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ENVIRONMENT AND SOCIETY

**MAJOR BREAKTHROUGH
COULD HELP DETOXYFY
POLLUTANTS**

» PAGE 31



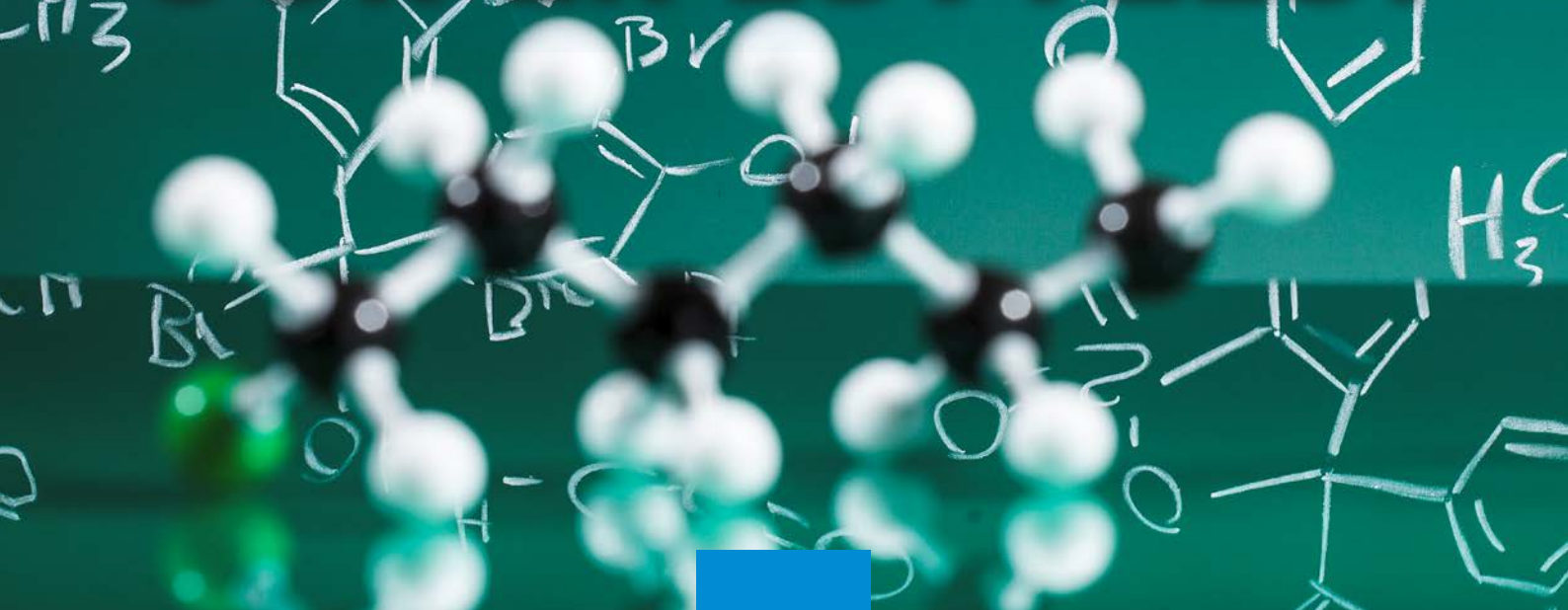
SPACE

**PREVENTING FATAL
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WITH THE EARTH**

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SPECIAL FEATURE

CAN HYDROGEN REVOLUTIONISE OUR LIFESTYLES?



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EDITORIAL

by the editorial team

CAN 2015 BE THE YEAR THAT SEES HYDROGEN FINALLY REACH MARKET SUCCESS?

Hydrogen fuel cells are often considered as a high-potential technology in the search for more efficient and less polluting energy sources. But a look at the current state of these technologies begs a double-sided question: are we ready for hydrogen and, on the other side of the coin, is hydrogen ready for large-scale commercialisation?

Fuel cells have been some 170 years in the making, with the first-ever successful demonstration having been given in 1839. While society's late concern over climate change has boosted

'The market response has so far been much more lukewarm than for other renewable energy sources'

research and innovation, the market response has so far been much more lukewarm than for other renewable energy sources. In the car industry — the most promising sector for the fuel cell market — 'electric vehicles' (EVs) are now quite a few steps ahead, to the point where some stakeholders have started questioning the pros of investing billions of euro in the necessary refuelling infrastructure. EU

Member States now have carte blanche when it comes to defining their alternative fuel station policy, and only 44 hydrogen fuelling stations are currently in operation in the EU.

There are multiple reasons behind these mixed results, some of which are approached in this magazine. First, there have been concerns about the safety of hydrogen which, as Dr Lourdes F. Vega explains in an interview on the H2TRUST project, are widely based on misconceptions and a lack of awareness rather than actual shortcomings of the technology. Then, there is the cost: that of fuel cells, which remains high compared to EV batteries, and that of creating and operating a dedicated refuelling infrastructure. Projects like HYTRANSFER, which is presented in our 'special' section, aims to bring down the latter by providing concrete solutions to make the refuelling of hydrogen-powered cars cost-efficient.

To enable the advent of a hydrogen economy, the European Commission together with hydrogen industries created the Fuel Cells and Hydrogen 'Joint Technology Initiative' (JTI) with an annual budget of EUR 470 million. Seven of the latest projects under this JTI are presented here, with a view to better understanding the remaining obstacles on the path to market success.

We therefore close this year's series of 'specials' with a very timely topic. This month, car manufacturer Toyota indeed announced the first commercially-available fuel cell vehicle, to be made available in 2015. Other manufacturers have already confirmed that they have similar plans, and public reception, along with a real industry commitment to developing the necessary refuelling infrastructure, could very well lay the foundations of the long-awaited hydrogen economy.

We look forward to receiving your feedback. You can send questions or suggestions to: editorial@cordis.europa.eu



Erratum

In the previous edition of the *research^{eu} results magazine*, our article about the SIREN project referred to the Best Learning Game going to the 'Village Voices' game developed during the project. Actually, Village Voices is one of two mini-games developed under the project, the other being called 'My Dream Theatre'. The SIREN game consists of both games played in turns with a single player profile.



Focus on
High tech
concepts to
sense the world

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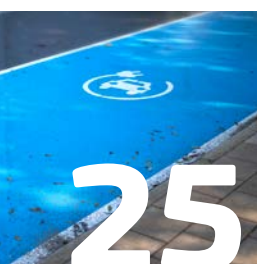
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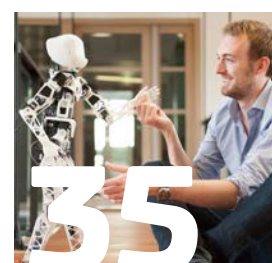
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SPECIAL FEATURE CAN HYDROGEN REVOLUTIONISE OUR LIFESTYLES?

INTERVIEW

BUILDING TRUST IN FUEL CELL HYDROGEN SAFETY

Can fuel cell hydrogen technology be considered as mature? Is it safe enough for regular use in cars, fuelling stations, combined heat and power generation and other applications? Those are the two major questions the H2TRUST project is trying to answer, to prepare the ground for large-scale commercialisation.

Whilst 'electric vehicles' (EVs) are starting to achieve commercial success and infrastructure is becoming more adapted, 'Fuel cell vehicles' (FCVs) are still lagging behind. Explanations for this rather slow adoption generally revolve around four issues: cost, lack of infrastructure, safety and, more generally, public perception.

In spite of its various advantages over electricity, such as compressed hydrogen storage tanks taking up much less space than batteries, fuelling time being much faster and range being much higher, hydrogen is still facing a lack of investment and political commitment, which is largely due to inaccurate popular beliefs, notably with regards to safety.

The H2TRUST (Development of H2 Safety Expert Groups and due diligence tools for public awareness and trust in hydrogen technologies and applications) project is looking into the latter with a view to challenging misconceptions and raising awareness among governments, industry and consumers. The project partners say they aim to foster a smooth and well managed transition to full-scale commercialisation of 'Fuel cell hydrogen' (FCH) applications in Europe and, from a safety perspective, to help inform about, prepare for and

increase confidence in this promising technology.

Dr Lourdes F. Vega, project coordinator and director of MATGAS — a joint venture between the company Air Products, the National Research Council of Spain and the Autonomous University of Barcelona — believes that developing good technologies is equally as important as selling them. In this exclusive interview for the *research*eu results magazine*, she explains what the project team has done so far to ensure that Europeans can make informed decisions about hydrogen's future.

★ What are the main objectives of the project?

Dr Lourdes F. Vega: The general purpose of the H2TRUST project is to foster a smooth and well-managed transition to full-scale commercialisation of 'Fuel cell hydrogen' (FCH) applications in Europe and, from a safety perspective, to aid the process by which all industry stakeholders are informed about, prepared for and become confident in the technology.

H2TRUST is a coordination and support action focused on risk assessment of industries in all the main hydrogen application areas. It builds on previous projects, mapping safety issues at the different stages of the hydrogen life cycle, from

production to transportation, storage and use, along with compiling best practices and making final recommendations. The goal of the project is to reach not only experts, but also society in general, promoting the change towards a new hydrogen-based economy, raising awareness about this, building on the project's knowledge and explaining the related advantages and safety issues.

★ What are, according to you, the main non-technical barriers to the advent of a hydrogen-based economy?

In our opinion, some of the non-technical barriers will depend on how the hydrogen market develops, which itself will be highly dependent on the environment created by governments and on the financial support for the production of hydrogen. Currently, in the case of transportation, there is a lack of hydrogen vehicles and infrastructure. The cost of hydrogen 'Fuel cell electric vehicles' (FCEVs) remains prohibitively high, though this is projected to decrease as manufacturers progress towards commercial levels of production. The expansion of the hydrogen refuelling station network will also require capital and operational support from governments in the early stages while vehicle uptake remains low.

We need a sufficient number of vehicles to justify the creation of fuelling stations and vice versa. This requires a cohesive approach, factoring in support mechanisms for production, obligations for suppliers, capital and operational support for hydrogen fuelling stations, and incentives or mandates for vehicle manufacturers to deploy hydrogen FCEVs.

In addition, it is important that final users and society are aware of these limitations, instead of just thinking that hydrogen technology is not ready yet. Although further technical improvements will help lower the price, they are not the main barriers, and this should be made known.

★ **What motivated you to do research in this area?**

MATGAS is working on sustainable processes and products. We firmly believe that R&D is still needed to boost the hydrogen economy, but we are also aware of the need to educate people about these technologies and their advantages.

We have been working on different aspects of fuel cells and their applications in different sectors, from transportation to 'Combined heat and power' (CHP) applications, among others. One of the things we noticed is that the barriers to making hydrogen a real alternative to fossil fuel are related to the lack of knowledge on how to handle it, which enhances the perception that there are many issues associated with hydrogen and safety. We want to change this perception.

★ **What are the main difficulties you have faced during the project and how have you resolved them?**

The safety aspects of hydrogen may sometimes be a challenging topic. For this reason, the main difficulty that we have faced is clearly the poor availability of data and information at the European level. Although there are some databases (e.g. HIAD)



available, they report only macro-statistics, without detailed information on the incidents/accidents, etc., or specific recommendations for given applications.

In H2TRUST, we gathered such information through different methods such as questionnaires, surveys, expert literature data, etc. We have also contacted equivalent entities in other regions, such as the US and Japan. They seem to be ahead of us in this regard. In our case, we found that some experts did not provide enough detailed information, because this is usually considered as 'sensitive data' by companies and stakeholders. Similar to this, we also found that, in some areas, there is very little data being shared between industrial partners, hindering the validated safety risk assessment methodology, which covers all application areas of hydrogen.

In order to resolve all these issues, we have focused on different case studies and document reviews as well. We will provide a summary of our findings, including the gaps, and will provide specific recommendations. Our aim is to advance the EU as much as we can in this area, from where we started, so that we or others can continue the work and build up solid knowledge, with the appropriate tools, on the advantages of technologies based on hydrogen and how to work with them in a safe and secure manner.

★ **Where do you stand with the project objectives?**

So far, we have gathered all the information from selected stakeholders, analysed it and issued different reports related to FCH safety issues, industry best practices and recommendations, a safety risk assessment and a public safety assessment. Moreover, we have

developed a webpage (h2trust.eu) and an online library where all documents related to hydrogen (from production to final uses) and safety are classified for easy identification.

Taking this into account, we have achieved most of the technical work to be done under the project. However, the next and last part is the most important one, as we need to disseminate our results. In addition to conference and fair presentations, we are writing a book using our findings and recommendations, and are also preparing videos for different audiences (school training, experts and society in general) as well as working with similar associations to disseminate our work and build on theirs as well.

“Contrary to popular belief, the technology is proven and ready to be used now.”

These actions are key to speeding up the hydrogen economy. We also hope to influence some regulations, codes and standards, as well as EU-funded projects addressing hydrogen safety.

★ **Electric car sales are starting to pick up with successful models being put on the market. How do you see this impacting other clean energy sources such as hydrogen?**

The truth is that hydrogen FCEVs tend to be less well known than battery electric vehicles. In fact, they are often perceived to be futuristic, but, contrary to popular belief, the technology is proven and ready to be used now. In fact, some EU countries are ahead of others, for instance, Germany, the UK and Denmark, to mention just a few. Importantly, of all possible alternatives to petrol/gas-powered vehicles (including battery electric cars), FCEVs are the only option with a comparable range, performance and refuelling time, since a hydrogen vehicle takes less than five min-



DR LOURDES VEGA



utes to fill up and can travel up to 400 miles on one tank of fuel. While battery vehicles are suited to small cars and short journeys, fuel cells enable full-function, larger vehicles, with long driving range and quick refuelling.

Again, the slow implementation is more related to the lack of infrastructures. It is also worth noting that hydrogen and battery cars are complementary technologies. They both have the same drive train, so economies of scale can be seen as both technologies are rolled out.

A number of automotive companies are developing fuel cell electric hybrid vehicles. In these, the fuel cell effectively recharges the battery, reducing the hydrogen consumption whilst delivering greater range.

★ **Where does the industry stand with regards to safety? Is the technology getting close to commercialisation?**

Hydrogen, like all fuels, must be treated carefully and with respect. For example, when filling a car with petrol or diesel, you do so carefully and ban all flames, for example from lighters, cigarettes or

matches. If you do the same for hydrogen, it is as safe as all other transport fuels.

That being said, safety is our priority. For example, all Air Products hydrogen plants, fuelling stations and transporters comply with industrial standards and go far beyond the required standards. Air Products has a long history of handling gases and hydrogen safely, and has won several awards in recognition of this. Hydrogen is transferred into a vehicle using a locked seal to ensure that no hydrogen leaks. If it does however, providing it does so in a well-ventilated or outside space, it will simply float up and disperse. This is because hydrogen gas is lighter than air. Furthermore, in order to ensure strict safety standards are set for the domestic use of hydrogen, Air Products is cooperating with the rest of the industry, notably the European Industrial Gases Association (EIGA) and BC Safety Authority (BCSA).

What we need now to move the industry forwards is to bridge the gap between demonstration stage and commercialisation. This is where governments need to play a bigger role, as is already the case in some EU countries.

★ **What are the next steps for the project, and do you have any follow-up plans after its end?**

The next step is clearly the dissemination of results not only to the experts, but also to society in general so that they understand these technologies and their advantages. But of course, we also have plans after the project's end. We are constantly in contact with other hydrogen-related projects, for which we will continue to provide consultancy and support on an expert panel, and we will also continue collaboration with different equivalent associations. We also hope that the EU will continue supporting projects and actions of this type so that we can capitalise on the work done and move it much further, building the trust hydrogen needs and deserves.

H2TRUST

- ★ Coordinated by MATGAS in Spain.
- ★ Funded under FP7-JTI.
- ★ http://cordis.europa.eu/project/rcn/109535_en.html
- ★ Project website: <http://h2trust.eu/>

HYDROGEN FUEL CELLS TO ADVANCE THE LOGISTICS INDUSTRY

New hydrogen fuel cell technology, to be tested on a system of forklifts and fuelling stations across Europe, could help advance the logistics sector and yield cleaner transport technology.

The success of commerce, trade and industry in Europe is based on efficient logistics systems and the synergy they bring to these sectors. Policymakers are constantly seeking ways to make logistics more energy efficient and sustainable in order to lessen transport costs of goods and streamline services. Against this backdrop, the EU-funded project SHEL (Sustainable hydrogen evaluation in logistics) is working on a pilot project involving forklift trucks to make this important class of vehicles more eco-friendly.

"The SHEL project's plans include using 10 forklift trucks and associated hydrogen refuelling infrastructure to be set up at sites located in four countries."

Project members plan to demonstrate how sustainable hydrogen technology and fuel cells could lead to the commercialisation of such hydrogen-powered vehicles for demanding logistics operations.

To achieve its aims, the SHEL project's plans include using 10 forklift trucks and associated hydrogen refuelling infrastructure to be set up at sites located in four countries: Greece, Spain, Turkey and the United Kingdom.

SHEL has already decided to purchase two hydrogen refuelling stations for two of the sites, and is working on other infrastructure solutions for the other two. Challenges also involve product certification and approval for building the



infrastructure in order to complete the pilot project. Things are looking promising here, with significant progress already achieved.

In addition, the project team has studied hybrid configurations for forklifts and other electric vehicles powered by batteries/supercapacitors and fuel cells. Progress made on this front as well as information on the project in general have

been disseminated through different channels, including the project website.

Ultimately, SHEL hopes to draw up system specifications and identify the costs of and training needs for installing this comprehensive forklift system. Inclusion of a monitoring and simulation system for real-time data analysis will support the commercial installation of the system. Such a low-impact hydrogen refuelling system for forklifts, which can deliver low-cost hydrogen from multiple sources, is bound to make the logistics industry more efficient and eco-friendly.

The project's results are important for developing more efficient forklifts and will bring added benefits when used in other types of vehicles. Industries such as trade, transport, travel and tourism all stand to benefit from this endeavour.

SHEL

- ★ Coordinated by the CIDETEC Foundation in Spain.
- ★ Funded under FP7-JTI.
- ★ http://cordis.europa.eu/result/rcn/91987_en.html
- ★ Project website: <http://shel.eu/>

FROM SUNLIGHT TO JET FUEL: EU PROJECT MAKES FIRST 'SOLAR' KEROSENE

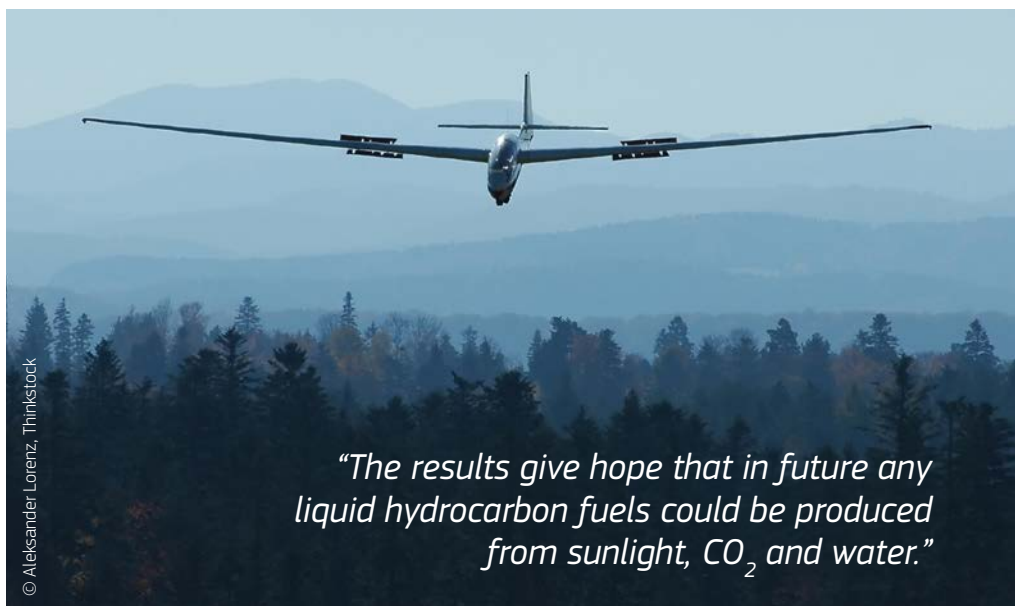
An EU-funded research project called SOLAR-JET has produced the world's first 'solar' jet fuel from water and 'carbon dioxide' (CO₂), a promising technology for better energy security and turning a greenhouse gas into a useful resource.

Researchers have for the first time successfully demonstrated the entire production chain for renewable kerosene, using concentrated light as a high-temperature energy source. The project is still at the experimental stage, with a glass-ful of jet fuel produced in laboratory conditions, using simulated sunlight. However, the results give hope that in future any liquid hydrocarbon fuels could be produced from sunlight, CO₂ and water.

In the first step, concentrated light — simulating sunlight — was used to convert carbon dioxide and water to synthesis gas (syngas) in a high-temperature solar reactor containing metal-oxide based materials developed at ETH Zürich. The syngas (a mixture of hydrogen and carbon monoxide) was then converted into kerosene by Shell using the established 'Fischer-Tropsch' process.

Although producing syngas through concentrated solar radiation is still at an early stage of development, the processing of syngas into kerosene is already being carried out by companies, including Shell, on a global scale. Combining the two approaches has the potential to provide secure, sustainable and scalable supplies of aviation fuel as well as diesel and gasoline, or even plastics. Fischer-Tropsch derived fuels are already certified and can be used by existing vehicles and aircraft without modifying their engines or fuel infrastructure.

The four-year SOLAR-JET (Solar chemical reactor demonstration and Optimization for Long-term Availability



"The results give hope that in future any liquid hydrocarbon fuels could be produced from sunlight, CO₂ and water."

of Renewable JET fuel) project was launched in June 2011 and is receiving EUR 2.2 million of EU funding from the Seventh Framework Programme for Research and Technological Development (FP7). The SOLAR-JET project brings together research organisations from academia and industry (ETH Zürich, Bauhaus Luftfahrt, Deutsches Zentrum für Luft- und Raumfahrt (DLR), Shell Global Solutions and management partner ARTTIC).

In the next phase of the project, the partners plan to optimise the solar reactor and assess whether the technology will work on a larger scale and at a competitive cost.

Finding new, sustainable sources of energy will remain a priority under Horizon 2020, the seven-year EU research and innovation programme

launched on 1 January 2014. In the Competitive Low-Carbon Energy call published on 11 December last year, the Commission proposed investing EUR 732 million over two years in this area. The call includes a topic on developing the next-generation technologies for biofuels and sustainable alternative fuels.

SOLAR-JET

- ★ Coordinated by Bauhaus Luftfahrt in Germany.
- ★ Funded under FP7-TRANSPORT.
- ★ http://ec.europa.eu/research/infocentre/article_en.cfm?artid=32498
- ★ Project website: <http://www.solar-jet.aero/>
- ★ <http://bit.ly/1yzclKU>



INTERVIEW

FUEL CELLS TO CONNECT OUR SMARTPHONES TO THE OUTSIDE WORLD

The potential of hydrogen and fuel cell applications goes way beyond the development of green cars. The FCPOWEREDRBS team is determined to prove this with a Fuel Cell technology to power off-grid telecom stations. They believe not only that this solution is better than standard generators, but also that it provides a significant advantage in terms of 'Total cost of ownership' (TCO).



© Giancarlo Tomarchio

GIANCARLO TOMARCHIO

Did you know that, in 2014 alone, worldwide smartphone usage has grown by 25%? Or that most of the telecom sites connecting these smartphones to the outside world are off-grid? This increasing pressure on self-powered installations requires continued efforts to come up with ever more innovative, reliable, efficient, cost-effective and sustainable energy generators.

Currently, most sites for which connection to the electricity grid is not an option rely on batteries and diesel generators. However, the FCPOWEREDRBS project has set out to convince telecom operators and local administrations alike that fuel cells represent a real alternative to such standard power sources. To this end, the project — which involves European industries and research centres Dantherm Power AS (Denmark) and MES SA (Switzerland), electrolyser manufacturer GreenHydrogen (Denmark), the University of Rome, the EU's Joint Research Centre and Ericsson — is testing a custom-made fuel cell solution on various sites across Italy. This specific solution has been engineered by the project team and integrates different energy provider components (fuel cells, photovoltaics and batteries) in the 'most efficient and reliable way.'

For Giancarlo Tomarchio, coordinator of the project and Customer Project Manager at Ericsson, the ultimate goal of the project is clear: demonstrating the industrial readiness and the market appeal of Fuel Cell technology for off-grid telecom applications. In this exclusive interview with the *research*eu results magazine*, he tells us how advanced he and his team are with the field trials, and how they intend to demonstrate the advantages of hydrogen and fuel cells for delivering the expected power supply service.

★ What are the main objectives of the project?

Giancarlo Tomarchio: FCPOWEREDRBS is a demo project within the Fuel Cells and Hydrogen Joint Undertaking Programme. We are conducting a set of field trials that aim to demonstrate the advantages of hydrogen and fuel cell

technology for off-grid telecom applications. These trials consist in replacing the power supply of 15 radio base stations in the live network of selected Italian telecom operators with a new one based on our solution — which integrates different energy provider components (fuel cells, photovoltaics and batteries) with efficiency and reliability in mind.

We are also committed to other initiatives aiming to increase the visibility of the fuel cell technology and facilitate its penetration in the telecom market.

★ What is the added value of using hydrogen and fuel cell technology to power telecom stations?

Remotely located 'Radio base stations' (RBS) for Telecom applications are becoming more and more important with the increasing penetration of mobile services. As for many of these stations, the connection to the electricity grid is not an option, and specific off-grid power generation solutions are required and quite often based on diesel fuel generators. With the solution proposed by our project, the amount of unattended hours can be increased thanks to an efficient usage of the different energy sources and to the storage potential of H₂. For a Telecom operator, this means lower operational

costs. In general, we think that it's possible to provide our customers (the Telecom operators) with certain benefits in terms of 'Total cost of ownership' (TCO), something that nowadays is a strong argument for any Energy Manager.

Moreover, the system includes a smart-metering and tele-control system providing the operator with more details on the energy behaviour of their base station.

★ What are the main difficulties you have faced in the project and how have you resolved them?

Even though this project is a demo, it is a major innovation for the telecom market. In all our activities, we have to challenge ourselves with the need to produce a system that complies with the demanding requirements of the telecom market: durability and reliability 24/7. Some of the issues we faced are comparable to those occurring when introducing a new product to the market, in this case aggravated by the nature of the fuel in use.

Resorting to H₂ storage in the system implies the adoption of specific processes and procedures in terms of safety. Joint work is needed between the project and the Telecom operators who accepted to host our solution on their sites, in order to customise existing O&M procedures.

When it was time to get the necessary authorisations from the different local administrations in the territories where the sites are located, we were sometimes faced with inconsistent knowledge of the national regulations, which led to misunderstandings and delays in obtaining permits.

"Really, our goal is to create long-term trust in fuel cells within the world of telecommunications."

We have adopted all the necessary precautions in order to avoid any loss of power for the radio station, as any interruption to the service would be the worst message to give, if we want to gain customers' trust.

Really, our goal is to create long-term trust in fuel cells within the world of telecommunications.

★ **Where do you stand with the on-site demonstrations?**

At the moment we have an agreement for installing 10 systems on Telecom Italia's live network, and three on H3G Italia's. We have already installed eight sites — five of which are now up and running — while the other sites are about to be connected. We expect a first annual projection of TCO by the end of 2014. The trial will then continue until next year to reach the 12 months of operation normally needed for the verification.

We are also finalising the agreement for an additional installation of a non-telecom application, but with similar electrical requirements.

★ **Are you happy with the results of the project so far?**

The project started at the beginning of 2012 with the initial purpose being to install a system which was a 'simple' integration of a commercial product. In reality, we discovered that, besides the system configuration tuning, some additional developments were needed both in the fuel cell equipment and in the control

logic. These activities have been successfully carried out and the lab tests hold much promise. We will spend the next few months continuously monitoring the system behaviour and optimising the parameters to make the system as efficient as possible.

★ **When do you expect this technology to hit the market?**

An exact forecast is always difficult. We definitely think that the solution proposed has high market potential: worldwide, more than 100 000 new cell phone base stations are installed every year. Most of them are installed in emerging and developing countries with a poor grid infrastructure, which means they have batteries and/or a backup power generator installed. The majority of these new base stations could be set up with a fuel cell system for power generation, if the technologies were proven safe and if the systems were available at competitive costs.

The FCPOWEREDRBS project still has some way to go to prove that such benchmarks are being achieved and opening up the way for broader commercialisation.

★ **What are the next steps for the project, and do you have any follow-up plans after its end?**

For the project team, it is now time to consolidate the results, optimise the solution and disseminate the results. We have already begun training activities to raise awareness among the telecom engineers about the FC technology, and we will also continue to share the telecom requirements with the FC world.

Should the project become a success story, as we all hope, there will be some further work to do in order to industrialise the solution so that it can be considered as a real product. The introduction or integration into a larger portfolio is now our dream and final goal.



FCPOWEREDRBS

- ★ Coordinated by Ericsson in Italy.
- ★ Funded under FP7-JTI.
- ★ http://cordis.europa.eu/project/rcn/101804_en.html
- ★ Project website: <http://fcpoweredrbs.eu/>

ADVANCING HYDROGEN AND FUEL CELL TECHNOLOGIES

A new software tool enables effective monitoring and assessment of new and emerging technologies. The development will help create cleaner transport solutions based on hydrogen technology and fuel cells.

Hydrogen energy and the advent of fuel cells represent promising non-polluting or less-polluting energy solutions for the future. A major EU initiative known as the Joint Undertaking for Fuel Cells and Hydrogen (FCH-JU) aims to speed up the process for getting new, relevant technologies onto the market. However, this requires a reliable method for monitoring and assessing the value of emerging technologies.

Against this backdrop, the EU-funded project TEMONAS (Technology monitoring and assessment) set out to help

develop technology roadmaps and evaluate the readiness of new technology. The project developed a software tool for monitoring emerging technologies effectively and ranking them in terms of how close they are to hitting the market.

One important feature of the TEMONAS tool is its ability to define a variety of objects, such as EU-funded programmes and calls for projects, as well as targets, sources and research organisations. It lists research objects, which can range from new materials for use in fuel cells to complete





SPECIAL FEATURE

vehicle systems. This enables effective comparisons to be made between technologies. Examples include benchmarking the performance of different car systems and assessing materials used in building vehicle or fuel cell components.

Another key feature is dubbed 'expert judgement mapping': input from experts is added into the equation using scales in order to assess emerging technologies and their market readiness. The system also features a powerful graphic engine to help expert users create advanced graphic data. Results and data can also be easily imported into commonly used software packages.

The project team identified strong interest from both industry players and funding agencies. It disseminated information on its progress in building the solution to innovation and technology programme managers from the hydrogen community, as well as management professionals.

In addition to providing the FCH-JU with a solution, the team enhanced its capabilities and marketed it to research and development consortia, industrial organisations and research agencies. The EU will therefore soon have a viable tool to help speed up the adoption of valuable technologies in this exciting domain.

TEMONAS

- ★ Coordinated by CLIMT in Austria.
- ★ Funded under FP7-JTI.
- ★ http://cordis.europa.eu/result/rcn/89823_en.html
- ★ Project website: <http://www.temonas.eu/>

"Another key feature is dubbed 'expert judgement mapping': input from experts is added into the equation using scales in order to assess emerging technologies and their market readiness."

INTERVIEW

HOW 'CHRISTMAS TREES' CAN HELP IMPROVE HYDROGEN REFUELLING TECHNOLOGIES

How can we ensure safe, fast and efficient refuelling of hydrogen-powered cars, all at the same time? This brain teaser, key to the successful deployment of hydrogen technology in our future green economies, is being mulled over thanks to sensor technologies and a prediction model developed under the HYTRANSFER project.



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SOFIA CAPITO

When discussing the market potential of hydrogen, the sceptics often have refuelling at the top of their list of cons. Not only will it take decades to build the necessary infrastructure, but the refuelling operation itself is challenging to say the least.

Let's pretend that you have a 'Fuel cell vehicle' (FCV) and need to fill the tank up before a long trip. With a 'standard' fuel car, the operation would be completed in about a minute, whereas the latest FCVs require about three minutes for the whole operation. And getting to this result hasn't exactly been a sinecure for engineers: unlike petrol or

diesel, hydrogen tends to heat up as it is being compressed into the fuel tank, and the composite materials used to create these tanks while keeping their weight as low as possible cannot withstand temperatures above 85 °C. In order to make the three-minute fast-filling operation possible, current refuelling stations pre-cool the hydrogen to -40 °C.

Improving this process to bring more efficient fuelling and even defuelling is the core objective of the HYTRANSFER (Pre-Normative Research for Thermodynamic Optimization of Fast Hydrogen Transfer) project, which started in June 2013 and will end in November 2015. Should it achieve its objectives, the project would help in reducing investment and operating costs, increase the reliability of refuelling stations and reduce maximum refuelling time, which would be a huge step forward in the successful rollout of the technology.

Sofia Capito, coordinator of the project, tells us more about HYTRANSFER's achievements so far, and how close it is to the ultimate goal of providing new recommendations for implementation into international standards and refuelling protocols.

★ **What are the main objectives of the project?**

Sofia Capito: In the HYTRANSFER project we develop methods and processes to adapt and reduce pre-cooling requirements, thus also reducing the capital and operating expenditure of refuelling stations. Experiments show that the heat transfer between hydrogen gas and the tank wall is rather ineffective. As a result, even when the hydrogen inside the tank reaches 85 °C — the maximum temperature composite-based tanks can be exposed to — the tank wall temperature will be significantly lower. Experiments conducted with nitrogen show a difference of 27 °C! Using

thermodynamics to determine the relation between injected hydrogen, filling parameters such as hydrogen flow rate, and ambient temperature, can lead to a hydrogen transfer process which is optimised for the real boundary conditions.

★ **What are the main difficulties you have faced during the project and how have you resolved them?**

Fortunately we are pretty much on track and many of the drawbacks we could have experienced just did not happen. The challenge for the two tank manufacturers involved, including project partner Hexagon Lincoln, are the particular requirements associated with the experiments: we need temperature sensors in the tank walls! And we don't need just one or two of them, but 30 sensors per tank. Positioning them during the manufacturing process is rather tricky, but both manufacturers put a lot of effort into it and eventually succeeded. With these sensors we can measure the temperature inside the tank walls. But we also need sensors to measure the temperature of the gas itself at various points in the tanks. As the tank openings are just a few millimetres in diameter, we introduce sensor arrangements nicknamed 'Christmas trees', narrow enough to fit through the tank orifices before they unfold themselves, similar to putting a ship in a bottle.

★ **Where do you stand with the project? Have you achieved a satisfying level of temperature control yet?**

At the moment three different laboratories conduct experiments on three different kinds of tanks, as examining tanks in several labs ensures reliability and reproducibility of the results. Many of the experiments take place at the Joint Research Centre (JRC) of the European Commission which is a project partner. In parallel, accompanying 'Computational fluid dynamics' (CFD) simulations are further developed to be consistent with the results of the experiments. The project partner TesTneT is currently pre-checking initial experiment results, while the French research institute CNRS has already produced

"This will result in reduced maximum refuelling time, increased reliability of the station and maybe even reduced hydrogen prices."

detailed measurements of the actual thermal properties of the tanks used. A simplified model with significantly reduced computation time — seconds to minutes instead of days to weeks — has been validated as well. So far, our experiments and modelling support our assumption that there is significant room for improvement in pre-cooling requirements.

★ **Are you optimistic about your approach impacting international standards?**

As one of the first steps in HYTRANSFER, we analysed optimisation opportunities for the hydrogen transfer process within existing international 'Regulations, codes and standards' (RCS) and state-of-the-art of hydrogen technology. Based on this and the results obtained so far, we are quite confident that the project will produce test results and validation of these results leading to strong recommendations for RCS.

The CCS Global Group (CCS), with its decades of leadership in RCS development and compliance in the FCH and



electrical sectors, is monitoring the relevant RCS activities and test results of the project so that we will be able to identify and extract RCS recommendations and develop a path forward for them to international bodies (e.g. CEN/ISO).

★ **How do you expect your conclusions to help boost the hydrogen car market?**

Car efficiency as such will not be boosted, but the interplay between refuelling stations and fuel cell vehicles will be improved. For the customers, this will result in reduced maximum refuelling time, increased reliability of the station and maybe even reduced hydrogen prices. Ludwig-Bölkow-Systemtechnik (LBST) will conduct a detailed techno-economic analysis to identify the impact of the improved processes.

★ **What are the next steps for the project, and do you have any follow-up plans after its end?**

Current vehicles typically have not just one, but two or three connected tanks, so we need to find a viable refuelling approach for both single tanks and tank systems. The next step for us is to conclude our experiments on single tanks and further develop our simulations based on what we learn, after which a new, detailed refuelling protocol will be developed and tested on tank systems supplied by FCV manufacturer and project partner Honda.

HYTRANSFER will be considered as successful when the newly developed refuelling approach is published as a recommendation to international RCS bodies, and when our recommendations related to defueling are published.

We don't have any specific follow-up plans yet, but when HYTRANSFER is concluded and finds its way into international RCS, further validation and an even broader spectrum of experiments will have to be conducted.

HYTRANSFER

- ★ Coordinated by LBST in Germany.
- ★ Funded under FP7-JTI.
- ★ http://cordis.europa.eu/project/rcn/108580_en.html
- ★ Project website:
<http://www.hytransfer.eu>



GREEN ENERGY: TOMORROW'S REALITY

More than 3 million people across the EU now work in eco-industries, producing nature-friendly goods and services. It is an increasingly competitive sector, buoyed by constant innovation. Let's see how scientists and manufacturers are joining forces to support this industrial evolution.

As in every big city, the air in London is increasingly polluted because of car fumes.

One solution is to try and make all taxis emission-free by 2020. A small fleet of hydrogen-powered taxis is being tested as part of this European project. These black cabs running on fuel cells rather than combustion engines are much cleaner and quieter.

'This vehicle drives entirely differently from anything I've driven before,' says taxi driver Phil Davis. 'It's much smoother, quieter, and it's a pleasure to drive. It's responsive, everything on it is electronic, which means less work for me to do. After getting out, after a few hours, it's like I've not been to work at all,' he says.

A tank-full of hydrogen gives the taxi up to 400 kilometres of autonomy. The tests should give researchers a better idea of how to make the vehicles lighter and more efficient.

'There's an enormous amount that we learn: the vehicle integration — how the different components talk to each other within the power chain; and how the vehicles operate: different taxi drivers, different driving style, different performance characteristics, and importantly, how they interface with hydrogen for refuelling,' says Dennis Hayter, from Intelligent Energy, a

London-based clean power systems company.

Today, converting a car to hydrogen fuel increases its price five-fold — making it completely unaffordable. But at the current rate of research, it's hoped this technology can become more competitive in the next few years.

'There are standards that will still need to be put in place for hydrogen vehicles, but part of projects like this helps to address those issues. As we move towards commercialisation of these vehicles in 2015, the required regulations will be addressed and in place,' says Diana Raine, project coordinator for the HYTEC (Hydrogen Transport for European Cities) project.

With a growing demand for clean fuels, governments and scientists need to get together to develop more efficient vehicles and better infrastructure.

The European Commission's in-house science service, the Joint Research Centre (JRC), based in northern Italy, works with a wide range of eco-industries. In the JRC's vehicle emissions laboratory, tests are being carried out on new equipment that reduces harmful engine exhausts.

'We look into different options, we assess these technologies, and then we share our conclusions with the

car-making industry, setting the new standard of the future for these cars,' says Alois Krasenbrink, Head of the JRC's Sustainable Transport Unit.

"Today, converting a car to hydrogen fuel increases its price five-fold — making it completely unaffordable."

But is hydrogen a cleaner alternative if it relies on fossil fuels for its production? Are electric cars running on batteries made of imported, rare earth compounds sustainable? Scientists are looking not only at the final product but also at its carbon footprint.

'It is certainly true that on a local level, on an urban level, electric and hydrogen fuelled vehicles are cleaner,' says Laura Lonza, scientific officer for vehicle and fuel innovation at the JRC.

'But it's important to carry out research on the full energy footprint, not just on what happens inside the car,' she adds.

Laboratory analyses of combustion engine emissions can differ from real-life situations.

This new mobile device, developed at the JRC, fits in a car trunk and works while the vehicle is on the road. 'The device is connected to the exhaust pipe. The exhausts go to the fume meter. This allows us to measure the fume exhaust flow directly, and to extract part of this flow which is then analysed,' says Alois Krasenbrink.

Mobile tools like this are able to provide much more accurate measurements. For example, these tests show that in certain real-life conditions, cars produce two to four times more emissions than in a lab.

HYTEC

- ★ Coordinated by Air Products in the United Kingdom.
- ★ Funded under FP7-JTI.
- ★ http://ec.europa.eu/research/infocentre/article_en.cfm?artid=32238
- ★ Project website: <http://hy-tec.eu/>
- ★ <http://bit.ly/1EtDWPN>



BIOLOGY AND MEDICINE

NEUTRALISING ANTIBODIES FOR SAFER ORGAN TRANSPLANTS

Health project MABSOT has developed a drug that could make organ transplants significantly safer and boost the European pharmaceutical sector.

Serious complications can arise following kidney transplants. If dialysis is required within the first seven days, then the transplanted organ is said to have a 'Delayed graft function' (DGF), and has essentially been rejected by the body's immune system. The risk of DGF increases, the longer the blood supply has been cut off from the kidney.

While there is currently no specific treatment for DGF, the EU-funded project MABSOT (Development of OPN-305 as an orphan drug for the treatment of Delayed Graft Function post solid organ transplantation) has developed a novel drug — OPN-305 — which can reduce both the incidence and severity of this condition. The project was completed in September 2014 and is expected to lead to safer, more effective surgical procedures and thus healthier patients.

During trials, OPN-305 was given to patients about to undergo kidney transplants. Antibodies — proteins in our body that attach to objects our immune systems do not recognise — can sometimes react

adversely to transplanted organs. When inflammation caused by specific proteins called TLR2 receptors is triggered as a response to a newly transplanted kidney, this can lead to DGF. This serious complication affects over half of those who receive kidneys from deceased donors.

What OPN-305 does is target these naturally-occurring proteins responsible for initiating an inflammatory reaction (the body's natural response to injury or infection). By blocking these TLR2 receptors, OPN-305 helps to trigger the immune system's response to organ transplants, and thus help prevent the onset of DGF. Initial clinical trials involving 50 medical centres in the US and Europe and 270 patients have shown that the drug is safe.

In addition to bringing significant benefits to patients, MABSOT will also boost Europe's pharmaceutical industry. Developing new drugs can be a time-consuming and extremely expensive process, which is why it was important that OPN-305 was

recognised as an 'orphan' by regulators. This means that the developers of the drug will benefit from a number of incentives, including scientific advice and market exclusiv-

ity once the medicine hits the market.

To qualify for orphan status, a medicine must be intended for the treatment, prevention or diagnosis of a disease that is life-threatening or chronic. Furthermore, it must be unlikely that mar-

keting the medicine would generate sufficient returns to justify the investment needed for its development. In other words, the application must be for a drug designed to treat a fairly rare disease.

Applications are examined by the European Medicines Agency's Committee for Orphan Medicinal Products (COMP),

using the network of experts that the Committee has built up.

Accelerated approval means that the MABSOT team has been able to move through the development process quicker than they would have if orphan drug status had not been given. Furthermore, the medicine could also be used for other organ transplants, such as lung, heart or pancreatic transplantation, and even for other diseases, including cancer and rheumatoid arthritis. MABSOT received nearly EUR 6 million in EU funding and was coordinated by Opsona Therapeutics in Ireland.

MABSOT

- ★ Coordinated by Opsona Therapeutics in Ireland.
- ★ Funded under FP7-HEALTH.
- ★ http://cordis.europa.eu/news/rcn/121899_en.html
- ★ Project website: <http://www.mabsot.eu/>

"The medicine could also be used for other organ transplants, such as lung, heart or pancreatic transplantation, and even for other diseases, including cancer and rheumatoid arthritis."

REINFORCING TISSUE ENGINEERING RESEARCH

The human body is made up of different tissues that can get damaged or diseased through age or trauma. Replacing or regenerating older tissues will promote good health and quality of life, particularly in Europe given its ageing population.

'Tissue engineering and regenerative medicine' (TERM) is a complex, multidisciplinary field requiring complementary and cross-sectoral skills in areas such as materials science and cell biology. The EU-funded project MULTITERM (Training multidisciplinary scientists for tissue engineering and regenerative medicine) recruited and trained 13 'Early stage researchers' (ESRs) who developed state-of-the-art innovative products and techniques for tissue regeneration.

MULTITERM conducted six multidisciplinary training workshops and nine generic courses in addition to offering supplementary courses.

This ensured that the ESRs gained the required skills at an early stage of their projects. The ESRs developed large-scale purification processes that are needed for soft tissue engineering.

They also developed novel materials — synthetic injectable gels, bone and skin substitutes as well as hybrid scaffolds made of collagen and knitted polymers.

The novel materials were tested *in vitro* for biocompatibility, efficacy and safety using cells from surgical specimens. Their mechanical properties and cell behaviour were studied in-depth to produce a superior collagen scaffold configuration. ESRs then prepared an extracellular matrix containing constructs to develop off-the-shelf scaffolds and confirmed the suitability of these materials for TERM applications.

A major issue limiting the effectiveness of *in vitro* tissues is the lack of an adequate blood vessel system. MULTITERM ESRs worked on pre-vascularisation of biomaterials using endothelial cells and stromal vascular fraction-derived cells to resolve this issue.

They successfully developed a pre-vascularised fibrin hydrogel, 3 centimetres in diameter, with research continuing to upscale this process.

For long-term follow-up studies in animals, ESRs also developed magnetic resonance imaging modalities with

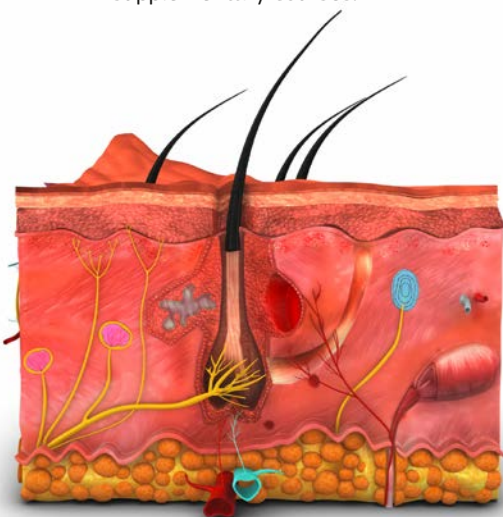
"A major issue limiting the effectiveness of in vitro tissues is the lack of an adequate blood vessel system."

contrast using modified hydrogels and bone cement. Better visualisation was achieved using contrast agents such as fluorinated dendrimers and super paramagnetic iron oxide nanoparticles.

In addition to strengthening the European work force in TERM, MULTITERM activities will also contribute to the development of innovative biomaterials for skin and bone tissues. This should enhance the EU economy and improve healthcare outcomes.

MULTITERM

- ★ Funded under FP7-PEOPLE.
- ★ Coordinated by the Stichting Katholieke Universiteit in the Netherlands.
- ★ http://cordis.europa.eu/result/rcn/148946_en.html
- ★ Project website: <http://www.multitermproject.eu/>



MAGAZINE EXCLUSIVE

GETTING MORE FROM LARGE-SCALE 3D RADIOLOGY IMAGE DATA

EU-funded researchers with the VISCERAL project are organising benchmarks to process large-scale 3D radiology image data with the ultimate aim of generating new medical knowledge.

“Ultimately, VISCERAL’s work will provide an unprecedented dataset on which to develop and test algorithms for the analysis of medical images.”

It is estimated that medical imaging data occupies 30% of all data storage worldwide. However, because this data is unstructured in the form of images which are all different, it is very difficult to use it to gain new knowledge about disease prevalence and disease development. The EU-funded VISCERAL (Visual Concept Extraction Challenge in Radiology) project is organising benchmarks for algorithms that can automatically turn the unstructured image data into semi-structured data. The ultimate aim is for new medical knowledge to be generated from the data for the benefit of patients and the research community at large.

The VISCERAL project, which has been running for two years and comes to an end in April 2015, has made impressive headway towards its objectives. The team created an evaluation infrastructure and software which has already been used in two completed and three ongoing anatomy benchmarks. These benchmarks facilitate the development of algorithms that can automatically turn the unstructured image data stored in radiology information systems in hospitals into semi-structured data.

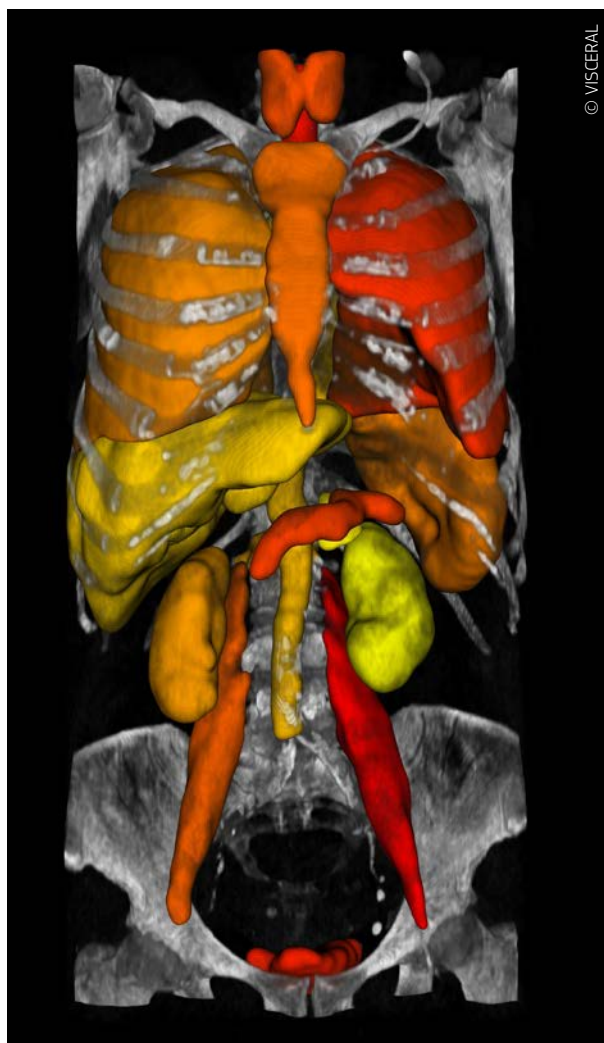
Project coordinator Allan Hanbury from the Vienna University of Technology explains how the completed benchmarks worked: ‘They involved the automated localisation and segmentation of organs in CT (Computed Tomography) and MRI (Magnetic Resonance Imaging) images of humans. We provided images and ground truth on the organs, and challenged participants in the benchmarks to create algorithms to do this automatically. We then tested the algorithms submitted by participants on images that they had never seen.’ The benchmarks provided information on which submitted algorithm performs best for which organ or structure.

‘Training’ algorithms to automatically recognise organs or pathologies in radiology images requires large amounts of training data to learn from. The VISCERAL team has adopted two approaches for getting this training data: a gold corpus and a silver corpus. Mr Hanbury elaborates: ‘The gold corpus is created by qualified radiologists manually annotating the radiology images, which means that the annotations are very accurate, but we cannot get many annotations as a radiologist’s time is expensive. The silver corpus is less accurate but there is no limit on how many annotations can be created. The silver corpus is created by fusing the submissions by participants in the benchmarks. The results of the fusion are better than each of the individual submissions, and can hence be used to train new algorithms.’

The benchmarks currently underway (focused on anatomy segmentation, lesion detection and the retrieval of radiology

images and reports) were actually an unforeseen addition to the project work plan, made possible by sponsorship for the cloud infrastructure used by the team. VISCERAL’s innovative cloud-based evaluation approach is another key aspect of the project. It allows for the data to be centrally stored on a cloud on which the benchmark participants have programmed their approaches to the benchmarks in Virtual Machines. Mr Hanbury adds, ‘In effect, we are bringing the algorithms to the data, rather than the traditional approach of bringing the data to the algorithms. This makes sense, as the programs implementing the algorithms are significantly smaller than the data on which they operate.’

The VISCERAL team has certainly enjoyed significant success over the past two years, but naturally this complex task has also presented it with challenges. The sheer size of the images and the volume of data have been an issue, as Mr Hanbury explains: ‘The data handling has been the greatest challenge. We are working with a large number of huge 3D images, so transferring the data between various systems and ensuring



that the quality of images is good enough for what we want to do with them have been challenging. Furthermore, ensuring that the manual annotations are of high quality has required some effort, as radiologists do not always fully agree with each other on the positions of the boundaries of the organs.'

Although VISCERAL is heading into the last few months of the project, the team is far from slowing down the pace of work. In fact, team members are currently running three benchmarks with submission deadlines in March 2015. They will gather to discuss the results of these benchmarks at two workshops next year. In parallel to this, the team is carrying out further analysis of the results of the first two anatomy benchmarks to extract the largest amount of knowledge from having run them.

Additionally, they are finalising the images, gold corpus and silver corpus for scientific use, as Mr Hanbury explains: 'Making the images, gold corpus and silver corpus available for scientific use beyond the end of the project will allow computer scientists to continue to improve the automated radiology image analysis algorithms. We have now satisfied an ethics committee that this will be done in a responsible way, so the data generated in the VISCERAL project will continue to be available for scientific use after the end

of the project. In terms of lasting scientific impact, this is a very significant point.'

Ultimately, VISCERAL's work will provide an unprecedented dataset on which to develop and test algorithms for the analysis of medical images. The conversion of unstructured medical image data to semi-structured data will allow new medical knowledge to be generated from this data which will be significant for the medical community and patients.

Considering VISCERAL's significant achievements, it's hardly surprising that the team is keen to build on the project's momentum, as Mr Hanbury concludes: 'We are working on potential follow-up projects. One particularly pressing challenge to getting this approach to evaluation more widely accepted is to provide more flexible Virtual Machines on the cloud; and we are currently having discussions on doing this.'

VISCERAL

- ★ Coordinated by Vienna University of Technology in Austria.
- ★ Funded under FP7-ICT.
- ★ http://cordis.europa.eu/project/rcn/106174_en.html
- ★ Project website:
<http://www.visceral.eu/>

NOVEL CARRIERS FOR EFFICIENT DRUG DELIVERY

Therapeutics based on genetics promise solutions for devastating illnesses that cannot be treated by conventional approaches. The development of gene carriers is necessary for specific, efficient and safe treatment.

The recent discovery of gene silencing by 'RNA interference' (siRNA) led to the development of a new class of oligonucleotide-based therapeutics.

"TACIT is likely to have a broad impact on the development of personalised therapeutics."

These genetic elements specifically inactivate genes and are being investigated for treatment of cancer, diabetes, viral infections and inflammation.

This novel drug development has been hampered by a problem known as systemic delivery. siRNA oligonucleotides suffer from a poor pharmacological profile *in vivo*. Attempts to use conventional liposomes for delivery have resulted in non-specific immune stimulation, toxicity issues and limited distribution.

The EU-financed TACIT (Targeted amphoteric carriers in immunotherapy) project was put together by two academic and two commercial partners to address the urgent need for an effective delivery system. The aim was to develop novel, clinically-relevant carriers for delivery to the immune system and test them in inflammatory disease models.

The TACIT researchers designed and synthesised new lipids with rational variations of the head group and lipid anchor chemistry. Amphoteric liposome carriers for systemic delivery of oligonucleotides were developed using the new lipids and a methodology that predicts the stability and efficacy of liposomes.

The liposomes were tested for siRNA delivery *in vitro*, and effective formulations were identified. New liposomal carriers were further tested *in vivo* for their tropism (attraction) to specific immune cell populations, such as macrophages and dendritic cells, their potency for

target knock-down and their safety. For topical administration of siRNA straight to the lung, the scientists developed several formulations.

In addition, TACIT evaluated novel peptide carriers for the *in vivo* delivery of siRNA molecules. These vehicles efficiently delivered cargo siRNA to macrophages in cell culture and *in vivo* in the model of allergic asthma in mice. Researchers used their expertise to target a central signalling pathway in macrophage activation (Akt kinase) in culture and *in vivo* in a model of aspiration-induced lung injury in mice.

Overall, new lipid-based and non-lipid carriers were developed and can be effective for systemic or topical delivery of siRNA to immune cells and inflamed tissues. TACIT is likely to have a broad impact on the development of personalised therapeutics.

TACIT

- ★ Coordinated by the Biomedical Research Foundation, Academy of Athens in Greece.
- ★ Funded under FP7-PEOPLE.
- ★ http://cordis.europa.eu/result/rcn/88923_en.html



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OPTIMISING VERTEBROPLASTY

Painful vertebral compression fractures of the spinal cord are commonly treated using vertebroplasty when other treatments prove ineffective. Sadly, the incidence of new fractures after the procedure has been linked to bone cement in the original fracture site.

“Ex vivo tests on human bone showed improved stability at the fracture site with no corresponding increase in overall stiffness in the vertebra.”

Vertebroplasty is a minimally invasive procedure used to treat osteoporosis, a bone disease characterised by low bone density and mass. ‘Poly methyl methacrylate’ (PMMA) is a material of choice here, as it features a high level of stiffness and good biocompatibility for creating the bone cements used to stabilise the fracture site in such procedures.

Unfortunately, PMMA’s high stiffness can increase the overall stiffness of the vertebra when used on osteoporotic patients during vertebroplasty. This can cause adjacent fractures in patients with lower bone stiffness than PMMA.

The EU-funded SPINEGO (Re-integration of a skilled researcher through an intra-European collaboration on pathology-specific bone cements) project investigated the biomechanics involved and developed novel bone cements with lower stiffness characteristics in order to reduce such fracture risks.

These bone cements also have to be biocompatible and biostable and have similar properties to PMMA to ensure that they get clinical acceptance and regulatory approvals faster. SPINEGO successfully developed a PMMA-based bone cement with a lower stiffness level that is closer to osteoporotic bone with good *in vitro* biocompatibility and handling properties.

Ex vivo tests on human bone showed improved stability at the fracture site with no corresponding increase in overall stiffness in the vertebra. Through this Marie Curie reintegration grant, long-term research collaboration between several institutions has been possible.



EU funding has been made available to these institutions for further research into biomaterials and biomechanics over the next five years. Commercialisation of the new bone cement should improve outcomes for osteoporosis patients following vertebroplasty and improve their quality of life.

SPINEGO

- ★ Coordinated by the University of Uppsala in Sweden.
- ★ Funded under FP7-PEOPLE.
- ★ http://cordis.europa.eu/result/rcn/148896_en.html

CANCER TARGETING USING NANOCAPSULES

Nanocapsules — for targeted drug delivery to diseased or damaged cells — hold promise for the treatment of many conditions that do not respond to conventional drugs.

‘Small interfering RNA’ (siRNA), also called silencing RNA, are double-stranded RNA molecules about 20-25 base pairs in length.

siRNA interferes with the expression of genes and selectively blocks protein synthesis. This could be the key to the development of innovative personalised therapies.

The EU-funded project NANOSIRNA (Transfection ability and intracellular pathway of LbL nanostructured siRNA delivery systems) worked on

developing new technology to effectively deliver siRNA to cancer cells. Scientists will embed siRNA into multi-layered and multi-functional ‘nanocapsules’ (NCs) to target pro-survival factors in human cancer cells.

Degradable polymer NCs were chosen as they might better protect the encapsulated siRNAs from nuclease digestion and last longer than naked siRNAs. This would also improve their therapeutic potency.

NCs were prepared using the ‘Layer-by-layer’ (LbL) strategy, which is

based on depositing interacting polymers onto a porous colloidal template followed by core removal. Different

“NCs were able to retain up to 85% of siRNA cargo and efficiently release it in a simulated intracellular environment.”

types of NC were successfully designed and synthesised and subsequently characterised for their structural and functional properties. They

were loaded with siRNA cargo, designed to target the mRNA encoding for the anti-apoptotic factor survivin.

Results showed that under different experimental conditions, NCs were able to retain up to 85 % of siRNA cargo and efficiently release it in a simulated intracellular environment. siRNA-loaded NCs displayed good biocompatibility in *in vitro* tests. Empty NCs, on the other hand, induced a perturbation of the intracellular

environment. This would activate a cell safeguard mechanism that may limit the therapeutic effect in tumour cells.

Several oral and poster reports were presented at international conferences. The success of the NANOSIRNA project has led to the publication of four papers in peer-reviewed international journals.

Project activities have demonstrated that NCs may represent a superior delivery system for siRNAs compared

to lipid-based transfection systems. The results also highlighted the need for a careful evaluation of possible off-target effects that may influence the therapeutic use of such nanodevices.

NANOSIRNA

- ★ Coordinated by Fondazione IRCCS 'Istituto Nazionale dei Tumori' in Italy.
- ★ Funded under FP7-PEOPLE.
- ★ http://cordis.europa.eu/result/rcn/148943_en.html

CLEVER PROBES DETECT LUNG INFECTION

Diagnosis of lung inflammation in hospitalised patients is often delayed, with fatal consequences. European scientists have set out to develop imaging probes for early detection of lung inflammation and infection to allow clinicians to accurately stratify patients for appropriate therapy.

‘Acute lung injury’ (ALI) is a clinical syndrome mainly encountered in patients hospitalised in an ‘Intensive care unit’ (ICU). It is characterised by heavy neutrophil infiltration in the lungs and often leads to ‘Ventilator-associated pneumonia’ (VAP), a cause of high mortality.

Tracking ALI remains a major diagnostic challenge for critical care clinicians. Seeking to address this issue, the EU-funded CIPL (New tools for real-time cellular imaging and protein labelling) project proposed to develop

specialised molecular imaging probes for detecting ALI and VAP.

These activity-based probes were designed to target either neutrophils, the primary cause of ALI inflammation, or gram-negative and gram-positive bacteria. CIPL members tested a labelling moiety targeted against neutrophil enzymes such as caspase and human neutrophil elastase or bacterial equivalents.

In vitro screening tests verified their discriminatory capacity against healthy lung tissue. Additionally, CIPL

researchers were interested in developing protein labelling methodology, which could be combined with their imaging probes.

To this end, they utilised the well-established histidine tag and modified specific tyrosine residues on the protein.

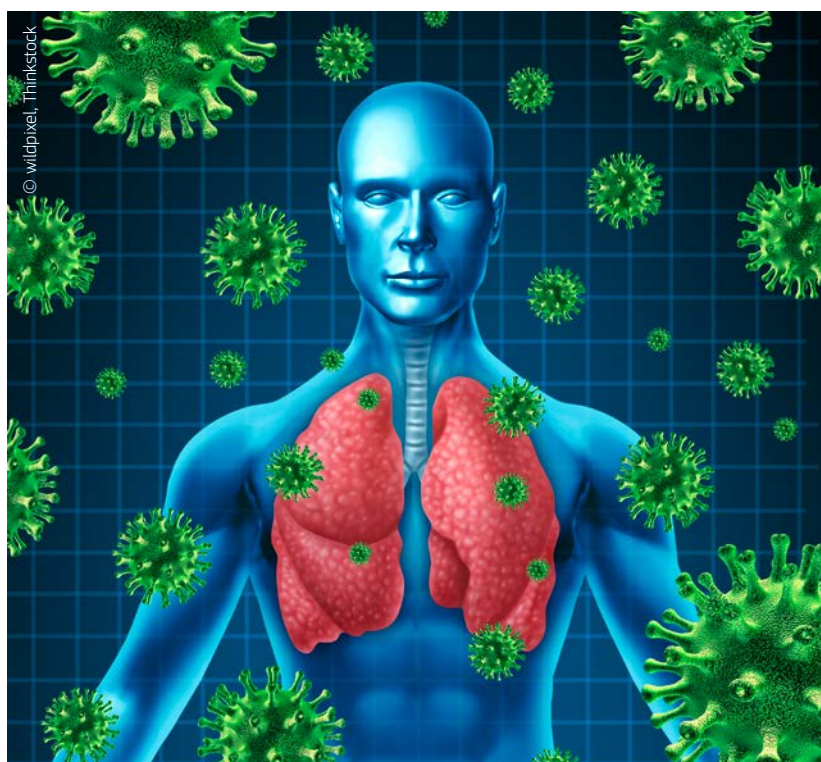
Detection of the modified proteins was carried out using specific probes containing ligands against these tags, as well as a fluorophore for imaging purposes. Although in their infancy, the CIPL optical molecular probes are expected to help identify critical inflammatory events in the lungs of ICU patients promptly.

“CIPL researchers were interested in developing protein labelling methodology, which could be combined with their imaging probes.”

In the long term, this method could be used to rapidly and accurately determine the aetiology of deteriorating respiratory function or the clinical status of patients.

CIPL

- ★ Coordinated by the University of Edinburgh in the United Kingdom.
- ★ Funded under FP7-PEOPLE.
- ★ http://cordis.europa.eu/result/rcn/148865_en.html





SOCIAL SCIENCES AND HUMANITIES

IMPROVED RISK COMMUNICATION DURING INFECTIOUS DISEASE CRISES

The TELL ME project is developing communication strategies that maximise opportunities and minimise risks during infectious disease crises.

As cases of the Ebola disease emerge in Europe, the crisis is gaining increasing levels of media coverage. Certain types of coverage can foster fear and stigmatisation, which leads to harmful consequences for the individuals, communities and countries involved. Therefore, communication strategies that maximise opportunities and minimise risks are vital. That's why the TELL ME (Transparent communication in Epidemics: Learning Lessons from experience, delivering effective Messages, providing Evidence) project is working to develop models for improved risk communication during infectious disease crises.

In the case of Ebola, the stigma of being perceived to be connected with the outbreak in the affected countries is intense and may make individuals hesitant to come forward with suspected symptoms. It may also impact the larger African community in Europe, including those who may have been settled here for many years. The TELL ME team is mindful that effective communication can make a crucial difference in this situation.

TELL ME is drawing on a range of disciplines (from public health to law and ethics) to develop original communication strategies for complicated messages as well as advice based on uncertainties. The aim is to develop a way of communicating that influences behaviours, reduces the spread of disease and avoids panic. The team is particularly keen to explore the huge potential of the information society in terms of evidence-based and participatory communication.

Stigmatisation, as a result of poor communication, affects not only individuals and families, but also entire countries. Paul Quinn from the TELL ME project notes the harmful consequences that he is seeing as a result of stigmatisation during this Ebola outbreak. He says, 'This sense of fear and stigma also affects the way in which foreigners are willing to deal with the countries in question. European airlines have for instance had to cancel flights to affected countries, often under pressure from the union representation of their employees who fear a risk of contamination. This has created not only economic problems for the countries involved, but

also major logistical headaches for international public health authorities attempting to manage an emergency public health response.'

The consequences, he continues, go beyond health: 'The effects that such events are able to create demonstrate that they carry serious risks not only in terms of human health and economic costs, but also in terms of serious social harms that can be felt both at the epicentre of the outbreak and beyond.'

Naturally, concerns and fear surrounding disease outbreaks are aired extensively on social media channels. As a TELL ME press release notes, 'Social media are a fertile ground for [feelings of concern and fears], as well as for the circulation of information, be they correct, distorted or totally wrong.' A TELL ME analysis report on the Ebola crisis which focused on Twitter over seven days in September showed that 632 712 tweets had been published and 17 023 hashtags using #ebola had been used.

The Ebola situation is pertinent for the research questions that TELL ME is exploring, in particular: 'What are the most appropriate communication methods used to deal with complexity, uncertainty, ignorance, information

asymmetries, overwhelming information, biased information, misinformation and malicious information?'

The project will come to an end at the beginning of 2015. Two of the main deliverables will be: an integrated, evidence based, communication work package (TELL ME Communication Kit) for outbreak communication; and a prototype of a computational method for simulating the actions and interactions of autonomous decision-making entities within a virtual environment during an epidemic outbreak.

"The aim is to develop a way of communicating that influences behaviours, reduces the spread of disease and avoids panic."

TELL ME

- ★ Coordinated by Vitamib in France.
- ★ Funded under FP7-HEALTH.
- ★ http://cordis.europa.eu/news/rcn/121958_en.html
- ★ Project website: <http://tellmeproject.eu/>
- ★  <http://bit.ly/1H8pnFk>

HOW MUSEUMS WILL LOOK IN THE FUTURE

2014 marks 2 000 years since the death of Augustus, founder of the Roman Empire. A unique new exhibition is using the anniversary to showcase Europe's very latest in virtual museum technology.

It's 2 000 years since the first Roman emperor, Augustus, died. Rome is marking the occasion with a new exhibition on the Empire, 'Keys to Rome', which opened on Augustus' birthday, 23 September, and is showing in three other cities at the same time. This is more than just another exhibition on the city and its ancient past. A European research network — made up of archaeologists, art his-

Rome exhibition, which is being held simultaneously in four different cities representing ancient corners of the Roman Empire: Alexandria in Egypt (Bibliotheca Alexandrina), Amsterdam (Allard Pierson Museum), Sarajevo (City Hall) and, of course, Rome (Imperial Fora Museum).

'Organising the exhibition in four cities at the same time has been a big challenge, a bit of a risk really. It has never been done before,' commented Sofia Pescarin, V-MUST.NET coordinator.

Roman collections from the four museums will be on display until May 2015 and shared through a stream of new apps and 'immersive' technology developed by the V-MUST.NET partners. Objects exhibited in the four cities are discovered through a digital itinerary using computer graphics movies, natural interaction installations, multimedia and mobile apps.

The journey is guided by two storytellers, an old merchant and his nephew, in the century following the end of the Roman Empire (6th century AD). Visitors are taken on a discovery of the secrets of their family through objects owned by their ancestors, using the 'Keys to Rome'

to unlock stories hidden in the items. 'The digital experience begins at this point,' said Sofia. "Travelling in time", they have to find those objects in the museum using a mobile application called Matrix, which connects the objects in the four museums in a sort of treasure hunt,' she explained.

Strolling through Rome 2 000 years ago

Visitors to any of the museums will be able to download Matrix, developed by the Fraunhofer Institute in Darmstadt, Germany, onto their smartphones for free and use it to choose a character to guide them around, find objects and access the four collections. The application will be made available on the Keys to Rome website.

Other tools include a wireless 'Radio-frequency identification' (RFID) system in the Allard Pierson Museum in Amsterdam that visitors can use to tailor-make content. In Rome, a Walking Map gives them the feeling of walking within the city now and 2 000 years ago. They can print out a sensor-laden 3D image of the famous Augustan Ara Pacis altar using another app, Virtex, touching the print-out button to learn more about the altar.

"The journey is guided by two storytellers, an old merchant and his nephew, in the century following the end of the Roman Empire."

torians, architects, computer scientists and communication experts — is using the event to showcase new virtual museum technologies. They will demonstrate how these technologies can be used to engage visitors in the future.

Exhibition in four cities at same time: a first

Members of the V-MUST.NET (Virtual Museum Transnational Network) project are curating the Keys to

Another augmented reality app, Nisar, from the French research institute INRIA enables visitors to see more details about an object by pointing their fingers at it. They can also explore reconstructed 3D scenarios through Admotum, a Kinect-based game that also links to Holobox, a manipulator of object holograms. These last two applications were developed by the Italian research council, CNR ITABC.

As well as the 18 project partners, V-MUST.NET has 120 associate members, some of whom are located outside Europe. It has set up a 'Competence Centre' to market the technologies once the project ends.

V-MUST.NET is a European Network of Excellence in Virtual Museums, a four-year project with funding of EUR 4.45 million from the European Commission's 7th Framework Programme. The project began on

1 February 2011 and finishes on 31 January 2015.

V-MUST.NET

- ★ Coordinated by the National Research Council in Italy.
- ★ Funded under FP7-ICT.
- ★ http://cordis.europa.eu/result/rcn/148258_en.html
- ★ Project website: <http://www.v-must.net/>
- ★ <http://bit.ly/1BxBUo>

THE SCIENCE OF RELEVANT NETWORKING

The EU SOCIETIES ICT research project has spawned a host of tools and applications allowing people to form smart communities in which they can discover, connect and organise 'relevantly' with one another.

W e all use social networks in our private or professional lives. But how many people in our networks are really relevant to us? How can we identify the best person to talk to on a given subject? How can we rapidly connect and network with this person? This was a focus of the EU's 3.5-year SOCIETIES (Self Orchestrating Community ambiEnT IntelligEnce Spaces) project: to create so-called 'Community smart spaces' (CSS) where members with highly-focused interests can connect, physically meet up, share problems and resources, and try together to find solutions in just about any area of life.

EU leads way in 'Internet of things' research

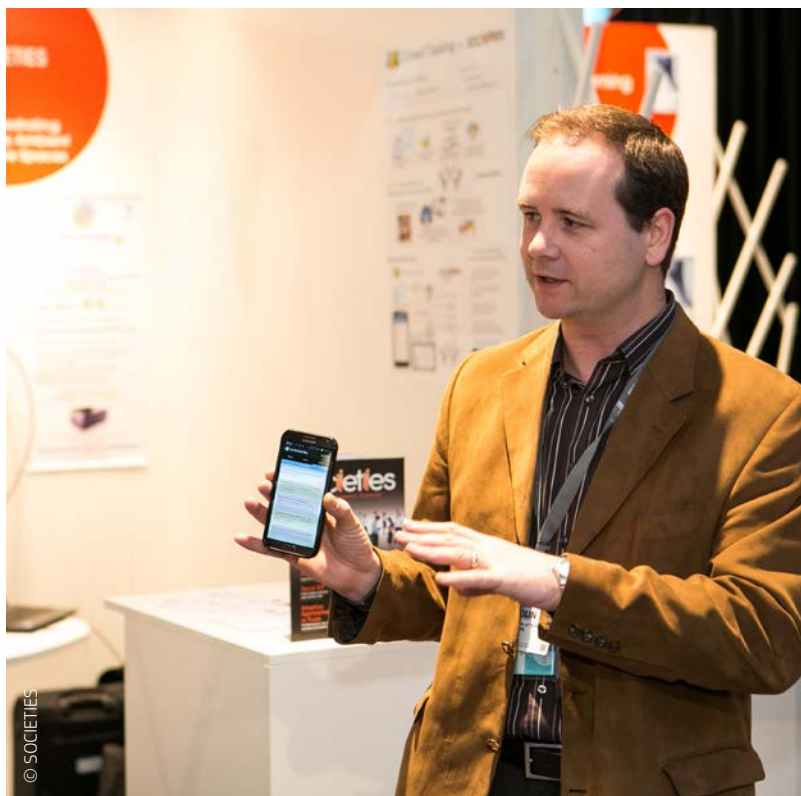
SOCIETIES researchers have been working on pervasive computing — known as the Internet of Things — for over a decade now. An earlier EU ICT research project, PERSIST, looked at personal smart spaces and how individuals could connect to technology in their homes and offices through one device. 'The obvious problem is, what happens when one or more personal smart spaces get together? That led us down the route of Community Smart Spaces and into the SOCIETIES project,' explained coordinator Kevin Doolin, of Waterford Institute of Technology's Telecommunications Software and Systems Group (TSSG) in Ireland.

The partners set about building a platform for matching people, resources and services, and discovered innovative areas where they could help users network in a more focused and private way. They identified eight of these as core innovations: Learning (about users); Preferences (specialised community templates); User Intent (helping users achieve their goals); Community Orchestration (identifying who and what are relevant); Community Context (benefiting from crowd 'wisdom'); Location (pinpointing who's nearby); Trust (stricter filtering mechanisms); and Privacy (integrating privacy into software development, rather than adding it on later).

Three user groups were chosen to trial services based on the innovations. For example, computer students at Heriot-Watt University in Edinburgh tested individual Personal Agenda and MyTV apps and the lecturer-questioning AskFree. Then, on a group basis, they participated in Browsing 'races', collaborative quiz games and organised meet-ups using a location app based on 'geo-fencing'. The SOCIETIES platform was found to be robust and reliable in

use, with very little downtime, and able to respond to the inventiveness of the students, running multiple services simultaneously with multiple users.

In another trial, researchers took SOCIETIES to the European Commission's 4 000-strong ICT 2013 conference in Vilnius, Lithuania, and tried out Relevance, a conference schedule, planner and networking app, customising it for the event. 'Relevance' leveraged the Community Orchestration innovation, using project algorithms and user-defined keywords to enable participants to decide which presentations to attend and find people they wanted to meet in the 'geo-fenced' environment. The feedback from users at the conference was that there was significant interest in having an application which reduces 'social clutter'. Indeed, six other conference organisers present also expressed an interest in having such an app at their events. This led to a company, Fuseami Ltd. being spun off from the project to tap into the potential.



A third trial involved rescue workers in a forest fire simulation in Germany. They wore 'iJackets' to connect with one another and with a remote disaster management centre.

SOCIETIES project spin-off launches in Ireland

Fuseami is launching its conference networking app based on 'Relevance' in November 2014. The app is based on intelligent professional profile matching. Its core innovation is a Relevance Orchestration Engine, which fuses a number of complex algorithms to provide each user with a similarity score for each potential connection, taking into account education, job title, areas of interest and key words based on who you would like to meet. TSSG says the app will allow users to 'discover, connect and engage with relevant business contacts.'

'The whole idea is to cut through all the social media clutter and allow people, if they go to an event or any location, to log into the Fuseami app, via LinkedIn, and find people relevant to them,' explained Kevin. 'It's not going to go out

and find your friends; the idea is to find people you don't already know. It's about making networking relevant.'

The SOCIETIES platform contains a wealth of architecture descriptions, context management systems, privacy controls, and other specifications which are available to any developer, on a whole or module basis, by downloading from: <http://www.ict-societies.eu/open-source/>

SOCIETIES, involving 15 partners in 10 countries, ran from October 2010 to April 2014 and received EUR 10.6 million of funding from FP7.

SOCIETIES

- ★ Coordinated by the Waterford Institute of Technology in Ireland.
- ★ Funded under FP7-ICT.
- ★ http://cordis.europa.eu/result/rcn/149097_en.html
- ★ Project website: <http://www.ict-societies.eu>

POLITICAL VIOLENCE, PUBLIC MEMORIES AND STATE FORMATION

European research has examined two specific periods in Cypriot and Irish history to compare the ways in which political violence in each was legitimised. Insurgencies against the state developed in the period 1916–1919 in Ireland and 1955–1969 in Cyprus.

The POLITICAL VIOLENCE (Political violence legitimization in Ireland and Cyprus) project studied evidence from the historical records of both islands. In parallel, the research considered the subsequent, post-United Kingdom periods.

"The outcomes of POLITICAL VIOLENCE offer important insights into the histories of two states still dealing with unresolved questions."

The interest here was in the public memories of the insurgencies and how they were intertwined in the processes of consolidation of the new states that emerged. Both secondary materi-

als and archival sources from the two areas were examined.

The research also involved over 30 in-depth interviews with Cypriot participants and spectators of the events unfolding there during the four-year period in question. The findings indicate that the legitimisation of political violence is situational. It is the result of many parallel processes integrating representations of violence and collective commitments.

Although there are some general differences between the two, Cyprus and Ireland present similarities in form. For example, the discourse regarding Cyprus included a much wider audience than that of Ireland.

In Cyprus, nationalist insurgency and the British counter-insurgency violence were central to the legitimacy discourse. However, in Ireland, where the violence played out mostly in the interwar period, the focus of discourse was more on the legitimacy of the state (United Kingdom) and on nationalist claim to a republic. Comparisons highlighted a key difference in the general configuration of the two islands' publics.

In Cyprus, those sympathising with the insurgency and those opposing it lived near to each other and the violence. However, in Ireland, much of the discourse developed from a relative distance and

reflected the (varied and fluctuating) views of third parties.

POLITICAL VIOLENCE also considered the respective periods of state consolidation in Cyprus and Ireland. Its research underlined differences in the development of conflict between those supporting compromise and those seeing it as betrayal.

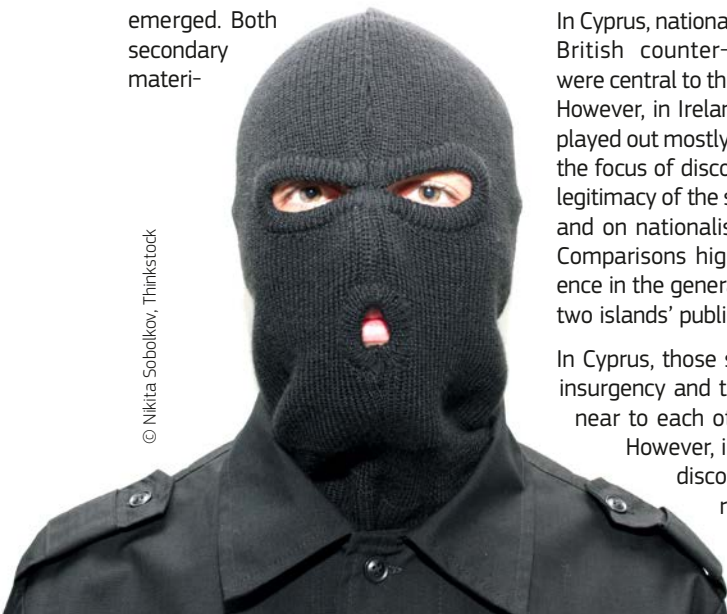
In each place, this development played a heavy role in how the collective memory of insurgent violence was figured, configured and reconfigured. A book manuscript outlining project research and findings is currently being completed.

The outcomes of POLITICAL VIOLENCE offer important insights into the histories of two states still dealing with unresolved questions. Results and the knowledge created are of interest both to academics of comparative-historical sociology and comparative politics and to policymakers.

The book will also impact political and conceptual debates surrounding violence and its role in state formation.

POLITICAL VIOLENCE

- ★ Coordinated by Queen's University Belfast in the United Kingdom.
- ★ Funded under FP7-PEOPLE.
- ★ http://cordis.europa.eu/result/rcn/148914_en.html



THE LONG HISTORY OF MINORITY INTEGRATION STRUGGLES



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With EU borders opening up and increasing mobility, minority integration is a hot topic in both academic circles and public debate. Researchers examined the early markings of this phenomenon.

To advance a better understanding of the subject, the EU-funded POLMIN-1418 (National Minorities at War: Integration, Identity and Combat Motivation among Poles in German and Austro-Hungarian Society, 1914-18) project endeavoured to highlight dilemmas regarding the integration of minorities with a long history in Europe. The project's design also afforded an opportunity to further knowledge in another two related areas.

With a focus on the First World War, the first questioned how war contributed to national identity formation and spread in east-central Europe. The second analysed the influence of ideology, nationalism in particular, on modern combat motivation.

An in-depth study of the Poles of Germany and Austria-Hungary looked into how polar opposite integration policies affected one minority. The time period in question went as far back as the four decades leading up to 1914.

Germany applied increasingly obtrusive assimilationist policies, while Austria had a more multicultural approach. To assess the effectiveness of these policies, POLMIN-1418 studied Poles' conduct during WWI. The outcomes indicate that both German and Austrian pre-war integration policies had limited success.

It also tested whether past integration policies had effectively promoted social cohesion. Official documentation and correspondence between minorities in military service and their families offered rich insights into the development of minority identities.

Materials were also gathered from archives and libraries in Warsaw, Cracow, Berlin, Vienna and Jerusalem. POLMIN-1418 showed that national identities hardened under the demands of war.

The study also revealed that minorities in national or imperial armies fought effectively even in the absence of an ideological investment in the states they served.

To deepen their findings, project researchers carried out a regional study on the Masurian people in East Prussia. Findings point to pre-war assimilation policies strengthening protestant and political affinities. This led to a higher identification with the German war effort.

A regional study on Cracow highlighted two important war-time phenomena. It tracked the rise and changing politics of Polish nationalism in the city, and analysed how wartime conditions affected inter-ethnic relations there.

The study's results are important for the historiography on WWI and Poland, and add to the multidisciplinary literature on nation building. The project highlighted the limitations and problems of both assimilationist and multicultural integration strategies, revealing their major socioeconomic impact.

With dilemmas of integration a central part of modern European history, POLMIN-1418 underlined that ethnic and religious diversity is not a new and unfamiliar phenomenon. Understanding the interplay of all of the above will help shift the public debate and better inform national and EU integration policymaking.

POLMIN-1418

- ★ Coordinated by the University of Warsaw in Poland.
- ★ Funded under FP7-PEOPLE.
- ★ http://cordis.europa.eu/result/rcn/148895_en.html

A NEW APPROACH TO HISTORIOGRAPHY

With the support of EU funding, a research project was set up to study a crucial period of Greek history. The approach is unique, due to the focus on the historical documentation of the period and the use of a specific text whose author and date of composition are unknown.

The period under study covers the last phase of the Peloponnesian War and the emergence of Spartan supremacy (i.e. from 412 B.C. to 386 B.C.).

The text in question is the *Hellenica Oxyrhynchia* (HO), which comprises three papyrus fragments.

Before addressing the topic of authorship, the HTDPSH (Historiographical tendencies during the period of Spartan hegemony) project spotlighted literary and historiographical questions deemed to be of more importance.

Through the application of various strategies (narratology, historical inquiry, papyrological investigation and literary comparison), the study first sought to shed light on how the text relates to Thucydides and Xenophon.

The analysis thus closely investigated vocabulary and style, without overlooking broader issues of narrative technique and interpretation. Initial research led to a refined set of project objectives, most of which have been achieved.

“The analysis closely investigated vocabulary and style, without overlooking broader issues of narrative technique and interpretation.”

These include an examination and clarification of the structure and narrative devices of the HO through a close comparison with previous and contemporary historical works.

Significant findings were detailed, revealing new narrative patterns in the HO. Other research findings related to the author's identity: it is possible that the HO and the Theramenes papyrus had the same author.

Despite this, HTDPSH carried out a revised reading of Diodorus, and also

examined the political language of Thucydides in an attempt to discover stylistic clues similar to those offered in the HO.

No definitive conclusions could be drawn from this exercise. Studies of the topic of moralism in the various writings studied revealed that the HO's historiographical view differs considerably from that of contemporary authors such as Xenophon, Theopompus and Ephorus.

This offers a new path for future research looking at the HO authorship issue. The project's main deliverable was a monograph that proposes a new methodological approach to studying

the HO and other fragmentary historians in general.

As such, it will constitute an unprecedented scientific tool, encouraging further studies in the field.

Future work is planned, with the final goal being the production of a manuscript detailing and discussing all findings relative to HTDPSH's subject.

HTDPSH

- ★ Coordinated by the University of Oxford in the United Kingdom.
- ★ Funded under FP7-PEOPLE.
- ★ http://cordis.europa.eu/result/rcn/148913_en.html



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ENERGY AND TRANSPORT

USING INTELLIGENCE TO UNLOCK THE MARKET FOR ELECTRIC VEHICLES

The EU-funded OPENER project has developed intelligent ways for electric vehicles to achieve energy efficiency, making them much more commercially attractive.

Our fuel-based economy must be radically overhauled if Europe is to achieve its ambitious emission reduction targets. One important piece of this jigsaw could be the increased commercialisation of electric cars, which use carbon-free energy sources and emit no CO₂ or other pollutants. As an added bonus, electric vehicles also generate less noise and vibration.

So why don't we see more electric cars on the road? Cost is undoubtedly a factor, but a key constraint is the fact that these vehicles have limited driving ranges, which decreases their attractiveness as viable alternatives to fuel-driven cars. What is needed is greater energy efficiency to preserve battery life, which is exactly what the EU-funded OPENER (Optimal ENERGY consumption and Recovery based on a system network) project has achieved.

After three years of intense collaboration and EUR 4.4 million of EU investment, the OPENER project recently presented two demonstration electric vehicles in Spain. Increased driving range was achieved not through enhanced battery technologies, but

by the development of an intelligent energy management and recovery system.

In particular, the team worked on improving the braking system, navigation system and surrounding sensors. An adaptive cruise control was also installed to guarantee more economical driving. These 'eco-routing' functions are the key to achieving energy efficiency and preserving battery life.

Safety was another driving factor behind the project, with sensory advice targeted not just at energy efficiency, but also at providing timely warnings. Optimised range predictions show reliable information on remaining driving range, thereby avoiding unwanted and potentially risky stops due to an empty battery.

In practice, this means that the car is intelligent, providing the driver with braking tips based on traffic flows and advice on the best route to limit energy use. Energy savings of up to 30% are therefore possible, with little time lost along the way. The project team, together with reviewers and members of the public, were able to drive

the new vehicles and try out the new functions.

The OPENER project, which was completed earlier this year, comprised six partners from across Europe who shared a firm belief that electric vehicles can — and should — be improved. The team now hopes that the new system will be progressively integrated into production from 2015 onwards.

The EU has stated that it aims to have between 8 and 9 million electric vehicles on the road by 2020. There are a number of challenges ahead however, including increasing the reliability and durability of batteries and super-capacitors, reducing battery weight and volume, safety, cost reduction, charging infrastructure and plug-in solutions. Nonetheless, the electrification of transport (or electromobility) is an EU research priority.

The European Green Cars Initiative (EGCI), of which the OPENER project was a part, was launched in 2011 as part of the European Recovery Plan. The initiative is designed to help achieve the EU's ambitious climate goals, such as the reduction of CO₂ emissions by 60% by the year 2050. EGCI also supports the research and development of road transport solutions that have the potential to achieve sustainable results.

OPENER

- ★ Coordinated by Robert Bosch in Germany.
- ★ Funded under FP7-TRANSPORT.
- ★ http://cordis.europa.eu/news/rcn/121770_en.html
- ★ Project website: <http://www.fp7-opener.eu/>

HYBRID NANOCOMPOSITES — AUTOMOTIVE SECTOR

Energy and climate change, inherently intertwined, are among the most pressing challenges of the 21st century. One solution, with a major impact on emissions, is novel batteries and solar cells that can be used in energy-autonomous automotive devices.

Energy harvesting will likely play an important role in meeting the EU's stringent restrictions on carbon dioxide emissions for 2020. Inorganic-organic hybrid nanomaterials will play a major role in the technological development of energy solutions.

The EU-funded project ORION (Ordered inorganic-organic hybrids using ionic liquids for emerging applications) created a multi-disciplinary, multi-sector consortium of experts in batteries and solar cells. Researchers worked on developing new materials exploiting ionic liquids to meet the energy challenge.

Ionic liquids can impart order and functionality in inorganic-organic hybrids. The team used them to guide the growth of inorganic nanomaterials and functionalise their surfaces. Following the synthesis, characterisation and modelling of a variety of novel materials, researchers turned toward the development of demonstrators to showcase the technology.

The team delivered two energy-autonomous devices for automotive applications exploiting the ORION solar cell and battery prototypes. These devices should also result in significant weight savings and simplify assembly processes, generating further savings in production costs. This in turn will reduce fuel consumption and emissions.

ORION's explosive activity led to over 70 publications and 11 patent applications, six of which have already been awarded. Patents are not the only evidence of progress toward

commercialisation. Sales outside Europe of novel metal salts developed by ORION skyrocketed from 11% in 2011 to 40% in 2012. Another partner produced dye-sensitised solar cell modules to cover the façade of the Swiss Tech Convention Centre using knowledge acquired during the ORION project. Numerous other project-related technologies are finding their way into products at partner facilities with outcomes generating positive repercussions throughout the EU.

Highlights can be found in the project newsletter and in videos of the two demonstrators.

The novel inorganic-organic hybrids exploiting ionic salts developed by ORION researchers were fundamental to the development of energy devices. Knowledge gained is likely to pave the way towards numerous other applications in optics, electronics, sensing, environmental sciences and medicine. The wealth of publications and products now on the market should fuel a new era of discovery, ensuring a leading role for the EU.

ORION

- ★ Coordinated by Cidetec in Spain.
- ★ Funded under FP7-NMP.
- ★ http://cordis.europa.eu/result/rcn/91020_en.html
- ★ Project website: <http://www.cidetec.es/ORION/index.html>



DEVELOPING MORE RELIABLE WIND TURBINES

Wind energy accounts for around 3% of Europe's overall electricity production and is projected to provide 12% by 2020. To achieve this target, wind turbines need to be increased in number and at the same time operate at optimum efficiency and cost.

Manufacturers of wind turbines are focusing on improving reliability in order to reduce operation and maintenance costs. To achieve this, new designs are being developed that require fewer regular service visits and less time lost through non-operation.

The EU-funded INTELWIND (Development of an intelligent condition monitoring system for application on critical rotating components of industrial-scale wind turbines) initiative aimed to significantly

reduce the number of failures in critical rotating components of industrial-scale wind turbines. It further sought to reduce the need for corrective maintenance by developing and implementing an intelligent monitoring system. This 'Condition monitoring system' (CMS) is based on integrating acoustic emissions, vibrations, torque sensing and oil data from sensors.

Sensors already included in wind turbine logging systems provided the reference parameters needed for data

"The CMS represents a major step forward in monitoring the condition of wind turbines."

analysis, such as wind speed and direction and power output. INTELWIND developed algorithms and embedded them into the CMS to provide data allowing for estimations of the wear

on bearings as well as other factors. The data are compared with a series of 'healthy' key performance indices. If a value outside the acceptance range is identified, an alarm is triggered. This provides the capacity for automated monitoring and early intervention.

The CMS represents a major step forward in monitoring the condition of wind turbines. It not only identifies faults in critical rotating components, but also enables continuous measuring and recording of the load on components making up the drive train. This is achieved using a surface acoustic wave sensor to measure torque in the high-speed shaft in combination with the developed software. Together with software for estimating

the remaining life of components, these developments represent a new era in preventative maintenance for wind turbines.

INTELWIND's intelligent system can be incorporated into both newly manufactured turbines and older installations. It will lead to significant savings related to expensive replacement equipment such as gear boxes, as well as savings on maintenance costs.

INTELWIND

- ★ Coordinated by Innovative Technology and Science Limited in the United Kingdom.
- ★ Funded under FP7-SME.
- ★ http://cordis.europa.eu/result/rcn/147176_en.html
- ★ Project website: <http://intelwind-project.com/>



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MAXIMUM ENERGY SAVINGS WITH MINIMUM INTERVENTION FOR HISTORIC BUILDINGS

Europe's historic buildings draw visitors from all over the world. But keeping them energy-efficient without having to carry out significant construction work can be a struggle. The EU-funded project SEEMPUBS plans on using a new ICT-based monitoring, visualisation and control system to reduce these buildings' energy consumption, cope with the existing energy systems in place and avoid possible damages caused by major building works.

The FP7-funded SEEMPUBS (Smart Energy Efficient Middleware for Public Spaces) project has developed a new computer-based system that can control lighting, heaters, air conditioners and other environmental units in large buildings. The SEEMPUBS technology includes a central control software system connected wirelessly to energy structures placed in different parts of a building or even a number of buildings.

Professor Enrico Macii of the Polytechnic University of Turin says that 'beyond any actual hardware, the most significant result has been the elaboration of an energy-efficient model for existing buildings and public spaces. This model can be applied to many different historic buildings where legacy energy systems are already in place, avoiding expensive construction work, disruption and possible damage.'

The functionality of this system is already being demonstrated on existing buildings at the Politecnico Campus, and Valentino Castle. By comparing reference and test rooms, average weekly savings ranging from 27% to 36% have been observed in heating energy in the winter period. These savings have ranged from 63% to 74% for cooling energy in the summer period.

Great economic potential

Light, temperature and humidity in such buildings are often difficult to control. 'Typically, these historic buildings have individual heaters and air conditioning units in the different rooms,' Macii says. 'There is no central environmental control. So someone has to walk around to the different rooms,

read temperature gauges and other sensors, and then adjust the heating and other units manually.'

The SEEMPUBS systems draw together building services, electronic devices and operations in order to optimise and integrate all maintenance functions. When possible, existing building management systems are left in place, while new hardware used for fine-grained monitoring and control can be added.

The SEEMPUBS operator can actually visualise different spaces and navigate through a building virtually, overseeing the entire inter-linked system of environmental and energy control.

The project has also developed a hand-held app allowing users to visualise and inspect various environmental systems as they walk through a building, providing real-time light, temperature, humidity and other data as well as architectural and structural information.

The project partners believe that the economic potential is significant, including creating a market for ICT-based solutions that integrate new and existing technologies, and opening doors to new services, from the design of customised systems to operations and maintenance.

"The SEEMPUBS operator can actually visualise different spaces and navigate through a building virtually, overseeing the entire interlinked system of environmental and energy control"



One of the project partners is currently working on a commercial version of the methodology, including a beta-release of the supporting software. Another partner is also exploiting some of the project's findings, namely those concerning sensor technologies, to enhance its portfolio of sensor devices for ambient sensing and monitoring. Finally, the features of the SEEMPUBS methodology are currently being extended for use at district level as part of another EU-funded R&D project, DIMMER.

The project is also looking forward to a new collaborative framework ultimately taking shape between the ICT and building and construction sectors, exploiting opportunities to develop ICT-based systems in compliance with the EU's Energy Performance of Buildings Directive.

'We are doing all of this while at the same time achieving more efficient and sustainable operations,' Macii says. 'The result is reduced energy consumption, cost savings and a "greener" overall environmental performance. We also want to raise citizen awareness, especially among youngsters, of the positive impact new technologies can have over the mid- to long-term. For this, we have developed a game called SEEMPubSDice using augmented reality technologies and a theatre show called ToBeSmart.'

The game allows players to interact with elements of the project (wireless sensors, temperature sensors, light bulbs, old electric wires, etc.) and to monitor the impact energy management can have on the overall energy consumption of a building. The theatre show, which was presented twice, used special projection technologies to teach the audience the basics of the project's technological development.

The SEEMPUBS project, completed in 2013, brought together nine partners from five countries and received EUR 2.9 million of funding under the EU's 7th Framework Programme (FP7).

SEEMPUBS

- ★ Coordinated by the Polytechnic University of Turin in Italy.
- ★ Funded under FP7-ICT.
- ★ http://cordis.europa.eu/result/rcn/148259_en.html
- ★ Project website: <http://seempubs.polito.it/>

LIGHTER AND STRONGER MATERIALS FOR GREENER AIRCRAFT

EU-funded researchers have used carbon nanotubes to create exceptionally strong, lightweight and cost-effective materials for aircraft parts. They have demonstrated the potential of this material for making lighter aircraft that burn less fuel — a big boost to the competitiveness of Europe's transport industry.

Aiming to improve environmental performance and cost efficiency, the transport industry is moving away from materials based on metal and towards lightweight composites, such as reinforced polymers. Less weight results in lower fuel consumption — and fewer greenhouse gas emissions.

"This integration allows us to eliminate a number of metallic parts and reduce weight."

Carbon-fibre-reinforced polymers are now the preferred composite materials as they provide low weight and high strength with cost savings — a particularly attractive combination for the airline industry.

The EU-funded project IMS&CPS (Innovative material synergies and composite processing strategies) has contributed to this advance by developing a new closed-mould manufacturing technology that produces integrated components. This integration allows manufacturers to eliminate a number of metallic parts — with the aim of reducing aircraft weight and manufacturing costs.

The team also created a pure carbon nanotube fibre fabric and a pure carbon nanotube yarn. Numerical models developed by the team can be used to integrate these materials within polymers.

The pure carbon nanotube fibre fabric is likely the first of its kind, says Emmanuel Dettaille from project coordinator Coexpair in Belgium.

'Around 998 million passengers travelled by plane in 2010, compared to 262 million in 1989,' he adds. 'In 2008, 25 million tonnes of kerosene were consumed for intra-European flights alone. We wanted to provide an effective answer to the issue of global energy by proposing technologies to decrease an airplane's total weight and thus fuel consumption.'

The carbon nanotube potential

Conventional carbon fibres are five to ten micrometres in diameter and made of carbon atoms in a crystal lattice. They have been successfully produced for commercial use, particularly in the aircraft industry, since the 1960s.

But new possibilities appeared with the discovery of carbon nanotubes.

These tube-shaped carbon molecules, with diameters in the range of nanometres or billionths of a metre, have unusual properties, including high electrical conductivity, making them very useful in a variety of electrical and mechanical applications.

For example, used in aircraft wings, the conductivity of carbon nanotubes could help provide protection against lightning strikes. This use would reduce weight compared to the

metallic parts currently used for such components — such as copper mesh.

As a demonstration of their work, the researchers produced two sections of an aircraft: a small part of a fuselage panel and a re-engineered nose landing gear door.

‘The “Same-Qualified-Resin-Transfer-Molding” (SQRTM) process can be used to produce a one-shot complex structure,’ adds Detaille. ‘This integration allows us to eliminate a number of metallic parts and reduce weight.’

IMS&CPS also studied different ways of integrating carbon nanotubes into composite materials. The studies resulted in a database on mechanical, electrical and fire properties for use by researchers and industry.

Next steps

The results of the project are expected to help manufacturers reduce the cost, weight and fuel consumption of new aircraft. Energy consumption will

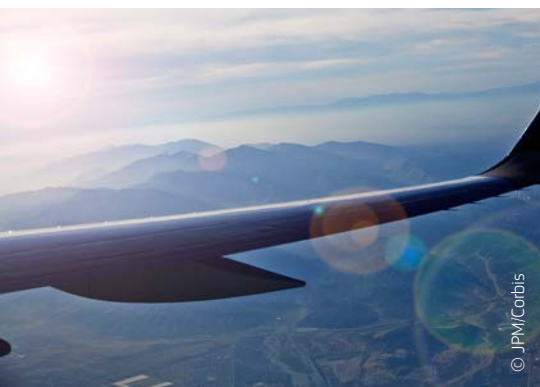
also be lower during manufacturing, because fewer parts need to be produced separately.

‘The results support the development of strong European expertise in both innovative materials development and composite materials manufacturing,’ adds Detaille.

Since the end of the project in September 2013, the companies involved have moved forward with a large-scale manufacturing programme based in part on the results from IMS&CPS.

IMS&CPS

- ★ Coordinated by COEXPAIR SA in Belgium.
- ★ Funded under FP7-NMP.
- ★ http://ec.europa.eu/research/infocentre/article_en.cfm?artid=32960
- ★ Project website: <http://www.materials.imdea.org/research/projects/IMS-CPS>



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MORE ENERGY-EFFICIENT CELLULAR RADIO NETWORKS

An EU-funded project has tackled the energy consumption challenge for cellular radio networks. The initiative developed advanced tools and software platforms to help operators improve the energy efficiency of their current and future network deployments.

Current mobile networks were not designed to be energy efficient and they consume more energy than is needed to satisfy user demand. Radio access networks are often responsible for most of the total power consumed by mobile network operators.

The GREENNETS (Power consumption and CO₂ footprint reduction in mobile networks by advanced automated network management approaches) project worked to increase the energy efficiency of radio networks. Developments in such areas will help the EU achieve ambitious energy and climate change objectives for 2020. Consortium partners developed energy-efficient equipment and improved network operations and radio deployment efficiency by operating only what was needed of the radio network.

Smarter use of existing and new radio equipment led to reductions in energy consumption, as did adapting the use of the radio infrastructure to reflect current demand. This included putting the unnecessary parts of the radio access network into sleep mode or temporarily switching them off to reduce power consumption.

Project partners created algorithms to map network key performance indicators and to form part of the ‘Energy efficiency optimiser’ (EEO). The EEO was designed as an automatic system capable of proposing and carrying out actions, such as the times to switch on or off parts of the radio network, resulting in energy savings.

GREENNETS’ work will enable mobile network operators to meet both commercial and sustainability targets in Europe and the rest of the world. Energy costs account for half of a mobile operator’s operating expenses. Solutions supporting improved energy efficiency are therefore not just beneficial for the environment, they also make good business sense.

GREENNETS

- ★ Coordinated by Datax in Poland.
- ★ Funded under FP7-SME.
- ★ http://cordis.europa.eu/result/rcn/147155_en.html

“Smarter use of existing and new radio equipment led to reductions in energy consumption, as did adapting the use of the radio infrastructure to reflect current demand.”



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IMPROVED SIMULATION OF NUCLEAR QUANTUM EFFECTS

The concurrent simulation of nuclear quantum effects for both electrons and light nuclei is now considerably less expensive, thanks to an EU project. This development will help to improve materials used in lithium batteries, fuel cells and many other chemical and biological applications.

At the quantum level, materials behave in a way that is substantially different to that in the everyday Newtonian world. This can affect the manner in which materials and devices that contain hydrogen or other light atoms function.

Computer-based simulation techniques are used to model this behaviour. For condensed-phase systems, 'Density functional theory' (DFT) provides an acceptably accurate framework for looking at the quantum electronic structure. DFT is, however, costly.

Combining DFT simulations with 'Path integral molecular dynamics' (PIMD), which is a convenient approach to deviations from Newtonian behaviour, is desirable in certain cases.

The problem is that using the two together is both highly expensive and time-consuming. The NQEAIMD (Fast

and accurate simulation of nuclear quantum effects in ab-initio molecular dynamics by a generalised Langevin equation) project aimed to make PIMD simulations less costly.

The idea was to facilitate a combination of 'Nuclear quantum effects' (NQE) with DFT simulations. The researchers began by applying a coloured-noise, 'Generalised Langevin equation' (GLE) to a PIMD simulation.

When they had established this methodology, they studied the impact of NQEs on the properties of water. Then they extended it to more complex problems in collaboration with experimental groups. The team developed a hybrid technique called PI+GLE, which reduces the cost to one fifth or less. PI+GLE was then improved to produce the PIGLET method, which could make it a routine

matter to include NQEs in *ab initio* molecular dynamics.

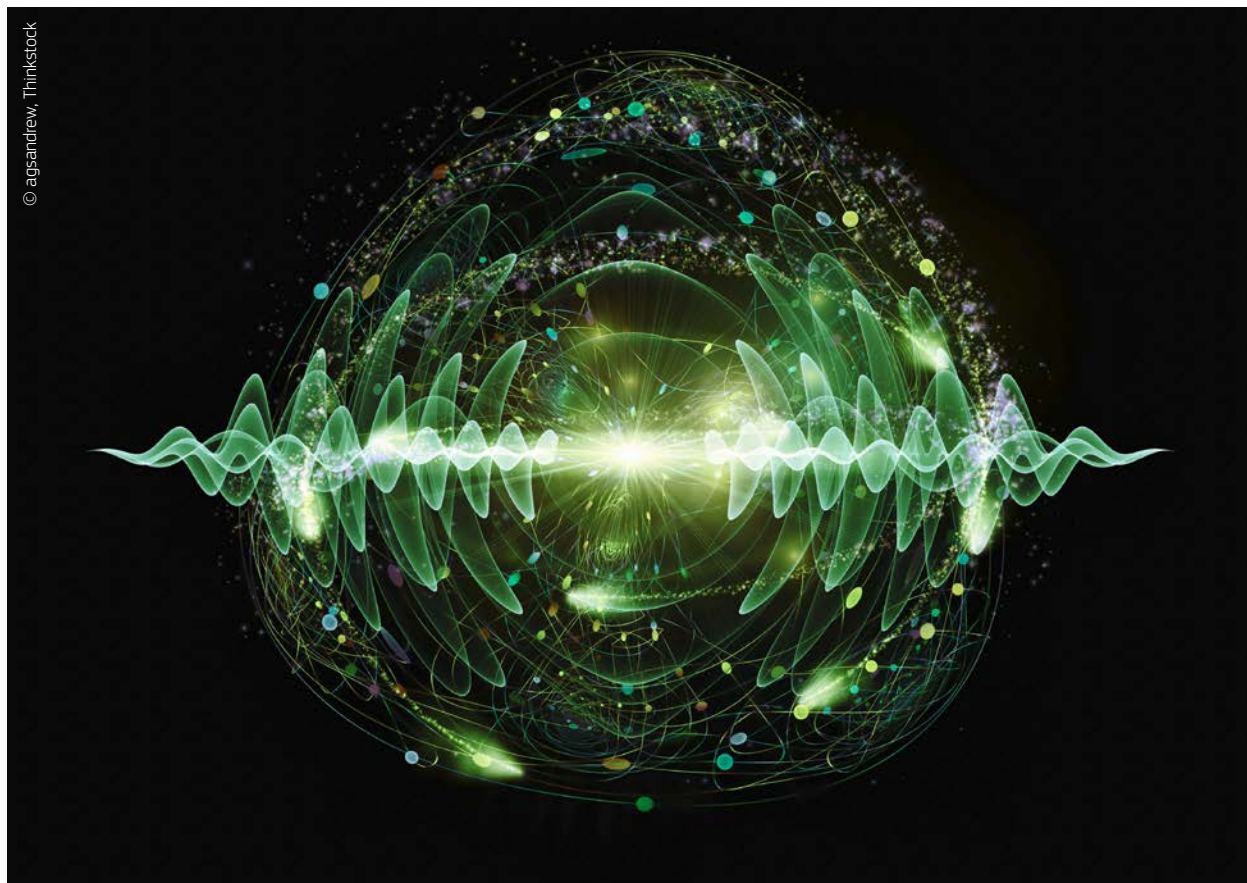
To this end, the researchers also developed i-PI, an interface using electronic structure codes, and released it as open-source code. The results of NQEAIMD will have an impact on computer simulation work by other scientists. Simulations should be more accurate in the case of materials and chemicals that contain light atoms, including hydrogen.

In turn, this could help fulfil the potential of computer-aided materials design, leading to better batteries, enzymes, fuel cells and other devices.

NQEAIMD

- ★ Coordinated by the University of Oxford in the United Kingdom.
- ★ Funded under FP7-PEOPLE.
- ★ http://cordis.europa.eu/result/rcn/148897_en.html

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ENVIRONMENT AND SOCIETY

MAJOR BREAKTHROUGH COULD HELP DETOXYFY POLLUTANTS

Scientists at the University of Manchester (UK) hope a major breakthrough could lead to more effective methods for detoxifying dangerous pollutants like 'polychlorinated biphenyls' (PCBs) and dioxins. The result is a culmination of 15 years of research and was published in *Nature* on 19 October. It details how certain organisms manage to lower the toxicity of pollutants.

The team at the Manchester Institute of Biotechnology (MIB) were investigating how some natural organisms manage to lower the level of toxicity and shorten the life span of several notorious pollutants.

Professor David Leys explains the research: 'We already know that some of the most toxic pollutants contain halogen atoms and that most biological systems simply don't know how to deal with these molecules. However, there are some organisms that can remove these halogen atoms using vitamin B12. Our research has identified that they use vitamin B12 in a very different way to how we currently understand it.'

He continues: 'Detailing how this novel process of detoxification works means that we are now in a position to look at replicating it. We hope that ultimately new ways of combating some of the world's biggest toxins can now be developed more quickly and efficiently.'

It has taken Prof. Leys 15 years of research to reach this breakthrough, made possible

by a dedicated European Research Council (ERC) grant under the DEHALORES (Breathing chlorinated compounds: unravelling the biochemistry underpinning (de)halorespiration, an exciting bacterial metabolism with significant bioremediation potential) project. The main difficulty has been in growing enough of the natural organisms to be able to study how they detoxify the pollutants. The team at the MIB were finally able to obtain key proteins through genetic modification of other, faster growing organisms. They then used X-ray crystallography to study in 3D how halogen removal is achieved.

The main drive behind this research has been to look at ways of combating the dozens of very harmful molecules that have been released into the environment. Many have been directly expelled by pollutants or from burning household waste. As the concentration of these molecules has increased over time, their presence poses more of a threat to the environment and humanity. Some measures have already been taken to limit the production of pollutants, for

example PCBs being banned in the United States in the 1970s and worldwide in 2001.

Professor Leys says: 'As well as combating the toxicity and longevity of pollutants, we're also confident that our findings can help to develop a better method for screening environmental or food samples.'

He continues: 'I am pleased to have been supported by an ERC grant over the last five years. This long-term funding has been crucial in reaching today's results on understanding pollutant removal by certain microbes.' He adds: 'This discovery is a great example of how the ERC promotes excellent work in the field of biochemistry.'

DEHALORES

- ★ Coordinated by the University of Manchester in the United Kingdom.
- ★ Funded under FP7-IDEAS-ERC.
- ★ <http://erc.europa.eu/erc-stories/major-breakthrough-could-help-detoxify-pollutants>

IMPACT OF CONTAMINATED SEDIMENTS IN RIVERS

Environmental impacts of sediment and its associated contaminants on aquatic ecosystems have long been recognised by scientists, land managers and policymakers. Long-term storage of pollutants in sediments is set to become a source of contamination in the future, threatening EU water quality targets, however European research has helped towards curbing these negative impacts.

The SEDSRES (Quantifying sources and residence time of contaminated sediment in human-impacted river basins: an integrated approach) project developed an integrated approach for measuring sources and removal times of contaminated sediment in river basins affected by industrial, mining and agricultural pollution.

Field sampling was carried out in the catchment of the River Tamar in south-west England. The region is synonymous with agriculture and has a history of metal mining, making it ideal for investigating key sediment-associated pollutants. Laboratory analysis used sediment tracers to measure the transport, in suspension, of different sediment sources and associated contaminants stored in water channel deposits.

The removal time for contaminated sediments was estimated in order to provide a time scale for river and catchment recovery from sediment contamination.

The Australian soil erosion model SedNet was used for the first time in a European context. This provided unique insight into the way river basins respond to land use and recent environmental change not otherwise possible using conventional monitoring alone. While considerable effort is being made to reduce the amount of 'Diffuse water pollution from agriculture' (DWPA) in rural lowland catchments, little attention has been given to the potential role of sediments stored in channels.

This knowledge gap could compromise management of the catchment. Therefore, the work conducted by the SEDSRES project will directly contribute to improving catchment management decision-making. It will also help achieve the EU Water Framework Directive (2000/60/EC) goal calling for United Kingdom rivers to achieve a good ecological status by 2015.



SEDSRES

- ★ Coordinated by the University of Plymouth in the United Kingdom.
- ★ Funded under FP7-PEOPLE.
- ★ http://cordis.europa.eu/result/rcn/147694_en.html

MAKING BUSINESS THE KEY TO SUSTAINABLE WATER MANAGEMENT

The EU-funded LIFE+ Investing in Water project has resulted in the adoption of conservation measures by businesses across Malta, saving an estimated 141 million litres in water each year.

While the history of Malta has been shaped by the sea, the future of this Mediterranean island may very well be determined by the sustainability of its freshwater supplies. The country is one of the driest in the world, and what little natural freshwater exists is contained in underground aquifers that only get replenished following rainfall.

This is why the EU-funded LIFE+ Investing in Water project has been of such importance. The initiative, led by the Malta Business Bureau (MBB), involved more than 130 enterprises implementing best practice in water saving. It was recently announced as the runner-up in the 'Supporting the development of green markets and resource efficiency' category of this year's

European Enterprises Promotion Awards.

Above all, this project has been about ensuring the long-term sustainability of Malta. The fact of the matter is that the island's natural resources simply cannot meet demand. Malta's water consumption is conservatively estimated to be around 65 million cubic metres per year, with only

23 million cubic metres of water available underground. Given this situation, effective and efficient water management must become an absolute priority.

"The project received the runner-up prize in the supporting resource efficiency category, which recognised policies and initiatives designed to support SME access to green markets."

The project began in early 2012 by carrying out a set of water audits with around 40 enterprises operating in various sectors. These audits highlighted where water could be saved. The solutions developed have since been published in a brochure, which has been distributed to businesses and hotels across Malta and made freely available through the project's website. Another key strength of this initiative has been

its ability to offer enterprises individual consultations on identifying possible water-saving solutions.

The project, which was completed in March 2014, has resulted in the adoption of water saving measures by businesses across the island, which will save an estimated 141 million litres of water every year. Enterprises have thus been able to reduce their operating costs and have a positive impact on the environment at the same time. MBB CEO Joe Tanti has credited Maltese enterprises for driving forward environmental sustainability.

One example of good practice can be seen in APS Bank's commitment to sustainable development at its new head office. The bank decided to invest in a holistic on-site water conservation programme, reducing operational costs and helping to conserve scarce national resources. Similarly, the Hilton hotel has installed a sewage treatment plant.

The importance and applicability of the Investing in Water project were key factors in the recognition received at this year's European Enterprises Promotion Award. The project received the runner-up prize in the supporting resource efficiency category, which recognised policies and initiatives designed to support SME access to green markets and help improve their resource efficiency through, for example, green skills development and matchmaking as well as funding.

The Investing in Water project received 50% co-financing under the EU's LIFE+ funding programme, with the Maltese government the main co-financier.

LIFE+ Investing in Water

- ★ Coordinated by the Malta Business Bureau in Malta.
- ★ Funded under the LIFE+ programme.
- ★ http://cordis.europa.eu/news/rcn/121776_en.html
- ★ Project website: <http://www.investinginwater.org/>

20TH CENTURY CLIMATE DATA GETS A FACELIFT

Long before global climate shifts became a concern, international researchers had been collecting data about Earth's systems. Located around the world, and often available only in analogue format, the potential of these data, in terms of understanding today's climate change process, had remained unexploited, until now.

There are plenty of 20th century records detailing atmospheric, oceanic and terrestrial conditions over the past hundred years. Such information has, as you might expect, proven useful to modern climate researchers and meteorologists. However, these data sets have often been incomplete, too varied to warrant comparison, and primarily derived from old-fashioned methods and instruments. The usefulness of these data has been further constrained because most records were available only on paper.

In 2011, a consortium of nine EU-funded institutions undertook the ERA-CLIM (European re-analysis of global climate observations) project in order to unlock the potential of these historic data. ERA-CLIM's primary objective was to recover, digitise and standardise climate-related data recorded over the past century.

In addition to locating and digitising remarkable quantities of observations, ERA-CLIM researchers standardised the resulting datasets, then analysed various metrics. By successfully comparing the data, researchers were able to fill in gaps in climate records which have persisted for much of the past century.

Finding and digitising a multi-faceted data set spanning 100 years of global climate observations is a noteworthy scientific feat in itself.

The project also accomplished the parallel objective of making these datasets and related analysis products open-source. Available online to anyone interested, the ERA-CLIM datasets offer unprecedented detail and precision, both for historic research and for modelling the future.

Judging by citation statistics, reanalysed data such as those offered by ERA-CLIM are of great interest to geoscientists. The project's work is likely to be used by researchers, practitioners

and government entities focused on atmospheric science, oceanography, climate science and other relevant fields including energy, health and environmental science.

Building on the ERA-CLIM data, the consortium has already secured funding for ERA-CLIM2. This second phase aims to transform the already-valuable datasets into a readily accessible product/service system. Further funding will enable ERA-CLIM partners to transform their efforts from research into a reliable service.

ERA-CLIM

- ★ Coordinated by the European Centre for Medium-Range Forecasts in the United Kingdom.
- ★ Funded under FP7-ENVIRONMENT.
- ★ http://cordis.europa.eu/result/rcn/90490_en.html
- ★ Project website: <http://www.era-clim.eu/>

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USING SOUND TO PICTURE THE WORLD IN A NEW WAY

Have you ever thought about using acoustics to collect data? The EAR-IT project has explored this possibility with various pioneering applications that impact on our daily lives. Monitoring traffic density in cities and supporting energy-saving devices in houses, for example, could well boost the development of smart cities and buildings.



The EAR-IT (Experimenting Acoustics in Real environments using Innovative Test-beds) project has taken intelligent acoustic technology developed in laboratories, and modified and adapted it to real-life environments. The project, involving both research institutes and market advisors, has focused on outdoor and indoor applications: traffic flow monitoring, and controlling the use of energy indoors based on the number of people in a room.

Helping urban traffic flow more smoothly and safely

As part of the FIRE initiative (an EU future internet concept), the city of Santander in Spain had turned itself into a huge experimental research facility, SmartSantander. It is the test bed for EAR-IT's outdoor applications: traffic flow monitoring at a junction near the city's hospital and analysis of traffic density on two city streets.

Project coordinator Prof. Pedro Maló explains, 'The complex junction was the scene of quite a few traffic incidents. Traffic comes in a variety of directions and emergency vehicles are trying to get through. EAR-IT has set up sensors which "hear" sirens and then trigger other sensors to track the vehicle. This data is then used to change traffic lights in the ambulance's favour.'

The sensors can help get people to hospital more safely and quickly, but they can also send a message to a smartphone app to tell you about a concert happening near you, or a street event you might enjoy. Once the sensor is in place, the data it collects can be used for a wide range of applications.

The project also tested the sensors' ability to count cars on a road. To check the data collected was accurate, EAR-IT used two streets which had electromagnetic induction sensors under the street surface.

'I was really relieved and delighted when, after a year of work to adapt the technology to a city environment, we found the acoustic and pressure sensors were giving us the same message,' says Prof. Maló. While the street sensors can only count cars, the acoustic sensors have a wide range of applications.

Since the sensors can identify the number of cars passing, even when they go by in large groups, the equipment can be used to check traffic density hot-spots. Added to that, the sensors can also be used in conjunction with pollution detectors. This could be a vital tool in the EU's bid to improve air quality for its urban population.

EAR-IT is notably taking advantage of the unique SmartSantander experimentation infrastructure and has set up 12000 devices all over the city. Devices run on

batteries and most of them are installed in lamp posts due to the energy-sustainability benefits they offer. The small batteries recharge overnight as the electricity flows and therefore require virtually no maintenance.

Energy-efficient, secure homes — a sound idea

EAR-IT has also worked on the use of acoustic data in the home to save energy by assessing what is going on in a room and how many people are in it. 'Windows can be made to open, curtains close and lights and heating turn on and off automatically', explains Prof. Maló, adding that users can choose their settings.

One very important application, in the light of Europe's ageing population, would be the use of acoustic sensors to detect if someone is safe at home. They could transmit a distress message if someone falls, for example, letting healthcare providers and family know if they need to intervene.

The need for privacy is not forgotten

With all the benefits the technology can bring, the project is well aware of the need to ensure no one's privacy is violated. It has created a tool for developers wishing to use acoustic sensors, which is available from the project's website. This assesses the situation, tells them of possible legal issues and proposes solutions to ensure our private lives remain private.

The project mobilised six European partners and an SME from China. Supported with funding of EUR 1.45 million from the EU's ICT 7th Framework Programme, the project ran for two years. It closed in September 2014 and will be fully wrapped up by the end of December 2014.

EAR-IT

- ★ Coordinated by Uninova in Portugal.
- ★ Funded under FP7-ICT.
- ★ http://cordis.europa.eu/result/rcn/149053_en.html
- ★ Project website: <http://www.ear-it.eu/>
- ★ <http://tinyurl.com/oxzgufj>

IT AND TELECOMMUNICATIONS

MEET POPPY, THE 3D-PRINTED ROBOT SET TO INSPIRE INNOVATION IN CLASSROOMS

Written in cooperation with Inria, France, European Research Council (ERC) grantee Dr Pierre-Yves Oudeyer, is today presenting the first complete open-source 3D-printed humanoid robot, called 'Poppy' (@poppy_project). Poppy is a robot that anybody can build — its body is 3D printed and its behaviour programmed by the user.

However, it is not just a tool for scientists and computer 'geeks' — the team of developers aims to use the robot as part of vocational training in schools, giving students the opportunity to experiment with and program 3D printed robots with various characteristics.

Poppy was developed in France by Inria's Flowers team, which creates computer and robotic models as tools for understanding developmental processes in humans. Dr Pierre-Yves Oudeyer, who holds an ERC Starting Grant in Computer Science and Informatics, comments: 'The advances offered by 3D printing have already revolutionised design and

industry. However, only very little has been done to explore the benefits of 3D printing and its interaction with computer science in classrooms. With our Poppy platform, we are now offering schools and teachers a suitable tool for cultivating the creativity of students studying in fields such as mechanics, computer sciences, electronics and 3D printing.'

Build your own robot

Poppy's body is 3D printed and its behaviour determined with freely available software, meaning users can design body parts quickly and easily, and program their robot's behaviour themselves. Dr Oudeyer provides

clarification: 'Both hardware and software are open source. There is not one single Poppy humanoid robot, but as many as there are users. This makes it very attractive as it has grown from a purely technological tool to a real social platform.'

Accessible hardware and software make it easy for users to experiment with building their own robots for the first time. Poppy is now also compatible with the Arduino platform, which allows the robot to interface with other electronic devices, including smart clothing, lights, sensors and musical instruments.

Do It Yourself in schools

Dr Oudeyer, who is a Research Director at Inria, plans to extend use of this technology beyond research labs, to the educational sector in particular. Commenting on the Poppy initiative, EU Commissioner for Research, Innovation and Science Máire Geoghegan-Quinn said: 'This is a great offshoot of an ERC project: a low-cost platform that could foster a more interactive and inspiring learning environment, allowing students to connect with research and design.'

The Poppy platform has come about thanks to the ERC-funded EXPLORERS (Exploring epigenetic robotics: raising intelligence in machines) project, in which Dr Oudeyer studies the mechanisms of learning and development using robots. 'Our hypothesis is that the body is an essential variable in the acquisition of motor and social skills in humans. To study this theory, we needed to create a platform allowing fast experimentation of new robot morphologies. This led to the Poppy platform.'

Talking about the benefits of his ERC-funded research, Dr Oudeyer highlights: 'My ERC grant was essential in developing problem-solving and critical thinking ability in robotics. I would now be glad if students who need more education in computer science, coding and design, could train using Poppy and perhaps, later, be able to find a job in the robotics sector.'

Gathering across frontiers

Poppy will also allow users to share their ideas and results in a very open and collaborative way through a dedicated web platform — gathering people across the frontiers of school, art, science and industry.

Dr Oudeyer's team has already used Poppy in other fields, including the arts. In an ongoing artist residence programme entitled 'Etres et Numériques', the team worked with a dancer and a visual artist to explore the emotions and perceptions of body gestures and movements using the robot. They expect to extend these experiments to other artistic performances.

"Poppy's body is 3D printed and its behaviour determined with freely available software, meaning users can design body parts quickly and easily, and program their robot's behaviour themselves."

In his recent TEDxCannes talk, Dr Oudeyer explained how open-source baby robots can help scientists, and society at large, better understand the human mysteries of learning, curiosity and language acquisition.

EXPLORERS

- ★ Coordinated by Inria in France.
- ★ Funded under FP7-IDEAS-ERC.
- ★ http://ec.europa.eu/research/infocentre/article_en.cfm?artid=33016
- ★ Project website: <https://www.poppy-project.org/>
- ★ <http://bit.ly/1BJNoSW>

TACTILE DISPLAYS OF THE FUTURE TO FEEL INFORMATION



We are more and more accustomed to interacting physically with technology — using touchscreens for example. We now routinely 'thumb-flick' through information on our phones or tablets rather than pressing keys. For Professor Sriram Subramanian and his team, this kind of technology needs to be pushed beyond a flat interaction with the screen under our fingers — instead we should be able to feel what we are currently touching. Only by doing so can we fully interact with the information we are accessing.

The concept underpinning this is known as haptic feedback: the ability to 'feel' and manipulate objects through our sense of touch. Professor Subramanian's ERC project INTERACT (Interactive systems involving multi-point surfaces, haptics and true 3D-displays) is a revolutionary exploration of the future possibilities of touchable technology. The work in his lab is multi-faceted — encompassing everything from touchless, floating displays to

sensory bubbles. Prof. Subramanian presented his research at the World Economic Forum Annual Meeting of the New Champions in Tianjin, China and will be at the Genoa Science Festival (Italy) this month.

He is a veteran of demonstrations, having presented the practical possibilities of his haptic technology to a wide variety of audiences from fellow scientists to potential investors: 'Audiences are always surprised to discover that we have

something concrete to demonstrate to them — they are expecting the technology to be purely theoretical. With our latest technology, SensaBubble, which uses sensory information delivered in airborne bubbles, there is an added novelty value — it has the entertainment factor as well as scientific significance. It has potential for both education and gaming applications.'

The science of touch

Behind all of these innovations lies a shared aspiration: to harness the rich sensory possibilities of touch to improve our relationship with the technology we use every day. The ambition is that a sea change in technology will lead to interactions that come naturally to us without the need to learn to use the technology. This means for example that medical students could concentrate on key surgical techniques, rather than on the medical device interface itself. Similarly, car drivers could focus on a safe and pleasurable driving experience rather than worrying about the dashboard controls. New display devices developed in this project will multiply the possibilities for applications of the technology: particularly in terms of teaching aids and in-vehicular interfaces.

Prof. Subramanian and his team are attempting to create displays we do not have to touch. We could feel and interact with these displays without entering into contact with them: the objective is to turn flat 2D information into 'feeleable' 3D interactions. The haptic technology they are developing is designed with multiple users in mind — each able to receive their own individualised 'feeleable' feedback from the screen. This technology is game changing not only because it will provide the user with customised feedback, but also because the information is generated with minimal interference: you can be as close as 3 cm or as far away as 2 m, and you do not have to wear gloves or use special equipment in order to interact with the screen.

Interactive workstations

One particular facet of this research is the 'MisTable' technology. Prof. Subramanian explains: 'The "MisTable" technology relies on creating a see-through and reach-through environment in which the user can interact with the tabletop

— reaching through the mist to proactively interact with both the tabletop and the space above it to receive tactile feedback as they learn.'

The idea of 'SensaBubble' came from a table tennis game: could information be projected in 3D rather than on a flat screen, and why not on a bubble? SensaBubble produces bubbles filled with fog delivering information to users in two ways: visuals are projected on the bubble and scent is released in the air when the bubbles burst, creating a multi-sensory experience.

The ERC funding has enabled the team not only to pursue their ambitious blue-sky research but also to attract talent. Prof. Subramanian's international team is larger than initially anticipated because 'we have had the freedom and flexibility to follow the science without external pressures,' he says.

'We try to combine good science with creativity and inspiration in order to further enhance the research we do,' notes Prof. Subramanian. The project has produced a spin-off company, Ultrahaptics, and the technology has been sold to several universities in order to further develop the tools for supporting learning. Ultrahaptics is enabling the technology to be scaled up and the team to explore further entrepreneurial possibilities.

An ERC 'Proof of Concept' grant recently received will allow the team to improve the perceptual quality of the tactile feedback whilst making the system noise-free. The team will also use the 'Proof of Concept' grant to demonstrate the technology at trade shows in order to help grow the spin-off company.

INTERACT

- ★ Coordinated by the University of Bristol in the United Kingdom.
- ★ Funded under FP7-IDEAS-ERC.
- ★ <http://erc.europa.eu/erc-stories/tactile-displays-future-feel-information>
- ★ <http://bit.ly/1qjxzv>

IN-BUILT SECURITY FOR A SAFER WEB EXPERIENCE

EU researchers have come up with an innovative security framework that gives both web users and developers greater protection against cyber attacks.

October is European Cyber Security Month and the awareness of online security in the EU has never been higher. Cyber crime is estimated to cost the European economy tens of billions of euro every year, much of it from the theft of credit card data later sold on the black market.

One of the projects the EU has funded in the battle against cyber crime is called WEBSAND (Server-driven Outbound Web-application Sandboxing), which has come up with new tools to make systems harder for hackers to crack.

WEBSAND's computer scientists have built solutions based on 'sandboxes', restrictive mechanisms that separate server systems and information flows

(between servers and users' browsers) from untrustworthy code.

Let's fix the Web

'The main success of WEBSAND has been to show developers how to make security a default part of the system, rather than an afterthought,' explained coordinator Dr Martin Johns.

The Web has changed considerably since 1990, when it was used as a static document-delivery tool. It has now become a real-time, multi-source environment, pushing developers to add security on to systems rather than making it an integral part of the client-server model. WEBSAND was formed to try to change that.



'We set a deliberately ambitious goal at the start of the project. We thought: "Let's try to fix the Web". And we have succeeded to some degree. We have built a lot of solutions directly on the server side that enforce the security we want for certain areas.'

"At SAP and Siemens, we use WEBSAND technology to make our own products more secure."

The aim was to put the developer in the driver's seat, by taking a server-driven approach to security and building a modular, easy-to-use framework allowing developers even with limited security backgrounds to build applications that are secure by default.

The other thing WEBSAND did was to develop a set of browser extensions for end users. These include CSFIRE, which is 'invisible' to users in that it tries not to interfere with the functionality of the applications they are using — be that an

email program, Facebook, Google or a currency converter, for example — while transparently guarding them from Web attacks.

WEBSAND's scientists have also explored and come up with solutions to some of the Web's fundamental ongoing problems.

They have designed a lightweight addition to the client side of browsers that prevents DNS Rebinding attacks, a common and reoccurring method of extracting information from a server without the host's knowledge. A slight expansion of the server's 'same origin policy' puts pay to this risk.

And they have also come up with a different way of authenticating passwords by implementing a new challenge-and-response system initiated by the server instead of the browser.

Now the core partners in the project — German companies SAP and Siemens, and the universities of Leuven in Belgium and Chalmers in Sweden — are working with the international internet standards bodies, W3C and IETF, to persuade browser companies to adopt WEBSAND

technology. They also belong to the non-profit organisation Open Web Application Security Project (OWASP) and are promoting their findings through its user groups and meetings.

'At SAP and Siemens, we use WEBSAND technology to make our own products more secure. But we would also directly benefit from a Web that is secure by default,' said Dr Johns. 'Security is very costly and a safer Web would also allow companies to devote more resources to functionality.'

WEBSAND, which ran from October 2010 to April 2014, received FP7 funding of EUR 3.2 million and involved five partners in three countries.

WEBSAND

- ★ Coordinated by SAP in Germany.
- ★ Funded under FP7-ICT.
- ★ http://cordis.europa.eu/result/rcn/149101_en.html
- ★ Project website: <https://www.websand.eu/>
- ★ <http://bit.ly/11xZui5>

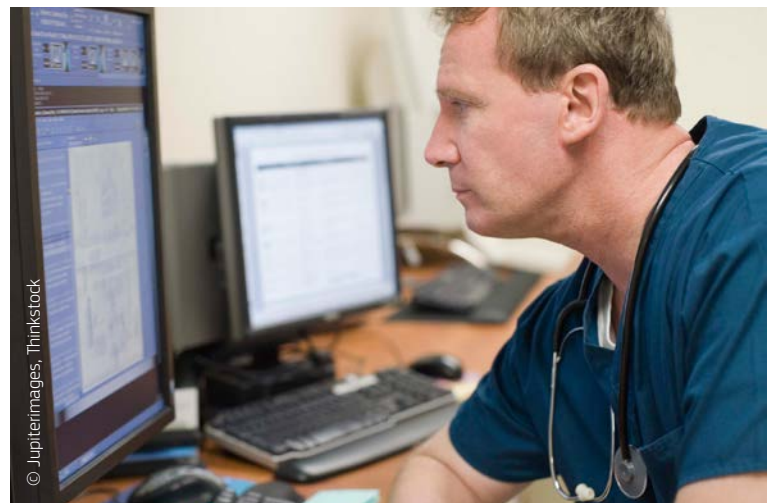
PROJECT REQUEST

TOWARDS INTELLIGENT SYSTEMS FOR BIOMEDICAL RESEARCH

Biomedical research has a tremendous impact on advances in disciplines such as biochemistry, anatomy, biology, pathology and genetics. But like all theoretical work, its performance largely depends on the ease of access to peer articles and data. Conscious of the problems faced by experts in the field, the BIOASQ team is helping shape the future of biomedical information retrieval systems.

Those who completed their studies with a dissertation or a thesis know it: the research part is sometimes reminiscent of looking for a needle in a haystack, with tools that do not always work how you would expect them to. Now imagine you are a biomedical expert looking for specific articles or data spread across hundreds of sources and databases, all working differently, on a daily basis: such an experience can turn into a real headache, especially when each minute counts.

The EU-backed BIOASQ (A challenge on large-scale biomedical semantic indexing and question answering) project was set up with a view to looking into these problems and encouraging the development of better information retrieval solutions. Over the course of two years, various 'challenges' — which saw biomedical experts testing and providing feedback on various systems — were set up in a bid to 'bring us closer to the vision of machines that can answer questions from biomedical professionals and researchers'. Participants included both industrial and academic institutions, with the most recent challenge welcoming registrations from as many as 216 users and 142 systems. A total of 28 teams (with 95 systems) from Europe, America and Asia eventually submitted their results.



In fact, the challenges were so successful that they exceeded the project team's expectations.

'The main surprise for me is that we were able to achieve a significant impact in a research field, without doing the research ourselves,' explains BIOASQ project coordinator George Paliouras, researcher from the IIT at the NCSR Demokritos in Athens.

A win-win experience

The project rationale is based on mutual benefits. On one hand, biomedical experts need better systems to work with, and they are willing to help developers create solutions that meet their specific needs. The problem is well summarised

by an expert interviewed towards the end of the project: 'As I'm growing older, I spend more time in front of the computer but I learn less. The complexity has increased, the variety has increased and my time has been reduced.' There is a general consensus among researchers that more natural and intelligent methods of requesting information are needed in order to meet these challenges.

'For articles, all experts use MEDLINE and PubMed, while a few of them also look at more general sources, such as Google Scholar, SCOPUS and even Wikipedia,' says George Paliouras. 'There, they are

"In every step that we take, biomedical experts benefit from faster access to more accurate information."

faced with high volumes of collected material and unnatural search methods. Sometimes results that cannot make it to a published article — for

example a drug trial that stopped due to an adverse effect — may be particularly interesting but it is nowhere to be found.' Searching for other types of data is no walk in the park either, as the relevant systems often require proper training. Experts therefore tend to focus on sources that they already know how to use, potentially ignoring others that may be more relevant.

'Efforts to link some of these databases and provide a uniform way to access them are particularly important, and BIOASQ supports solutions such as Linked Life Data that are aiming to do just that,' Paliouras explains.

The main incentive for industry, on the other hand, was the promise to boost product improvement based on concrete user feedback. 'Computer scientists are eager to help achieve progress in other domains, particularly in biomedical research. There are very strong research groups around the world, working hard to improve information access in the field. We were particularly glad to see many of them participate in BIOASQ,' Paliouras says. And this participation is already proving very fruitful: the performance of the National Library of Medicine's 'Medical text indexer' (MTI), for example, was improved by 4.5% thanks to the first BIOASQ challenge. While this might sound like marginal progress to the general

public, Paliouras stresses that the impact on public health can be very significant. 'That's what makes it worth our effort,' he says.

Towards more intelligent systems

Thanks to the project's results, George Paliouras and his team now have a very clear idea of what the ideal information retrieval system would look like. It should first be able to understand what kind of information the expert needs based on a request in natural language, before converting this request into a machine-readable format and matching it to the information and data available across various sources. 'In order to achieve this, integration of information from different sources and large-scale semantic indexing, far beyond what can be achieved by human curation, is needed. There is a lot more work to be done before we achieve this vision, but in every step that we take, biomedical experts benefit from faster access to more accurate information,' Paliouras explains.

In addition to the challenges and an award system for the winners, BIOASQ provides an open-source infrastructure that is always available and open to all. It includes data for training and testing systems, as well as evaluation services and the possibility for anyone to set up new challenges — be it for biomedicine or any other interesting field.

Although the project ended in September, George Paliouras says the BIOASQ venture will continue. 'I believe that BIOASQ will be pushing the boundaries of research in biomedical information access for several years to come,' he concludes. 'The attention that BIOASQ has attracted allowed us to seek external sponsorship, a process that is currently in progress. Furthermore, the lessons learned in BIOASQ have helped us shape ideas about how we could assist biomedical researchers in finding answers to complicated questions. We are currently forming a research agenda on the basis of these ideas.'

BIOASQ

- ★ Coordinated by the National Centre for Scientific Research 'Demokritos' in Greece.
- ★ Funded under FP7-ICT.
- ★ http://cordis.europa.eu/project/rcn/105774_en.html
- ★ Project website: <http://www.bioasq.org/>

TV EVOLUTION LEAVES NO ONE BEHIND

European broadcasters and technology companies have teamed up to set the trend for future TV services. Thanks to EU funding under the HBB-NEXT project, they were able to further the integration of TV and internet technologies.

Television companies realise they can really make use of the internet now that it's fast and benefits from broad bandwidth and geographical reach. They are beginning to air services not just on TVs, but also simultaneously on PCs, tablets and smartphones — however such integration is often limited.

Thanks to technology known as 'Hybrid broadcast and broadband TV' (HbbTV), broadcasters can offer additional internet services directly to the TV set. Demand for broadcast and broadband integration is growing fast, and to this day HbbTV is the only open standard to support it. This led the European Commission to fund a project, HBB-NEXT (Next-Generation Hybrid



Broadcast Broadband), to drive the next generation of this technology. The project partners have come up with many novel solutions, from synchronising video across consumer devices via the cloud to controlling TVs using face and gesture recognition technology along with innovative accessibility solutions.

Synchronising video across smart devices

Thanks to the HbbTV standard, a plethora of new services are now appearing across devices. These include complementary content (for anything from elections to sports coverage), home shopping and links to advertisers' web pages, catch-up TV and educational courses.

'When we started to prepare the HBB-NEXT project, the HbbTV 1.0 standard had just come in,' explained coordinator Bettina Heidkamp, of German public broadcaster RBB, part of the ARD.

'We identified several missing pieces in the user experience for which we and our partners designed and developed solutions. These include the personalisation and recommendation of content for users, notably in a multi-user environment, and the synchronisation of broadband with content broadcast onto one or more screens.'

HBB-NEXT came up with novel middleware that uses the cloud where a consumer device does not have the

capability, e.g. to synchronise video. This is no small achievement, since even a delay of 40 milliseconds between devices is noticed by users. 'With HBB-NEXT, we contributed four features that will be supported in the new HbbTV 2.0 standard hopefully to be released later this year,' said HBB-NEXT technical coordinator Michael Probst, of IRT, the German broadcasting technology institute.

HbbTV allows broadcasters to add information into their signal, enabling a TV to load apps retrieving related content from the internet and displaying it on your TV. And HBB-NEXT came up with a range of novel applications for editors' consideration, including instant voting (first aired on a popular TV science programme in Germany). Others, benefiting users, permit customisation of subtitles, sign language for the hearing-impaired, smartphone audio for the blind or partially sighted, and services for minority languages — all of them sourced via the internet.

Television recognises viewer

The project partners also developed an app that makes recommendations to individuals and groups of viewers about what they should watch, combining it with face, voice and gesture recognition technology. When a viewer, whose profile has already been loaded into the TV, walks into the room and says 'Hello', the television recognises the person and replies by suggesting programmes he or she might like to

see. A second person might then come in and both will receive their 'group' recommendations.

'The face and gesture recognition achieved in the project goes beyond what has been possible before,' said an enthused Bettina. 'It is really innovative and people will enjoy it. It is the future, I think!'

'As for the broadcast apps, we are now creating an HbbTV Toolbox based on HBB-NEXT so that very soon editors will be creating them on a day-to-day basis so that everyone can personalise and enrich the television they are watching,' she added.

HBB-NEXT involved representatives of the various sectors affected economically by the advent of hybrid TV, from broadcasters and application developers (many of whom are SMEs), to TV and consumer electronics manufacturers, and telecoms companies.

The HBB-NEXT project involved nine partners from five countries and ran from October 2011 to March 2014. It received EUR 2.98 million from FP7.

HBB-NEXT

- ★ Coordinated by RBB in Germany.
- ★ Funded under FP7-ICT.
- ★ http://cordis.europa.eu/result/rcn/149087_en.html
- ★ Project website: <http://www.hbb-next.eu/>
- ★  <http://bit.ly/1BJ02Qp>

ROBOTS COMING TO THE AID OF HUMANS CAUGHT UP IN DISASTER ZONES

The FP7-funded ICARUS project is developing unmanned search and rescue devices to get people trapped in life and death situations to safety more quickly.



Following the high death tolls in the wake of the Haitian and Japanese earthquakes, the European Commission has committed itself to funding projects to bring more robotic 'search and rescue' (SAR) technology from the lab to the field.

One such project is ICARUS (Integrated Components for Assisted Rescue and Unmanned Search operations), which aims to help bridge the gap between the discoveries being made within the research community and practical,

on-the-ground application, by developing a tool-box of integrated components for unmanned devices.

Such devices, used alongside human intervention, can be vital tools in detecting, locating and rescuing people caught up in natural disasters such as earthquakes or incidents such as collapsed buildings and mines as well as transport and industrial accidents. Rescuing people in such conditions can be very risky for the emergency crew members first on the scene. Unmanned devices can help prevent further accidents while working efficiently in challenging conditions.

In September 2014, ICARUS tested unmanned aerial and ground vehicles and sensors in Marche-en-Famenne, Belgium. The project successfully ran field trials on devices such as the Skybotix Hexacopter, designed to search for victims indoors, and the Multicopter which can search outside, both using 3D reconstruction to locate victims. To control the vehicles, the project also tested a Command, Control and Intelligence platform and a communications system connecting all the various platforms.

The consortium feels the tests demonstrated that although a lot remains to be done, the components are not only functioning well, but are robust enough to be deployed in the field.

ICARUS devices have already been used in the aftermath of the worst natural disaster Bosnia-Herzegovina has faced in the last century. An unmanned aerial vehicle, the Microdrone MD4-1000 quadrotor, was used to assess the damage caused by the 2014 floods and to detect the possible location of landmines displaced by resulting landslides.

To ensure they are meeting the needs of the emergency services and other users of their technology, ICARUS is announcing an early adopter programme. The project is selling the new Visual Inertial sensor, which can be used in unmanned vehicles and robotics, for EUR 3900. The price is discounted to encourage research teams around the world to use it and provide their

feedback to the project, thereby turning the sensor from something that is market-ready into a product that is user-friendly.

The ICARUS project, coordinated in Belgium, involves nine countries and 24 partners from the research, business and non-profit communities. Running since February 2012 and ending in January 2016, it has a total budget of just over EUR 17 million, of which EUR 12.6 million comes from the EU.

ICARUS

- ★ Coordinated by the Royal Military School in Belgium.
- ★ Funded under FP7-SECURITY.
- ★ http://cordis.europa.eu/news/rcn/121874_en.html
- ★ Project website:
<http://www.fp7-icarus.eu/>
- ★ <http://bit.ly/1xLkBbE>

ROBOTIC SOLUTIONS INSPIRED BY PLANTS

EU-funded researchers are demonstrating revolutionary robotic techniques inspired by plants, featuring a 3D-printed 'trunk', 'leaves' that sense the environment and 'roots' that grow and change direction.

Humans naturally understand problems and solutions from an animal's perspective, tending to see plants as passive organisms that don't 'do' much of anything, but plants do move, and they sense, and they do so in extremely efficient ways.

Barbara Mazzolai of the Istituto Italiano di Tecnologia (IIT) coordinates the FP7 PLANTOID (Innovative Robotic Artefacts Inspired by Plant Roots for Soil Monitoring) project, funded via the 'Future and emerging technologies' (FET) scheme. She says humans can learn a lot from plants. 'Our aim is to design, prototype and validate a new generation of ICT hardware and software technologies inspired by plants.' And she sees potential applications for such technologies in agriculture, medicine and even space exploration.

The PLANTOID prototype was designed with two functional roots: one root demonstrates bending capabilities, responding to input from the sensors at the tip of the root. This way the root is bending away from a stumbling block or aggressive or toxic products. A second root demonstrates artificial growth. 'Layers of new material are deposited near the tip of the root to produce a motive force, penetrating the soil,' Mazzolai explains. Practically, the robot

grows by building its own structure and penetrates the soil.

The roots are connected to a trunk housing a micro-computer. The trunk itself is made of plastic and was produced using a 3D printer. Finally, just like natural leaves, the 'leaves' of the PLANTOID robot include sensors that can assess environmental conditions, including temperature, humidity, gravity, touch and chemical factors.

Unique design exploiting unique plant properties

Backed by EUR 1.6 million of EU funding, the PLANTOID project is the first to design and develop robotic solutions based on plant models. The prototype is not meant to serve a particular application as such, but represents a demonstration of new robotic techniques. However, Mazzolai says real-life applications in the future could include detection and assessment of pollutant concentrations, e.g. heavy metals or nutrients in the environment, as well as mapping and monitoring of conditions in terrestrial soils.

Indeed, plant-like robots could be uniquely suited to space exploration, able to dig and

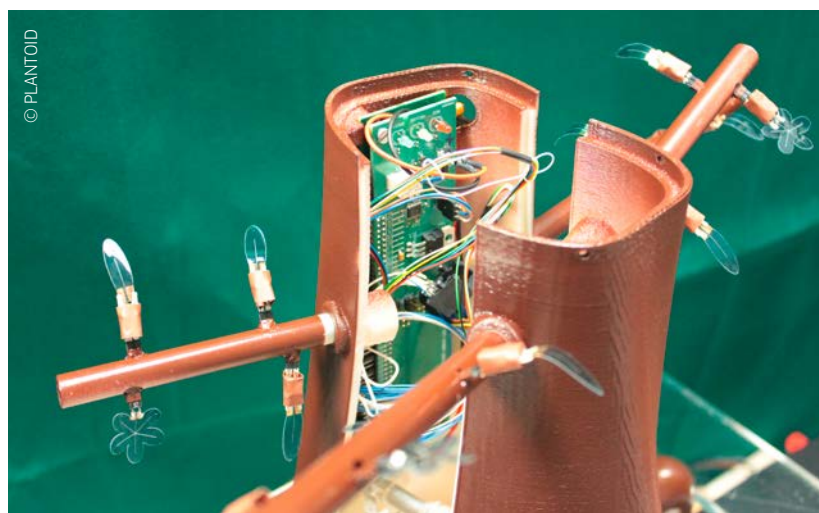
implant themselves on alien worlds, following sensory leads while adapting to potentially harsh external conditions.

Other promising applications could include flexible endoscopic robots for delicate surgical applications in the medical field, while larger plant-like robots could be of use in search and rescue operations, for example after a natural disaster.

'Plants are very efficient in terms of their energy consumption during motion,' says Mazzolai, 'and this suggests many approaches that are muscle-free and thus not necessarily animal-like for the world of robotics.' Indeed, the unique characteristics of plants could become a source of inspiration for new companies that can produce smart and useful plant-like robotic devices.

PLANTOID researchers are set to complete the three-year project in April 2015. They are now working to integrate more functions into a single root, to both penetrate and steer in the soil. Other interesting topics include plant structures that can exploit external environmental energy.

And they are asking whether plants are capable of 'intelligent' behaviour, i.e. if the robot's growth can change over time, based on previous experience. This could lead to the development of even 'smarter' devices with the ability to sense, but also to follow stimuli and take decisions.



PLANTOID

- ★ Coordinated by the Italian Institute of Technology in Italy.
- ★ Funded under FP7-ICT.
- ★ http://cordis.europa.eu/result/rcn/148260_en.html
- ★ Project website:
<http://www.plantoidproject.eu/>
- ★ <http://bit.ly/1EYNunO>



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INDUSTRIAL TECHNOLOGIES

SMART OPERATION OF EQUIPMENT

A group of researchers in Europe has recently been focusing on reducing energy consumption by 25 % in the manufacturing industry. They believe that this should be possible if the existing infrastructure is optimised in terms of processes and machinery, and they are determined to find a way.

New industrial processes and new ways of operating existing processes seem to be the global mantra for higher energy efficiency and reduced carbon dioxide emissions. In particular, process control and operation, rotating machinery and electrical equipment are becoming radically more integrated. This offers new opportunities for energy saving through better equipment management, automation and optimisation.

However, there is a need for further training and research work to address current technology gaps. In response to this, scientists initiated the EU-funded project ENERGY-SMARTOPS (Energy savings from smart operation of electrical, process and mechanical equipment) to train a cohort of early-stage engineering researchers to investigate this area.

Through tailor-made programmes, researchers will gain experience and

in-depth training in research projects. They will also be offered short courses on technical topics and training on complementary skills, and take part in workshops and symposia.

Researchers are working on generating and testing creative ideas for energy savings in large-scale industrial sites through case studies. The focus is placed on developing scalable monitoring systems that will integrate multiple measurements from the process, mechanical and electrical subsystems. New algorithms for better overall performance and control will be devised through integrated automation. Optimisation will provide energy savings with better integration of operations across the process, mechanical and electrical interfaces.

Researchers have already modelled electromechanical systems and used electrical drives for diagnosing

mechanical-electrical interactions. On top of that, they developed a model methodology for turbomachinery processes and a platform for online monitoring, diagnosis and optimisation. The interconnections between process, mechanical and electrical equipment have been designed, and maintenance has been planned based on equipment performance.

ENERGY-SMARTOPS is in line with the European strategy for reducing energy consumption by at least 20% by 2020.

ENERGY-SMARTOPS

- ★ Coordinated by the Imperial College of Science, Technology and Medicine in the United Kingdom.
- ★ Funded under FP7-PEOPLE.
- ★ http://cordis.europa.eu/result/rcn/144773_en.html
- ★ Project website: <http://www.energy-smartops.eu>

ENGINEERING-BASED FOOD PROCESS CONTROL

Key food processing procedures have been the focus of attention for a team of EU scientists who have developed novel smart and integrated control to optimise plant operations. The benefits are wide-ranging and include improved product quality and lower energy and water consumption.

An increasingly savvy food consumer base is driving the food processing industry towards healthy new products and environmentally-friendly preparation methods. The EU-funded project CAFÉ (Computer-aided food processes for control engineering) developed smart control for four common processes: bioconversion, separation, preservation and structuring.

CAFÉ's success stems from exploiting sensing devices and technology that analyses processes, in combination with simulations and models. Case studies from wine making, microfiltration of food beverages, freeze-drying of lactic acid bacteria and ice cream crystallisation demonstrated the benefits.

Smart control configurations for an entire food plant are used to efficiently adapt several different production lines, offering greater flexibility when it comes to dealing with demand. Food processing is a diverse and complex business, yet process monitoring typically evaluates simple parameters such as temperature and pressure. These parameters are not directly related to product quality or to energy and water consumption.

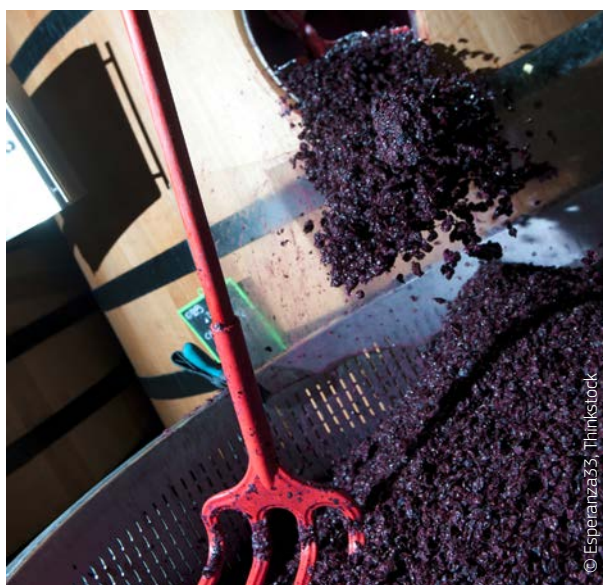
Incorporating the ability to monitor and control physico-chemical food properties, such as nutrient content, colour, viscosity or microbiological characteristics associated with food safety, provides ample opportunity to improve product quality and diversity. More efficient use of information through advanced data acquisition, analysis and prognosis tools enables accurate estimations of as yet unmeasured plant states and predictions of future scenarios.

CAFÉ delivered novel technology for sensing and controlling four common food processing procedures and optimising

general plant operations in real time for better product quality and safety. For a variety of food processing sectors, it is expected to bring major benefits, including decreased operating costs and greater market adaptability and penetration.

CAFÉ

- ★ Coordinated by UCL in Belgium.
- ★ Funded under FP7-KBBE.
- ★ http://cordis.europa.eu/result/rcn/86577_en.html
- ★ Project website: <http://www.cafe-project.org/>



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FRESH APPROACH TO WATER-BASED WOOD COATINGS

Researchers in Europe have successfully developed novel water-based wood coatings, as an environment-friendly replacement for organic solvent-based coatings such as varnish.

Recent EU legislation has put a limit on the use of volatile organic compounds, such as those found in conventional varnishes. However, current water-based wood coatings take longer to dry, have a less attractive finish and do not protect wood effectively in comparison to solvent-based coatings.

"The polymers were all synthesised from plant sources to reduce the environmental impact of the final product."

The EU-funded ECOVARN (Development of a wearable, functional, regulation-compliant water-borne wood coating) project was set up to address this perceived

need in the furniture industry. Its approach was to research new compounds, test them and scale the best ones up to industrial production levels.

Three different families of polymers were investigated. The polymers were all synthesised from plant sources to reduce the environmental impact of the final product.

Project researchers found ways to attach various functional chemical groups, such as acrylates and fluoro-polymers, to the polymer backbone structure to improve the coating's physical properties. The production methods for the most promising coatings were then successfully tested at industrial scale, and showed good physical and mechanical properties.

Overall, ECOVARN produced and patented several new coatings that can compete with conventional varnishes. A market strategy was developed and an economic analysis conducted, with the result that products will be commercially available within the next few years.

ECOVARN

- ★ Coordinated by Inspiralia in Spain.
- ★ Funded under FP7-SME.
- ★ http://cordis.europa.eu/result/rcn/92103_en.html
- ★ Project website: http://www.inspiralia.com/proyecto.php?id_proyectos=10
- ★  <http://bit.ly/1xTAqOY>

NEW TOOL TO EXPOSE WELDING DEFECTS

The safety of car repairs has been enhanced following the development of an easy-to-use, affordable and non-destructive testing tool using ultrasound. The results of this EU-funded project mean that flaws in spot welds in vehicles are now much easier to detect.

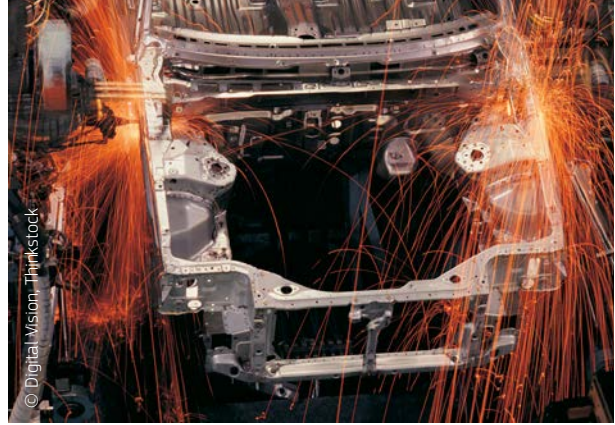
When considering the thousands of spot welds present in any car, it is inevitable that some will need to be reworked if a vehicle goes in for a repair.

It is clearly not possible to destructively test repair welds. Matching test samples could be produced to provide some reassurance, however there is currently no suitable method available to ensure that the welds will hold once vehicles get back on the road. The EU-funded project SPOTTRACK (Development of an automated spot weld inspection device for safe vehicle repair) set out to address this need and developed such a device.

With a consortium of nine partners, the project first focused on assessing the market needs and then designed the device using a numerical model. The ultimate aim was to develop a lightweight and low-cost device as well as a probe that can access difficult regions and be used by a non-expert. Project partners pioneered the finite element modelling methods for ultrasound prediction.

The models make it possible to study a large set of samples relatively inexpensively and provide more detailed insight. The modelling results provide visualisation of the sound field throughout the entire area at any point in time during the weld test.

This provides a greater understanding of the variables' effects on the reliability of test results. For better inspection results, SPOTTRACK uses an array probe and a multiplexer with a single pulser-receiver.



The multiplexer allows signals to be collected, eliminating the need for expensive phased-array equipment.

The project team also created a set of samples to ensure that the SPOTTRACK could reliably determine the quality of spot welds. Samples included good welds and a range of defective welds.

The team used the data from these tests to develop novel signal processing algorithms for the inspection system. Novel algorithms that automatically identify the main reflections (from the backwall of the weld), intermediate reflections (in the case of an undersized weld or defects in the weld) and certain parameters of the reflections such as arrival time and amplitude, were developed.

Using this information, the team could determine the thickness and the approximate size of the weld and decide whether the weld was defect-free or not. Two prototype devices were developed and field trials were conducted on cars being repaired.

With a false call rate under 1%, the SPOTTRACK device guarantees safe vehicle repairs.

SPOTTRACK

- ★ Coordinated by Vernon in France.
- ★ Funded under FP7-SME.
- ★ http://cordis.europa.eu/result/rcn/148937_en.html
- ★ Project website: <http://www.spottrack.eu/>

ECO-FRIENDLY HELICOPTER DOOR MANUFACTURE

Producing helicopter components from laminated composites is currently a highly energy-intensive process. Novel laser-assisted processing eliminates the need for the energy-hungry autoclave, providing numerous other benefits as well.

High-performance composites for helicopter doors provide reduced weight, high strength and recyclability. However, conventional processing of thermoset composites requires a highly energy-intensive autoclave step to cure the fibre-reinforced pre-impregnated sheets (prepregs) that have previously been manually aligned.

Scientists in the EU-backed project DEFCODOOR (Development of an Ecological friendly final consolidation step using Thermoplastic Fibre Placement for a helicopter door) developed technology to make helicopter door manufacturing more sustainable. It is based on using thermoplastics and laser-assisted 'Thermoplastic fibre placement' (TFP).

TFP enables the rapid deposition and *in situ* consolidation of thermoplastic unidirectional tape, eliminating the need for various joining steps. Eliminating the autoclave also decreases production time.

Thermoplastics offer several advantages compared to thermosets and are gaining ground rapidly. They do not require the autoclave for curing to form cross-links.

As they are not irreversibly formed, they can be melted and reused, making them highly recyclable.

The process used to manufacture them is also more eco-friendly than thermosets, which require large amounts of energy and produce noxious chemicals. The team developed technology to produce structures consisting of skin and stiffener (to prevent buckling) for helicopter components.

Customised stiffener laminates with local reinforcements were produced by laser-assisted TFP and thermoformed into a hat profile to be used in helicopter doors. These were joined *in situ* to skin laminates again via the laser technology.

Scientists compared the properties of *in situ* consolidated laminated specimens with conventional post-consolidated

specimens, providing important insight into processing. DEFCODOOR demonstrated the many benefits of laser-assisted TFP and subsequent thermoforming for producing structural components for helicopters from eco-friendly thermoplastics.

Not only does the process decrease energy consumption and scrap, but the scrap can be reused to produce smaller components.

Eliminating bonding processes and materials thanks to *in situ* consolidation can also reduce assembly costs by about 40%.

With continued optimisation of product quality, technology could make a major impact on the competitive position and sustainability of the helicopter industry.

DEFCODOOR

- ★ Coordinated by TUM in Germany.
- ★ Funder under FP7-JTI.
- ★ http://cordis.europa.eu/result/rcn/148848_en.html

SPACE

PREVENTING FATAL ASTEROID COLLISIONS WITH THE EARTH

More than 10 000 asteroids and comets are within striking distance of the Earth. An asteroid as small as 50 metres wide that penetrates the atmosphere could damage an entire city or part of a country. To prevent such a potential disaster, an EU-funded project, NEOSHIELD, is studying ways to deflect an incoming asteroid or destroy it before it has a chance to collide with the Earth.

‘We have known for a long time that asteroids could hit the Earth, but until recently no one knew how many were out there. Now, we are detecting hundreds of such objects every year,’ says Alan Harris, coordinator of the EU-funded project NEOSHIELD (A Global Approach to Near-Earth Object Impact Threat Mitigation) and senior scientist at the German Aerospace Centre (DLR) in Berlin.

Harris is leading a team of researchers from European countries that have space programmes, as well as from Russia and the United States, to develop plans for using spacecraft to deflect asteroids from a possible collision course with the Earth.

The NEOSHIELD team is studying three techniques: slamming a spacecraft into the object to change its path (‘kinetic impactor’); using the gravitational pull

between a spacecraft and the object to alter its course (‘gravity tractor’); and using an explosion to nudge or destroy the object (‘blast-deflection’).

Fortunately, using observations and projections, astronomers would be able to know decades in advance if a large asteroid were to pose a threat. ‘In such a case,’ explains Harris, ‘scientists would begin working perhaps 15 years or more in advance to prepare a mission to deflect the object.’

In addition to designing the plans for a potential mission, the NEOSHIELD team is also developing a roadmap for the sort of international collaboration needed to realise such an endeavour. ‘A lot of effort has to go into this. There is a need for broad international agreements, and at least a handful of major space-faring countries [countries that have space programmes] should be involved in the scientific and technical

work,’ says Harris. ‘There would be a lot of questions: Exactly who is going to do this and how?’ he adds.

Even though not part of the NEOSHIELD project’s tasks, ‘a test mission to demonstrate a deflection technique on an asteroid that is not threatening the Earth should be seriously considered,’ says Harris. ‘This could be envisaged as a collaborative effort including the European Space Agency and the United States National Aeronautics and Space Administration (NASA),’ he concludes.

Asteroids and comets have frequently hit the Earth throughout its history — including the sizeable object that struck present-day Mexico 66 million years ago and which many experts believe contributed to the extinction of the dinosaurs. More recently, on 15 February 2013, a meteor exploded in the atmosphere above Chelyabinsk, Russia, injuring 1 500 people and damaging 7 200 buildings, according to international media reports.

Such collisions could become preventable in the future if NEOSHIELD researchers successfully developed a method to deflect or destroy incoming celestial objects. ‘Relatively speaking,’ concludes Harris, ‘even a very small change of trajectory would be enough to steer an asteroid away from the Earth, given adequate warning time.’

NEOSHIELD

- ★ Coordinated by DLR in Germany.
- ★ Funded under FP7-SPACE.
- ★ http://ec.europa.eu/research/infocentre/article_en.cfm?artid=32956
- ★ Project website: <http://www.neoshield.net/>
- ★  <http://bit.ly/11yw97m>

PIONEERING DATA SERVICE FOR GROUND MOVEMENTS

Landslides and ground subsidence can cause major economic, environmental and health problems. A recent project has developed sophisticated tools for monitoring ground movement using satellite and ground sensor data.

Across Europe, landslides and other ground deformations are a serious and underestimated problem. These can be natural or caused by human activities such as mining and construction work.

The EU-funded DORIS (Ground deformations risk scenarios: An advanced assessment service) project set out to develop a data processing service to detect, map, monitor and forecast

ground deformations in Europe.

DORIS pioneered new data processing techniques in order to use 'Synthetic aperture

radar' (SAR) archive data from environmental monitoring satellites. This approach provided time series and maps of ground deformation in unprecedented detail.

Project members also developed new techniques to analyse data from differential SAR interferometry — established ground

deformation modelling software. These were coupled with ground-based sensor data to model and monitor rapid ground movements such as landslides.

Case studies at several test sites around Europe provided real-life data to validate the new techniques. A spatial data infrastructure was built to make the new DORIS tools easier to use.

Researchers produced a business model and sustainability strategy for DORIS to ensure that it would be able to function successfully as an independent service. The project has provided a sensitive and robust service for downstream users such as civil authorities and emergency rescue groups.

"Case studies at several test sites around Europe provided real-life data to validate the new techniques."

DORIS

★ Coordinated by the National Research Council in Italy.

★ Funded under FP7-SPACE.

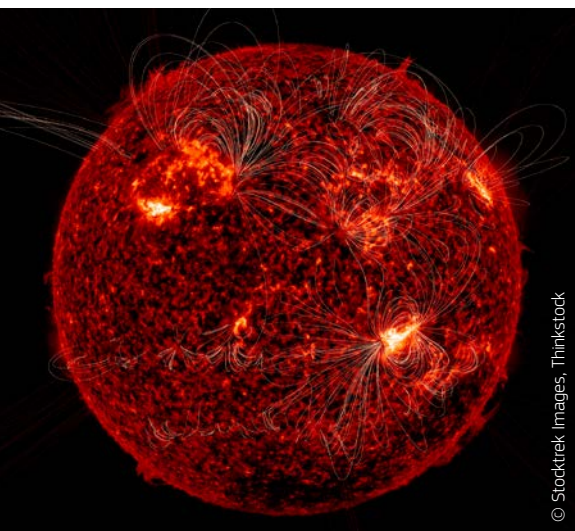
★ http://cordis.europa.eu/result/rcn/90025_en.html

★ Project website:

<http://www.doris-project.eu/>

FINDING OUT HOW SOLAR FLARES AFFECT LIFE ON EARTH

Solar flares can strongly influence life on Earth, causing power outages, disrupting radio communication and airplane navigation, and posing potential threats to astronauts and spacecraft. To better understand these cosmic events and therefore anticipate their effects, the EU-backed project HESPE has developed a range of advanced techniques.



Flares, for example, can interfere with aircraft navigation, forcing planes to reroute away from the poles and towards the equator. Better information on the effects of flares could make it easier for pilots to manage these adjustments, smoothing air traffic worldwide. This is a prime example of how enhanced data on solar flares could provide tangible benefits for life on Earth.

These solar explosions are thought to be triggered by changes in the shape of magnetic fields that encircle the Sun. 'For the first time,' explains Piana, 'researchers have been able to detect these changes at a level of clarity not previously achieved.' This is an example of how the HESPE team could use all available data and open new insights into the behaviour of solar flares. 'One of the nicest things about our database is the ability to conduct statistical analyses of the flares,' says Piana. 'This has not been done before.'

HESPE's novel analytical methods are expected to be adaptable to STIX, an X-ray telescope planned to be mounted on the European Space Agency's Solar

Orbiter, scheduled to be launched from the Kennedy Space Centre in 2017. 'Even beyond this,' comments Piana, 'our methods could be used for all future satellite missions that involve high-energy measurements.'

Though the first solar flare was observed more than 150 years ago — noticed and recorded by British amateur astronomer Richard Carrington — scientists still cannot predict when they will occur, nor do they fully understand their causes or mechanisms.

HESPE involved a team of researchers from Europe and the United States sharing all available information on solar flares with a wide audience of astrophysicists, solar physicists and others in the scientific community.

HESPE

★ Coordinated by the University of Genoa in Italy.

★ Funded under FP7-SPACE.

★ http://ec.europa.eu/research/infocentre/article_en.cfm?artid=32856

★ Project website:

<http://www.hespe.eu/>

'Solar flares have a big impact on the Earth's atmosphere. By processing all the available data from satellites and ground-based sources, we can begin to foresee the possible harm that flares can cause,' says HESPE (High Energy Solar Physics Data in Europe) project coordinator Michele Piana, a professor of numerical analysis at the University of Genoa in Italy.

EVENTS

JANUARY
05 ▶ 06

Barcelona, SPAIN

CONFERENCE

INTERNATIONAL CONFERENCE ON HUMAN GENETICS (IHGC 2015)

The International Conference on Human Genetics (IHGC 2015) will take place from 5 to 6 January 2015 in Barcelona, Spain.

IHGC 2015 will bring together innovative academics and industrial experts in the field of Human Genetics. The aim is to promote research in the field of Human and Medical Genetics and facilitate the exchange of new ideas in these fields. Claudio Franceschi, Scientific Director of the Italian National Research Centres on Aging will be the keynote speaker.

For further information, please visit:
<http://genetics.conference-site.com/index.html>

JANUARY
12 ▶ 14

Dublin, IRELAND

CONFERENCE

APPLICATIONS OF NOVEL SCINTILLATORS FOR RESEARCH AND INDUSTRY (ANSRI 2015)

The Applications of Novel Scintillators for Research and Industry workshop (ANSRI 2015) will take place from 12 to 14 January 2015 in Dublin, Ireland.

The primary goal of this workshop is to address the shortfalls of current scintillator detectors and to explore possible solutions to these problems. The latest developments in inorganic and glass scintillator technologies will be discussed. Another goal of the event is to bring together experts from diverse backgrounds in order to identify the limits of the current generation of scintillators in the relevant application areas, and present promising new materials and possible pathways for future developments.

For further information, please visit:
<http://ssmr.ucd.ie/ansri2015/Home.html>

FEBRUARY
14 ▶ 15

Amsterdam, NETHERLANDS

CONFERENCE

SIXTH INTERNATIONAL CONFERENCE ON ENVIRONMENTAL SCIENCE AND DEVELOPMENT (ICESD 2015)

The Sixth International Conference on Environmental Science and Development (ICESD 2015) will take place from 14 to 15 February 2015 in Amsterdam, Netherlands.

ICESD 2015 provides a common forum for innovative academics and industrial experts in the field of Environmental Science and Development. The primary goal of the conference is to promote research and developmental activities in these fields. Another goal is to promote scientific information interchange between researchers, developers, engineers, students and practitioners working in Amsterdam and abroad.

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

EVENTS

For more forthcoming events:
<http://cordis.europa.eu/events>

FEB.
18 ▶ 20

Tromsø, NORWAY

CONFERENCE

SEVENTH INTERNATIONAL CONFERENCE ON MARINE BIOPROSPECTING (BIOPROSP_15)

The Seventh International Conference on Marine Bioprospecting (BIOPROSP_15) will take place from 18 to 20 February 2015 in Tromsø, Norway.

BIOPROSP is a biennial conference on bioprospecting from cold marine environments. The conference brings together scientists and industry representatives to address issues of how to translate basic research into applied research on possible industrial applications.

There is limited space available for exhibitors (companies and cluster organisations) at BIOPROSP_15.

For further information, please visit:
<http://bioprospect.com/>



Twenty years for CORDIS on the World Wide Web



In November, **CORDIS** celebrated its 20th World Wide Web-Birthday. Indeed, it was on 7 November 1994 that the www.cordis.lu domain was registered, leading to the launch of the EU institutions' first permanent website.

While the CORDIS web server was initially used for the partner search service, expressions of interest and the first calls for proposals of the 4th research Framework Programme (FP4), it quickly became clear that the web was not just an additional technology. The early 2000s saw CORDIS become the central web platform of the research and innovation programmes, hosting thousands of web pages for each programme and developing web applications for a variety of needs.

Now CORDIS contains information on over 100 000 EU-funded projects, stretching from some of the earliest EU research under the first framework programme (FP1) though to the planned publication of emerging Horizon 2020

projects. The core information on projects and results is complemented by multilingual top stories and news services, including articles submitted by the research community. These and highlights of project 'Results in Brief' are included in this magazine.

After 20 years on the web, we are again experiencing a shift, as the number of website visitors is less of a measure of success than making it easy for clients to find and reuse our rich repository of data. After the launch of the new suite of web applications, the future of CORDIS will be driven in the years to come by the European Commission's strategy for the dissemination and exploitation of research results.

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