. It basically reflects the diversity of people, languages and cultures. And we can't lose that.

We detected a number of problems with systems that are used to access cultural heritage resources which deal with film. Some of those included distributed sources which store huge amounts of information and different content formats. Finally, and what we find even more crucial for the content providers is the complete lack of systems needed to support user needs. This includes enriched content, interaction with the information, usability, and exchange of experiences with other users.

[ML] We took these gaps into account when designing the device. Our goal was to design and implement a mobile rich media collaborative information exchange platform. This platform had to be scalable and accessible through a wide variety of networks and therefore, interoperable and location-based for the promotion of film heritage. Cities with a strong connection to the film sector, like Venice, Glasgow and San Sebastián were instrumental to the project.

• *Your research involves some state-of-the-art technology. Can you take our readers*

through some of the innovations you're proposing in Cinespace.

[ML] Cinespace enables people to interact with location-based multimedia content while strolling through a city. Audio-visual information is delivered through small low-cost wireless binoculars. These binoculars have a high definition screen located near the eye and a set of audio phones. The binoculars also have a small camera that can record or send what you are 'seeing.' You can then upload it to a database through a WLAN hot spot or a 3G connection. That's how we create collaborative experiences with other people.

This is why the device can be used as a way to access cultural heritage media content. At the same time, it also allows visitors to create their own multimedia content which they can share with friends or relatives. Anyone really.

Your 'binoculars' fuse reality with virtual reality — an 'augmented reality' (AR) of sorts. Can you explain briefly how this works and how it benefits users, cultural tourists, cultural heritage?

[GD] You first need to log into a system at a tourist office or some other collection point. You also have your own icon. You can then start moving through the city while the Cinespace sensor fusion module calculates your coordinates in real time. Your position is refreshed every 5 seconds while your current situation is displayed on a map. Also, you are placed at the centre of the map so that, while you wonder around the city, the map will adapt so that you always remain in its centre. The system also displays the existing points of interest (PoIs) on the map.

[GD] One of the most outstanding features of the whole Cinespace approach is to place users in the setting where a famous movie scene may have taken place. When you want to navigate to a location, you simply click on the PoI on the map and then choose the navigation icon. You'll then be guided to the location. As you get closer, the system tells you where to turn.

[ML] And once there, the system will alert you. The PoI is identified by its coordinates and a radius around it. You can then retrieve multimedia content related to your profile, both from the city's providers and from other users.

Essentially, what happens is that rich media servers are sending you relevant content to match your immediate surroundings. You can then click on it and browse with ease any number of items that appear on the touch-screen.

If you see something interesting, you just select the content. As there are several types of content, the system analyses the format of the content and decides whether it should be rendered on the PDA or on the binoculars.

[ML] You can also look through the binoculars. When you pick them up and look through the eyepiece, the system will remind you to change modes from PDA to binocular. It then corrects your position and orientation. The system matches up the first frame of the selected clip with the real scene using marker-less tracking techniques. Once the process is finished, the clip is rendered. You can then pause the clip and restart it again.

• *A stroll along the canals in Venice, a walk through George Square in Glasgow. What would one expect to see in these two places while looking through the 'binoculars'? Is this what you refer to as film tourism?*

[ML] Basically, we call this a film-induced tourism concept. The relationship between tourism and feature films is a relatively new field of academic study. Film-induced tourism has been defined as 'tourist visits to a destination or attraction as a result of the destination being feature on television, video or the cinema screen.' Films with great commercial impact provide spectators with a concrete vision of the environment. This vision can influence spectators in such a way that they travel to the shooting locations.

Take for example Peter Jackson. When he shot the Lord of the Rings, he could not have imagined the impact on tourism in New Zealand. Nowadays, all of New Zealand's destination management organisations and tour operators use the film alongside special deals and on their websites.

[GD] Another example is Venice. Some would say the city is a perfect place for romantic scenarios. It's not surprising that a lot of films about love are shot there. Another cinematographic genre with a lot of examples is represented by historic



films. Venice can be seen as a metaphor for many themes and genres represented by different characters and famous actors. The travels of Marco Polo, Casanova's love story, or the mad adventures of Indiana Jones and James Bond. Mystery, getaways, secrets, decline and death like Death in Venice have all been shot on location in the famous Italian city.

• *We read somewhere that you could also, for instance, place yourself in the same spot where Audrey Hepburn stood at St Marks Square in Venice. Does this mean you can actually re-enact scenes from films in real time?*

[GD] The idea behind this is for people to get to experience events that were recorded in a real place. Many film lovers seek out these spots where well-known films were shot. I imagine this kind of makes them feel like the stars themselves! The audience tends to identify itself with the main character and like to visit the locations where their film star once stood. This is already happening in Australia's Kakadu National Park. A lot of people go there to recreate the adventures of Crocodile Dundee.

• *Famed science fiction writer William Gibson was once credited as having imagined a world where 'data dances with the human mind.' Immersing an individual into an environment that is both real and virtual seems potentially disorienting. What kind of reaction have you had from people who have tested the device?*

[GD] Well, our first user test was with a preliminary version of the prototype.

It took place in January 2008 and in different settings like St Marks square in Venice or La Concha beach and the Town Hall in San Sebastián. Overall, these tests were successful and provided us with valuable feedback. People were satisfied with the project concept and the potential of the prototype. They also gave us a range of suggestions that we used to enhance the on-going development process.

The final Cinespace system was tested in San Sebastián and Venice in July of last year. People who tried the device had positive reactions. They rated highly the overall concept of the system and the quality of the AR content. Most in both cities were satisfied or quite satisfied with the area selected for the trial. With respect to content and services, most were satisfied with the content quantity and quality, although film lovers are obviously severe judges when it comes to quality. Finally, almost everyone found the experience useful. In fact, they wanted to keep using it to discover other areas of the city. Everyone said they would use the device again. I think this demonstrates the great potential of such technologies for film-induced tourism experiences.

For tourists and local citizens, such AR and location-aware systems offer a new way to discover a city or even to rediscover your home town. During the San Sebastián tests we also used it to help film professionals scout film locations, and to show locals more about their own city. The reaction of many was: 'Wow, I didn't know that



film was shot here! Or I didn't know this area used to look like that!'

• **Social network services, the internet, mobile devices have redefined how people communicate. It seems to me that your device has a similar potential because it is able to create visual information while 'on the move' that can then be uploaded and shared in a collaborative environment. Is this a new type of interactive communication platform? And what would this collaborative environment look like?**
[ML] First of all, it must be mentioned that the project began several years ago, before the boom of mobile AR applications based on Layar or Wikitude, so many of the concepts about collaborative environments have already been overtaken. Cinespace targets two main concepts related to collaborative environments: creation and sharing of contents; and peer-to-peer interaction.

People can create, annotate and store several types of content on-the-move, including images, audio and video when using this device. While walking through the city, they may watch something interesting and want to record it. You can choose the type of multimedia content to be recorded, some keywords about it and a personal message. If the system detects that the generated content is a video or audio, it will enable you to select a language item on the list or create a new one. Moreover, the system locates your position and orientation to help you understand some concepts behind the annotation process.

You are represented on the map using your own personal icon. This way you can chat with a list of friends when you

hook up to a WLAN hot spot. You can also take a picture and just send it in real time, without annotating or storing it.

• **People are familiar with the dusty work of archaeologists meticulously recording artefacts as they dig them up. But explain how ICT research projects like this help to preserve the past digitally. Do old and new-school archivists always agree on the methods?**

[GD] We kind of touched on this at the beginning of this interview. Essentially, the documentary heritage in libraries and their archives constitutes a major part of the collective memory because it reflects the diversity of people, languages and cultures. Collective memory is recorded in hundreds of hours of films stored in many audiovisual archives. Unfortunately, these archives are underused. Europe's cities have a wealth of audiovisual content, from historical images and documentary footage to film scenes and photographs that they can use to enhance the experiences of visitors, local residents or even film professionals.

• **We are perhaps only seeing the beginning of what is possible in this field. If you had a crystal ball, where do you think we'll be in 10, 20 or 30 year's time? Does Europe have an advantage in the field of cultural heritage [i.e. it has so much to preserve and so much to offer]?**

[ML] Although it is difficult to predict the status of the technology in such a long period of time, it is clear that Europe should take advantage of ICT research initiatives like ours to preserve and enhance its rich and valuable cultural heritage. In our opinion, two main challenges remain; the interoperability of digital contents based

on standards, and enriched interaction with those contents. One of the main current bottlenecks for the dissemination of cultural knowledge is its fragmentation and lack of standardisation. Despite the big effort done by Europeana — the portal of European digital artefacts — it is still very difficult for cultural organisations to join this trend. Also, experiences provided by cultural institutions are far from interactive and exciting when compared to other ICT applications, such as games or mobile services. Therefore, new efforts should be conducted in both directions.

• **Are we converting this into a technological leadership or advantage?**

[ML] Europe has a large cultural and creative industry, which can make profit out of these experiences. However, this industry has not been recognised as such and it is still considered as a grant-based industry. The main challenge is to convert this technological leadership. It's not just a financial problem. In fact, it's more of a social issue.

• **The Cinespace project ended June 2009. What kind of interest has it generated in the tourist industry and/or business community?**

[GD] Results of the project have been disseminated through the industry. Although the business plan is confidential, we can affirm that our device has been successfully presented to several industrial representatives in the cultural sector. It may be possible to see innovative applications based on the device in the future. Eventually, implemented semantic content retrieval systems will be used in cities to provide advanced services over other mobile platforms. There-in lies the future.

Giving shape to public opinion at museums and galleries

The power of video for assessing the human response to new forms of artistic expression was successfully demonstrated during the 'Situating hybrid assemblies in public environments' (SHAPE) project.

Museums and galleries are experimenting with cutting edge exhibitions that blur the line between the real world and the virtual world. They are populated with hybrid artefacts that possess both physical and digital attributes. It is essential to gauge the public's reaction

to these so-called 'living exhibitions.'

Rather than rely upon traditional methods of eliciting public opinion, such as questionnaires or interviews, scientists at



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King's College London came up with a new approach. Their pioneering research was supported by the Information Society

Technologies Programme in the framework of the SHAPE project.

The technique involved an intricate analysis of video footage of museum visitors observing and discussing the exhibits. Body language and spoken language were examined both separately and in relation to one another according to the tenets of

ethnomethodology. This provided insight into key aspects of social interaction in the context of the exhibits.

A crucial advantage of this method was that it captured both the individual and group response in real-time as the exhibit was being experienced. The researchers with King's College London have moved

to copyright this technique, which has been described in a number of papers and presented at several conferences.

Funded under the FP5 programme IST
(User-friendly information society).

Collaboration sought: further research or development support.
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The city, 2.0

Augmented reality tours of real monuments, instant visualisation of virtual objects on living cityscapes and user-generated, digital story telling around famous landmarks are just some of the new applications made possible by breakthrough European research into mixed reality. This is the city, 2.0.

You are walking through modern-day Cologne on a beautiful morning radiant with the promise of summer. Abruptly, you are approached by a short, elf-like character.

Instantly, the cityscape morphs strangely and you now stand, in the same street, before a tent that obviously dates from Medieval times. You have entered a time warp. To escape the various time periods you must complete a series of challenges posted by the elves.

This was the augmented experience of around 60 volunteers at the TimeWarp field trial held in real-world Cologne in January 2010. The trial was a test and a demonstrator of one of the applications developed by European researchers at the IPCity project.

It had a surprising impact. The media were fascinated, the participants enthralled and the passers-by mystified: 'Why were these cyborgs bursting with technology and gesturing oddly at empty space?'

The IPCity project coordinator, Rod McCall, explains: 'The users quickly got used to the augmented reality technology that they carried, and they would act in odd ways. Passers-by were often confused about what exactly was going on and even intervened, but it was a convincing and fun experience for the participants.'

Real, virtual experiences

It is a very unusual concept; it was a real experience, the users did interact with elves

that were invisible to the rest of the world. It happened in a world that mixed virtual people and objects with modern streetscapes in a new cross-reality. For the users, it was a new fusion between real and virtual worlds.

TimeWarp is a mobile augmented reality game originally played in the Old Town of Cologne by two players. They take on the role of agents working for the so-called ChronoGuard, investigating breaches in the time-space continuum. Their task is to locate little gnome-like robots called 'Heinzelmännchen', inspired by the real Heinzelmännchen legend from Cologne.

To complete the task, players use their ultra-mobile PCs (UMPCs) to travel into different time periods, evoked by a mix of music, sound-effects and virtual 3D objects and characters superimposed onto reality via VR glasses.

In this way, players visit Roman, Medieval and future versions of the surrounding city where they are confronted with different tasks and dilemmas. In addition, the UMPC has a motion sensor which allows players to interact with the game more intuitively.

While the hardware elements are fairly standard, it is their combination with subtle effects that created an engaging and enjoyable experience for users.



'It also brings them into contact with the history and culture of the city, so it has an educational and participative element, too,' notes Mr McCall.

Presence, interaction, experience

That was a crucial element of all IPCity's work. The applications revolved around presence, interaction and experiences with the city, though many of the techniques and technologies could be adapted to other scenarios.

The City Tales application, for example, sought to place a user-generated digital layer over the physical fabric of the city, a bit like a Facebook of the physical world, where users could post personal stories about the city based on a physical element rooted at a specific point in the landscape.

Storytelling is a particularly interesting example of IPCity's work, because it demonstrates the range of tasks the project had to execute. For example, GPS is not nearly accurate enough to map virtual contents accurately into the cityscape, therefore alternative approaches had to be developed.





For example, IPCity developed a localisation technology driven by computer vision. It automatically recognises real-world elements based on captured images from the user's location. For example, users can leave virtual graffiti on real-world locations — without incurring the wrath of city authorities.

Other work included authoring tools, so companies or city authorities can easily set up services and create appropriate content for it. The authoring tools work with all the applications developed by the project.

Furthermore, device integration and software interfaces had to be developed for each application, and fundamental to all applications was the theoretical and analytical work that defined the rules for creating engaging mixed reality experiences.

Through the looking glass

In some respects the work of IPCity represents a radical shift in direction for digital technologies. For much of the history of the internet, people entered deeper and deeper into the virtual world, through social networking, gaming and virtual reality.

But in IPCity, 'virtuality' reverses direction, bringing internet concepts into the real world, with objects in the streetscape unlocking virtual characters, messages and information. Instead of people entering the digital landscape of the internet, digital objects are beginning to colonise the real world. So, prepare to be V-Ex'd!

The IPCity project received funding from the FET-Proactive strand of the EU's Sixth Framework Programme for research.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&id=91378>

New paradigm for scientific publication and peer review

Scientific knowledge has been shared in the same way for centuries. A European research project advocates replacing papers and peer reviews with a new process inspired by the social Web.

Scientists spend too much of their time publishing papers and ploughing through the mountains of papers produced by their colleagues, and not enough time doing science.

That's the observation — and frustration — that spurred Fabio Casati and his collaborators to launch 'Innovating the scientific knowledge object lifecycle' (LiquidPublication), an EU-financed research project that seeks to revolutionise how scientists share their

work and evaluate the contributions of their peers.

'The more papers you produce, the more brownie points you get,' says Mr Casati. 'So most of your time is spent writing papers instead of thinking or doing science.'

Besides wasting untold hours, Mr Casati says, the current scientific publication paradigm produces other toxic fallout including an unduly heavy load for peer

reviewers and too many papers that recycle already published research or dribble out results a bit at a time.

'The current system generates a tremendous amount of noise,' he says. 'It's hard to find interesting new knowledge because there's so much to see.'

Mr Casati and his colleagues are developing and promoting a radically new way to share scientific knowledge, which they call 'liquid publication.' They want to tap the power of the Web — including its ability to speed communication, facilitate data storage, search and retrieval, and foster communities of interest — to replace traditional peer reviews and paper publications with a faster, fairer and more flexible process.

'If we can make scientists' work even ten percent more efficiently, it will give a great benefit to the community,' Mr Casati says.

Don't print it; post it

Following the lead of physicists and mathematicians who for years have been posting early versions of their papers on a website called arXiv.com for quick dissemination and peer critiques, Mr Casati and his colleagues propose that all scientists jumpstart the dissemination of their findings by posting them online.

'The idea is that when people write papers, they put them on their webpage quickly, easily and for zero cost,' Mr Casati says.

At the same time, Mr Casati suggests, every scientist and research group can create its own 'liquid journal' which groups publications that are interesting and relevant to a given topic.



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'Suppose I want to create a journal on, say, interesting findings in peer review, that I want to use to collaborate with my research group and my peers,' says Mr Casati. 'I will go fish for interesting papers that are on the Web. People don't submit to my journal, they just post to their webpage or to an archive. I find the paper and include it in my journal. Everybody can do this.'

Furthermore, a journal need not contain only papers. Experiments, datasets, and even blogs can be first-class citizens in the work of science,' he says.

Readers of a liquid journal can 'create' knowledge too. Besides accessing or commenting on papers, readers can link papers (for example to point out that paper P2 is an evolution of paper P1, or to note that paper P reports on a given experiment which is, in turn, performed on a certain dataset). Such contextual knowledge is essential to finding information easily, Mr Casati suggests.

Another benefit Mr Casati foresees from liquid publication is a reduction in multiple papers that merely report incremental new results. Instead, borrowing a tool from software developers, he would like to see such incremental changes clearly identified by versions – for example 'beyond peer review' versions 1, 2 and 3.

'Instead of completely different papers, version 3 would appear as a small adjustment to version 2,' Mr Casati says. 'When I as a reader search for knowledge, I can go directly to the most recent version. And this 'connection knowledge' is provided for free by the community.'

Don't review it; use it

This radical new approach to scientific publication offers an equally radical alternative to the peer review process. For the past 300 years, Mr Casati argues, printing and publishing a scientific paper was a costly process. Because of this, gatekeepers were needed to judge which contributions were worth publishing; hence peer reviews. Since liquid publications cost nothing, he says, a major justification for those gatekeepers vanishes.

But what about quality control, the important task of shepherding good research into the limelight and blocking sloppy or even falsified findings from the research canon?

'We've studied this and found that peer review doesn't work, in the sense that there seems to be very little correlation between the judgement of peer reviewers and the fate of a paper after publication,' says Mr Casati. 'Many papers get very high marks from their peer reviewers but have little effect on the field. And on the other hand, many papers get average ratings but have a big impact.'

Mr Casati and his colleagues suggest replacing peer review — in which typically three researchers determine the fate of a piece of research — with the assessment that is implicitly given by the relevant community while editing and reading liquid journals.

'If you and I include this paper in our journals, we are giving it value,' says Mr Casati. 'When this is done by hundreds of people like us, we're using the selection power of the entire community to value the contribution. Interesting papers will rise above the noise.'

Scientists already supplement peer review with measures of how frequently a paper is cited by other papers. Mr Casati believes that the community evaluation approach would prove more immune to distortions, for example by researchers pushing their findings or authors citing papers they haven't bothered to read.

A further bonus of liquid publication, Mr Casati says, would be to give appropriate value, for the first time, to contributions such as a stimulating blog, a nice data set or a useful computer code. 'With liquid publication and community evaluation,' says Mr Casati, 'everything counts.'

The LiquidPublication consortium is putting its ideas into practice, starting with an open source software platform and its own liquid journal on peer review.

'We're bootstrapping this approach,' says Mr Casati. 'We believe that people will start doing this when they find that it's useful to them, like Google or Facebook.'

They may be starting small, but the interest of consortium members, such as the French National Centre for Scientific Research and the publishing powerhouse Springer Science, reflects the fact that they are tackling a large and extremely important problem.

The LiquidPublication project received funding from the FET-Open strand of the Seventh Framework Programme for research.

Promoted through the ICT Results service. <http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&id=91404>

Understanding the role of agents in virtual cities

A new platform developed by computer science experts in Sweden will be of interest to both academic and commercial organisations engaged in advanced software agent research.

The idea behind the Information Cities (ICITIES) project was to apply knowledge of how real cities evolve over time and how their inhabitants interact to their virtual counterparts. The project participants included universities, research institutes as well as industry representatives. Support was

provided by the EU's Fifth Framework Programme (FP5).

ICITIES researchers with the Swedish Institute of Computer Science (SICS) helped develop a large-scale agent-based simulation environment. Virtual cities of the future will no doubt rely



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heavily on software programs that will carry out tasks on behalf of users. ICI-TIES developed infrastructure capable of testing a wide range of such software agents simultaneously.

A specification mechanism made it possible to configure and run multiple models at the same time, including different configurations of the same model. Agent collections and landscape elements had to be defined for each individual model

simulation. The ability to retrieve and reuse basic software components from a dedicated library helped the design phase.

Another key element of SICS' platform focused on managing the behaviour of the agents. Several so-called workers could be deployed, each assigned to a particular collection of agents. The computing power required to run the simulation environment was provided by clusters of workstations operating in

parallel. Where possible, the user requirements with respect to programming skill were minimised. Finally, commercially available graphics packages have been recommended for visualisation of the simulation results.

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Collaboration sought: further research or development support;
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Virtual reality you can reach out and touch

A team of European researchers has 'virtually' teleported real objects through cyberspace, touched things in virtual reality and even felt the movements of a virtual dance partner.

It sounds like science fiction, but advances in haptic technology and a new approach to generating virtual reality (VR) content are helping to create virtual experiences that are far more realistic and immersive than anything achieved before.

Not only do users see and hear their virtual surroundings, objects and avatars, but they can touch them as well, paving the way for new applications in telepresence, telemedicine, industrial design, gaming and entertainment.

'The audiovisual aspects of VR have come a long way in recent years, so adding a sense of touch is the next step,' says Andreas Schweinberger, a researcher at Technische Universität München in Germany. 'We know that the more senses that can be used, the more interaction, the greater the sense of presence. And a stronger sense of presence means the experience is more immersive and realistic.'

Mr Schweinberger led a team from nine universities and research institutes in developing technology to make VR objects and characters touchable. With funding from the EU in the Immersence project, they developed innovative haptic and multi-modal interfaces, new signal processing techniques and a pioneering method to generate VR objects from real-world objects in real time.

The latter technology, developed at the Computer Vision Laboratory of Swiss

project partner ETH Zürich, uses a 3D scanner and advanced modelling system to create a virtual representation of a real object, such as a cup, box or, in one experiment, a green fluffy toy frog. The 3D digital representation of the object can then be transmitted to someone at a remote location, who, by wearing VR goggles and touching a haptic interface, can move, prod and poke it.

'Haptic technology is still in the early stages. For the haptic interface, we used a robotic arm called a Phantom that has one contact point. This gives the sense of touching an object, but you can't pick

it up or handle it. However, one of the other project partners, the Universidad Politécnica de Madrid, is developing a haptic device with two contact points that should make it possible to grasp an object with a virtual hand,' Mr Schweinberger explains.

The researchers also worked on techniques that would allow a user to feel different textures and sense the stiffness of an object, enabling them to differentiate between a hard box, a soft fluffy frog or even a liquid.

Would you care to dance?

The 'Immersive multi-modal interactive presence' (Immersence) researchers did not stop at human-object interaction, however. Technische Universität München also developed technology to enable human-human interaction in a virtual environment.



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At the lab in Munich, they used a mobile robotic platform with two arms to serve as the dance partner for a real human dancer. By wearing VR goggles, the user would see a dancer of the opposite sex and could dance with them by holding the 'hands' of the robot.

'To program the robot we first recorded the forces, balance and movement of a real human dancer and applied these to the robot. In a VR environment, the robot could be a computer-controlled agent or the avatar of another person,' the project manager says.

French partner Université d'Evry went one step further and studied how to give the sensation of two people handling an object, such as lifting a heavy box, all virtually.

'It is not as simple as one person taking the lead and the other following. In real-

ity, it is a negotiation process and the robotic interface has to be programmed for that,' Mr Schweinberger notes.

Gamers will obviously be delighted by the developments, which promise to bring a whole new dimension and realism to VR environments. Besides entertainment, however, there are many serious applications for haptic VR technology. Doctors, for example, could use it to treat patients remotely, physiotherapists could use it for training and rehabilitation and industrial designers could collaborate remotely by virtually 'teleporting' touchable digital mock-ups of designs over the internet.

'The research will also help in the development of cognitive robots that are better able to interact with humans,' notes Mr Schweinberger, whose team is continuing research on that aspect of the Immersence project, which received

funding under the FET-proactive strand of the EU's Sixth Framework Programme. ETH Zürich, meanwhile, is set to continue developing its virtual teleporter.

Several of the project partners are also continuing their work in the EU-funded Beaming project where they plan to develop a virtual reality room in which several mobile robots will move around autonomously and simulated objects, such as a table, chair or door, will be experienced by the user immersed in a virtual world.

Star Trek's Holodeck, it seems, may only be a few years away.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&id=91335>

Cut-and-paste simplicity for computer animation

Tools developed by European researchers bring cut-and-paste simplicity to gaming and animation. Users will be able to cut-and-paste complex elements like emotion, tone of voice and facial expression, making compelling new content, cheaply and quickly.

There is an explosion. Victims lie maimed or dead around the street. You are part of the emergency response and you have to quickly decide who needs urgent medical treatment. Breathing rate, skin tone, the wound severity and mental acuity are key indicators, and you quickly perform brief confirming tests as you move through the scene.

This is an animation, but it is much richer and more detailed than the current triage simulations available on the healthcare training market. What's more, the simulation was developed more quickly and cheaply than the current state of the art.

It is also a clear demonstration of 21st century audiovisual animation, where recently developed European technology has brought the cut-and-paste simplicity of the internet to animation, audio-processing and semantic search for audiovisual elements.

Cut-and-paste simplicity

It is the work of the Salero project, a large continent-wide effort to streamline the production process and maximise content reuse in computer gaming and animation for online and broadcast entertainment.

Thirteen partners spent over EUR 13 million (EUR 8 million provided by the EU) to create two dozen applications, tools and showcases in an all-points efforts to dramatically improve audiovisual animation workflow. Audio and video transmission, processing and transformation are all affected by the broad range of tools and techniques developed by the project over the last four years.

The fundamental concept behind the project 'Semantic audio-visual entertainment reusable objects' (Salero) was to create systems that would allow audio and video content to be easily and quickly repurposed for many different scenes

within one project, and for transferring and adapting content between different projects.

In the long term, film and TV producers, animators, video game developers and performing arts groups will be able to mix and match digital elements simply. And they will be able to quickly and convincingly modify and adapt the content to suit their specific needs.

Synthetic emotions

The project focused on three main areas; audio processing, computer animation and semantic search. In each area, they produced tools that will enable existing media to be found and adapted to new content, either automatically or semi-automatically.

With the synthetic emotional model, for example, artists can animate a large emotional range by simply changing two variables, called activation and evaluation. Activation controls the strength of the emotion while evaluation controls the positive and negative balance between, say, a smile and a frown. Using just these two variables an animator is able to create dozens of expressions in a fraction of the time it takes currently.



Another tool, the Maskle, provides an easy way to transfer already defined emotions to a new face. In a first step, the animator selects 'handles' on the characters face, at the top, bottom and sides of the lips, for instance, and so defines basic expressions simply by moving these handles. The Maskle is then applied to a newly designed face and can help to specify a spectrum of emotions based on the defined basic expressions using the synthetic emotional model.

But Salero's animation tools go way beyond facial expression. They work on body mechanics, too. The user can set a range of variables for a character, including his or her gender, ethnicity, age and weight, with each element modifying the appearance, according to Georg Thallinger, a researcher with Joanneum Research and coordinator of the Salero project.

'But these variables also impact the character's gait and body movement. Using other tools we have developed, the animator can then simply point to an area where the character must go, and the software chooses the path and animates the character variables, and the quality of the surface along the route,' he says.

The required gait is determined automatically, so if a character must move across sand, or tarmac, body movement adapts appropriately.

Sophisticated semi-automation

This is an enormously sophisticated, semi-automated process, and it will save thousands of production man-hours. Tools like these, and others developed by Salero, will ultimately mean that state-of-the-art animation effects reach beyond big budget movie-making.

Audio processing, too, received a big boost in Salero. Here the team developed audio processing and synthesising tools to make voice recording cheaper and faster. Audio transformation, for example, can take a voice recording and change the gender, age, speed, timbre and pitch of the voice, easily adapting it from a strong, young woman to a weak old man.

Even the emotional stress of the voice can be adapted, from joyful to angry, by adjusting certain values. Computer-generated voices can be created and then transformed, too.

'It means you do not need as many voice actors, which is expensive, and it does not take as long to create a wide variety of characters expressing a broad range of emotions,' notes Mr Thallinger.

Intelligent content

Work within the project even developed a system to identify emotional stress, so that the character animation can be perfectly synched with tone of voice. 'It leads to a much more realistic and convincing animation when movement is synched across voice and video in this way,' Mr Thallinger stresses.

Underlying all these efforts is a broad thrust to create intelligent content, which advertises its elements or component structure. For this task, Salero borrowed ideas from the 'semantic web', developing an ontology, or dictionary of specific terms, to describe audiovisual content.

It also developed archiving and retrieval tools and, particularly, a very clever annotating tool. 'We knew that there is no way an animator is going to spend much time tagging content in a real work environment, there is just no time, so we used a statement-based annotating tool that quickly populates the content with relevant metadata by getting the animator to make specific statements about it.'

Excited studios

The work of the Salero project has generated a lot of interest. 'In particular, studios are very excited about the audio and animating tools,' reveals Mr Thallinger. 'For the annotating work, they were less enthusiastic, mainly because I think they are not familiar with it. But towards the end of the project, audiovisual companies started expressing a lot more interest about semantic technologies, because I think the concepts around that field start to get known also in industry.'

Indeed, over time the annotating tools promise to deliver the greatest impact to the industry, allowing producers to rapidly create content from an ever-expanding library of earlier work. It could lead to stock animation galleries, in the same manner that stock photo galleries exist now.

In the meantime, Salero has permitted studios to create compelling, Hollywood-quality content quickly, efficiently and cost-effectively.

The Salero project received funding from the ICT strand of the Sixth Framework Programme for research.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&id=91392>



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Towards streamlined ship monitoring and data transfer

Public awareness of devastating shipping accidents has brought about a call for more stringent safety standards. In response, an EU project study has covered one important aspect - the long-range ship monitoring and data transfer conducted by coastguard coordination services.

The 'Maritime transport co-ordination platform' (MTCP) project addressed the necessity for boosting Europe's maritime activities and expertise. Safer waterway travel can reduce accidents and pollution caused by oil spills. The aim was to improve sustainable surface transport and arrive at safer and more efficient operations.

One such study covered the coastguard coordination services of the EU, focusing on long range ship monitoring and data transfer. Particular emphasis was on the electronic processing of ship and cargo

data and the long-range ship-to-shore transmission of information concerning maritime safety and pollution prevention.

Information requirements and candidate systems for long-range information transfer were analysed and criteria were established for the comparison of various candidate systems. From this, the study provided several important conclusions. Among these was that the volume of information communicated from the vessel should include only legal requirements set at an

international level, leaving transfer of larger data to be done from the shore.

All of the information obtained from the study can be beneficial for EU Member States coastguard services and can be integrated into other initiatives dedicated to the safe and efficient of maritime information. A cooperative effort could serve as an effective measure for dealing with oil spills and other similar environmental accidents.

Funded under the FP6 programme Sustdev
(Sustainable development, global change and ecosystems).

Collaboration sought: information exchange/training.
<http://cordis.europa.eu/marketplace> > search > offers > 5500

See also page 24 **'When the law works against natural habitats'**



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Watch this space!

Coming up in issue 28 of *research*eu results supplement* a special dossier on 'Clean technology: change that Europe can believe in'. What Europe's researchers are doing to meet growing energy needs and the climate challenge.

Europe's first mobile robotic bin-on-call

European researchers have built a robot for 'on-demand' rubbish collection – just make a call and it will soon arrive at your door. It's ideal for collecting waste in the narrow streets of many historical towns.

It is 6.30am, a beautiful sunny morning. But instead of awakening to the merry singing of birds, there are scrapes and bangs, a roar of an engine and the unmistakable grinding of the rubbish lorry as it crushes its load and moves on up the street.

Before you groan and roll over back to sleep, spare a thought for the many residents who do not have the luxury of door-to-door rubbish and recycling collections. In the historical centres of so many towns and cities in Europe, where the streets are narrow, pedestrianised or otherwise inaccessible to vehicles, residents usually have to deal with their own rubbish.

But an EU-funded project called 'Networked and cooperating robots for urban hygiene' (Dustbot) has come up with an ingenious solution. A robot, about the size of a person, can navigate the narrowest of alleys, stop outside your door and take your rubbish away. And the best bit is this: the robotic service is 'on demand'. You don't have to remember when to put your bin out, but simply make a telephone call. Soon the robot, called 'DustCart', is waiting outside your door, ready to receive your rubbish.

Advanced robotics for rubbish

Professor Paolo Dario, the coordinator of Dustbot, says the robot is essentially a mobile bin, but this description does this rotund little machine a disservice: it is bristling with state-of-the-art sense and control technologies.

'We've taken the very best and most advanced robotics components to build DustCart which solves a very real problem for waste authorities across Europe,' explains Prof. Dario. 'Yes, it is a bin on wheels — there's the drawer in which you place your bag of rubbish or recycling — but there's a lot more to the robot than that.'

For a start, DustCart is safe to let loose on the street on its own. The robot is mounted with cameras and other sensors so it can 'see' where it is going. It scans the path ahead and processes

the information to avoid stationary objects. It also picks out moving objects — pedestrians, bicycles, even stray dogs — quickly computes their trajectory and alters its course to avoid a collision. The visual images are also relayed to a control centre where human operators can check everything is OK and intervene if necessary.

To navigate its way to a resident's home, DustCart uses a clever triangulation system, interacting with a wireless network set up across the robot's area of operation. The network can pinpoint the robot, calculate optimal routes between pick-ups, and communicate this information to the robot.

'It is the dream of every robotics research to develop a fully automated and intelligent system,' says Prof. Dario, 'but we have chosen a different approach. Here, we have a smart robot in a smart environment; the robot "talks" to its surroundings and the surroundings communicate back. This means the robot has access to a lot more information and computing power.'

DustCart has three levels of intelligent control. First there are the autonomous, built-in systems including motion sensing, obstacle avoidance and user-interface functions including speech recognition. Then there is the ambient intelligent environment which supervises the robot, sends it commands and navigates it through the streets. Finally, a human control centre monitors operations, but only intervenes in an emergency or where the technology fails.

'The control centre also provides security for the robot,' Prof. Dario adds, 'just in case anyone tries to steal or tamper with it!'

Waste no time

As part of the project DustCart performed demonstrations in six European locations, plus two in Japan and one in South Korea. 'We have substantial information on the performance of the system and its safety. We have had no major failures yet and no safety breaches. The robot is supervised through CCTV. And we also have insurance, which basically means that the insurer is satisfied that the robot is safe to use on the streets.'

The Dustbot project received funding from the Sixth Framework Programme for research and came to an end in December 2009. But two SMEs from the project and Professor Dario's research department at the Scuola Superiore Sant'Anna in Pisa are spearheading further development work.

In May 2010, DustCart entered a two-month period of service in the small town of Peccioli in Italy — around 100 households being served by two DustCart robots. Crucially, during pilot trials like this, the houses do not receive their normal waste collection service.



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'This [was] an excellent real-world trial [to] assess, most importantly, customer satisfaction. We've had interested from several municipalities, but investors need to know that there is a credible market for the system, that residents will favour the new approach.

'We have talked to numerous potential investors and could raise several million euros in investment, but there first needs to be more evaluation. If this trial is successful we will immediately work to raise the cash and hope to begin early development of a commercial system by the end of 2010,' he says.

Prof. Dario estimates that there could be a market for at least 100 000 of these robots across Europe. Moreover, the cost of using these robots would be comparable to door-to-door waste

and recycling collections that most people have today, and a more convenient service should help to increase recycling rates.

'There's a really strong financial and environmental case for this "on-demand" approach, which we think will also be more user-friendly and convenient,' says Prof. Dario.

Certainly those of us woken by the early morning bin round couldn't agree more.

Dustbot was funded under the ICT strand of the EU's Sixth Framework Programme for research.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&id=91382>

See also page 24 'Best ways to collect urban waste'

How three-legged dogs improve robot design

EU scientists working at the Friedrich Schiller University of Jena in Germany have examined how three-legged dogs move in order to develop robots that can help them continue functioning in the event of the loss of a limb.

EU support for the research came from the 'Robust robot locomotion and movements through morphology and morphosis' (Locomorph) project, which received EUR 2.7 million from the 'Embodied intelligence' initiative within the 'Information and communication technologies' (ICT) thematic area of the Seventh Framework Programme (FP7).

Canines are known for their resilience in the face of limb-loss, often managing to move about admirably on three legs. So researchers in Germany wanted to discover how they managed to move so capably without a full set of limbs. They looked at walking and running techniques in dogs with fore-limb or hind-limb amputations and found that the animals adopted different coping techniques or 'compensation strategies' to retain their mobility depending on which limb was missing.

'Natural terrestrial locomotion is designed for an even number of limbs,' explained Dr Martin Gross, lead researcher and biologist at the Friedrich-Schiller University of Jena. 'After limb loss, for example by an injury, a re-organisation of the locomotive system is required.'

Dr Gross and colleagues discovered that the dogs found it more difficult to deal with a missing fore-limb than a missing hind-limb. They explained that with

a hind-leg amputation, the fore-limbs continued to act as they would normally in a four-legged dog, showing little or no compensation strategy.

However, if a fore-limb was missing, the remaining limbs were forced to undergo careful adaptation to coordinate with each other via a process known as 'gait compensation', concluded the researchers. They suggested that this difference was due to the higher loading of the fore-limbs in comparison to the hind-limbs because of the distribution of the dogs' body weight.

The scientists came to these conclusions after analysing dogs with fore-limb and hind-limb amputations running on a treadmill, synchronised to 10 high-speed infrared cameras, for 2 minutes at a time. They placed reflective markers on the dogs' skin to follow the movement of separate parts of the body and recorded the trajectory of the movements. They then made complex comparisons of the characteristics of movement, known as kinematics, between dogs with different limbs missing and also with the 'normal' movement of four-legged dogs.

The results of this study were presented at the Society for Experimental Biology Annual Meeting in Prague in the Czech Republic on 1 July 2010. But the scientists insisted that their research was ongoing and said they hoped to make further measurements to consolidate their findings.

Their work is an outcome of the four-year EU Locomorph project being carried out by biologists, physicists and engineers at a host of institutions, notably the University of Zurich and the Ecole Polytechnique Fédérale de Lausanne in Switzerland, the University of Syddansk in Denmark, the University of Antwerp in Belgium and the University of Ryerson in Canada, as well as the University of Jena.

Kick-started in 2009, the project's goal is to advance robotic locomotion and movement through a multidisciplinary approach that takes into account biology, biomechanics, neuroscience, robotics and embodied intelligence.

Researchers hope to find ways of increasing the efficiency, robustness, and thus the usability of robots in unknown environments.

Future work under the Locomorph project to develop a better understanding of locomotive activity will examine voluntary and involuntary changes to body movement in a wide range of different animals, from lizards to okapis, and baboons to humans.



Promoted through the Research Information Centre.

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Designer optoelectronics — quantum mechanics for new materials

European researchers have combined computer modelling of quantum mechanics and precision fabrication processes to create novel transparent conductive oxides made to order for a wide range of scientific and consumer applications.

Imagine specifying exactly how you want a new material to behave, handing those specs to an engineer, and getting back a brand-new material with exactly the qualities you need.

That's what the EU-funded project 'Novel advanced transparent conductive oxides (NATCO)' set out to do. They designed and developed novel transparent conductive oxides (TCOs) to exacting specifications by applying quantum mechanics to predict a material's optical and electronic properties, fabricating it, and checking their results experimentally.



The results? Completely new TCOs with a wide range of potential applications in sensors, solar cells, smart windows, and dozens of other scientific, commercial and consumer products.

'In the field of optoelectronics, there's a great need to find better and less costly materials,' says Dr Guy Garry, coordinator of the NATCO project. 'The route we took was first to make calculations to find the best way to get the properties that we needed. When we fabricated these materials, we found that their properties were the same as we had calculated.'

This rational design process — using first principles to calculate the conductivity and transparency of novel materials before fabricating them — allowed the researchers to develop new TCOs with enhanced performance rapidly and efficiently.

'We were able to make these calculations very quickly, which allowed us to enhance existing properties and find new properties,' says Dr Garry.

TCOs — materials that combine transparency and conductivity, qualities that are not usually found together — have multiple applications. As sensors, photovoltaics, light emitting devices and electronically controllable films, they are found in scientific instruments, DVDs, digital cameras, mobile phones, computer displays and hundreds of other products.

Until recently, most TCOs relied on a material called ITO, an oxide of indium which is doped — slightly modified — by the addition of a small quantity of tin. ITOs have proved useful, but, Dr Garry says, suffer from two drawbacks. Their transparency is not very good, especially in the near-infrared range, and indium is in short supply and very expensive.

The NATCO team decided to explore a completely different material, strontium cuprate doped with varying amounts of barium. Copper, barium and strontium are far more abundant and much less expensive than indium.

Extensive calculations applying quantum mechanics predicted that, by doping strontium cuprate with a few percent by weight of barium, the researchers could create precisely the materials they wanted, combining good electrical conductivity and optical transparency.

Fabricating the new materials was a challenge. At first the materials were fabricated in the form of bulk ceramics and then, for actual applications, thin layers were deposited on suitable substrates.

In the end, the researchers settled on two deposition techniques — pulsed laser deposition (PLD) and metal organic chemical deposition (MOCVD).

In PLD, a burst of laser light vaporises the material to be deposited, creating a thin film on a glass or silicon surface. It allows precise control, but can't be used on large surfaces.

MOCVD uses organic chemistry to create gasses that deposit the desired material

onto a surface. It is a more complicated procedure, but has the advantage of being able to be scaled up to coat large surfaces.

Once they had fabricated the materials, the researchers could test how well their electrical and optical properties matched the predicted values. 'This was the first time that this kind of work was done on TCOs,' says Dr Garry.

Multiple applications

Today, one of the most promising applications of NATCO's new TCOs is in the area of exquisitely sensitive biosensors. These devices, with the tongue-twisting title of 'Electro-chemical optical waveguide light-mode spectroscopy sensors', are fabricated by the Hungarian consortium partner MicroVacuum. They work by measuring how light is bent as it passes through a very thin optical wave guiding layer.

When target molecules bind to the surface of the detector, they change the TCO's refractive index, which in turn changes how light passes through the waveguide. Applying a varying electric field through the layer provides further information about the molecules.

'We got very good results on these devices using our strontium cuprate materials,' says Dr Garry. He foresees a wide range of applications for these sensors, especially in the area of proteomics.

The project's commercial and academic partners are pursuing other applications for NATCO's designer TCOs, including more efficient solar cells, smart windows, novel light sources, and materials to modulate laser light.

For Dr Garry, the results of the project's first-principles modelling and precision fabrication approach are so encouraging that he plans to apply them to more challenging problems.

'We'd like to use this route to study more complicated materials,' he says. 'For example, to look at ferro-electricity to see why some materials with the same structure are ferro-electric while others are not.'

The NATCO project received FP6 funding.

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Novel micro-technology for SMEs

A European project has developed a one-stop shop to support companies, especially SMEs, in the rapid design and manufacture of novel micro-devices for use in applications ranging from medical diagnosis to mobile phones.

No one relishes the long wait between a doctor taking a medical sample and getting back the results. Medical diagnostics is still a job for specialists in a diagnostics lab and sometimes it can take weeks for results to be returned.

But that tortuous waiting time could soon be cut to just a few minutes, thanks to intense research and development on point-of-care diagnostics. Soon it will be commonplace for a doctor or nurse to take a drop of blood, put it on a slide which then slots into a small device. Within seconds you find out your results.

This transformation of medical diagnosis is being driven by tremendous progress in the area of micro-fluidics. It is now possible to form, typically using lasers or precisely milled moulds for polymers, tiny channels within materials through which fluids — such as your blood — can flow. Mere micro-litres of a sample can be mixed, reacted and analysed. Many biosensors are now available, often integrated into silicon chips, to detect target molecules or make a variety of other measurements.

Miniaturisation gets big

Micro-fluidic devices and other microscopic electro-mechanical devices — tiny switches, motors, pistons, etc. — have come a long way since their early development in the 1980s. The demand for miniaturisation is relentless, and companies are finding it necessary to design and develop increasingly intricate micro-components.

SMEs, however, are finding themselves at a distinct disadvantage because they do not have the capital or resources to invest in the development of micro-devices. Even if an SME can design a micro-device and produce a functional prototype, it is then extremely difficult to scale up production to the volume necessary for commercial viability.

The EU-funded 'An integrated modular service for microfluidics' (Microbuilder) project was established with these SMEs in mind. It brought together partners from every stage of micro-device produc-

tion to develop a one-stop shop for any company wishing to produce a micro-device. In simple terms, the partners have established a set of rules and standard procedures to smooth out the problems that tend to occur when a design moves to prototyping and the prototype enters commercial production.

'We have created a set of tools that should reduce the time it takes to get from a good idea for a micro-device to a commercial, sellable product,' says Liv Furuberg, the project's coordinator. The Microbuilder system supports companies, especially SMEs, in designing prototypes and then launching commercial production of highly innovative micro-devices, she explains.

Material challenge

One of the hardest obstacles for developing novel devices is finding ways to integrate different materials into a single device. For example, a blood sample may first flow through channels in a polymer slide and react with a labelled antibody. But the detection of the target molecule may involve a silicon-based sensor. You therefore need to continue the channel through silicon, without any perturbation to the flow.

'A lot of sensors are based on silicon, but silicon is much more expensive than polymer,' explains Ms Furuberg. 'To keep micro-devices as cheap as possible you want to minimise the amount of silicon. So you need to find ways to plug different modules made of different materials together.'

Starting with a commercial micro-fluidics polymer prototyping kit (from ThinXXS), the project successfully developed a 'template' polymer system into which silicon components can be simply 'plugged in.'

The partners also developed standard procedures for designing and manufacturing other devices made from several materials, including silicon and glass, and fluid channels coated with reactive molecules.

The partners had particular success in the integration of a material known as

piezoelectric thin film (PZT) into micro-structures. PZT bends when a voltage is put across it; it also produces a voltage when it is bent or distorted. PZT is ideal for microscopic valves, switches and sensors. A follow-up research project, PiezoVolume, funded under the Seventh Framework Programme (FP7, NMP) for research, is seeking to automate this PZT thin film manufacturing process.

Flexible manufacturing

The integration of different materials and the application of PZT are just two examples of a diverse portfolio of advances made by the project. The partners produced several prototype devices to demonstrate the project's achievements, including a cell counter, a gas detector, a DNA extractor and a flow sensor. The PZT technology has already been used by a Norwegian firm to build a tiny auto-focusing lens for small CCD cameras.

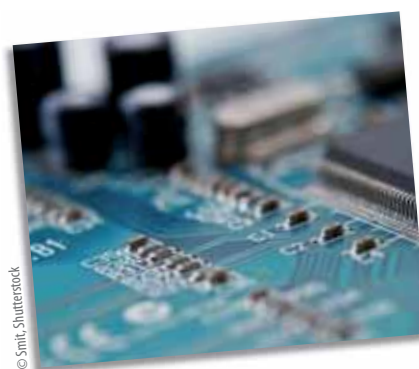
But perhaps the most important output from the project is the accompanying 500-page handbook and training materials which will make the development of micro-devices accessible to European SMEs.

"We are making it possible for small firms to build much more functional, intricate and innovative micro-devices. They can mix and match the materials to optimise functionality and they now have standardised procedures and components for their designs which can be rapidly prototyped and then commercially manufactured. Microbuilder should help SMEs in this domain regain a competitive position."

The Microbuilder project received funding from the Sixth Framework Programme for research.

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<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&id=91385>



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Overhauling the aircraft maintenance system

A European project has improved and automated the scanning processes for maintenance of engine parts in aeroplanes. With a management system for the resulting data, expensive aircraft-on-ground time for repair is much reduced.

A goal for all aircraft operators, private or military, is to minimise the turnaround time for repair and maintenance of their planes. Partners from Belgium, Germany, Ireland, and Portugal joined their engineering and data management forces to speed up, and make the whole process more efficient.

The EU-funded project 'Automated repair and overhaul system for aero turbine engine components' (Arosatec) took the maintenance, repair and overhaul (MRO) of the components, previously a string of manual processes, and automated the whole chain.

Repair of aero parts presents complications. New software was installed into the scanning system so the set up procedure only has to be done once. After that, the whole process is automated for the complete series of parts.

Installing a new part means that it must be first decoated and then coated, welded

in, then milled and polished. Each part has its own individual size and shape so even if one part of the process is automated, the series of events in the repair schedule can not flow.

The answer was to provide access to a database for information so each part can be measured first. All steps in the process have an interface so relevant data is accessible and can be stored. The status of each individual repair part can be monitored.

Aircraft parts are very expensive and a single engine blade costs hundreds of euros. The database can be accessed from all MRO shops, so components can be obtained from a particular location, reducing time waiting for the part.



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The Arosatec research means that there is more efficient life cycle monitoring and repair for aircraft parts. For the future, virtual MRO workshops could be set up with the different repair steps carried out in remote countries.

Funded under the FP6 thematic area

'Aeronautics and space'.

Collaboration sought: information exchange/training.

<http://cordis.europa.eu/marketplace> > search > offers > 5511

European aircraft industry aims for the stars

The aviation industry and its continued expansion depends on advanced research to provide the facelift it needs in terms of pollution reduction and technological needs. An EU-funded project has made sure research for the industry has the necessary management and administrative support.

The importance of air transport to the European economy cannot be understated. It is directly responsible for 3 million jobs and 2.6 % of gross domestic product

(GDP). With its spin-off effect - how it lubricates business and commerce - its contribution to the economy is estimated to be a staggering 10 % of GDP.

The project 'Aeronautical stakeholders tools for the European research agenda 2' (Aster 2) is the foundation underpinning aeronautical research. Through support for the 'Advisory council for aeronautical research in Europe' (ACARE), it is indirectly responsible for guiding a strategic research agenda (SRA). Importantly, the research plan is in line with 'Vision 2020', a landmark report in the history of European aeronautics

recommending how to achieve more efficient and effective research.

The SRA has produced a series of future air system scenarios. Their modelling tools merge existing predictions with the glimpse of the future for air transport. Also highlighted are those projects that are particularly value-adding. Their observation platform helps to prevent duplicate work and having an overview fosters efficient collaboration.

Aster 2 was funded under the FP6 Aerospace programme to the tune of EUR 1.4 million over its two year lifespan. When comparing project cost with that of aerospace research, the success of the project means effective guidance is money well spent.

Funded under the FP6 thematic area

'Aeronautics and space'.

Collaboration sought: information exchange/training.

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New alloys for aircraft design

The ground-breaking IDEA project investigated the application of new magnesium (Mg) alloys to the latest state-of-the-art aircraft by replacing components such as seat frames and electronic casings with the new materials.

The use of lighter Mg-alloys enabled significant weight savings to be made, resulting in reduced fuel consumption, air pollution and noise. The alloys also demonstrated increased strength and good resistance to corrosion.

Magnesium alloys were originally developed for the automotive industry, especially in components that needed to withstand high temperatures. Researchers sought to increase the number of Mg-alloys available for use in the aerospace industry by advising aircraft designers on their correct usage and standardisation.

New light-weight alloys were developed which possessed the properties necessary for high pressure die casting, investment casting and sand casting. Researchers also

created the modelling tools for characterising the properties and standard of Mg-casings.

A design manual for cast magnesium components was produced and acted as a guide for aircraft designers. The manual helped designers to select the most suitable Mg-alloys and production techniques for aircraft components.

Increased understanding of the advantages and applications of Mg-alloys can lead to aeroplanes that have a lower environmental impact than the ones currently in service. The new materials

can therefore give a welcome boost to the European aerospace industry by enabling it to compete more effectively with global competitors.

Funded under the FP6 programme Aerospace (Aeronautics and space: thematic priority 4 under the focusing and integrating community research programme 2002-2006).

Collaboration sought: information exchange/training.
<http://cordis.europa.eu/marketplace> > search > offers > 5493



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Building a bridge to the future

Safe, green and cost-effective civil engineering structures were investigated by the 'New road construction concept' (NR2C) project. The aim was to create a global vision for the road of the future that addressed the challenge of increased transit capacity while reducing safety risks and environmental impacts.

A review of the latest innovations in bridge building, focusing on modelling and the properties of new materials, was carried out by researchers. The study supplied engineers with the necessary information for designing bridges and determining their performance when using fibre-reinforced concrete or fibre-reinforced polymers.

The NR2C consortium focused on new designs for bridges that were durable, light, and easy to assemble on site. Researchers studied the use of materials that could be incorporated into the bridges, including the possible use of renewable building materials.

Project partners developed innovative slab bridges that used a sandwich con-

struction to produce spans of 10 to 25 metres. The segments could also be supported by structural elements made from innovative materials to create longer spans.

The sandwich construction comprised a fibreglass reinforced composite sheet, a lightweight concrete core and a skin made up of a thin layer of ultra-high performance fibre reinforced concrete (UHPFRC). Researchers also investigated the use of pre-stressed UHPFRC or mixed UHPFRC/composite and UHPFRC girders.

Civil infrastructure projects require huge financial investment but are expected to last for generations, during which time society will undergo major changes. The NR2C consortium can help in assessing and developing vital infrastructure, such as bridges, by taking into account growing transport needs while meeting sustainability goals.



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Funded under the FP6 programme Sustdev (Sustainable development, global change and ecosystems).

Collaboration sought: information exchange/training.
<http://cordis.europa.eu/marketplace> > search > offers > 5525

The following upcoming events were selected from the event diary of the Directorate-General for Research and from the CORDIS event calendar.

For further information on past and upcoming events, please visit:

<http://ec.europa.eu/research/events>

<http://cordis.europa.eu/events>

International Union of Anthropological and Ethnological Sciences Inter-Congress

The annual IUAES Inter-Congress will take place from 3 to 6 October 2010 in Antalya, Turkey.

The general theme for the event is 'From the crossroads of civilisations: understanding cultural diversity to connect societies.' The congress will allow participants to investigate and share methods for exploring key anthropological subjects, including: cultural diversity, multiculturalism, migration, transnationalism, 'the other', belonging, religion, politics, ethnicity, culture and gender.

Discussions on global challenges will also take place, helping to shed light on the implications for individuals and societies of such issues as the rapid movement from rural to urban, emigration and transnational networks.

During three days preceding and following the conference, excursions will be arranged to historical sites in Antalya, Istanbul, Cappadocia and Ephesus.

For further information, please visit:
<http://iuaes2010.org>

ESA workshop on antennas for space applications

The 32nd ESA workshop on antennas for space applications will be held in Noordwijk, the Netherlands from 5 to 8 October 2010.

The workshop is designed to be an open forum focused on space antennas (the satellite and user ground segments) with

the aim of fostering exchange of ideas between researchers and developers involved in the electrical and thermo-mechanical domains.

The main objectives of the event will be to:

- present the state of the art and to explore innovative technologies and architectures for satellite and user antennas regarding electrical, mechanical and thermal aspects;
- address needs for future remote sensing, scientific, telecommunication and navigation missions, and identify new trends and required developments.

Workshop participants will have the opportunity to share their technical expertise and experience through formal presentations, both in oral and poster formats.

A visit to the European Space Research and Technology Centre Test Facilities is also being planned.

For further information, please visit:
<http://www.congrex.nl/10C09>

Renexpo trade show

The 'Eleventh trade show for renewable energies and energy efficient building and renovation' (Renexpo) will take place from 7 to 10 October 2010 in Augsburg, Germany.

This year's edition will focus on bioenergy, covering the entire value chain of wood energy. An additional focus will be cogeneration, presenting the latest products and technological developments.

The show will also see a number of conferences taking place at the same time. Many, although not all, are being held in English and German. The conferences will include:

- the 10th 'Bundesverband bioEnergie' (BBE) conference for wood and energy;
- the 'Fourth conference on small- and micro-cogeneration';
- 'Energy efficiency — an overview of the Italian market';
- 'Intelligent energy — a conference on the state of the art';
- 'Energy from biogenous wastes';
- 'Small and middle wood gasification';
- 'Small wind plants.'

Attendees are expected to include a range of decision-makers, exhibitors and business professionals from Europe and further abroad. The conference is part of the EU's 'Sustainable energy Europe' campaign, and will also feature a business exchange forum.

For further information, please visit:
<http://www.renexpo.de>

IEEE PES conference on innovative smart grid technologies Europe

The IEEE Power and Energy Society (PES) conference on innovative smart grid technologies will be held in Gothenburg, Sweden from 11 to 13 October 2010.

The conference provides a forum for discussion on the latest in research and innovation in smart grid technologies. A series of paper sessions, panels, tutorials and lectures by international experts will take place. The conference is open to researchers, policy-makers, students and practitioners.

For further information, please visit:
<http://www.ieee-isgt-2010.eu>

Twenty-third IAEA fusion energy conference 2010 (FEC 2010)

FEC 2010 will take place in Daejeon, the Republic of Korea from 11 to 16 October 2010.

The International Atomic Energy Agency (IAEA) fosters the exchange of scientific and technical results on nuclear fusion research through the series of its series of fusion energy conferences. This edition is aimed at providing a forum for discussing key physics and technology issues as well as innovative aspects of direct relevance to fusion as a source of nuclear energy.

For further information, please visit:
<http://www-pub.iaea.org/MTCD/Meetings/Announcements.asp?ConfID=38091>

Eurocean 2010 conference

Eurocean 2010 will be held in Ostend, Belgium on 12 and 13 October 2010.

The Eurocean 2010 conference will provide a unique forum for the European marine science community to consider, discuss and respond to new policy developments and achievements since the last conference was held in Aberdeen in 2007. The conference will highlight new challenges and opportunities for marine research in the next decade.

The Eurocean 2010 conference and Ostend Declaration come at a crucial time for the European marine science community to influence how marine science is supported in Europe in the coming decade. It will provide a timely opportunity to reinforce the importance of marine science in effective maritime policy making and the key role it will play in the path towards economic growth and recovery in Europe.

The conference is a Belgian EU Presidency event, organised in close collaboration with the European Commission and the Marine Board-ESF.

For further information, please visit:
<http://eurocean2010.eu>

Fourth international workshop on system and concurrent engineering for space applications (Secesa)

This edition of Secesa will take place in Lausanne, Switzerland from 13 to 15 October 2010.

The event will focus on innovative approaches, enabling concurrent engineering (CE) methodologies, the latest tools and techniques and examples of applied system engineering (SE). The aim is to promote the creation and exchange of ideas and to identify new trends and required developments for space applications.

Among those expected to attend the workshop will be representatives from universities, institutes and other stakeholders in the area of system and concurrent engineering (SCE).

The workshop will be organised around a number of topics and themes of interest and importance to stakeholders.

For further information, please visit:
<http://www.congrex.nl/10C08>

First world congress on sugar & salt reduction strategies 2010

This inaugural event will take place on 28 to 29 October at the Radisson SAS in Saint Julian, Malta.

The aim of the congress is to put forward strategies to prevent chronic conditions such as obesity, cancer, neuro-degenerative diseases and cardiovascular diseases. In order to achieve this, the conference will bring together business and academic communities to discuss innovations and strategies to decrease and cut sugar and salt levels in food.

The conference will be organised in two parts. The first part, which will be held on 28 October, will focus on sugar reduction and will examine possible alternatives such as the natural sweetener stevia. Experts will be invited to discuss the biological and pharmacological effects of stevia, highlight recent advances, discuss possible applications in the agri-food sector and address regulatory aspects in Europe.

The second part of the conference on 29 October will focus on salt reduction. Various experts will talk about different strategies to decrease salt in food. A special session will focus on the so-called 'fifth flavour perception' umami and how it might replace glutamate and salt addiction.

A networking session on sugar and salt reduction will also be held to establish collaboration between companies, ingredient producers and health marketing companies.

The 'Malta immunity ingredients 2010' event will also be held at the Radisson in Saint Julian, Malta on 28 October. The second edition of this congress will gather delegates from science and the food and cosmeceutical sector to discuss the latest advances on immunity and health and how to boost the immune health system.

For further information, please visit:
<http://www.sugar-salt-strategy.com>

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