Newsletter

Issue 6 | February 2008

UNIVERSITY OF CAMBRIDGE
Department of Engineering

Executive Introduction

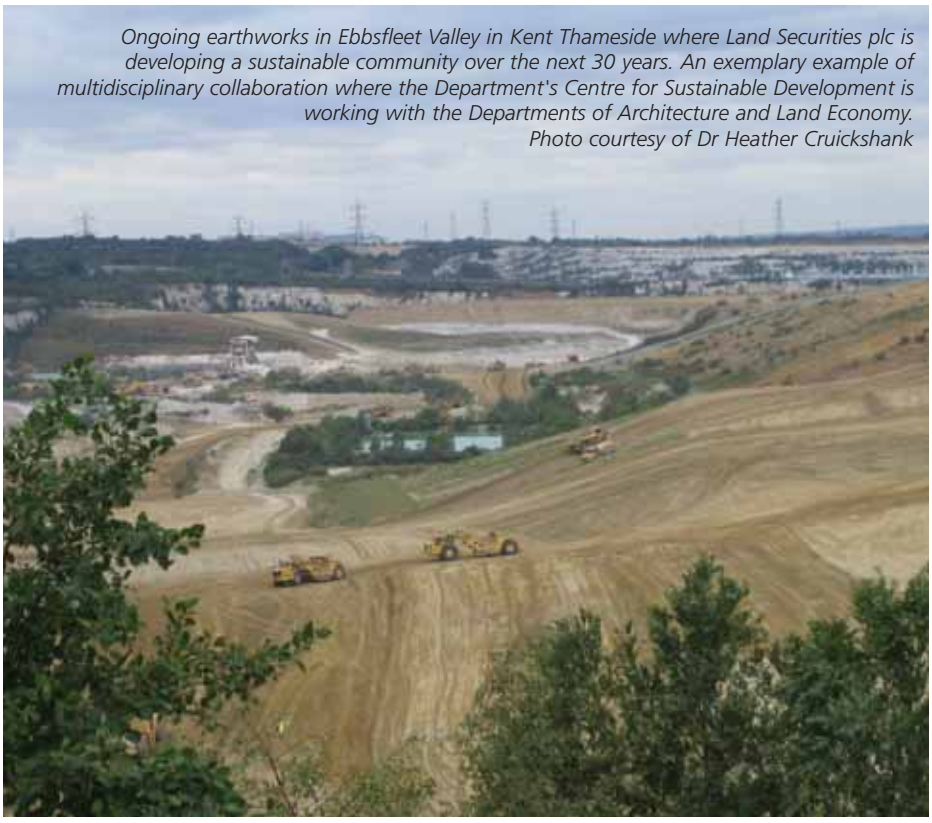
The Department's progress since 2000 was revealed in a set of facts and figures gathered for the UK Government Research Assessment Exercise last year (www.rae.ac.uk). They show that the Department has not only grown rapidly, but also developed more connections both between its divisions and out to other disciplines.

The Department is unusual for being a single integrated engineering department. This quirk of history is now a key strength as engineering challenges increasingly demand large-scale multidisciplinary approaches.

The basic growth statistics speak for themselves: research expenditure has doubled since 2000; so has the number of post doctoral researchers; and research student numbers are up by 40%. But perhaps the most interesting metric is the Department's share of expenditure on grants jointly held with other departments, which has increased by a factor of six. This increase in multidisciplinary research is exemplified and increasingly driven by the Department's three themes: sustainable development; cognitive systems; and engineering for life sciences.

In 2008, we will continue to drive for more collaboration among engineering academics and with those from other departments. The themes will play an important role. Investment in infrastructure will also be essential. Development on the Trumpington Street Site in the centre of the City and new facilities on the West Cambridge Site will open opportunities to build new and stronger connections.

The results of the Research Assessment Exercise will be published towards the end of 2008 and, in the meantime, we are encouraged by the two most highly respected world university rankings produced last year: the Shanghai Jiao Tong University ranking in the broad field of engineering/technology and computer sciences; and the Times Higher Education Supplement ranking in the field of technology. Both of these rankings placed Cambridge above all other institutions outside the USA.



Ongoing earthworks in Ebbsfleet Valley in Kent Thameside where Land Securities plc is developing a sustainable community over the next 30 years. An exemplary example of multidisciplinary collaboration where the Department's Centre for Sustainable Development is working with the Departments of Architecture and Land Economy. Photo courtesy of Dr Heather Cruickshank

In this issue

Date for your diary

Alumni Weekend 2008
Friday 26th – Sunday 28th September
Cities of the Future
Speakers:

- Professor Nick Collings
  Streets ahead: the future of personal transport
- Professor Randall Thomas
  Sustainable cities: mirage or miracle?
- Dr Stuart Scott
  Powering our cities in the 21st century

www.foundation.cam.ac.uk/weekend.php

An integrated engineering department founded on core strengths spanning all engineering disciplines and also cross-connected by three strategic themes:

- **Cognitive Systems Engineering**
- **Engineering for Life Sciences**
- **Sustainable Development.**

www.eng.cam.ac.uk

Teaching excellence rewarded

Dr Tom Hynes, a Senior Lecturer in the Department of Engineering, is one of eleven University of Cambridge lecturers who have been recognised for their excellence in teaching, at an awards ceremony for the 2007 Pilkington Prizes.

Dr Tom Hynes receiving his prize from Professor Alison Richard, Vice-Chancellor of the University Photographer Mike Cameron

All of the lecturers have made outstanding contributions to the development of teaching in their departments and faculties. The benefits of their work have reached not only students at the University of Cambridge, but also other students and professionals world-wide.

Dr Tom Hynes has been for many years one of the most dependable, flexible and successful lecturers in the department. In a typical year, he may be found demonstrating computing to first-year undergraduates, lecturing part 1B students in thermo-fluids and mathematics, and lecturing in specialist modules on turbo-machinery.

All of Dr Hynes's courses are noted for their clarity. His success in conveying Mathematics to students has been a particular cause for congratulations. Dr Hynes is an attentive teacher who takes great care not to make assumptions about his students' needs.

The Pilkington Prizes were set up by the late Sir Alastair Pilkington, former Chairman of the Cambridge Foundation. The prizes are supported by Cambridge University Press, and are awarded annually by the Vice-Chancellor, Professor Alison Richard. Professor Richard said, "These rewards have gone to outstanding lecturers and professors and reflect the breadth and depth of this University's commitment to outstanding and innovative teaching." Andrew Gilfillan, Managing Director of Europe, Middle East and Africa, at Cambridge University Press, said, "We are delighted to support the annual Pilkington Teaching Prizes award ceremony. Today's prizewinners have been selected by their own students and peers; we know of no better testimonial to their talents and we congratulate them on the recognition they have received."

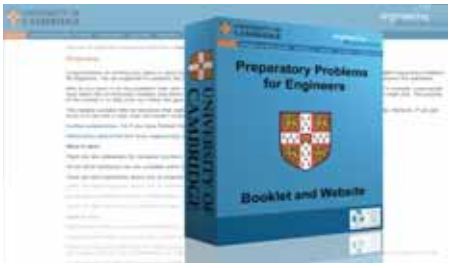
Bridging the gap before term starts

A new way of bridging the gap between A-level and university is being pioneered by the Department of Engineering.

Students come to Cambridge with varying levels of knowledge and experience because there is a very wide range of options at A-level. For example, some have taken several mechanics modules and others very few. Some have taken Further Maths and others not. This presents a significant challenge to the first year lecturers, who typically have to cover their subject area in just 16 lectures. Ideally, some students would receive more tuition in some areas before starting the lectures.

Before they arrive, new undergraduates are sent a Preparatory Problems Booklet, which shows them the level that is expected at entry and helps them to identify any areas in which they could improve. This year a website has been created to run in conjunction with the booklet. It provides a wide variety of resources, ranging from a simple maths formula sheet to tutorial-like animations from the first year lecturers, as well as links to good external sites. The aim is to make it very easy for students to fill any gaps in their knowledge before coming to Cambridge.

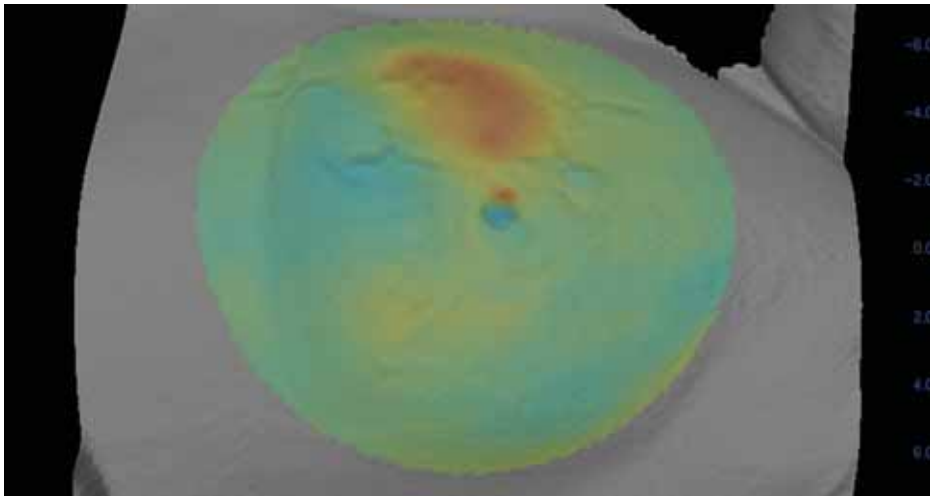
The website has been funded by RLO-CETL (The Centre for Excellence in Teaching & Learning in Reusable Learning Objects) and created by Megan Davies Wykes, a UROP (Undergraduate Research Opportunities Programme) student supervised by Matthew Juniper. The project is led by Dawn Leeder, with technical input from Matthew Juniper, Jim Woodhouse, Andrew Gee and Tom Hynes.



A new way of bridging the gap between A-level and university

Cambridge researchers scoop breast cancer prize

Dr Charlotte Coles and Miss Jenny Wilkinson accepted Breast Cancer Campaign's 'Research Team of the Year 2007' award on behalf of the Cambridge Breast IMRT Trial Management Group at Addenbrooke's Hospital, for their outstanding work looking into improving radiotherapy for breast cancer patients.



An image of the 3D surface of the breast captured with a laser scanner. The colour from blue to red signifies how much the breast has changed shape after radiotherapy - red indicates a significant change

The primary objective of the Cambridge Breast IMRT Trial is to prove that IMRT (Intensity Modulated Radiotherapy) decreases toxicity compared with standard breast radiotherapy. Over 1100 patients have now been recruited.

In order to do this it is necessary to measure the way that the size and shape of the breast changes in response to the radiotherapy. This involves comparing the three-dimensional outline of the breast at regular intervals during the treatment with its initial outline. The complex curved shape of the breast makes this comparison difficult to achieve in a repeatable and reliable way.

A novel analytical tool to assess breast shrinkage after radiotherapy has been developed in collaboration with Dr Graham Treece and his team here at the Department of Engineering. Graham wrote the laser surface matching software based on an original algorithm devised by Tom Drummond. This laser surface matching software will give information about the position and extent of breast shrinkage, by measuring the subtle changes in the 3D breast shape and hence measure the quantitative effects of the various treatments under evaluation. This can then be mapped to the original radiotherapy plan.

This high quality clinical trial data is linked with patient blood DNA samples to look for genetic variation in normal tissue side effects. The IMRT Trial has now contributed 50% of samples for the multi-centre translational study RAPPER, developing individualised radiotherapy based on patient's genetics.

Presenting the 'Research Team of the Year 2007' prize at the inaugural awards ceremony at the House of Lords, Professor Alastair Thompson, Chair of the Campaign's Scientific Advisory Board said, "Campaign's Research Team of the Year Award, now in its fifth year, is given to the Campaign research team whose work has made valuable advances in breast cancer research during the past year."

Dr Charlotte Coles said "We are delighted to receive the Team of the Year award. Campaign's funding has allowed us to establish a large trial and follow-up patients over several years to assess the success of this new type of radiotherapy."

For further information please contact Dr Graham Treece email: gmt11@cam.ac.uk

Chancellor visits Schofield Centre

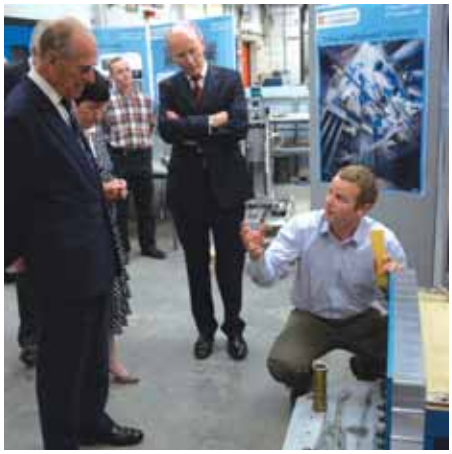
The Chancellor, His Royal Highness Prince Philip, and the Vice-Chancellor, Professor Alison Richard, visited the Schofield Centre in October 2007.

Part of the Department of Engineering, the Centre carries out simulations of earthquakes, tsunamis and other geological phenomena to inform and assist industry on the design of tunnels, pipelines and even housing.

The Chancellor had previously visited the Centre in 1989. He was keenly interested in and impressed by developments in technology and understanding since then, as he was shown around by Professor Malcolm Bolton and Professor Robert Mair and met several researchers.

The building he visited was completed in November 2001. It was designed around the existing Schofield Centrifuge Centre, which opened in 1986 and is named after the University's Emeritus Professor of Soil Mechanics, Andrew Schofield, who was present to meet the Chancellor.

Further information on the Schofield Centre can be found at: www-civ.eng.cam.ac.uk/geotech_new/geotech.htm



Alec Marshall, a second year PhD student, discusses his research project with the Chancellor

Gopal Madabhushi wins a Medical Futures Innovation Award

Above: Gopal Madabhushi (second from left) and team win a Medical Futures Innovation Award.
Below: Normal and improved prosthesis.

A team of surgeons and engineers from Southampton University Hospitals NHS Trust, the School of Engineering Sciences at the University of Southampton and the Department of Engineering at the University of Cambridge recently won the Best Surgical Technology award in Bone and Joint Category of the Medical Futures Innovation Awards 2007.

Theirs was selected from over one hundred entries and described the development and testing of a new technique to improve the compaction of bone graft in revision total hip replacement. The use of vibration to compact bone graft (crushed bone) around the prosthesis leads to smaller hoop stresses in the femur improving the success of the revision hip replacement operations. It also gives the surgeons better control on how much compaction is required to achieve good results without the risk of fracturing the femur.

Doug Dunlop and Ben Bolland from Southampton General Hospital provided the clinical input and Andrew New of the School of Engineering Sciences and Gopal Madabhushi of the Geotechnical and Environmental Research Group here at the Department provided the engineering know-how. The team were awarded the prize at a gala awards ceremony hosted by Joanna Lumley and Rory Bremner at the Honourable Artillery Company in London. The paper on this work has also appeared in the May 2007 issue of The Journal of Bone and Joint Surgery.

An abstract of the paper can be found at www.jbjs.org.uk/cgi/content/abstract/89-B/5/686

More details on the Medical Futures Innovations Awards can be found at www.medicalfutures.co.uk

FACT BOX

Since 2000 the Department has created over 20 spin-out and start-up companies with a total investment of over £50 million.

Student Autonomous Underwater Challenge – Europe

The Student Autonomous Underwater Challenge – Europe (SAUC-E) is a competition for students from across Europe to design and build Autonomous Underwater Vehicles (AUV) to attempt an underwater assault course. The course varies from year to year but can consist of gates, drop targets, surface zones, and many other obstacles. The aim is to advance the state of the art of AUV technology and the competition provides opportunities for students to gain industrial links.

This is the first year Cambridge has competed in the SAUC-E competition and the team won second prize. This is a fantastic achievement for an undergraduate student team comprising mostly first years. Paul Esparon, Richard Mathie, Alex Ridge, Simon Calcutt, Sunil Shah, Oliver Hughes and Andy Pritchard had no prior experience of autonomy or underwater vehicles. As the team said "A most significant factor in our success was the generous donations from our sponsors Sentec, Qinetiq and IET without which there would be no team."

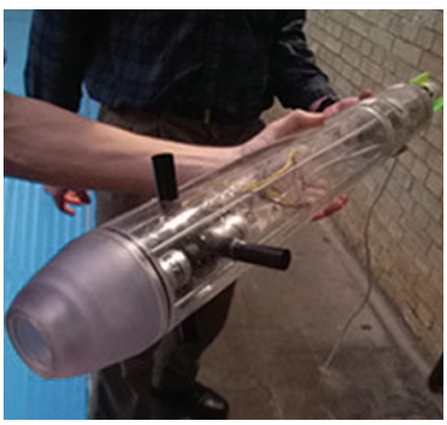
The students gained an enormous amount of real life engineering experience, putting ideas into practice, and they all thoroughly enjoyed the event. Paul Esparon, project director of the team, said "It is definitely a beneficial part of our engineering degree. We learned how to work on an engineering project against all adversity and set backs which is a vital skill that sets any student who undertakes such a challenging project a cut above the rest."

The event was four days long. The first two days were practice and time to make last minute adjustments to the AUV. The third day was qualifying and the fourth day the finals. Points were awarded based on the final run, technical documentation, presentations and innovation.

The competition will be held in Brest, France in 2008 and the team are enthusiastic about recruiting more members. The current team have already begun new designs for 2008.

Further information
www.cambridgeauv.co.uk

The team from left to right Alex Ridge, Simon Calcutt, Sunil Shah, Paul Esparon (Team Captain), Oliver Hughes, Richard Mathie, Andy Pritchard. Photo courtesy of Crown Copyright DSTL.



AUV at pool test during early stages of development.

Completed AUV submerged and ready to tackle the final competition run. Photo courtesy of Crown Copyright DSTL.

Correction

Victoria Grinevich has written to us to point out a correction that is needed in the "Professor Kenneth Johnson awarded the Timoshenko Medal" article in the last issue of the Department Newsletter. In the 4th paragraph it is written: "When Timoshenko emigrated from Russia to the US...", and it should have been written "When Timoshenko emigrated from Ukraine (a part of Russia at the time) to the US...".

Stephan Timoshenko (Ukrainian: Stepan Tymoshenko) was born in the village of Shpotivka in Poltava Gubernia (currently Chernihiv Oblast, Ukraine).

Cambridge Students build Millau Bridge

The final structure. Photograph courtesy of Jenny Auton

Seventeen third-year students from the Department have taken part, for the first time, in Constructionarium, a scheme designed to introduce students to team working, construction management, and practical issues that affect work on site. The students built a small-scale version of the new Millau Viaduct in France, but with a central span of 10 metres it was a still a sizeable structure in its own right.

The scheme is run at the National Construction College in Norfolk. Each university is teamed with a Contractor. The team from the Department of Engineering teamed up with Stephenson Construction and Consulting Engineers WhitbyBird. The structure had to be completed within a week.

The students had to excavate the foundations, cast reinforced concrete bases for the abutment bearings and the columns, erect the columns and assemble the cable-stayed deck units on embankments at the side. These had to be launched across the valley and were then locked into position before anyone was allowed to cross the structure.

The steelwork for the structure had been prefabricated, but had to be assembled by the students, and as in real life they found that the steelwork did not match the drawings exactly, nor could the structure be launched in the way envisaged. These problems had to be overcome, as did some errors introduced by the students themselves.

Millau Cable Bridge, between Clermont-Ferrand and Béziers in southern France

The final structure almost met perfectly in the middle, and was declared safe by an engineer, allowing the team photograph to be taken. The project was hard work but was a great introduction to real-world engineering, and showed how an engineering drawing, showing precise millimetre tolerances as used in the original structural analysis, is not always a realistic view of what happens on site.

It is intended that the scheme will be repeated next year, with a larger number of students undertaking several different projects.

We would like to express our thanks to Stephensons and WhitbyBird for their financial sponsorship and the investment of their time, and to Constructionarium for making the whole scheme available to the University of Cambridge.

Further information can be found at the link below:
Constructionarium website:
www.constructionarium.co.uk

The car that diagnoses its own servicing needs

An intelligent system that could before long enable cars to tell mechanics which of their parts need servicing has been unveiled by engineers here at the Department.

The specially-adapted Fiat prototype, which was presented at a European technology show, can tell garage staff about the state of its components in seconds by using electronic tags inside its engine.

The system has been designed by academics at the Institute for Manufacturing (IfM), part of the Department of Engineering. In conjunction with sophisticated software, it could be used to speed up servicing, and identify which parts can be recycled or reused when the vehicle reaches the end of its life. Combining such information from many vehicles would pinpoint which parts of a car need redesigning.

In those rare cases that a faulty batch of cars are actually sent to showrooms, the technique could instantly single out which models need to be recalled before they hit the road.

Radio-Frequency Identification (RFID) tags, each with its own unique identification number, are attached to the car's engine parts. The vehicle is then driven at low speed over a one-metre square servicing pad, which is fitted with an Ultra-High Frequency reader and four antennae.

As the car passes over the pad, the readers transmit the ID number from the electronic tags to a computer. By cross-referring this information with a computerised database – for example one showing the parts' date and manufacturer – mechanics would be able to identify those parts that needed to be checked for wear at the click of a mouse.

Professor Duncan McFarlane, from the University of Cambridge's IfM said; "Ultimately motorists could be driving into a garage over the same sort of sensor, which would instantly tell both the driver and the garage staff which parts needed replacing and which might be good for several thousand miles more.

"But there are potentially great benefits beyond this as well. When the car is sent to be scrapped, for example, RFID tagging could be used to identify which parts still have a useful life left in them. The system will tell the car producer whether separate parts can be reused, recycled, or need to be disposed of in landfill. It will also highlight which parts need improving for a longer life."

Fiat prototype car with sensor pad

This demonstrator forms part of a EU funded project called 'Product Lifecycle Management and Information Tracking Using Smart Embedded Systems', conveniently abbreviated to PROMISE. The system has already been demonstrated at Fiat's research centre in Turin.

"The PROMISE system has much wider potential as well," Professor McFarlane added. "It allows us to trace and update information about any product, after its delivery to the customer and up to the end of its useful life. In time it could be possible to tag all sorts of products, components, and even airport baggage and boarding passes."

"Ultimately motorists could be driving into a garage over the same sort of sensor, which would instantly tell both the driver and the garage staff which parts needed replacing and which might be good for several thousand miles more..."

For further information please e-mail: ifm-enquiries@eng.cam.ac.uk

Igniting Engineering Ideas - Engineering Students attend CfEL's entrepreneurship programme

The Cambridge Integrated Knowledge Centre (CIKC) recently sponsored five students to attend the Ignite programme which took place between 8th and 14th July 2007. The course, run by the Centre for Entrepreneurial Learning (CfEL) at Judge Business School, is an intensive, one week training programme for aspiring entrepreneurs and corporate innovators to trial and prepare business ideas for the commercial environment. Now in its tenth year, Ignite attracted over 50 delegates from a wide range of business disciplines spanning many countries.

"This collaboration with CIKC is a great opportunity for us to foster innovation at the University", stated CfEL Programme Manager, Yupar Myint. "CIKC's objective to enable and accelerate the commercialisation of technology through building appropriate business skills is a perfect fit with Ignite. The CIKC support is a significant bonus for the programme ensuring a high quality of delegates and technology ideas."

CIKC received a large number of applications for the course when the sponsorship was advertised and three of the five successful applicants were from the Department of Engineering. Zhihan Wang, currently completing his PhD under Dr Patrick Palmer's supervision in the Power & Energy Conversion Group, found the course instructive and beneficial particularly because during the course he was introduced "to a very supportive network of seasoned entrepreneurs, venture angels, business mentors and MBA students". Zhihan is now discussing the feedback from the course with his colleagues and supervisor and the next stage will be to utilise the Cambridge Venture Programme to explore market research opportunities and to approach Cambridge Enterprise about commercialising their idea.

Another PhD student from Electrical Engineering, Hang Zhou, felt that the course gave him the confidence to consider starting his own business in the future. Hang learned about important aspects of marketing as well as the kind of business model that would be best suited to exploit his product commercially. Hang was judged an ideal candidate for the course, since he arrived with a "business idea that seemed to be a viable piece of technology and made a good economic case for its potential and opportunity".

The third delegate also from Electrical Engineering was Chi Hang Kwok, currently completing his PhD under the supervision of Professor Ian White, Head of the Photonic Communication Group. Chi Hang applied for one of the CIKC funded places already armed with a well prepared business plan and was keen to attend the course, not only to subject his business ideas to expert scrutiny, but to "increase contacts and to improve my networking skills". He commented that "the practical content of the course improved my business proposition and presentation skills which are invaluable for taking my business plan forward in the future".

The five CIKC sponsored attendees at the Ignite course pictured with CIKC Administrator Maggie Tanner and the Director of CfEL Shai Vyakarnam.

The course has been a great success and the CIKC are planning to repeat their sponsorship next summer.

The CIKC has been set up with funding from the Engineering and Physical Sciences Research Council (EPSRC) to develop advanced manufacturing technologies based on new macromolecular materials systems, for example polymer electronics or advanced liquid crystals, and to create valid commercial exploitation models for these innovations.

CIKC brings together research activities in molecular and macromolecular materials in the Electrical Engineering Division (in particular, the Centre for Advanced Photonics and Electronics) and in the Cavendish Laboratory.

It also draws on the expertise of Judge Business School, the Institute for Manufacturing (IfM) and the Centre for Business Research (CBR), to create innovative knowledge exchange activities spanning business research, training and specific exploitation.

Combining world-class research with a strong partnership with business, CIKC engage with industrial partners to shape and prioritise the work programme, allow the secondment of researchers from industry and from other universities for knowledge exchange, and enable the provision of pilot manufacturing lines for prototyping.

The mission of the centre is to provide the business and technical expertise and infrastructure to enable those with exploitable concepts to achieve commercial success.

For further information please contact Maggie Tanner mt451@cam.ac.uk
Read more about the CIKC in the University of Cambridge research magazine 'Research Horizons' - issue 3 - Summer 2007 edition found at: www.rsd.cam.ac.uk/research_horizons/

Professor Palmer receives an honorary doctor of science degree at Clarkson University's 114th Commencement

Professor Andrew C. Palmer, an Emeritus Professor of the Department, has received an honorary doctor of science degree at Clarkson University's 114th Commencement. The degree was awarded "for his exceptional contributions to pipeline and offshore engineering, his years of dedicated guidance of students of engineering, and his notable successes as both an academician and a businessman."

Professor Palmer addressed the Clarkson University class of 2007 telling them that although he may not have the expected uplifting and instructive graduation message for them, he would leave them with three thoughts: "When you look back on your life, you don't regret the things you have done, only the things you haven't done," he said. Second was a quote from the author, T. H. White: "When you feel unhappy, the remedy is to learn something new." His final thought was an inspiration from George Fox, one of the founders of the Society of Friends – the Quakers. Fox went on a mission to South Wales and climbed to the top of a mountain, where he had a religious experience. Descending from the mountain, he gave a sermon and told the faithful, "Go cheerfully through the world and speak to that of God in every man." Palmer said he wasn't certain he could define God, "but I can say to you, go cheerfully and speak to that of goodness in every man."

Professor Palmer is the world's leading authority on the incremental movement of pipes on the sea bed as a result of cyclic pressure and temperature changes – an area in which his knowledge of soil mechanics, stability theory and non-linear analysis makes him a unique expert. He is also known for his contributions to pipelines and the offshore industry, his work as a Professor of engineering and his successes in engineering consulting.

Professor Palmer earned his bachelor's degree in engineering from Cambridge University in 1961, and after completing his PhD at Brown University in the USA, followed by a spell at the University of Liverpool, he returned as a lecturer in 1967. Wanting to try real engineering, in 1975 he joined a consultancy firm, R.J. Brown and Associates, the leading consultant in underwater pipelines. He worked on underwater ploughs, ice mechanics and new techniques for Arctic pipeline construction. He was the project manager for the first Arctic offshore pipeline, built off the coast of Melville Island in Canada.

In 1970 he advised BP on a soil-structure interaction problem, the effect of thawing permafrost on the Trans-Alaska oil pipeline. A year later BP asked him about a structural analysis problem in the construction of the Forties pipeline, the first North Sea pipeline in what was then thought of as deep water. "That sounds interesting", he replied "but I don't know anything about underwater pipelines". "We think that's an advantage", BP replied "you'll bring a fresh mind to it. Come and see us tomorrow". That telephone call changed his life.

After another spell in academia, as Professor of Civil Engineering at the University of Manchester Institute of Science and Technology (UMIST) (1979-82), he again departed to the immediacy of consultancy work, eventually setting up his own company in 1985.

He founded Andrew Palmer and Associates, a company of consulting engineers who specialise in marine pipelines and have been engaged in pipeline projects on every continent. After selling his company in 1993, Palmer remained as technical director until he returned to university teaching as the Jafar Research Professor of Petroleum Engineering at Cambridge University in 1996. He was a visiting professor in the Division of Engineering and Applied Sciences at Harvard University in 2002–2003. He retired from Cambridge in 2005 and is now Keppel Chair Professor in the Department of Civil Engineering at the National University of Singapore. Professor Palmer is a Fellow of the Royal Society, a Fellow of the Royal Academy of Engineering, a Fellow of the Institution of Civil Engineers, a Chartered Engineer, a member of the Society of Petroleum Engineers and a member of the Academy of Experts.

He is the author of three books and more than 180 papers on pipelines, offshore engineering, geotechnics and ice.

Professor Andrew C. Palmer

"When you look back on your life, you don't regret the things you have done, only the things you haven't done,"

FACT BOX

Since 2000 over 500 research grants have been awarded to the Department with over 25% of the funding coming from industry.

CUEA Annual Conference: Engineering – building a better world

The Cambridge University Engineering Association conference was held as part of the annual Alumni Weekend. The event was a great success with contributions from the following groups in the Department:

Enecsys – Asim Mumtaz, Lesley Chisenga, Nabin Shrestha, Andrabadu Viraj
Enecsys, a spin-out company from the Engineering Department, is developing a series of power-conditioning units (PCU), or inverters, that take the output directly from individual solar panels and conditions it so that it can be fed directly into the mains grid, thus qualifying for government incentives on 'feed-in' tariffs where applicable. The patented Enecsys technology provides several key advantages over existing systems, especially ease and cost of installation, reliability and improved system efficiency giving faster payback on capital costs than current systems. The Enecsys team demonstrated this next generation power converter for solar modules.

Silent Aircraft Initiative – Alex Quayle
The aim of the Silent Aircraft Initiative is to generate a credible commercial aircraft design that would be inaudible outside of an airport in a typical urban environment. This Cambridge-MIT Institute project is a joint venture between the two universities involving over thirty academics and a large number of industrial partners.

CUER Cambridge University Eco Racing – Geoff Cunningham
Cambridge University Eco Racing (CUER) is a student-led initiative aiming to design and build a Solar Electric Vehicle to compete in the World Solar Challenge (WSC) in 2009. Founded in January 2007, CUER has successfully recruited 20 enthusiastic team members and secured strong departmental support. CUER displayed posters, photos and a slideshow about the team, with sponsor packs available to pick up.

A small scale "Non-Inertive-Feedback-Thermofluidic-Engine" (NIFTE) pump – Christos Markides
This type of pump is thermally powered, in the case of the demonstration by using heat from an electric heater, but in a real life application this would be waste heat, or heat from the sun, to produce hydraulic (pumping) work without the need of

mechanical moving parts. NIFTEs are self-starting and require only small temperature differences to operate. They are simple, reliable and cheap to manufacture and run. They have many humanitarian applications, such as the supply of drinking water or water for agriculture in the developing and third world, as well as other applications such as domestic hot water circulation.

Sustainable manufacturing group at the Institute for Manufacturing (IfM) – Kathryn Jackson
Projects include incremental sheet forming, polymer recycling, recycling of aluminium by cold bonding and removal of toner from printed paper. A rig for removal of toner from paper was demonstrated.

Cambridge Vehicle Dynamics Consortium – Jonathan Miller
Long combination heavy goods vehicles provide benefits such as reduced congestion and fuel consumption. These vehicles are not presently used in the UK because they cannot negotiate our roundabouts. This project looks at active rear steering for articulated heavy vehicles to make them safer and more manoeuvrable.

High speed in-cylinder sampling in internal combustion engines – Simon Regitz
High speed sampling valves are useful tools in understanding the combustion process and emissions characteristics of internal combustion engines. In the work presented a high speed sampling valve based on a gasoline direct injector has been developed. Cyclically resolved measurements of in-cylinder nitrogen oxide (NOx) and carbon dioxide (CO2) have been carried out to evaluate Exhaust Gas Recirculation variations and nitrogen-monoxide (NO) formation.

Engineers Without Borders – Miranda Segar, Ben Taylor, Ciaran Malik
EWB-UK's mission is to facilitate human development through engineering. Run by students and assisted by professional volunteers, EWB trains and educates students and recent graduates in development theory and practice. EWB's actvities include local community work, talks and trips, training courses for students, and running annual placements for suitable students and graduates in organisations and developing communities around the world. EWB-UK is a registered charity.

Markerless Motion Capture Using Multiple Cameras – Paris Kaimakis
Motion capture systems allow computers to quantify and digitise human motion. Once the motion has been captured, a separate recognition process can take place. This technology can be used in surveillance systems and human-computer interfaces. Other applications include animation and data compression.

Centre for Sustainable Development – Dr Heather Cruickshank and Priti Parikh
The Centre for Sustainable Development has grown to encompass the delivery of a one-year full-time taught MPhil in Engineering for Sustainable Development, which was introduced in 2002 and a research community covering sustainable development issues in the fields of water, waste, sustainable communities, assessment methodologies and fragile nation states. The work adopts a multi-disciplinary approach and focuses on the context and complexity in which engineering products and services are delivered.

Geotechnical Engineering – Ulas Cilingir
Seismic behaviour of the underground structures. Ulas is looking at the soil-structure interaction between the tunnel and the surrounding ground during the earthquakes. His research involves advanced techniques like dynamic centrifuge testing, digital image analysis and finite element modelling.

Department of Engineering Educational Outreach – Joy Warde
Introducing young people to the fun and creativity of engineering in a University research environment. In 2006-7 over 2200 young people and their parents and teachers visited the University for a hands on design-build-test engineering challenge. These events were supported by 110 engineering student, staff and alumni volunteers who acted as role models for the next generation of engineers. To support these visits Joy has developed a variety of hands-on projects for all age groups ranging from 'Rocket Launchpad' for primary school children, to programming lego robots for A level students to 'Crane Construction Challenge' for family teams. Outreach displayed a range of projects, feedback from participants and plans for the future of Engineering Outreach.

Wind Technologies Ltd – Ehsan Abdi Jalebi
Wind Technologies Ltd was founded to bring to market a new generation of electrical generator systems for the wind turbine industry. The new technology, through offering high reliability and low capital and maintenance costs, will significantly contribute to the wider adoption of wind power generation. The technology promises significant applications in a wide spectrum of wind turbines, from micro wind systems for domestic power generation, up to multi-megawatt turbines for on and off shore developments.

This year's Alumni Weekend, Friday 26th – Sunday 28th September, will focus on "Cities of the Future". Speakers will be: Professor Nick Collings "Streets ahead: the future of personal transport", Professor Randall Thomas "Sustainable cities: mirage or miracle?" and Dr Stuart Scott "Powering our cities in the 21st century". More information can be found at: www.foundation.cam.ac.uk/weekend.php

Celebrating 21 Years of Materials Selection

A "coming of age" party last year marked twenty-one years of materials selection software at Cambridge University and Granta Design.

In 1986, Professors Mike Ashby and David Cebon first collaborated on developing software tools to systematically select materials for engineering applications. Their work, at the Department, led to the founding of Granta Design and the development of new technologies and products that are now used by world-leading engineering organizations such as NASA, Rolls-Royce, Honeywell, GE, and Emerson Electric. These products include:

CES Selector – advanced software tools, used in industry to support analysis and selection of engineering materials and processes

GRANTA MI – an integrated system to manage materials information throughout the engineering process

CES EduPack – the leading toolkit for teaching materials engineering, now used at over 550 universities worldwide.

The celebration party, at Queens' College, Cambridge, brought together current and former employees and researchers at Granta Design and Cambridge University, and other longstanding friends of the materials selection project. A display, supported by hands-on demonstrations, charted the development of Granta's materials information technology from the "back of an envelope" in 1986 to today's advanced commercial tools.

Granta Chairman, Mike Ashby, Managing Director, David Cebon and Chief Operating Officer, Patrick Coulter, thanked all of those at Cambridge University, Granta Design, partners and customers, who have contributed to this progress. They also noted the promising future for materials information technology. Good decisions about materials usage will be central to eco-design and to the ability of business to reduce its carbon footprint and meet environmental regulations. These decisions require the right materials information and analysis tools – so Granta's solutions are well placed to play a vital role in an increasingly eco-aware economy.

Further information about Granta Design can be found on their website www.grantadesign.com

David Cebon and Mike Ashby

Engineering students display their design skills

Manufacturing Engineering students at the Department's Institute for Manufacturing Design Show, displayed a range of new products that they have developed as part of their course.

The Design Show is held each year for an invited audience of local industrialists and designers. Students put together displays to explain the technical and business ideas behind the products, together with design details and prototype models of the products themselves.

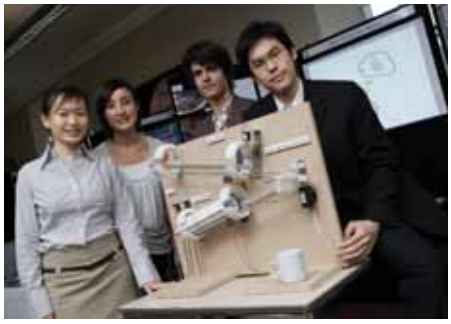
"The students have been working on their projects for most of the past year and the results are fantastic," said Lecturer Dr James Moultrie. "Some ideas have real commercial potential and they will be seeking finance to take them further."
Dr Moultrie said: "These designs not only reflect the imagination of our students, but the emphasis we place on turning technology into products that are attractive, user-friendly and above all meet a real customer need. Hopefully some of the ideas will see the light of day in a commercial setting in the not-too-distant future."

The projects

BrailleBelt: A revolutionary pocket-sized Braille output device

BrailleBelt saw a need to develop a portable device that would capture an image containing text and output the information in either audio speech or Braille. The reading material could be anything from newspapers to novels, from cereal packets to medicine instructions and could even include electronic displays such as microwave LCD displays.
BrailleBelt is now focusing purely on the Braille output technology. The students developed a method of producing a refreshable Braille display on a small and flexible belt. New and existing Braille products can use this device, allowing continuous reading and true portability. There are currently no commercial products that use a Braille output device smaller than around a foot wide and the team believes its innovative technology can enable the world to make pocket-sized Braille output devices.
Team members: Pete Budge, Anne Jenkins and Frankie Leung

The Clean Cup Sauna: no more plastic cups, no more washing up: an eco friendly cup cleaning solution.



This team developed a radical new solution for office workers who enjoy a hot drink but are too busy to wash up. Unlike a dishwasher which is time-consuming to run, or disposable cups which are unpleasant to drink from, the Sauna would be a drop off for dirty cups, cleaning and storing them, ready for re-use. Designed to use 85% less water than a traditional dishwasher, the machine would be cost effective and eco-friendly.
Team members: Andrea An, Justin Chang, Daniel Neal and Sarah Ong

Easy-Rise: An affordable alternative to adjustable beds

The Easy-Rise mattress will address the needs of elderly people who have difficulty getting in/out of bed, and sitting up. Its key feature is that it is incorporated into a mattress. This will provide both portability, comfort and will also fit with the style of the bedroom. It will enable the user to sit up in bed for prolonged periods of time to watch TV or read. The intention is to create a product that will cost considerably less than the current bed raisers on the market, which the team believes are far too expensive for many elderly people to afford. The main target market for easy-rise is the elderly, but there is also a potential opening in the luxury market for those who want an easy way of sitting up in bed.
Team members: Natasha Close, Kevin Davies, Kunal Patel and Melia Xiao

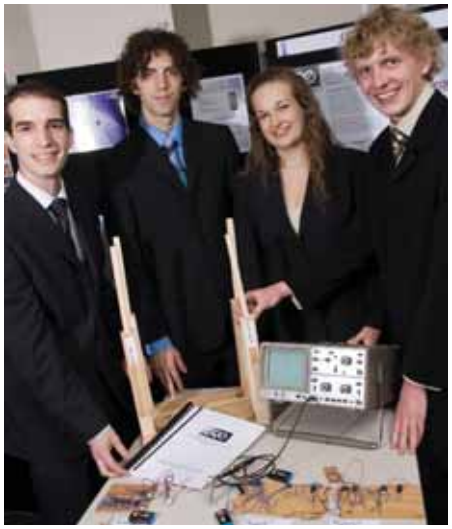
The Driftboard: Allowing snowboarders to practice and improve their skills in non-snow conditions

The Driftboard will allow snowboarders, both professional and beginner, to experience the feeling of carving powder without the need for snow. The board will be suitable for use on slopes with a relatively smooth terrain, such as tarmac. The Driftboard consists of a flexible deck to allow shock absorption attached to our unique Drift-fx trucks. The trucks allow full 360 degree motion to be achieved with the board by the use of specially engineered castors. To enable the 'carving' effect the castors will be directionally biased based on the relative angle of the board. This will recreate the responsiveness shown by snowboards when turning using the edge of the board, replicating the variable bite felt on snow.
Team members: Monique Chawia, Will Clayton, Chris Paley-Smith and Lisi Pan

Activ-Back: Perform better, feel better, Activ-Back

ActivBack is a unique new way to improve technique and reduce the chance of spinal injury, ideal for sportsmen and women looking to gain a competitive edge. Activ-Back offers unparalleled freedom of motion to the user, unlike existing products which are restrictive and cumbersome. By using a novel approach to posture measurement, the team believes it could produce ActivBack at a much lower cost than products currently available.
Team members: Wina Appleton, Tom Cock, Mark Palmer and Sarah-Rose Rogers

CPE AgentWand: Room dimensioning and plotting device to aid Estate Agents when mapping homes



AgentWand is designed for Estate Agents who need to produce professional and accurate floor plans for clients quickly and efficiently. There are two components to the device; a 'wand' carried around to key features of the room (e.g. corners, doors etc.) and a 'base station' that precisely locates these features. Using multilateration techniques, the base station locates the feature co-ordinates from ultrasonic pulses emitted by the wand. Advantages over conventional products include: rapid plan production, provision for complex, non-rectangular rooms and less room for human error.
Team members: Alex Drofiak, Jason Joannou, Guy Rumens and Ellie Smith

SocketSaver: An energy saving device which detects standby mode, switches the power off, and can be turned back on without effort as soon as the appliance is needed.

A device to be used between the plug of an electrical appliance and the wall socket in order to minimise energy lost on standby mode. It is estimated that household electricity bills could be cut by up to 20%, saving the average household £37 per year.
Team members: Natasha Fowlie, Michael Gardiner, Nick Tovey and Alana Vogt

SpeedSmart: A novel device that alerts drivers if they are speeding and impedes the vehicle

The SpeedSmart system is an intelligent speed calming system designed to alter the behaviour of drivers by giving regular visual feedback and rewarding those drivers who adhere to the speed limits.
The SpeedSmart system uses the latest Automatic Number Plate Recognition technology to calculate the average speed of the vehicle throughout the system. The driver is alerted to whether their speed is safe or not via visual feedback signs located along the roadside system. A dedicated traffic signal is located at the end of the SpeedSmart system and will turn red and stop speeding vehicles. The amount of time that the vehicle is stopped is proportional to the average speed of the speeding vehicle. A sign located at the traffic light displays the speeding vehicle's registration number, average speed and counts down the waiting time at the traffic light.

The innovative SpeedSmart system is designed to alter drivers' behaviour, and aims to lead the non-prosecuting speed calming market.
Team members: Claire Davies, Kat Hedley, Chris Hough and Adam Tun

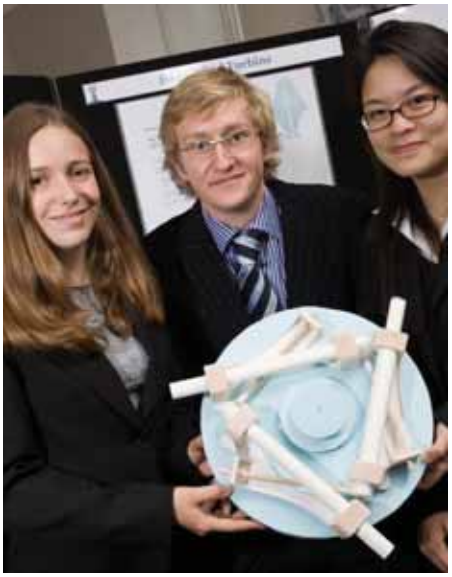
Buddy Umbrella: An innovative umbrella that keeps the wet surface of the umbrella inside once closed

The Buddy Umbrella is an innovative design set to challenge the traditional model of the standard umbrella. Encompassing both the notion of quality and fashion into a single executive umbrella, the revolutionary opening-closing mechanism aims to provide the user with ample protection in the rain and after use.
Team members: Alan Bowe, Wendy Ho, Derek Kwan and Ji Zhuang

Jet Slicer: A versatile and hygienic kitchen appliance for slicing fresh meat
A novel, hygienic and safe alternative to kitchen knives. This water jet slicing machine efficiently slices food, including raw meat, into multiple strips ready for cooking. This product will reduce

preparation time for repetitive slicing jobs, and could provide a new set of possibilities for the creative chef.
Team members: Richard Brimfield, Addy Ho, Kevin Lleung and James Watson

Iskra Wind Turbine



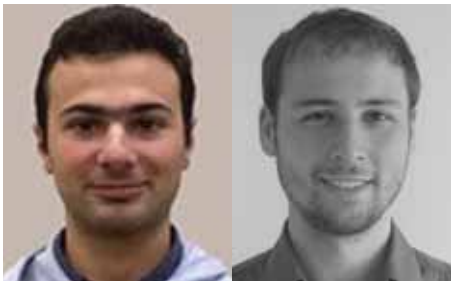
A redesign of the Iskra Wind Turbine to reduce manufacturing costs and improve ease of use.
Team members: Sachi Findlater, Serina Kwan and Duncan Morrison

European Materials Research Society Graduate Student Award

Congratulations go to Vittorio Scardaci and Simone Pisana, PhD students in the Electronic Devices and Materials Group (EDM), who have been awarded the European Materials Research Society (EMRS) Graduate Student Award for their work on nanotube photonics and electronics presented at the EMRS 2007 in Strasbourg.

The application for Vittorio's work is in telecommunications. He explains: "Data transmission by optical fibers plays a crucial role in worldwide communications, demanding higher and higher transmission rates. Efficient and low cost components like ultrafast lasers, all-optical switches, noise suppression filters, utilizing materials with strong optical nonlinearities, are thus of great importance. Carbon nanotubes possess strong optical nonlinearities in the telecom wavelength region 1300–1550 nm and are expected to replace traditional materials, as they are cheaper and easier to fabricate and integrate in optical fiber networks. My work at Cambridge University, Department of Engineering, consists of developing carbon nanotube-polymer composites for application in photonics. The composites can be integrated in prototype optical circuits either as thin film sandwiched in connectors or as waveguides, for ultra-short light pulse generation or noise suppression filters in optical signal regenerators. If nanotube-based composites are employed, it is possible to generate optical pulses shorter than 10–12s from a continuous laser source by the mode-locking technique. Without up-scaling optimization, in a single experiment we are able to potentially produce ~500 composites ready for integration in real optical networks, with costs subsequently dropping by several orders of magnitude, and potential strong impact on current technology."

Simone describes the work he submitted for the EMRS 2007 Graduate Student Award as follows: "Modern microelectronics is one of the main driving



Vittorio Scardaci (left) and Simone Pisana

forces of today's economy. It is based on technology developed in the 1960s, and since then it has not undergone any major alterations other than drastic miniaturization. As this technology evolves towards its ultimate limitations, a widespread search for novel electronic materials has spurred research in the field of nanomaterials. These materials, with features in the nanometer scale, sometimes just mere atoms thick, enable a range of novel physics that plunge into the quantum world. Materials such as fullerenes, carbon nanotubes, nanowires and graphene have tantalizing potentials for applications in many fields such as electronics, photonics and composites, as well as being outstanding tools for research. Throughout my doctoral studies at the University of Cambridge, Department of Engineering, I have worked on some of the challenges related to carbon nanotube growth, carbon nanotube electronics and new physics of graphene."

For further information email Vittorio at: vs288@cam.ac.uk and Simone at: sp406@cam.ac.uk

FACT BOX

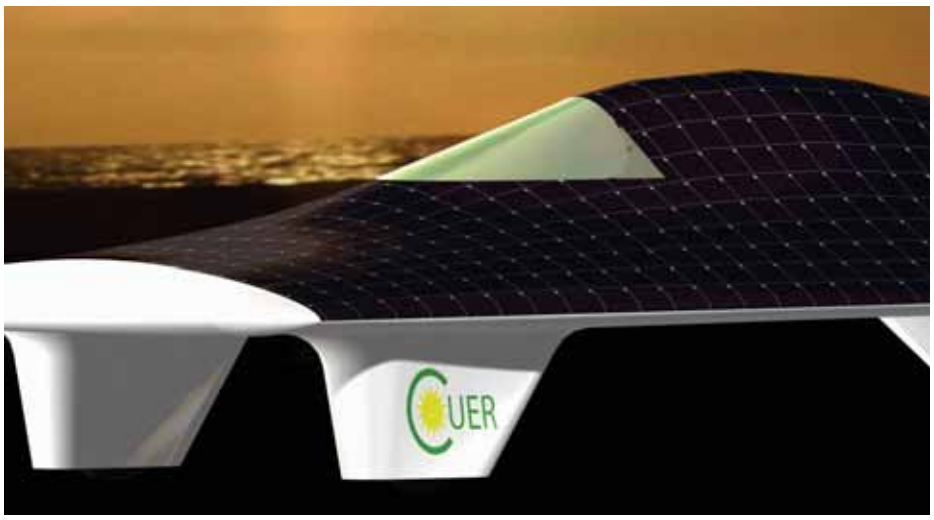
The outstanding research conducted by the Department's staff has been recognised by fellowships with the learned bodies of the UK:
16 Fellows of the Royal Academy of Engineering
6 Fellows of the Royal Society
1 Fellow of the Academy of Medical Sciences.

In addition, the Department includes holders of the following prestigious research fellowships: 4 from the Royal Society; 2 from the Royal Academy of Engineering; and 2 from EPSRC. There are 47 fellows of major UK institutions such as IET, ICE, and IMechE.

Cambridge University to compete in World Solar Challenge

A multi-disciplinary group of Cambridge University students have formed Cambridge University Eco Racing (CUER) with the aim of competing in the 2009 World Solar Challenge www.wsc.org.au. The challenge is to design and build a Solar Electric Vehicle to complete a gruelling 3000km race across the Australian outback harnessing only the power of the sun.

CUER Founding Team, MIT, March 2007



Preliminary vehicle design

The team comprises students from Cambridge's world renowned engineering and business schools who have come together to design, build and race against other student and industry teams from across the globe. Given the pedigree of engineers from Cambridge, including Frank Whittle and Harry Ricardo, expectations are high.

CUER is one of only three UK teams amongst a field of around 30 aiming to be the fastest to travel from Darwin to Adelaide. They will be competing against teams from other top institutions including: MIT, Stanford and University of Michigan from the USA; TU Delft from the Netherlands; and many others from across the globe.

Work has already started on the design for the vehicle, and discussions with potential sponsors are well underway. The team aims to have a prototype vehicle ready for summer 2008 to undertake a test run from Land's End to John O'Groats giving a further year to refine the design before the race in Australia.

Team Captain, Martin McBrien, a final-year Mechanical Engineer, said "CUER has progressed very quickly in just six months since it was founded; we have assembled a team with a broad array of talents, gained strong support from the Department of Engineering, and have had considerable interest from industry sponsors in backing our project. We're looking forward to getting on with the task of designing and building our vehicle and demonstrating this technology to the public."

Project Ambassador, Professor Peter Guthrie, Head of the Centre for Sustainable Development at the Department of Engineering, said, "The CUER team are building on the past successes within the Department, and are doing a great job of highlighting the issues we all face in providing sustainable forms of transportation for the future. Whilst solar racing is a lot of fun, there is a serious message underlying it that we should encourage our brightest engineers to apply their talents to producing sustainable solutions to the world's problems."

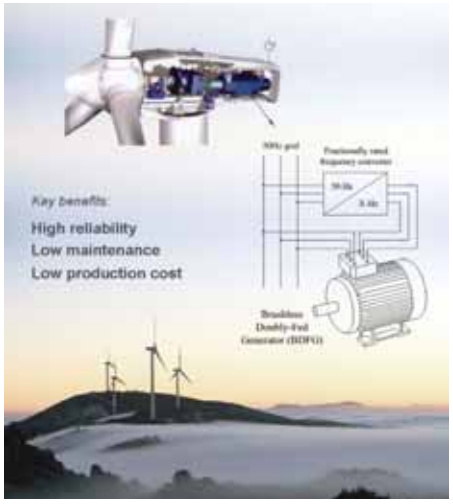
Nuna 3 - the Team Nuon car.
Photo courtesy of Hans-Peter van Velthoven

Australian Outback, World Solar Challenge

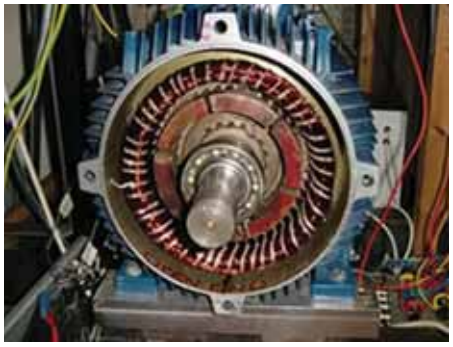
For further information contact Cambridge University Eco Racing at contact@cuer.co.uk or visit the website at www.cuer.co.uk

New technology improves the reliability of wind turbines

Dr Ehsan Abdi Managing Director of Wind Technologies



Laboratory prototype BDFG (left) on test rig with torque transducer and DC load machine (right)



Laboratory prototype BDFG

The world's first commercial Brushless Doubly-Fed Generator (BDFG) is to be installed on a 20kW turbine at or close to the Department's Electrical Engineering Division Building on the West Cambridge site in 2008. This will help the University meet its obligations under new legislation, which requires a new building to obtain ten percent of its electricity from renewable sources.

The research team based here at the Department, led by Dr Richard McMahon, have developed a new generator technology for the wind turbine industry to the point of commercial exploitation. This type of generator can be used in a wide spectrum of wind turbines ranging from multi-megawatt systems for wind farms down to micro turbines used for domestic power generation.

Research in Cambridge on this type of generator was started by Professor Williamson in the 1990s and, since 1999, is now being undertaken by Richard and his team. The team are collaborating with Durham's Head of Engineering, Professor Peter Tavner. The research has recently matured, enabling practical and complete designs to be made with confidence. Wind Technologies Ltd has recently been founded to exploit the technology.

"We are very excited about the new installation. This will be the first time BDFG is to be used commercially. The benefits to the wind power industry are clear: higher reliability, lower maintenance and lower production costs" recalls co-researcher and Managing Director of Wind Technologies, Dr Ehsan Abdi. "The West Cambridge medium size turbine should successfully demonstrate the applicability of the new generator, and we hope it will encourage the developers of other new construction projects to consider local wind-powered electricity generation to meet their obligations", adds Ehsan.

On a larger scale, a 600kW generator built by Wind Technologies is to be tested on a DeWind turbine in Germany, starting next spring. Its planned one-year test should demonstrate the improved performance of the BDFG technology to the key players in this industry. "This will put Wind Technologies in a position of strength in pursuant discussions on technology trade sale, licensing or partnering with large generator manufacturers, which is the strategy of choice for tackling this concentrated marketplace", says Ehsan.

A contemporary Brushless Doubly-Fed Machine (BDFM) is a single frame induction machine with two 3-phase stator windings of different pole numbers, and a special rotor design. Typically one stator winding is connected to the mains or grid, and hence has a fixed frequency, and the other is supplied with variable voltage at variable frequency from a converter.

In the majority (more than 90%) of newly-installed wind turbines in the world, generation is from a slip-ring generator. There are drawbacks to the use of slip-ring generators, particularly the additional cost and bulk of a machine which incorporates slip-rings and the need to maintain brush-gears including replacement of the brushes on a regular basis. Studies have shown that problems with brush-gear are a significant issue in wind turbine operation and reliability, and that the problem will be

more severe in machines deployed offshore where there are stronger winds and accessibility is impaired.

The project received the Scientific Instrument Makers Award and the Cambridge University Entrepreneurs Business Idea Award in 2004. In 2005, the Institution of Electrical Engineers, now the Institution of Engineering and Technology, added its Innovation in Engineering Award. The company has recently received grants from Cambridge University Challenge Fund and East of England Development Agency to carry out market assessment, file patents and complete the pre-production prototype.

Harnessing wind power for electricity generation is becoming ever more common, both by large-scale wind farms, and increasingly by small domestic installations, with the UK the world's leading market for micro wind generation. "We hope that our generator, through offering high reliability and low maintenance, will significantly contribute to the wider adoption of wind power generation, particularly in offshore developments. This will lead to significant reductions in CO2 emission and further reduce our dependency on fossil fuels" says Ehsan.

For further information the Electronics, Power and Energy Conversion group web pages can be found at: www-g.eng.cam.ac.uk/epec/ or email: info@windtechs.com

FACT BOX

The total number of visitors at the Department, staying for one month or more in the academic year 2006/7 was 215.

These visits are generally associated with reciprocal visits by our academics.

Set your clock to 'British green time'

Turning the clocks back each autumn has generated millions of tonnes of carbon emissions as well as increasing electricity costs during GMT months.

These are the findings of a report by Dr Elizabeth Garnsey of the Department's Institute for Manufacturing (IfM) and Brendan Cronin a student in the Department on the MPhil in Engineering for Sustainable Development. "No evidence in favour of imposing Greenwich Mean Time in winter was found," says the report. Putting the clocks back results in "more traffic accidents and higher, more costly, evening peaks in electricity consumption than would occur on British Summer Time, also known as GMT+1." This is because people are more active in the early evening than in the early morning, with adverse effects from early evening darkness in Scotland as well as England and Wales. A significant factor in the energy surge is that, under GMT, around 35% of the population are asleep when the sun rises in winter and so make no use of the extra daylight. Then, because they arrive home from school or work in cold and darkness, they use more lighting and heating, causing a surge in demand, especially between 4pm and 6pm.

The report adds a new twist to an argument that has lasted more than a century.The only unfavourable impact of ending the return to GMT would be on early morning workers. The report suggests that working hours could be altered for particular groups to counter this.

It has long been said that Britain would benefit economically from synchronising clocks with its European neighbours and that people would prefer to have more daylight in the afternoon and evening during the winter. However, such moves have been stymied by concerns over the impact on Scotland, where moving the clocks forward an hour would leave northern areas in darkness until about 9am.

Consumers are paying much more for electricity as a result of ending summer time. Delaying the timing of sunset in winter would give an extra hour of light in the evening and reduce the surge of energy demand, even taking into account the later sunrise. The costs and emissions are amplified because Britain can only meet these daily surges by switching on less efficient back-up generating plants such as oil-fired power stations. Such plants can take hours to heat up and cool down, pushing the costs and emissions of such power even higher.

The report did not look at the impact on demand for gas consumption but the authors believe it would show similar trends.

The energy-saving benefits of keeping clocks forward an hour were clear to wartime politicians. British Summer Time/GMT+1, was created in 1916 to save coal. During the second world war, Britain used GMT+1 during the winter and GMT+2 in summer, again to reduce fuel consumption.

Britain might have moved permanently to such a regime in 1971 but MPs voted against after an emotive debate involving claims that putting the clocks forward had caused an increase in winter morning road accidents to schoolchildren. What they were not told was that this was more than offset by the much greater fall in accidents in the evenings.

The report calculates that the 1971 decision has caused an extra 46 million tons of CO^2 to be released since then.

Dr Elizabeth Garnsey

There are signs that senior politicians are ready for a rethink. A spokesman for Pat McFadden, the employment minister who also has responsibility for timekeeping, said he was reading the report "with interest".

Tim Yeo, Tory chairman of the environmental audit select committee, who earlier this year tried to use a private member's bill to bring the clocks forward by an hour in both winter and summer for a three-year experimental period, said: "The environmental case for action is unanswerable."

Download a copy of the full report at www.ifm.eng.cam.ac.uk/people/ewg/garnsey_gmt_policy_191007.pdf

Inclusive Design Toolkit

A toaster viewed with full vision capability, compared to the same toaster viewed by someone with reduced contrast sensitivity. A suggested redesign improves the contrast of areas so users with reduced contrast sensitivity can still identify the controls.

To coincide with World Usability Day 2007 researchers in the Department's Engineering Design Centre (EDC) announced the "Inclusive Design Toolkit". This is a new guide which aims to show companies how their products could be improved to appeal to the widest possible range of people.

As well as guidance covering all stages of the design process, the toolkit – which comprises a book and web resource – has interactive features that simulate impairments and generate graphs to show how many people would be unable to use a product because of its capability demand.

By 2020, more than half the adult population will be over 50 years old. People's capabilities reduce as age increases – be it through medical conditions, or as a result of deteriorating eyesight and reduced grip strength.

These physical limitations may put them off certain poorly-designed products, even though people in older age groups conversely often have the highest disposable income, having paid off their mortgages and climbed the career ladder. They also tend to have the most free time. As a result there is a business case, as well as a strong moral argument, for designing products that make appropriate demands on the user.

"We can all cite examples of products that are difficult or frustrating to use," project leader John Clarkson said. "For example, the average purchaser of a sports car is aged 55, but many models put off older buyers because they are extraordinarily difficult to get into and out of. By applying inclusive design principles, involving users in the design process, and considering the needs of people with reduced capabilities, products can be made more usable, useful and desirable."

The toolkit features numerous examples of how poorly-designed products become especially difficult to use for those with reduced capability in seven different areas, namely: vision, hearing, thinking, communication, locomotion, reach and stretch, and dexterity.

The inclusive design toolkit is now available to buy as a book providing tools and guidance so that organisations and designers can produce better products that are accessible to the widest possible range of people. The guidance ranges from corporate level strategy to project level advice, and the tools include graphs that estimate the number of people who would be unable to use a product, because of its capability demand. The book contains 350 pages with 280 full colour images, costs £30 + postage, and can be purchased through the inclusive design toolkit website: www-edc.eng.cam.ac.uk/books

The same content is freely available at www.inclusivedesigntoolkit.com the website also includes interactive resources such as visual impairment simulators and an exclusion calculator. Users can sample how a normal public address system, replayed through the hearing loss simulator, suddenly becomes muffled to the point where it can barely be heard at all. The visual simulator shows how common impairments like cataracts, colour blindness or glaucoma can make everyday activities like buying a train ticket or using a toaster near to impossible. It also demonstrates how simple improvements to the layout and contrast of these devices could make them easier to use for all.

The inclusive design toolkit was commissioned by BT, and constructed by the Department's Engineering Design Centre (EDC), together with contributions from Sagentia and the Royal College of Art, Helen Hamlyn Centre. The guidance and resources contained within the toolkit reflect the outcome from i~design projects, an on-going collaborative research programme on inclusive design, of which the EDC is a research partner. i~design is funded by the Engineering and Physical Sciences Research Council.

The sections within the inclusive design website translate into colour co-ordinated chapters for the book

Please see www-edc.eng.cam.ac.uk/books/ for details of other inclusive design books available through the Engineering Design Centre.

Further development of the toolkit over the coming year will focus on customising the toolkit so that it integrates seamlessly with an undergraduate degree project on inclusive design, and developing pro-formas to assist the use of the inclusive design process within industry.

For further information please contact Sam Waller sdw32@cam.ac.uk

A pressure washer that has a high physical demand, compared to a redesigned product that reduces the physical strain required to use it. Images copyright Helen Hamlyn and B&Q

School pupils come face to face with Nanotechnology

Teenagers from across the UK were offered a rare insight into the exciting and dynamic field of Nanotechnology.

The Department's Nanoscience Centre

Thirty school pupils came to the Department's Nanoscience Centre at West Cambridge for a four-day residential course organised by The Smallpeice Trust, an independent charity which promotes engineering as a career.

Cutting across many scientific disciplines, nanotechnology explores the manipulation of atoms and molecules to produce innovative products like cars that never need polishing or self-adjusting sunscreen.

Through a combination of compelling lectures, challenging workshops, stimulating, hands-on projects and site visits, experts in the field introduced students to the extraordinary concepts and practical applications of this rapidly expanding technology.

Students explored the nano-world using powerful electron microscopes, creating macro-scale molecular models and conducting surface science experiments.

The teenagers were also able to visit TWI, a world centre for joining technologies where they were able to see nanotechnology in practice and observe the way other industries have benefited from a range of joining techniques.

Cambridge is widely seen as a leader in nanotechnology research with successes across the University in nanoelectronics, novel materials and coatings, biologically inspired nanostructures and advanced characterization tools.

Spokesperson for The Smallpeice Trust, Gemma Murphy commented, "It is a real privilige to be working with this international research centre and being able to give students an insight into how this has the potential to revolutionise our lives."

Mark Welland, Professor of Nanotechnology and Director of the Interdisciplinary Research Collaboration in Nanotechnology, reflected, "The Smallpeice residential course is an important element of our nanotechnology outreach programme that engages with schools in the UK as part of FRONTIERS, an EU funded Network of Excellence".

The Nanotechnology course is run by The Smallpeice Trust as part of an ongoing programme of residential courses designed to help young people aged 13–18 learn and develop skills in engineering, design and management. Through these courses and Science, Technology, Engineering and Maths (STEM) enrichment sessions, The Trust has reached out to more than 8,000 students across the UK in the past year – a 20-fold increase over a 6 year period.

Alumnus shares Nobel Peace Prize for 2007

As Vice Chairman of the Intergovernmental Panel on Climate Change (IPCC), Professor Mohan Munasinghe, an alumnus from the Department, shared the 2007 Nobel Peace Prize with other IPCC colleagues and Al Gore, for their efforts to build up and disseminate greater knowledge about climate change, and to lay the foundations for the measures that are needed to counteract such change.

Professor Mohan Munasinghe

The IPCC is a UN "Think Tank" consisting of the world's leading experts on climate change. It was created by the World Metorological Organisation (WMO) and United Nations Environment Programme (UNEP) over 20 years ago. Professor Munasinghe has contributed to all four of the authoritative assessments on climate change produced by the IPCC in 1990, 1995, 2001 and 2007.

In its recently released report, the IPCC states that global warming is unequivocal and very likely caused by human activities that have steadily increased atmospheric concentrations of greenhouse gases (especially carbon dioxide) since the industrial revolution. Among the alarming outcomes are increased global average temperatures (around 3°C by 2100), sea level rise (about 0.4 metres by 2100), more severe droughts and floods, and increases in extreme weather events like cyclones and storms. Ironically, while greenhouse gas emissions from rich countries have contributed most to global warming, the poor countries will be hardest hit, and poor groups will be the most vulnerable. Thus, climate change will significantly worsen existing problems like poverty, hunger and disease. More generally, unchecked climate changes will alter and threaten the living conditions of the over 6 billion inhabitants of the planet, who are all stakeholders.

Through the scientific reports it has issued over the past two decades, the dedicated scientists in the IPCC have created an ever-broader informed consensus about the connection between human activities and global warming. Whereas in the 1980s global warming seemed to be merely an interesting hypothesis, the 1990s produced firmer evidence in its support. In the last few years, the connections have become even clearer and the dire consequences still more apparent.

Professor Munasinghe has been in the forefront of the IPCC efforts recognized by the Nobel Prize award, to integrate climate change policies into development strategy, and thereby make development more sustainable. He proposed the Sustainomic Framework at the 1992 Earth Summit in Rio de Janeiro, to practically achieve this goal, based on the sustainable development triangle (with social, economic and environmental dimensions). The methodology has been applied worldwide jointly to address climate change and sustainable development, the two pre-eminent issues of the 21st century.

Professor Munasinghe is also Chairman of the Munasinghe Institute for Development (MIND), which has contributed to the work of the IPCC. MIND is a non-profit body which provides scholarships to Sri Lankan students and conducts research and training work worldwide on climate change and sustainable development.

By awarding the Nobel Peace Prize for 2007 to the IPCC Team and Al Gore, the Nobel Prize Committee is seeking to contribute to a sharper focus on the processes and decisions that appear to be necessary to protect the world's future climate, and thereby to reduce the threat to the security of humankind. Prompt action by world leaders and all concerned stakeholders is necessary now, before climate change moves beyond human control.

FACT BOX

Professor Munasinghe is the first Sri Lankan to receive this coveted award and he represented the IPCC as a shared winner of the Prize at the award ceremony in Stockholm in December 2007.

Cambridge launches project SMiRT

The Environment Agency has estimated that 300,000 hectares of land at over 325,000 sites in England and Wales are contaminated with a variety of pollutants. On average 250 new sites have been classified as contaminated each year since 2000.

Using landfill alone is no longer a sustainable option. But the remediation and re-use of contaminated and brownfield sites allows this land to be used for essential housing, commercial or environmental development whilst also helping to protect valuable greenfield sites.

Cambridge University has recently launched the largest Technology Strategy Board funded project on Contaminated Land Remediation Technologies. Project SMiRT (Soil Mix Remediation Technology) is a £1.24M project led by the contractor Bachy Soletanche. Cambridge is the only academic institution involved and is a major partner in this project. The project also includes three engineering consultancies (Arcadis Geraghty & Miller, Arup and Merebrook Science & Environment), three trade associations (British Urban Regeneration Association, British Cement Association and UK Quality Ash Association) and four materials suppliers (Amcol Minerals Europe, Richard Baker Harrison, Kentish Minerals and Civil & Marine Holdings).

Project SMiRT aims to achieve significant technical advancement and cost-savings by developing an innovative single Soil Mix Technology (SMT) system for integrated remediation and ground improvement, with simultaneous delivery of wet and dry additives, and with advanced quality assurance system. Soil Mix Technology involves the use of a range of different mixing tools and additives to construct permeable reactive in-ground barriers, low-permeability containment walls, "hot-spot" soil treatment by stabilisation/solidification and for the improvement of soft soils

The project involves extensive laboratory treatability studies in which a wide range of conventional and novel binders and additives will be tested together with a range of soils and contaminants. The novel equipment will be designed and manufactured in parallel. Extensive field trials will then follow, scheduled for the first half of 2009. In-situ testing, sampling and groundwater monitoring will then be carried out together with laboratory testing of the site samples and assessment of the field measurements.

As a major step towards increased understanding and uptake of SMT in the UK, the project will also involve consultation meetings with a wide range of stakeholders and a major dissemination programme through the organisation CL:AIRE (Contaminated Land: Applications in Real Environments).

Trenchmix System

For further information contact Dr Abir Al-Tabbaa, e-mail: aa22@eng.cam.ac.uk.

FACT BOX

Over 2,561 journal papers, 2,337 conference papers, 82 books, 832 chapters in books and 133 patents have been published since 2000 by the Department.

Graphics chips rev up research results

Every serious PC gamer knows what a difference a good graphics card can make to the fun they have. But it is not just hardcore gamers who have recognised the worth of a PC graphics card; increasing numbers of research scientists have woken up to their potential too.

The scientists in question are not using the cards to appreciate the detail in PC games. Instead they are using them as cheap sources of supercomputer-class processing power, reports Mark Ward, Technology Correspondent on the BBC News website. The way that graphics cards are built makes them very good at the repetitive computational tasks many scientists use to test theories, models and predictions. With the latest graphics processors having more than 100 processing cores that can add up to a lot of number crunching.

By harnessing that processing power, many scientists are getting results from simulations far faster than before.

Designing turbine blades

Rolls Royce Trent jet engine, PA. Improvements in efficiency have big rewards in turbine engines.

Dr. Graham Pullan, and research student Tobias Brandvik, from the Whittle Laboratory here at the Department of Engineering have sped up the simulation of flow around turbine blades by up to 40 times using a single graphics card. "People will have noticed that their PCs now have 2 or 4 cores. GPUs are way ahead with over 100 cores," says Graham. "It is getting easier to programme them as well. We no longer have to re-write our code entirely in graphics commands - there are now several general purpose programming methods available."

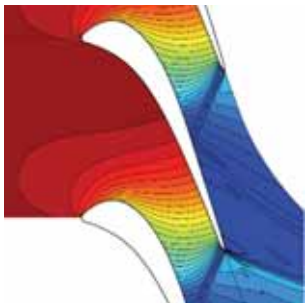
With such a dramatic reduction in run-times, Graham and Tobias hope their programmes will lead to improved efficiencies for jet engines and for power generation turbines. "We could either run simulations at current resolutions much faster, and hence make the design process more interactive. Or we could take the same time as we do now, and get much more detailed simulations which are more accurate," says Tobias.

But there are still problems to be overcome. A typical cluster of networked PCs used in jet engine design would have a total memory of at least 100GB - 100 times greater than a typical graphics card. "We need to have multiple cards in each PC and we need to network several PCs together," says Graham. "It is not easy to do this and retain the overall performance, but we, and the graphics card manufacturers, are working on it."

If you are interested in this new field, you may wish to attend the "Multi-Core and Reconfigurable Super-Computing" conference in Belfast in April www.mrsc2008.org

For further information, email Dr. Graham Pullan at gp10006@cam.ac.uk or visit his web pages at: www.eng.cam.ac.uk/~gp10006

Ray-tracing and real-time processing of video signals from a camera

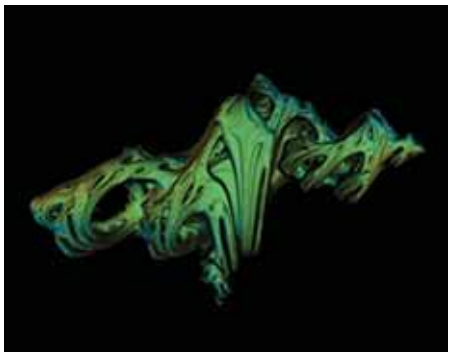


Flow in a turbine calculated on the GPU:contours of pressure

The Department's Dr Rich Wareham is also using graphics cards in his work to perform ray-tracing, a technique used in computer graphics to create realistic images by calculating the paths taken by rays of light entering the observer's eye at different angles. The sample image shown is generated in real time from his application and shows a special sort of mathematical object known as an 'escape time fractal'.

Rich says "Fractals like the one shown have long been used as a test bed for new computer graphics systems. With recent advances in graphics processing unit (GPU) technology, the amount of computing power available to scientific researchers has grown to hitherto unimagined levels.

Graphics processing unit (GPU)



A three dimensional 'slice' through a four dimensional fractal as generated by Rich's ray tracer.

The computing power of a consumer-grade GPU now present on mid-range graphics cards is truly staggering. With cards you can buy off the shelf for a hundred pounds theoretically capable of performing 340 billion calculations per second it is worth investing in the time required to learn how to leverage the computing power of these processors in applications beyond computer graphics."

In addition to his work on ray-tracing, he is working on new techniques for reducing the storage requirements for three dimensional objects by converting them to a 'depth map' on a sphere, much like the surface of the Earth is represented via a topological map on a piece of paper. The system was originally developed for processing and compressing the large spherical images of the sky generated from modern astronomical observatories.

He is collaborating on a project to use GPUs for real-time processing of video signals from a camera. He says "The system is designed to record the performance of an athlete in real time and give track-side performance data to the coach. Our cameras are very high-speed

Real time projection of a head model onto a sphere and the resulting reconstruction.

but the raw data that we get out of them is unsuitable for traditional image processing. We use GPUs to perform the initial conversion and processing because they are able to handle the sort of frame rates (>100 frames/second) that we require for accurate analysis."

Rich has recently given a talk covering the modern graphics processing pipeline providing tips and techniques on how it may be 'tricked' into performing useful computation. The talk covered the actual code required to implement a simple image processing example capable of dealing with full HD resolution video streams in real-time.

For further information email: Dr Rich Wareham rjw57@cam.ac.uk or visit his web pages at: www-sigproc.eng.cam.ac.uk/ga/index.php?title=Rich_Wareham

Jan Maciejowski's book receives the 2007 best textbook award

The Japanese edition of Jan Maciejowski's book "Predictive Control with Constraints" has been awarded the 2007 Best Textbook award by SICE, the Japanese Society of Instrument and Control Engineers.

The award is shared with the translators, Prof. Shuichi Adachi and Dr Masaaki Kanno, and was presented at the SICE Annual Conference in Takamatsu, Japan, in September. The original English edition of the book was published by Prentice-Hall in 2001. The Japanese edition was published by Tokyo Denki University Press in 2005.

Jan Maciejowski's book "Predictive Control with Constraints"

First Hibbitt Lecturer, Dr Garth Wells is appointed

Cambridge engineering graduate David Hibbitt founded the engineering software company ABAQUS, Inc. David and his wife Susan have donated more than £2million to endow a post in solid mechanics.

After an international search to find the first incumbent for the new post, Dr Garth Wells has been appointed as the first Hibbitt Lecturer in Solid Mechanics at the Department. He has joined a group which is pushing the boundaries of research in solid mechanics and communicating its importance to the next generation of engineers through undergraduate teaching.

Garth originates from Australia where he graduated from The University of Western Australia. He went on to do a PhD at Delft University of Technology in the Netherlands. Garth moved to the USA as a Post-doctoral researcher at Stanford University, then took the post of Assistant Professor at the Faculty of Civil Engineering and Geosciences at Delft University of Technology. He was a visiting researcher at the Institute for Computational Engineering and Sciences at the University of Texas, then took the post of Associate Professor at the Faculty of Civil Engineering and Geosciences at Delft University of Technology before joining the Department. He is a fellow at Jesus College.

Garth says "My research interests are broad, with an emphasis on computation for mechanics. My background is in solid mechanics, but I'm active currently in computational aspects of solid mechanics, fluid mechanics, multi-physics problems and scientific computing. An example of some new work is the computer modelling of tar sands and heavy oil. There are enormous reserves in Canada, and the modelling is important and very challenging. I have a research group in the Netherlands working on various aspects of computational mechanics that I'm hoping to host regularly here in Cambridge."

A symposium 'Future Directions in Solid Mechanics' was held at Robinson College on 26 October. Guests from academia, industry and funding agencies attended. The symposium also marked the launch of the Hibbitt Lectureship and the Ashby Studentship, which is now very close to being fully funded. The audience was welcomed by the Head of Department, Professor Keith Glover, and the University's Vice Chancellor also spoke. A number of speakers from the UK and overseas gave presentations, including David Hibbitt and Mike Ashby.

For further details please visit the Mechanics, Materials and Design Division webpages www.eng.cam.ac.uk/research/div-c/divhomeC.shtml

Dr Garth Wells the Hibbitt Lecturer in Solid Mechanics

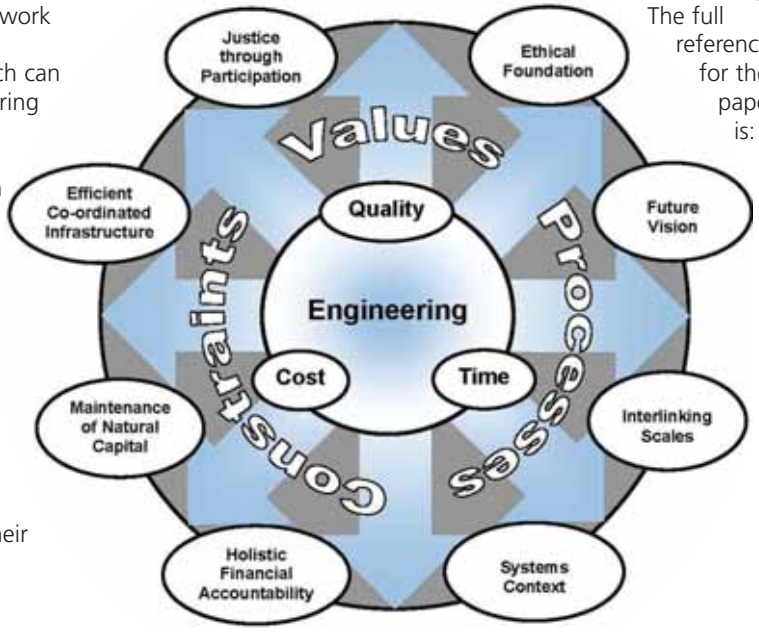
George Stephenson Gold Medal

Dr Dick Fenner, Dr Heather Cruickshank, Professor Peter Guthrie from the Department's Centre for Sustainable Development and former Visiting Professor Charles Ainger (Head of Sustainable Development for MWH (Europe)) were recently presented with the George Stephenson Gold Medal by the President of the Institution of Civil Engineers (ICE), Quentin Leiper, at the ICE Awards ceremony in London. The medal was awarded for the second best paper overall in the Proceedings of the Institution of Civil Engineers for 2006.

Professor Charles Ainger, Dr Heather Cruickshank, President of ICE, Quentin Leiper, Dr Dick Fenner, Professor Peter Guthrie

The title of the paper is: "Widening engineering horizons: addressing the complexity of sustainable development" and it is intended to help practising civil engineers answer the question "Am I being sustainable?" during different phases of project delivery. This is achieved through a set of questions based around an 8 point framework (shown in the diagram) which can be applied during the design, construction and operation of an engineering project. The value of the questions is tested against a case history of a wastewater treatment project and their use leads to the consideration of a wider problem boundary than that traditionally adopted by civil engineers.

The George Stephenson Medal was instituted by the council of the ICE in 1881 and is one of the Institution's most prestigious awards for best papers published in the Proceedings. The full reference for the paper is:



A sustainable framework for engineers

Fenner R.A., Ainger C.A., Cruickshank H.J., Guthrie P. (2006) Widening horizons for engineers: addressing the complexity of Sustainable Development. Proceedings of the Institution of Civil Engineers, Engineering Sustainability Journal , Volume 159 ES4 pp 145-154.

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