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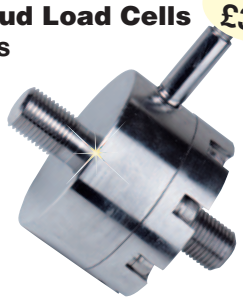

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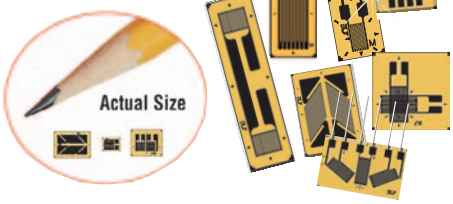

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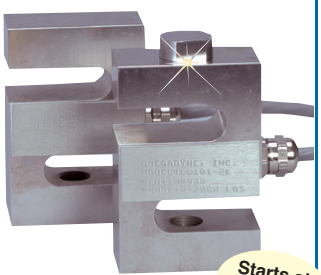

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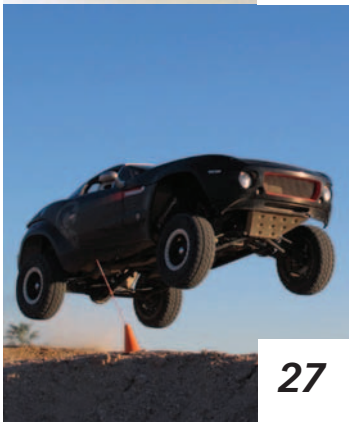

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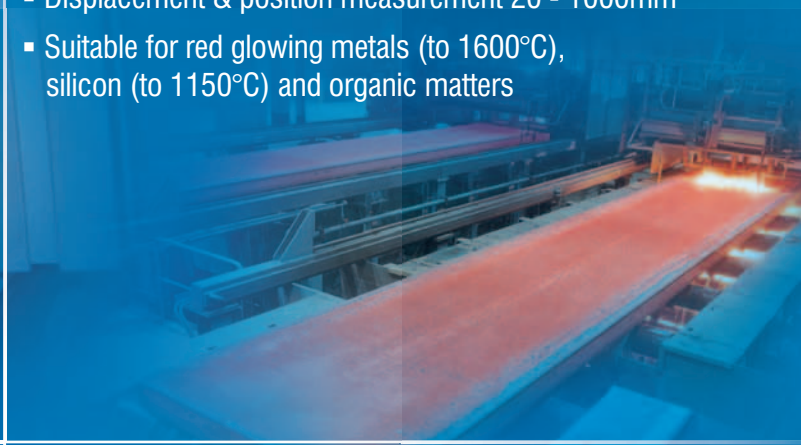

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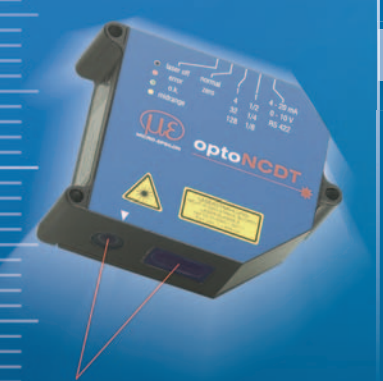

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Putting a value on engineers' success

Paul Fanning, Editor (pfanning@findlay.co.uk)

Since its announcement in November last year, the Queen Elizabeth Award for Engineering has generated considerable comment. Launched by the Government and the Royal Academy of Engineering, it has attracted cross-party support and is funded by 11 British and Indian companies including BP and Tata Steel. Most significantly, perhaps, it will award the winner the pleasingly round number of £1m.

Inevitably, comment about this has been both negative and positive, with some hailing this as "the Nobel Prize for Engineering", while others have tended to suggest it is window dressing that, while nice to win, does not address the fundamental issues facing the UK's engineering sector.

While having some sympathy for both sides of the argument, I would argue that this award is highly significant. However, I would say that its true significance lies not in its 'prestige' or its profile but in one, simple thing: the million-pound prize.

The direct association of engineering excellence with cold, hard cash is an association that will be welcome to many. For one thing, the 'prestige' associated with the prize is pretty much bound up in te financial reward for it.

There is nothing vulgar or inappropriate about making an explicit association in the public mind between engineering and financial success. Too often, we hear stories of excellent engineers who achieve amazing feats, but never see the rewards due to them. This would go some way to countering such tales.

After all, a story where engineering innovation results in the handing over of a large cheque seems likely to do more for the public perception of the profession than any amount of talk of heritage or vocation.

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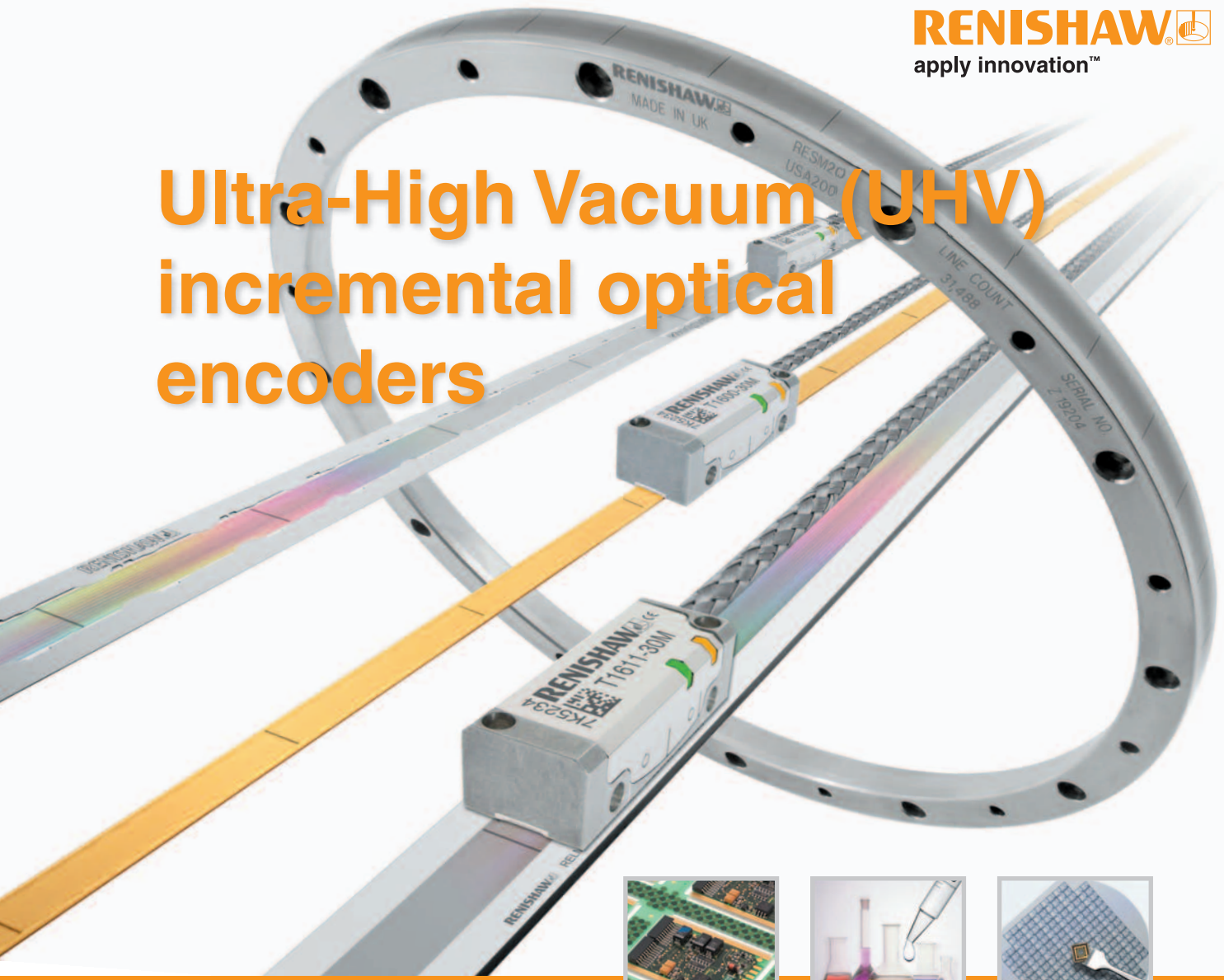

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£1million engineering prize open for nominations

Nominations are now being accepted for the inaugural Queen Elizabeth Prize for Engineering - the biggest and most prestigious prize ever created to celebrate the achievements of today's engineers.

The £1million award, announced by Prime Minister David Cameron last year, aims to encourage innovation in the UK and raise the profile of engineering. The prize will be awarded to an individual or team of up to three people for a 'groundbreaking advance in engineering which has led to significant international public benefit'.

As well as recognising and celebrating the best, the prize will provide an opportunity to demonstrate how engineers and engineering are making a real difference across the world. The Royal Academy of Engineering will deliver the accolade, which will be overseen by a charitable trust chaired by former BP chief executive Lord Browne.

Leading engineering companies such as defence giant BAE Systems, oil producer Shell and drugs company GlaxoSmithKline are providing the funding. "Engineering underpins every aspect of our lives," commented Browne. "As the bridge between scientific discovery and commercial application, engineering feeds and clothes us and enables us to work, travel and communicate.

"But too often the engineers behind the most brilliant innovations remain hidden. The Queen Elizabeth Prize aims to change that." Industry bodies are hoping the prize will inspire young people to study engineering and generate pioneering new ideas. The Prime Minister said he hoped the award would carry the same stature as the Nobel Prizes.

"High skilled, high value manufacturing and engineering should be a central part of our long term future," he said. "I hope this prize will go some way to inspire and excite young people about engineering, so they dream of becoming engineers."

Prime Minister David Cameron attends the launch of the new award at The Science Museum, London

Photo: Lewis Whyld/PA Wire

The confirmed judging panel is as follows:
Prof Frances Arnold, chemical engineer, professor at Caltech, USA
Lord Alec Broers, FREng Hon FMedSci FRS (Chair), electrical engineer. past president, Royal Academy of Engineering, UK
Prof Brian Cox, OBE, particle physicist. Royal Society Research Fellow, University of Manchester, UK
Prof Lynn Gladden, CBE FREng FRS chemical engineer. professor at University of Cambridge**Diane Greene**, director of Intuit, director of Google, USA
Prof Calestous Juma, HonFREng FRS, professor of International Development and Director of Science, Tech and Globalisation Project, Harvard University, USA
Prof Hiroshi Komiyama, chemical engineer, president Engineering Academy of Japan
Prof John Hennessy, electrical engineer. president, Stanford University, USA
Prof. Dr. h.c. Reinhard Hüttl, president, acatech, Germany
Nathan Mhyrvold, co-founder, Intellectual Ventures, USA
Narayana Murthy, electronic engineer. founder, Infosys, India
Prof Choon Fong Shih, mechanical engineer. president, King Abdullah, University of Science and Technology, Saudi Arabia
Dr Charles Vest, FREng mechanical engineer. president, National Academy of Engineering, USA
Paul Westbury, FREng, civil engineer. ceo, Buro Happold, UK
http://qeprize.org/

EPSRC to support graphene research

The Engineering and Physical Sciences Research Council (EPSRC) has issued a call for proposals in graphene engineering research.

Up to £20million is being made available to research on manufacturing processes and technologies linked to graphene that will help accelerate the development and generation of novel devices, applications technologies and systems.

Dave Delpy, chief executive of the EPSRC said: "This call is hugely exciting. There is an increasing awareness among the global research community of the opportunities and the need to exploit and commercialise technology based on graphene and related nanomaterials. With a firm foundation of graphene science, the UK is in a prime position to build on its strength in this field to lead the commercialisation of this material."
www.epsrc.ac.uk

IED receives Royal approval

The Institution of Engineering Designers was presented with its Royal Charter by HRH Prince Philip The Duke of Edinburgh on 23rd February. The presentation was made by the Duke to the IED President St George Cox at a ceremony at St James' Palace.

There were also presentations to four new honorary Fellows of the IED: Sir Martin Sweeting (Surrey Satellite Technology); Amanda Chessell (IBM); Professor Dame Ann Dowling (Cambridge University); and Professor Amaresh Chakrabarti (India Science Institute).

Established in 1945, the Institution of Engineering Designers is the UK's only professional body representing those working in the many fields of engineering (and product) design.

In addition to providing a range of benefits to members from networking to CPD support, the IED also works to promote and facilitate the advancement of engineering and product design within industry and education.
www.ied.org.uk

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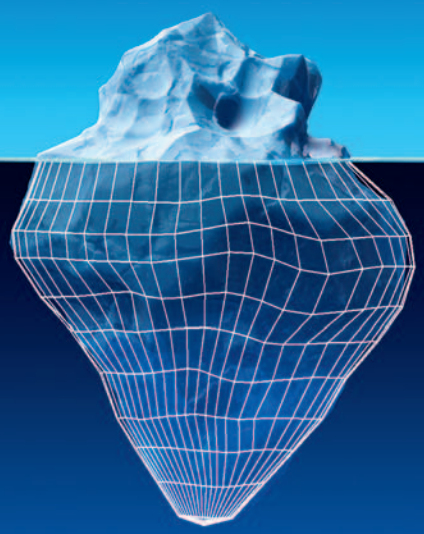

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Event to explore lightweight materials

Global Automotive Lightweight Materials 2012 will be held from April 25-26, London, UK

Designing and manufacturing a commercially viable lightweight vehicle, whilst maintaining structural performance, remains a top priority for the automotive industry, as they battle to meet stringent carbon emissions targets and fulfill consumer demands for highly fuel efficient vehicles.

However, significant cost barriers remain across the advanced lightweight materials cycle from procurement and manufacturing processes to end of life recycling. Clearly tackling these costs will be key to mass-market application, in tandem with resolving the remaining technical challenges to ensure optimal part performance.

At the Global Automotive Lightweight Materials Initiative 2012 you will be able to join the lightweighting community to benchmark your gram strategy, examine best practices and discover innovative, commercially viable solutions for sourcing, integrating and manufacturing advanced lightweight materials.

This is your opportunity to find out actual results being delivered in weight savings, amongst a backdrop of candid debate on collaborative opportunities to enable widespread adoption of advanced lightweight materials and finding the most feasible routes to achieving scale..

www.global-automotive-lightweight-materials.com

Engineering design show

10th -11th October 2012 · Jaguar Exhibition Hall · Ricoh Arena · Coventry

New exhibitors for Engineering Design Show

Maxon UK, National Instruments, Objet Printer Solutions, Alcoa Fastening Systems, Nexus (GB) and Ogle Models & Prototypes have joined the list of exhibitors for this year's Engineering Design Show

The Show, whose headline sponsors are Schaeffler, Heidenhain, Altium and Premier EDA Solutions, will take place on October 10th and 11th 2012 at the Jaguar Exhibition Hall at the Ricoh Arena, Coventry, will focus on the needs of design engineers in both the mechanical and electronic fields and will include a comprehensive conference and workshop programme.

Running throughout the two days of the show, the conference will focus on a broad range of themes and topics focused on the requirements of design engineering within the UK, and have the UK's leading technology and engineering firms on hand to showcase the latest innovations. The conference will bring together high profile speakers from across industry, government and academia.

Much of the floorspace has already been sold, meaning that opportunities to exhibit are going fast. For more details of the event or become an exhibitor, please visit the website or contact Luke Webster at *lwebster@findlay.co.uk*

www.engineeringdesignshow.co.uk

“Control Techniques drives are now our standard product.”

Warren Critchley
Technical Services Manager,
Alton Towers Resort Hotels

As part of a rolling replacement programme, Control Techniques drives now constitute around 20% of the drives at Splash Landings and Alton Towers Hotels – controlling the fans in the air handling plant and the hot water supply pumps.

“Many of our electrical employees have now been trained in the use of Control Techniques drives,” says Technical Services Manager Warren Critchley, Alton Towers Resort Hotels.

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New ball bearing materials from igus

Since xiros ball bearings were launched five years ago, polymer material and bearings expert igus has completed lots of development work resulting in five separate xiros ball bearing materials, many new dimensions and a wide range of different designs available ex-stock within 24 hours. In addition, specially developed engineering tools for design engineers, ranging from 3D CAD downloads through to the xiros Lifetime Calculator are available to use online.

Lubricant and maintenance-free, xiros polymer ball bearings can endure temperatures of up to +150°C, are highly corrosion-resistant, can be washed and cleaned, are non-magnetic and are light weight. xiros ball bearings provide an economic alternative for many applications where the use of conventional metallic ball bearings is problematic. These applications are varied, ranging from all kinds of medical equipment, pumps and measurement machines, through to transport and conveying technology – particularly in the industrial sectors of chemicals, food, laboratories and packaging. In addition to the lack of lubricant and corrosion, weight reduction, the avoidance of magnetism, very good friction coefficients and longer service life are further benefits of the use of xiros plastic ball bearings.

www.igus.co.uk

Hydraulic breaker from Atlas Copco

Atlas Copco Construction & Mining has launched a new lighter and more efficient Hydraulic Breaker than the HB 4200. The HB 4100 subsequently provides better performance than its predecessor which was heavier and therefore not as energy or time efficient to use.

The reduced weight and better performance of the HB 4100 means that improved results can now be achieved with a smaller hydraulic breaker, while the lightweight design allows it to be combined with a smaller excavator; facilitating a saving in investment and operating costs.

In addition to other improvements, the guide system of the HB 4100 is also different from its predecessor and is now even more stable and resilient.

With a service weight of 4,100 kg, the HB 4100 is suitable for carrier machines from 40-70t. All proven features of Atlas Copco's heavy hydraulic breaker series are also found in the new HB 4100, including the VibroSilenced system to protect operators against noise and vibrations, and PowerAdapt, which switches off the breaker in the event of a hydraulic overload. AutoControl, enables the adjustment of the blow frequency and blow energy to the hardness of the stone, whilst ContiLube II, provides integrated, automatic lubrication apparatus. With StartSelect, the operator can influence the start-up and shutdown behaviour of the hydraulic breaker, while the optional DustProtector offers protection against the penetration of dust and rock particles into the lower part of the breaker.

www.atlascopco.co.uk

DUAL-OUTPUT INDUSTRIAL ENCODER

As part of its range of Leine & Linde industrial encoders, McLennan can supply ruggedised shaft encoders that provide a dual electrical output with two incremental outputs or combined incremental and absolute outputs. The Leine & Linde RSD525 series offers options of TTL, HTL or RS422 incremental output and single- or and multi-turn absolute SSI output to 25 bits. The absolute encoder is available with a preset zero position or the datum reference can be set from an input, or a pushbutton fitted to the case of the encoder.

These dual encoders are typically used where both absolute high precision angular position and incremental speed is required in the same motion control application but where space constraints or cost and convenience prescribes the choice of a combination encoder device.

www.mclennan.co.uk

NEW COMPACT, SELF-CONTAINED LIFTING SYSTEM

Camloc Motion Control has launched the new 'Camloc Hydraulic System' – a compact, electro-hydraulic unit that is ideal for applications with limited space. From tail-lifts and access ramps, medical and patient-handling, to machine guards and height adjustment on industrial machinery, the Camloc Hydraulic System does all the hard work.

Billed as 'the perfect solution' when electro-hydraulic lifting is needed on an application, this innovative design can be mounted horizontally or vertically. It is easy to install, robust and maintenance-free, and has been designed as a modular unit to allow customers the flexibility to build a system that best suits their individual applications.

www.camloc.com

Fasteners enable screwless attachment

New microPEM TackPin fasteners for compact electronic assemblies enable sheet-to-sheet attachment, replacing costly screw installation in applications where disassembly is not required. Their use eliminates typical screw-related issues (including tapping, cross-threading, torque control, and vibration backout) and ultimately promotes quick and easy installation with minimal hardware.

TackPin fasteners can serve as ideal alternatives to welds or adhesives. Among notable applications, these aluminum fasteners can be specified to attach super-thin membranes to very thin cosmetic substrates, such as keyboards.

Type T microPEM TackPin fasteners install by first preparing properly-sized mounting holes in the sheet to be attached and the base panel. After inserting the fastener into these holes, the fastener is pressed into place. The fastener clinches into the base panel and the fastener's head subsequently holds the top sheet (as thin as 0.2 mm) firmly and permanently in place. The base panel can be as hard as HRB 45 or less on the Rockwell "B" scale and should be at least 0.89 mm in thickness for blind holes or 0.5 mm in thickness for thru holes.

www.pemnet.com

Henkel offers health and safety range

Henkel offers a comprehensive range of hazard-label-free engineering adhesives that cover the lion's share of applications. These Loctite products are as effective – and in some cases even more effective – than alternatives that carry health and safety symbols.

The Loctite brand has always had a very strong health and safety ethos with its R&D being driven by sustainability and responsibility. Continuous development has led to the introduction of the hazard-label-free Loctite 2400 and 2700 threadlocking products and now these have been joined by others with similar credentials.

In addition to dedicated threadlocking adhesives, the new Loctite Health and Safety range now also encompasses thread sealing, gasketing and retaining.

www.loctitesolutions.com

Solution to last month's Coffee Time Challenge

The solution to February's Coffee Time Challenge of how to improve on sticky tape comes from researchers at the Zoological Institute at the University of Kiel in Germany have turned to the biology of gravity-defying ceiling walkers, such as geckos and insects. These creatures served as inspiration for a new dry adhesive tape that not only boasts impressive bonding strength, but can also be attached and detached thousands of times without losing its adhesive properties.

The secret to the wall climbing ability of many insects and geckos lies in the thousands of tiny hairs called setae that cover their feet and legs. The sheer abundance of these hairs, coupled with flattened tips that can splay out to maximize contact on even rough surface areas, make it sufficient for the Van der Waals forces, which operate at a molecular level and are relatively weak compared to normal chemical bonds, to provide the requisite adhesive strength that allows them to scurry along walls and ceilings.

It is this technique that the research group, led by Stanislav Gorb, have mimicked with their silicone tape. By patterning the tape with tiny hairs similar to setae, they created a tape that was at least two times harder to pull off of a surface than a flat tape of the same material. Additionally, the bioinspired tape leaves no sticky residue, can also work underwater, and can be repeatedly peeled off thousands of times without losing its ability to grip.

Providing an illustration of the adhesive properties of the new tape, a 20 x 20 cm (7.87 in) square piece was able to support the weight of one team member dangling from the ceiling.

The researchers are also looking to nature in the form of beetle coverwings, snake skin, and anti-adhesive plants, for inspiration for other bio-inspired materials.

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A sporting chance

The London Olympic and Paralympic Games are just around the corner and Team GB is calling on the expertise of UK industry to help its athletes achieve record levels of speed, strength and endurance.

With the difference between first and second place often measured in fractions of a second, a hi-tech arsenal spanning mathematical modeling software, nanotechnology and materials science could play as important a role as fitness and conditioning.

It is with this in mind that government body UK Sport has been overseeing a research and innovation project since 2008 with the country's leading engineering firms and universities.

One of the partners involved in the initiative is BAE Systems, which is providing £1.5 million of its engineering time and access to more than 18,000 of its UK-based engineers.

BAE's Technology Partnership project manager, Kelvin Davies, explains: "In their normal day jobs, our engineers would spend their time developing submarines, aircraft carriers or jet fighters. Under this partnership, they can turn their hands to leveraging technology and expertise from the defence sector and transfering it to the sports industry. The goal is to create performance enhancing equipment which will make people go faster and win medals."

One such device is a performance monitoring system installed by BAE at the Manchester Velodrome to give the likes of Sir Chris Hoy an edge in training. The laser timing technology, derived from a battle space identification system, brings a new approach to monitoring cyclists.

According to Davies, it improves on traditional photoelectric break beam systems, which are unable to differentiate between individual athletes. Now, up to 30 cyclists can train simultaneously as the laser can read a personalised code from a retro-reflective tag attached to each bike. Installed at multiple points around the track, the system gives individual recordings for each cyclist with 'millisecond accuracy'.

"We've also been working with McLaren on a data logging system which is helping the cyclists establish not only how fast they're going, but how much power they're using," says Dr Scott Drawer, head of research and innovation at UK Sport."The data logger sits underneath the seat and allows information to be collected from the cranks. By the time an athlete gets off the bike they have all the information they need about their workout."

As with much of the research UK Sport is involved with, the technology is centred around fuel-based diagnostics – not just evaluating how fast an athlete can go, but understanding the underlining physiology behind training.

"The big push is in creating much more meaningful knowledge to accelerate the development of the athlete," notes Dr Drawer. "To do this we rely on things like advanced software, telemetry and miniature sensing technologies."

One such sensor, developed at Imperial College London, is inspired by the semicircular canals of the inner ear responsible for controlling motion and balance.

Resembling a hearing aid, the device fits behind the ear and gathers large amounts of data about posture, step frequency, acceleration and response to shock waves travelling through the body as an athlete's feet hit the ground.

A miniature processor inside the earpiece collects data and transmits it wirelessly to a laptop so that the athlete's performance can be monitored at the trackside in real time. This process allows a coach to detect problems such as incorrect posture at the start of a run, and rectify them.

Skeleton crew

One of UK Sport's most successful cases has been the creation of 'Arthur', the skeleton bopsled that propelled Amy Williams to Britain's first individual gold medal win at a winter Olympics in three decades.

Working in collaboration with Sheffield Hallam and Southampton Universities, BAE recruited PhD students Rachel Blackburn and James Roche to crack the problem of customising each sled.

Previously, sleds used by the British team were shared between men and women of varying heights and sizes. "The balance would be all wrong, it wouldn't suit an individual athlete's sliding style. As a result, everybody suffered," says Davies. "What we had to do was make each sled configurable to each athlete."

As well as using advanced materials such as carbon fibre to build

Laura Hopperton reports on how technology is transferring between sport and industry ahead of this summer's Olympic Games.

Left: BAE Systems' data logging system
Below: Amy Williams with 'Arthur', her skeleton bobsled

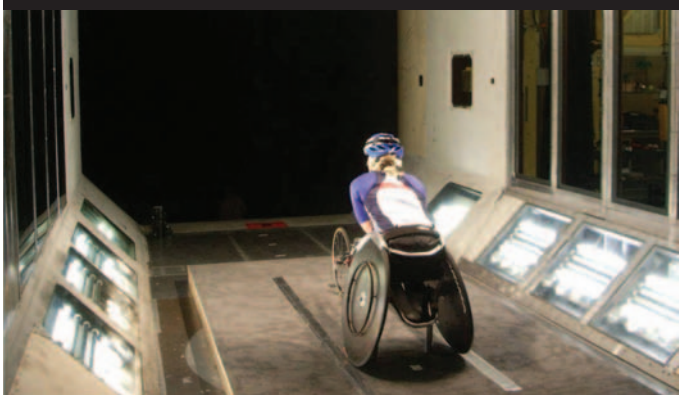
lighter and stronger sleds, the engineers used finite element analysis to redesign the vehicles' internal structure. This meant that the energy of an athlete's unique movements and technique could be transferred efficiently into the way the sled was propelled.

Davies explains: "The sled that Amy had suited her riding style so perfectly that, instead of battling the sled all the way down the slope, it felt part of her and it felt more responsive to her movements. Understanding the individual athlete's requirements is a critical part of the design process, something that can take days to talk through and months to get right."

Drawer also notes the importance of optimisation and points to an innovative new rapid manufacturing process being used to create bespoke high performance sports footwear.

The technology, developed at Loughborough University, works by first quantifying the effects of the sports shoe on the foot's movement by analysing 3D motion data and force data. This information is gathered from a series of sprint-related tasks performed by the athlete

Computational fluid dynamics data from BAE's wind tunnel facility has helped wheelchair athletes improve their aerodynamic efficiency



wearing sprint shoes of differing stiffness and a barefoot equivalent control shoe.

Selective laser sintering is then applied to sinter small particles of plastic to create precise, complex 3D components, removing the need for expensive moulds and tooling. The researchers are then able to easily change the properties of the footwear to match the needs of the individual athlete.

The Loughborough team recently applied the technology to help Paralympic sprinter Ben Rushgrove control his running style and help prevent injury. The researchers conducted in-depth analyses of his gait and the impact made with the ground whilst he was sprinting using high-speed video footage. It was identified that Rushgrove's disability caused a lack of muscular control on the medial side of his foot, resulting in severe foot injures.

"In the case of Rushgrove, the team was able to explore how to use personalised running shoes to support his feet more effectively when subjected to the impact forces of sprinting," said Professor Mike Caine, director of Loughborough's Sports Technology Institute. "What we learnt from working with him has enabled us to better understand the potential benefits of this emerging technology."

Drawer says: "Because every athlete is so different, being able to use rapid manufacturing processes to make sure equipment is optimised to their specific needs can help them gain a real advantage. We also use the technology a lot when working with Paralympic athletes to help them better manage their health and welfare."

Designing differently

In 2010, Drawer led a project between UK Sport and BAE to help wheelchair athletes reduce their drag resistance and therefore increase speed. Shelly Woods, a Paralympic silver and bronze medallist in Beijing, and David Weir, a Paralympic Games multimedallist, spent time in BAE's wind tunnel facility in Wharton as part of the initiative.

Computational fluid dynamics data gathered from the wind tunnel sessions were used by UK Sport to review the aerodynamic efficiency of the athletes' seating position in the chair to highlight the optimal racing position for different situations on the track.

"The whole premise of getting athletes behind the wind tunnel is to try and reduce drag and is a major application in all sports where people are travelling very fast," says Davies.

"An athlete and a wheelchair has an effect on the aerodynamics, so we needed to make them as streamlined as possible. We were looking at the equipment they were using – at the chair itself – but most importantly, the athlete's positioning and movement. So we could quickly and easily do a large number of experiments and provide a very accurate model of the most streamline and efficient position to be in."

Sensors recorded force measurements and from those readings, the most efficient position could be established. "In wind tunnels, data can be collected in real time so we can collate information quickly and do a large number of experiments," Davies notes. "Normally, we would have a section of wing, a nose cone or a tail and we'd conduct exactly the same kind of experiments to get the most aerodynamically streamline profile of the equipment. The big challenge for us was adapting the wind tunnel speed."

The tests were the first phase of a project to help wheelchair athletes improve their performance with the support of technology. Another aspect of the initiative was to examine the overall design of the chair to see where improvements could be made. The assessment encompassed factors affecting performance, from the material the chair is made from, right down to the ease with which it can be stored, set up and maintained.

Both BAE and UK Sport are now looking ahead to the 2014 Winter Olympics and the Rio 2016 Olympic Games. Drawer believes a lot of the technologies will eventually have applications in the medical sector. "We're also looking at remote healthcare," he says. "Olympic level sports provide a great model to test and develop technologies which can move into and benefit society at large."

Davies concludes: "We've been overwhelmed by the huge applications for what we do in sport. When we first began talks with the British cycling team, for example, we weren't sure what we could offer. It was quite exciting. The partnership has not only been a great platform for us to demonstrate some of our most innovative technologies, but a means to inspire the next generation."

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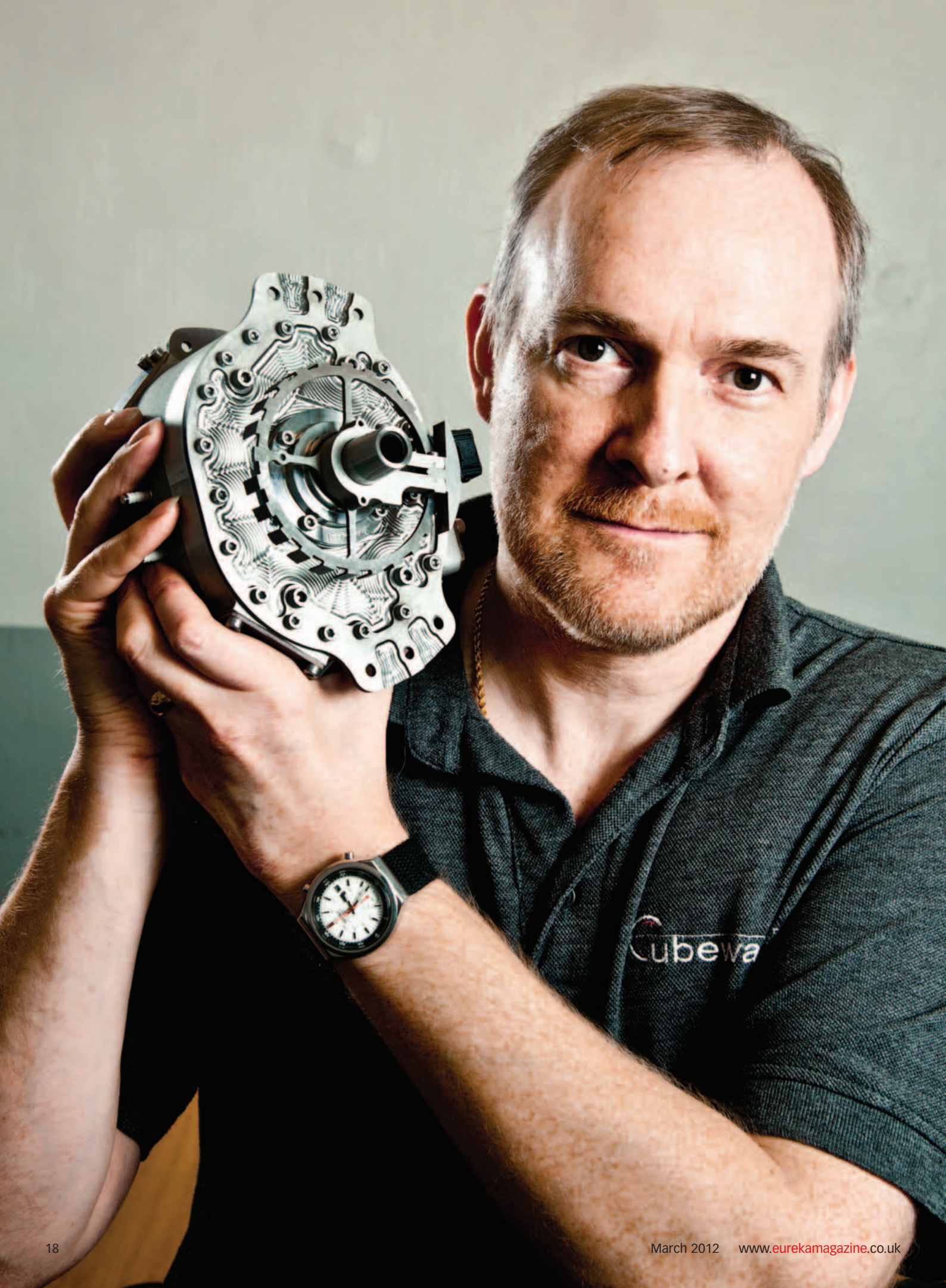

The engine man

11-hour days six days a week are what it takes to be Design Engineer of the Year, as Paul Fanning discovers.

It is natural to expect that the winner of 'Design Engineer of the Year would be a highly dedicated and hardworking individual – indeed, it would almost seem a prerequisite of even being considered. However, when 2011 British Engineering Excellence Award winner Shaun Addy lets slip when arranging the interview that his working hours are 5am to 4pm, it's hard not to be impressed.

"It's a passion," he says. "I was always passionate about tuning cars from when I was helping my brother rebuild his Mini engine when I was about 10 or 11. In fact, even today when I run an engine I get excited - my palms start to sweat. When you get a feeling that you're on the ragged edge, it's not a cold thing for me. I've always had a sensitivity to mechanical things. I can hear things in an engine."

This passion has taken Addy through various positions at the cutting edge in automotive and engine design – Lotus, BMW, Perkins – to his current role with Cubewano. Here, he has developed the Cubewano rotary engine, distinguished by the fact that it can run on kerosene – the only such engine in the world with this ability and something previously believed to be impossible. The engine is designed for use in defence and aerospace applications, where a high power to weight and low vibration levels are demanded.

Addy explains: "One of the main applications for these is in UAVs (Unmanned Air Vehicles). Increasingly, the military is looking at just taking one single fuel into combat, which is why it has to run on kerosene. Equally, it has to have a high power-to-weight ratio and needs smooth power delivery, meaning it has low vibration. After all, a lot of these UAVs are used for taking pictures and, while there's some excellent anti-vibration systems out there, it's much simpler just to ensure it's not vibrating."

In 2009, the company obtained a $9 million order from the USA and is presently in the final stages of producing a prototype 1kW heavy fuel generator. The complete unit weighs 24lb (11kg). In the last year, he has refined the design of the engine's fuel injection system, reducing fuel consumption by 50%.

"I want us to become the 'go-to' name for this technology. I'd like us to be able to sell our skills in the same way that a Ricardo or a Lotus Engineering does. So that, if someone wants a rotary engine made, they will come to us."

The system has received considerable interest both from the MoD and from US defence contractors, but there are applications possible far beyond the narrow field of UAVs, as Addy explains: "We're working on making the engine multi-fuel, so you can throw virtually anything into it. That would open up other markets. For instance in auxiliary power units and other forms of power generation. There are also possibilities in terms of developing a range extender for EVs. The companies that make EVs need a quiet engine to act as a range extender to ensure that the driver isn't even aware there has been a change of power generation. You simply couldn't do that with a small piston engine."

In terms of his ambitions for the company, Addy is aiming high. He says: "I want us to become the 'go-to- name for this technology. I'd like us to be able to sell our skills in the same way that a Ricardo or a Lotus Engineering does. So that, if someone wants a rotary engine made, they will come to us."

His commitment does mean he has trouble letting go of projects, as he readily admits. He says: "I probably don't make myself terribly popular in that I insist on involving myself at every stage even when things have been delegated. I can be a fairly hard judge of people's work. It can be hard to let go of things. I always feel a strong urge to do the work myself. Although I do enjoy delegating more now because I have people around me in whom I have confidence."

Some things will never change, however. He says: "I love to get my hands dirty and try things out on the test bed. If I didn't do that, I wouldn't be enjoying my work. I'm never going to be hands off. If I were in my work, then I'd have to get a garden shed and work in there. At the moment, this is in many respects my garden shed."

So is there any chance of him ever reaching the stage where he can just relax? Apparently not. He says: "I like to think that I could eventually head off somewhere and have some more 'me time', but it wouldn't stop me building that garden shed. It would just be a question of where it was and how well-equipped it was."

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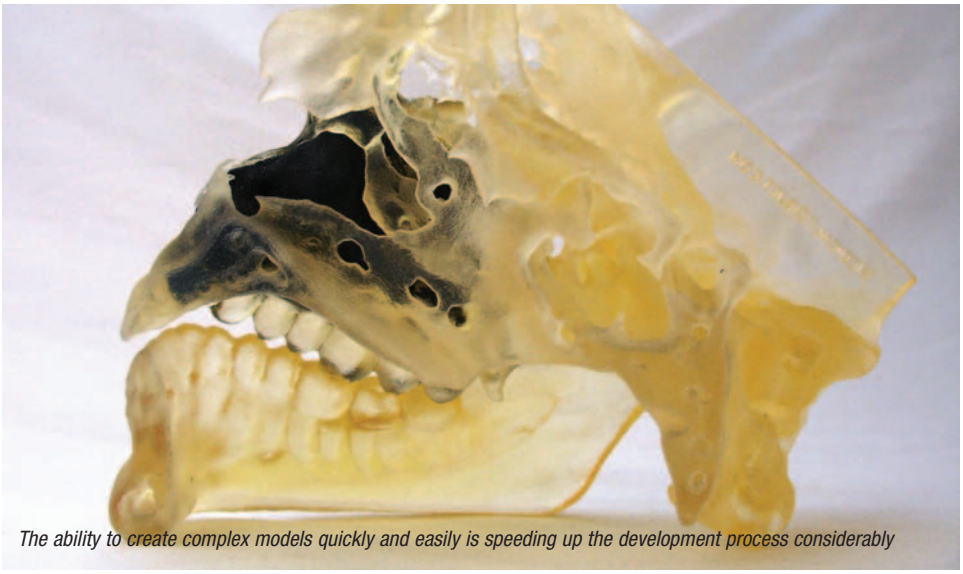
Designing in 3D

3D printing is changing the way product design and development are taking place. Paul Fanning finds out how.

The availability and variety of additive manufacturing technologies has fundamentally altered the time and approaches taken in product development and seems likely to continue to do so.

This is certainly the view of Peter Pendergast of IDC Models, the prototyping arm of leading design consultancy IDC. Today, the company operates a Viper stereolithography machine alongside various other technologies. Having been with the company from the beginning in 1987, Pendergast can remember the days before this technology. He says: "One of the first jobs we did was the Vax upright cleaner, which had 'saddlebag' water tanks and back then we probably had 10 modelmakers and everyone was handmaking a component for this, so you used to have huge numbers of staff that were involved in the process."

While the speed and efficiency with which it allows models to be created is a desirable end in itself, perhaps even more interesting is the way in which the availability of 3D printing has changed the way in which product design and development takes place. Says Pendergast: "We operate as bureau to some extent, but the machine is also used as a design tool because the designers can work during the day and get things 'grown' overnight, which means that the next day they can see what they've been working on. This means they very quickly get an idea of whether they've been going down the wrong route in the creative process."



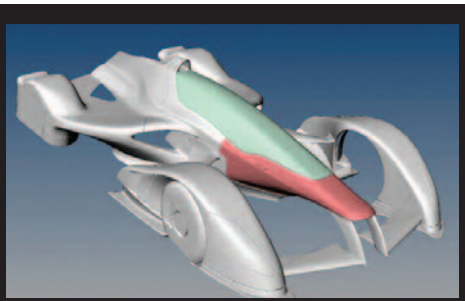
The ability to create complex models quickly and easily is speeding up the development process considerably

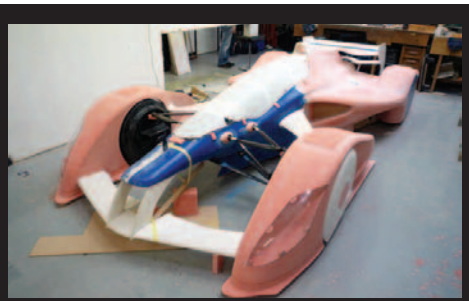
Nick Broadbent of Cambridge Design Partnership agrees that the 'proof of principle' phase is where rapid prototyping has the most immediate benefits. He says: "If you put garbage in, you'll get garbage out. RP allows you to produce multiple designs for a part overnight and thereby trying new design after new design and fine-tune the results empirically."

However, this flexibility brings with it certain demands. Designers, given the freedom to experiment, will do so, printing as many variations of a design as they can – something that obviously puts pressure on IDC Models. Pendergast says: "Before 3D printing, they had to be a lot more certain they were right. There was no building on an experimental basis because it was so costly and time-consuming to produce working models. However, with the advent of overnight printing of models, that has changed."

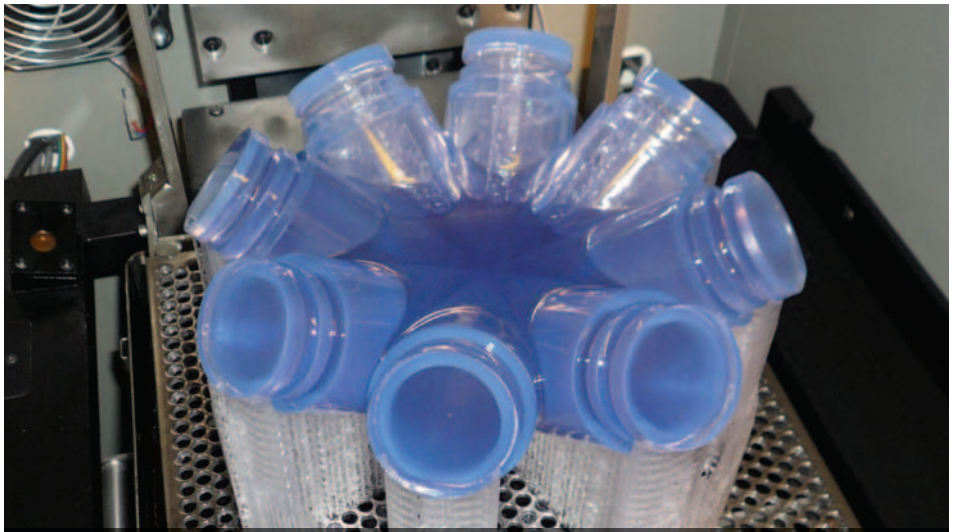
3D printing technologies have also allowed the development process to include factors such as consumer research to play a much larger part in the design process, with end user feedback to lifelike models being available at much earlier stages of the development process.

Of course, this level of work for 3D printing facilities inevitably puts pressure on in-house





IDC Models created a full-size model of a Red Bull Racing car, assembling it '"like an Airfix kit" according to Peter Pendergast



IDC Models uses a range of technologies to create models

facilities, hence the requirement for external bureaux such as Industrial Plastic Fabrications, which performs much of the beta testing for 3D Printer and materials manufacturer Objet Geometries. With projects ranging from Formula One to Olympic mascots, the company's portfolio is wide and its expertise extensive.

According to IPF's head of rapid prototyping Gary Miller, there is no inherent conflict between companies having in-house 3D printing machines and using bureaux such as his. Indeed, he feels that, as people become more familiar with the technology, it can only work to his advantage. He says: "We did the models for the Lewis Hamilton/Santander ad last year and the client then went on to buy their own entry-level Objet machine. That doesn't worry me because they still come back when they need something that's too big for their machine or if they need something flexible on it or whatever. If anything, it's advantageous for us, if anything."

Miller believes that, as awareness of 3D printing technology increases, so does the extent to which companies realise how it can be of value to them. He says: "Once people get a taste of the technology and see what it can do, they start realising all the things they could do with it. Not everyone wants to buy one, of course, but they start to realise the possibilities offered by the different technologies."

In this regard, Miller believes that the purchase of entry-level machines by designers can only be a good thing from his perspective. He says: "There are at least two dozen product development companies that have used us and then gone on to buy their own Objet machines. They all still come back because they're buying the entry level machines, so some stuff is too big for it and they don't do what the Connex does, but they are investing in order to proof their designs."

As an example, Miller offers his work with Bentley, for whom he had produced a number of models for free, including a model of a Bentley wheel that took 14 hours to print. On the basis of these models, Bentley purchased two Objet machines – an entry level machine and a Connex. However, rather than damaging IPF's business, this has only enhanced it. Says Miller: "They've got so much overflow because everyone is using it that they are having to come to me to do it. So before he bought a machine, I got nothing and I was giving him models, but now he's got two Objet machines and I'm doing work for him."

Peter Pendergast of IDC Models concurs that there is clearly a value in entry level – even tabletop – machines as far as design offices are concerned. He says: "It depends on which way the design office goes. There are lots of tabletop FDM machines that are very good for having a look, but in terms of surface finish and accuracy it's not great and has limited uses...

"There will be a time in the future when we're using these machines. Just as we started with drawing boards and gone to 2D files and then to 3D CAD, it won't be long before FDM machines will accompany every seat of CAD as an essential

These 'Angry Birds' iPod docking stations are one of IPF's high-profile examples of 3D printing

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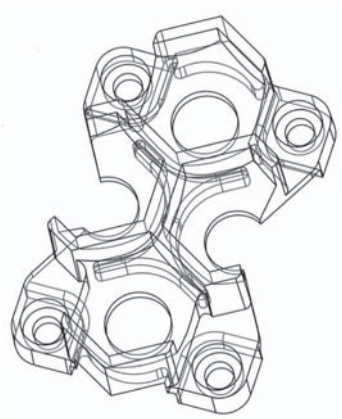

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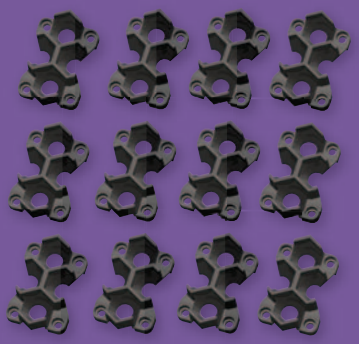

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More of IPF's models

designer's tool – allowing people to get a feel for their designs. You see this sort of thing developing and, from a designer's point of view – if you're working on screen, it can be difficult to get a sense of scale sometimes with CAD – being able to produce to scale would help you get a sense of proportion."

Of course, there are still gaps in the understanding of customers and potential customers. One of these, of course, is the importance for designers of understanding the current limitations of the technology as well as its benefits. One of these limitations lies in the gap between being able to 3D print a part and being able tom manufacture it. Says Pendergast: "People don't always realise that there are things you can 3D print that you simply can't manufacture. That relies on the designer's knowledge of the manufacturing process because the fact is that you can design and 3D print things that are totally unmanufacturable."

Neil Brotherton of Cambridge Design Partnership points out the risk that the ability to print such 'unmanufacturable' items poses, saying: "It's so easy and quick to print a part that looks like it's ready that you can raise the client's hopes unrealistically. You then have to explain to them that the part cannot actually be manufactured in this form."

Miller, too, encounters this gap in understanding among his customers and potential customers. However, he does not see it as being entirely negative. He says: "You do get a decent percentage of people asking whether you can do metal and flexible. You have to be honest and say that isn't where the technology is right now. But people are thinking about what they want and that is filtering back to the likes of Objet. Their ideas start the brainstorming process."

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‘Co-creation’ brings big ideas together

The Local Motors crowdsourcing design model is moving forward fast. Paul Fanning reports.

The concept of collaborative design – ‘crowdsourcing’ ideas in order to design and develop genuinely innovative commercial products – has been a minor obsession of the design community as long as the technology to enable easy communication of ideas has been available.

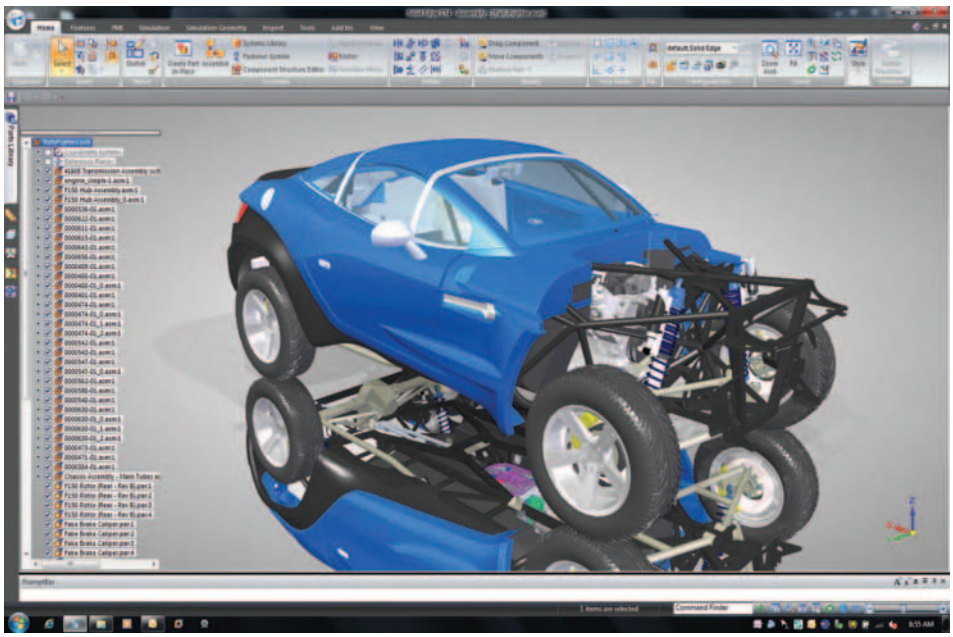
Among the best examples of this becoming a reality is the Local Motors project, which has successfully harnessed the talents of an international community of industrial designers, engineers, CAD modellers and fabricators to not just design, but also to build and sell vehicles.

This ‘co-creation’ leverages the popular crowdsourcing concept to design collaboratively and develop a vehicle by involving an open design community, in this case a community of 13,000 – including the eventual customers of the vehicle. The first – and most fully-developed – effort of this collaborative process resulted in the Rally Fighter, the world’s first open source production vehicle. 25 of these vehicles were built and sold in 2011, with another 110 to be produced this year.

The vehicles are to be produced in a number of local ‘micro factories’. Local Motors will build micro-factories in regions where demand is highest. Cars are built and sold from the micro-factories on a just-in-time basis. The development and manufacturing process dramatically reduces waste while maintaining the flexibility to incorporate new, efficient technologies as they emerge.

But the Rally Fighter is far from being the only project being worked on by Local Motors. Indeed, in a speech about manufacturing delivered on June 24, 2011 at Carnegie Mellon University, United States President Barack Obama recognised Local Motors for designing and building a new combat support vehicle for the U.S. Defense Advanced Research Projects Agency (DARPA) in less than four months. The president credited Local Motors’ ability to collapse development time for not only delivering the vehicle “ahead of schedule”, but also for its potential to “save taxpayers billions of dollars” and possibly even “save lives” by getting necessary equipment to the battlefield faster.

Another part of Local Motors’ business plan lies in holding open competitions among its community to design particular parts or products.



The DARPA vehicle, for instance, came about as a result of a challenge to create a new process for the development of future military vehicles. The first step in this new process is to test the co-creation of a Militarily Relevant vehicle through a unique Experimental Crowd-derived Combat-support Vehicle (XC2V) Design Challenge. The winning design from this challenge was then rapidly developed and transformed into an operational prototype that was shown around the United States as a proof of concept. The stakes are high: In addition to being able to have the winning design turned into a functioning concept vehicle, the winner received a $7,500 cash prize.

Current competitions also include the Shell GameChanger DRIVEN (Design of Relevant and Innovative Vehicles for Energy Needs) challenge. This asks members to design a vehicle that could be produced in the next 5-10 years for one of five chosen locations: Amsterdam, Bangalore, Basra, Houston, or Sao Paolo. The vehicle design should use locally sourced energy and materials, and should help address social challenges that each of these locations are currently facing.

Another such challenge was Local Motors' 'Open Wheel Challenge', which requires entrants to model in 3D the most innovative wheel rim designs they could think of. These are then uploaded in IGES, STEP, or STL. At the end of each month, the five designs that have been 'liked' most are 3D printed in miniature and sent it to the authors. Ultimately, though, the idea is to create a resource to help the community to design other projects – pulling from the entries already made.

One of the most recently-launched aspects of Local Motors is what is known as 'Local Forge'. Launched in November last year, this is the new face of the Local Motors community. This is designed to bring together the key elements of design, engineering and fabrication more effectively.

Damien Declercq, Local Motors' director of new business development, believes that this business model will change the face of engineering design, saying: "It has the potential to be completely disruptive for the whole mobility and transport industry."

A major step towards this for the project took place when Local Motors announced a partnership with Siemens PLM whereby it would adopt Solid Edge software as the computer-aided design (CAD) tool for its recently launched Open Electric Vehicle project and is recommending the software to its entire product design community - available for less than $20 per month.

"It was crucial for Local Motors and the level of interaction that all of our community has not access to professional level CAD software. In order to take LM to the next step, the community needed a design tool that capable of designing and assembling an automobile. The partnership with Siemens has given us that," says Declercq.

Siemens has developed two new products, and is making them available through Local-Motors. The first is a browser-based version of its JT viewer. JT is the most widely used lightweight 3D file format in the automotive industry. With this viewer, a community member can view, section, and measure 3D models from directly within the Local Motors website.

The second is a special version of Solid Edge, called Design1. Solid Edge has traditionally been a feature-based parametric solid modeling CAD system. Several years ago, Siemens added direct modeling to Solid Edge, in the form of Synchronous Technology. The new Solid Edge Design1 product is a Synchronous Technology only version with no feature-based parametric modeling tools. Even so, however, Declercq believes the ability for Local Motors' members to be on the same page as far as software is concerned has the potential to revolutionise its activities.

www.local-motors.com
www.plm.automation.siemens.com

Local Motors is seeking to increase the number of its 'micro factories' considerably in 2012

Smart systems find broader use

So-called 'smart' systems are bringing a range of benefits to industrial applications. Paul Fanning reports.

The number and sophistication of 'smart' industrial motion control systems is rising all the time. What is more, these technologies, which incorporate a range of electronic control systems within them, are increasingly proving capable of replacing more traditional technologies.

One example of this can be seen in the smart electromechanical numerical joining systems from Kistler, include a piezoelectric force sensor and a rotary encoder to measure and control position. The actuator is linked to a servo controller and a programme/monitor unit.

This approach offers a number of benefits, making it possible to specify a series of positions and speeds, to define clearly the fit process. A position repeatability of <0.01mm is possible. A fit programme consisting of a series positions and speeds can be entered into the control electronics, while for some operations force feedback can be used. This control programme can easily be adjusted for different parts and materials: the degree of control offered by electrical systems greatly exceeding that offered by hydraulic or pneumatic systems.

And, as Nick Gittins, Kistler's sales manager, makes clear, it is in applications where accurate positioning is required that the sort of control offered by 'smart systems' really comes into its own. He says: "If you've got a requirement where you need to closely control position, then this is an ideal tool. With things like drug delivery devices, for instance, where the plastic means the forces are quite low, but the quality threshold is high because these things need to work, you need careful control or both you and the end user in trouble."

This sort of application involves the interference fit of parts. This is where a part is pushed into a recess, which is slightly undersized, causing interference. The fit is made possible by the material elasticity, which gives rise to a compressive force between the part and the recess. The join is maintained by the friction, which is a function of this compressive force.

Hydraulic actuation is usually used for interference fit operations. Occasionally, pneumatic or mechanical cams are used for low forces. However, in recent years industry has been switching to this new generation of electrical actuators.

For many years, interference fit processes have been monitored with force and displacement sensors, providing a quality assessment of all fit operations. Sensors are linked to an electronic monitor, to generate an XY plot for each fit operation. The monitor can then apply limits to the plot and, for example, reject a fit with an inadequate interference force at a specified position.

Electromechanical NC joining systems are, claims Gittins, taking over from the familiar hydraulic presses and conventional joining modules, not least because the piezoelectric force sensor, rotary encoder to measure and control position – plus the link to a servo controller and a programme/monitor unit – offer much higher levels of positional accuracy.

Another instance where 'smart' equipment is making a big difference is in damping, where EasyERF Intelligent Damping from German manufacturer Bansbach, offers electronically adjustable dampers with reaction times measured in milliseconds.

Combining smart Proportional Integral Derivative (PID) systems and the latest in electrorheological fluid (ERF) technology, this autonomous system continuously monitors and modifies resistance forces within the damper. Achievable by digitally managing an electronic input signal to change the ERF fluid's viscosity within the damper, this unique system offers instantaneous control of dynamic damping requirements with infinite adjustment possibilities.

Smart PID Systems consist of at least one adjustable easyERF damping cylinder and one amplifier with an integrated controller. In its basic form, this 'open loop' system involves manually managing the controller to modify the damping properties. For autonomous 'closed loop' systems, control measurement elements

such as sensors can easily be integrated into the system to measure parameters such as acceleration, displacement and weight.

Highly energy-efficient with low power consumption (24 volt DC), damping can be adjusted using a variety of digital controls which can include 0 – 4V analogue, a standard PWM or, with a 24 volt DC SPS. Silent in operation with no 'laminar flow' or 'whistling' noises, the system has no movable parts to ensure maintenance free operation.

With a wide adjustable range of forces between 100N and 2500N through strokes ranging from 25mm to a maximum of 125mm, accurate positioning is achievable to within 0.1 of a millimetre.

This range of intelligent dampers was initially developed for active suspension systems within the top marque automotive sector it was instantly recognised that this technology had a much broader scope of possibilities, particularly within industrial sectors involving machine suspensions, precise motion control actuators or self adaptive end-of-stroke damping elements.

Electrorheological fluids (ERF) belong to the group of Bingham materials and are dispersions consisting of oil (mineral or silicon oil) and solid polymer particles. The viscosity of such fluids can be modified by the application of an electrical charge. The greater the charge, the greater the viscosity, even to the point of solidifying liquids. Fully reversible, this effect of changing the fluid's properties is achievable within a few milliseconds. The ERF fluid remains unaffected by the number of times it's viscosity changes and Bansbach easyERF dampers have been tested to over half a million cycles with no signs of deterioration.

Kistler's NC joining systems come in a range of sizes

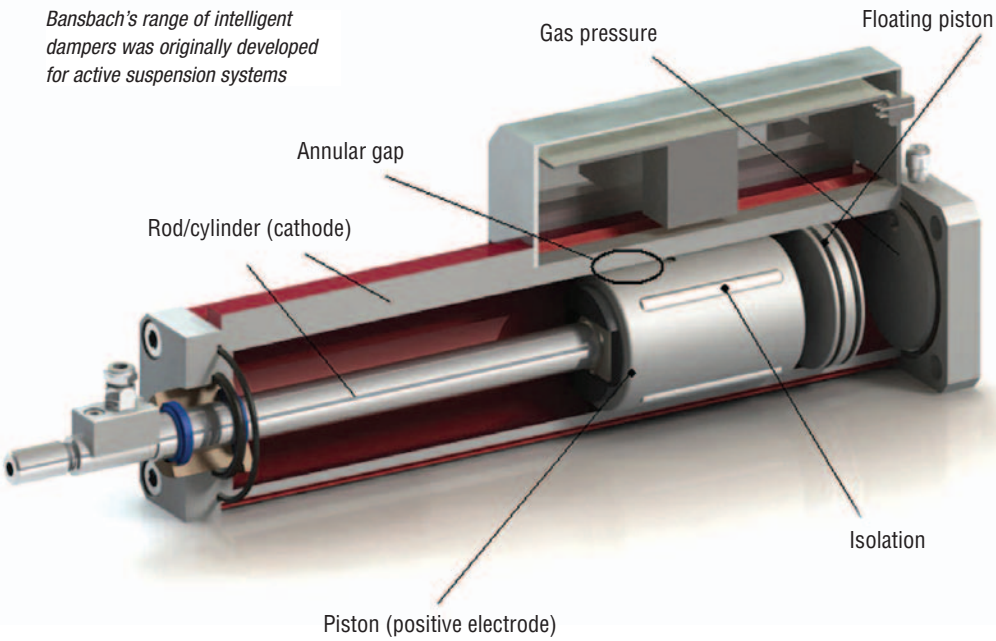
The system consists of a piston with a defined gap, known as the Annular Gap between housing and piston and two chambers filled with silicon-based electrorheological fluid. With no electrical charge applied, the fluid flows through an annular valve as in a standard damper. The inherent resistance is caused by the hydraulic drag coefficient of the laminar fluid flow. On application of an electrical charge, the viscosity of the fluid increases, thus choking the annular valve, resulting in an increase in the resistance force of the damper. A special feature of a smart PID system is that by increasing the electrical field to it's maximum the ERF solidifies resulting in a total blocking of mass movements, achieving 'zero velocity' or 'clamping'.

The system also offers continuous force control, as there is a wide range between soft and hard damping characteristics, which can be adjusted at any point along the stroke.Equally, smart PID Systems need only a few milliseconds to increase the damping force, so it is possible to control processes with high frequencies, while at zero velocity, it is possible to clamp or block the ER damping cylinder by supplying an electrical field, similar to that of a friction clutch, thereby eliminating the need for other clamp elements.

This electrorheological technology also offers new possibilities for the development of mechatronic systems. By incorporating Smart PID Systems it is possible to dramatically improve performance efficiencies of a diverse range of applications which could include, automated handling equipment such as conveyors, crushers, dryers or centrifuges; production machinery involved in drilling, forming, or milling; or even within the medical equipment arena such as exercise machines typically used in resistance training for heart attack patients or victims of congenital or acquired limb loss.

www.kistler.com
www.albert-jagger.co.uk.

Bansbach's range of intelligent dampers was originally developed for active suspension systems



Decentralised drive made easy

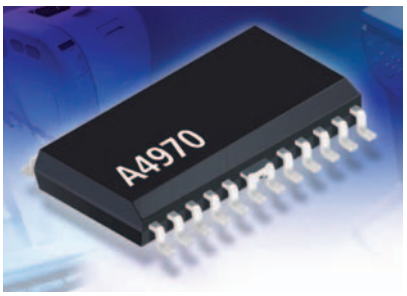
The Lenze 8400 motec range of terminal box inverters has been extended and new covers powers from 0.37 to 7.5kW. By decentralising frequency inverters instead of fitting them in the control panel, machine cabling and installation is simplified. The motec range can be mounted directly on the motor in place of the terminal box, or onto a nearby surface - an option made easy with the enclosure rating of IP65. Either way, panel sizes can be reduced and the cost of cabling is lower.

Lenze offer the motec range as 'drive packages' consisting of the frequency inverter, the motor, and as appropriate an in-line or right angle gearbox. Two, four and six pole motors can be chosen together with options such as brakes, blowers and encoders. Power connection to the motec frequency inverter can be done with unshielded cables which reduce cost.

In addition, the cable length can be minimised by looping the cable from one inverter to the next. The control connection can be from a simple AS-i bus, the more common industrial fieldbuses of PROFIBUS and CANopen, or even by PROFINET and EtherCAT real time buses. Choosing the control bus is simply a matter of plugging in the appropriate communication module.

www.lenze.co.uk

Motor driver cuts switching losses



The new A4970 from Allegro MicroSystems Europe is a dual, full-bridge PWM motor driver IC featuring the latest DMOS technology to provide a significant reduction in quiescent and switching power losses.

The new device incorporates a DMOS output stage that drives both windings of a bipolar stepper motor or bidirectionally controls two DC motors. Both bridges are capable of sustaining 45 V and include internal pulse-width modulation (PWM) control of the output current to 750 mA.

For PWM current control, the maximum output current is determined by user selection of a reference voltage and sensing resistor. Two logic-level inputs select output current limits of 0%, 33%, 67%, or 100% of the maximum level. A phase input to each bridge determines load current direction.

www.allegromicro.com

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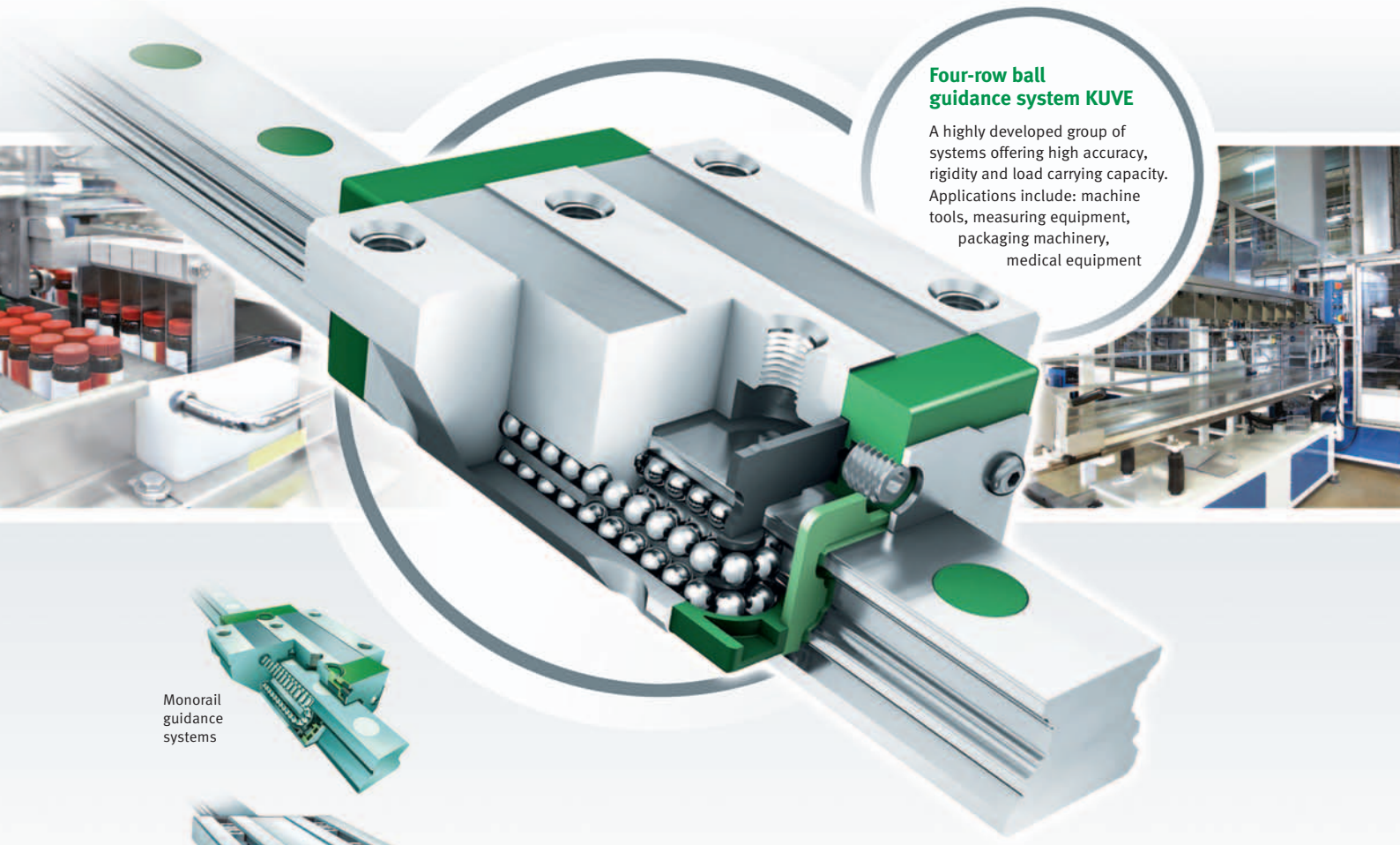

Four-row ball guidance system KUVE

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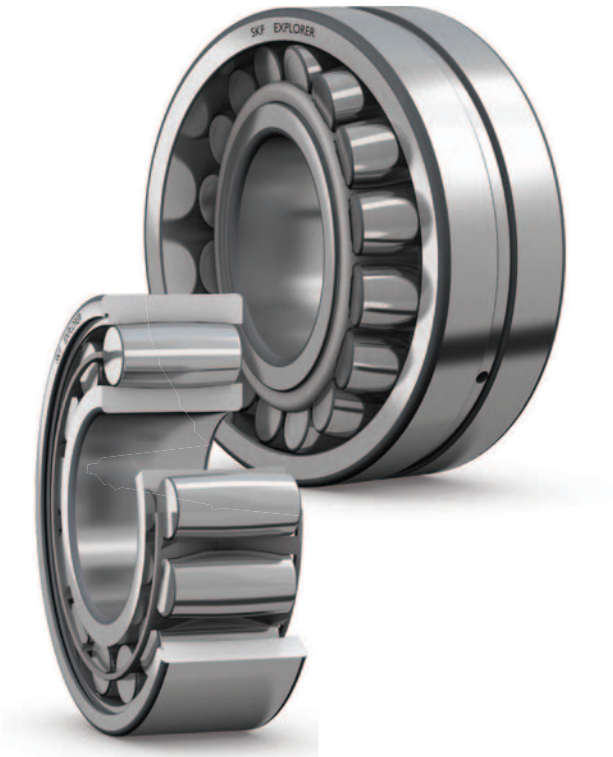

New upgraded SKF Explorer self-aligning roller bearings can provide up to twice the service life as the original under difficult operating conditions.

Combining clean and homogenous high-quality steel with an improved heat treatment, new upgraded SKF Explorer bearings have a superior balance between hardness and toughness. This advancement gives upgraded SKF Explorer self-aligning roller bearings a higher degree of wear resistance, enabling as much as twice the service life as the original, in applications where there are high levels of contamination or poor lubrication conditions.

All standard SKF spherical roller bearings, CARB toroidal bearings and most spherical roller thrust bearings have now been upgraded to the SKF Explorer performance class.

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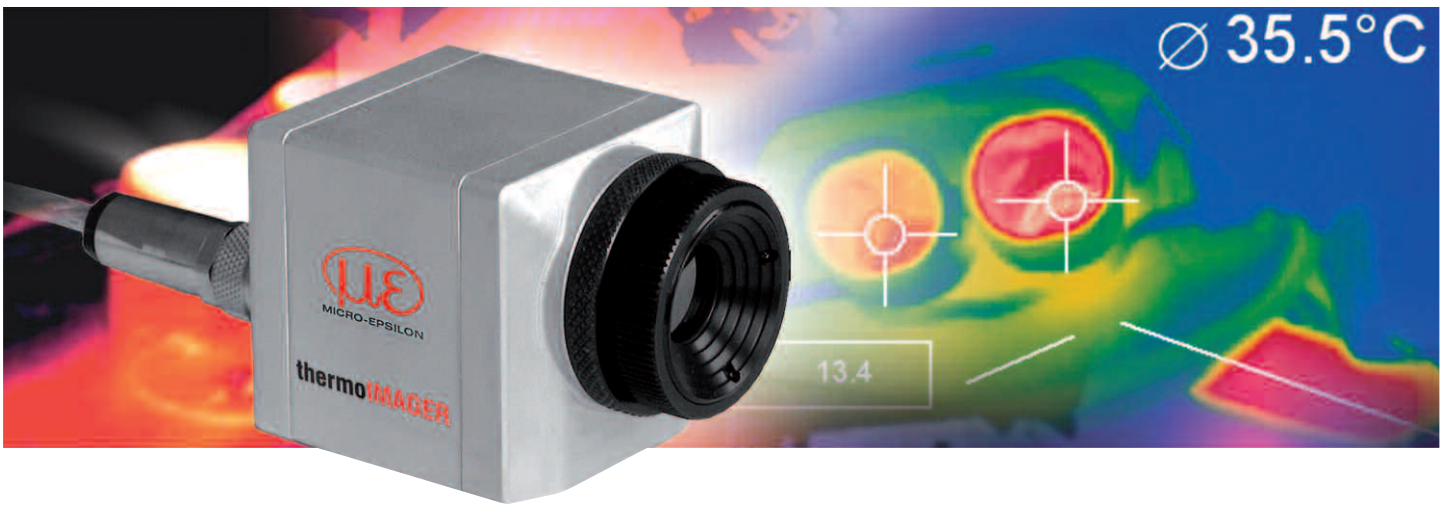
Monitoring technology takes the strain

Intro: Stress analysis is a critical and complex procedure. Paul Fanning finds out more about the applications and technology involved.



The monitoring of energy flow plays a critical part in stress analysis in a range of different markets and processes. By measuring often tiny temperature changes in a material under strain, it becomes possible to gauge the possibility of cracks or weaknesses in a material or component.

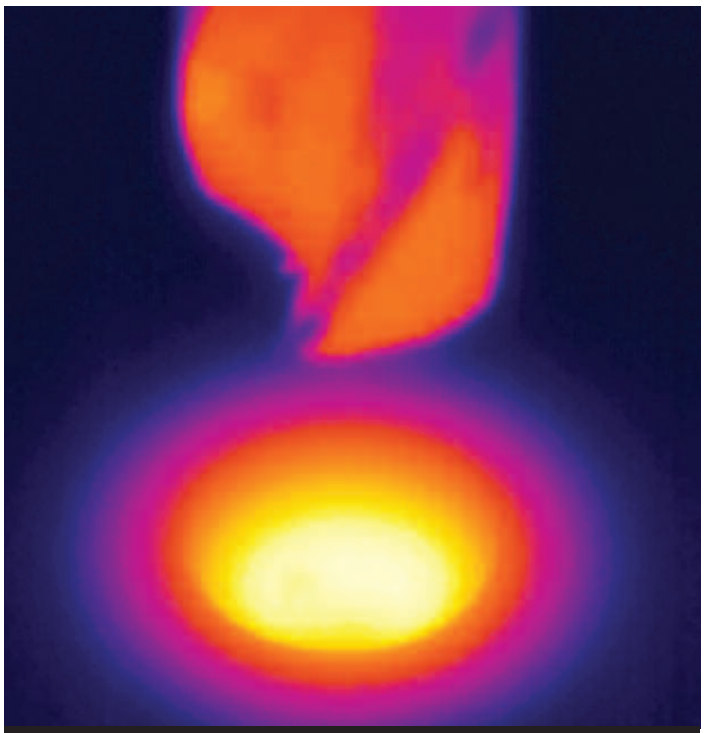
This is the specialist area of Chesterfield-based Strain Solutions, which has been providing stress analysis consultancy services, education and training to industry and academia in the United Kingdom, continental Europe and North America since 2004. With a range of experimental mechanics and non-contacting infrared measurement tools at our disposal, it offers an unusually focused service for the design, commission and optimisation of stress analysis hardware and test methodologies, and associated mechanical test rigs.

Dividing its workload roughly equally between applications involving aviation, bio-mechanical medical implants (metallic and polymeric) and chemical pressure vessels, Strain Solutions undertakes photoelastic stress consultancy, thermoelastic stress analysis consultancy, as well as thermal NDE (Non-Destructive Evaluation) using state of the art micro-bolometer array infrared cameras.

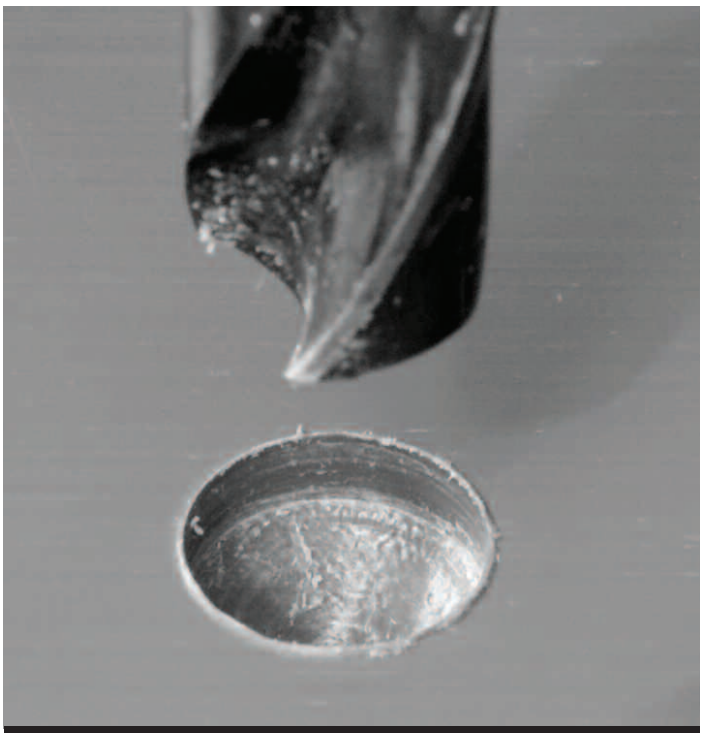
Dr Richard John Greene, Strain Solutions' managing director, explains in detail how the process works, saying: "If, for example, you are running a fatigue test for a piece of aeroplane or a gas turbine, as you fatigue the structure, you are putting energy into the system – vibrating it or cycling it in a test frame or something – that energy has got to go somewhere. Some of it goes into the elastic straining of the material, but inevitably, some of it goes into irreversible damage of the specimen. The classic thing is, if you have a crack in there, as you load and unload tensile compressive stresses on your bit of wingspar, at the crack tip, you get an energy loss from the system, which makes the crack grow. That energy loss produces an increase in surface temperature that you can see. So one of the things we do is, during cyclic test work, we monitor the surface temperature of aerospace and biomechanical structures. By looking for hot spots – very small changes in surface temperature, we can locate fatigue crack initiation and growth."

Much of Strain Solutions' work relies on infrared cameras

Another function undertaken by Strain Solutions is stress monitoring within the plastic forming of materials. This is performed in applications where there is a component that needs to be plastically deformed as part of a



The process as viewed through the TIM160...



...and viewed normally

fabrication. If, for instance, there is a plate and the application requires it to be made it into a bracket by bending it through a right angle, the energy being put into the system as the bend is created causes millions of dislocations through the structure. That energy then produces a temperature rise and, as the material is formed, the quality of the microstructure after forming is strongly rate-dependent. In other words, Thus, if this process is performed quickly, a very large temperature rise is created, leading to a very particular, very dense microstructural change in the component.

Says Greene: "If you do it more slowly, the microstructural change is more gentle, the temperature rise is much lower and you basically get less work hardening. So, by monitoring the surface temperature during the forming process you can control the resulting work hardening and therefore the microstructural condition and therefore the hardness of the material and the fatigue properties."

Clearly, these processes call for some fairly specialised equipment, not the least of which are the infrared cameras used to measure the changes in temperature. Dr Greene's previous experience of these processes involved working with nitrogen-cooled thermal imaging cameras for the military. He says: "Because the military want to do high-speed differential imaging, they're very, very sensitive, have a very, very fast response time and very programmable. They're great things, but they're way out of the price range of a little UK start-up like us. Thus, when I started the company in 1994, I was looking around for a piece of kit that could do 90-95% of what I needed them to do, but at a tenth of the price."

The equipment that was considered to best fit the bill was Micro-Epsilon's thermoIMAGER TIM160 inline radiometric thermal imaging camera. Powered and operated via a USB 2.0 interface, the thermoIMAGER TIM160 is a low cost inline radiometric thermal imaging camera that provides temperature images and profiles of a target area. This plug-and-play unit is supplied with a full software package, TIM Connect, that enables the user to configure all device parameters, as well as enabling the real time capture (at 120Hz full frame rate) and storage of images or video of an event for slow motion play back or snapshots at a later date – an important feature in R&D and failure diagnostics work.

The cameras are sufficiently sensitive to be able to pick up changes of a tenth of a degree. The ability to monitor a steady state temperature rise of a few tenths of a degree, allows the user to track the growth of a fatigue crack.

Greene is unequivocal that what marks these cameras out is their capability relative to their cost (it costs less than £3,000 plus VAT). He says: "If I could afford it, I'd love to spend £100,000 on a military spec camera. This is not the best thing out there – that's not the point. The point is that this thing is amazing for the price."

He continues: "The TIM Connect software provided with the camera is easy to use and surprisingly fully featured for such a reasonably priced camera. We particularly like the software's ability to stream every frame to memory, which allows the full, uncompressed, raw data to be captured for post-processing at a later stage. The Software Developer's Kit [SDK] also provided with the camera has enabled us to make a rapid start in creating our own software applications to capture and process the raw data stream from the camera. The sample C++ code is well laid out and comprehensively annotated and demonstrates most of the useful camera functions."

www.strainsolutions.com
www.micro-epsilon.co.uk

Q&A

Rapid Prototypes you can use

Q Can 3D printers produce realistic prototypes?

A There are a number of different prototyping methods using 3D printers but the functionality of the parts produced varies greatly. Rutland Plastics has an Objet Connex 350 – one of a range of the world's only 3D printers capable of printing using multiple materials. You are able to get high resolution prototypes with smooth surfaces and fine details.
The finished prototype parts can be painted, machined, drilled or chrome plated. Rapid prototypes produced using this method are as close as you can get to the final plastic injection moulded part so form, fit and function can be accurately assessed.

Q What materials are available?

A The ability to combine two different prototyping materials in varying proportions means that a wide variety of different grades of polymer can be simulated. Combinations can be made up of rigid materials, flexible materials and any combination with transparent material. It is also possible to produce prototypes using a combination of black and white materials to create a range of grey scales. In total there is the option of choosing from more than 50 materials with varying mechanical properties simulating ABS, Polypropylene and 11 different variations on the rubber shore scale. A high temperature grade is also available capable of withstanding temperatures up to 90C.

Q What is the maximum size of prototype that can be printed?

A The maximum build size of any part from this particular printer is 342mm x 342mm x 200mm although larger prototypes are possible by joining two or more smaller prototypes.

Q I have an assembly, do I need several prototypes to be printed?

A Traditional prototyping can be expensive. With this system, parts and assemblies can be made from multiple materials, with different mechanical properties, in a single build. Gaskets and seals, for example, can be produced individually or integrated with the main part. Testing prototypes from Rutland Plastics gives you confidence in the final design before investing in an injection mould tool.

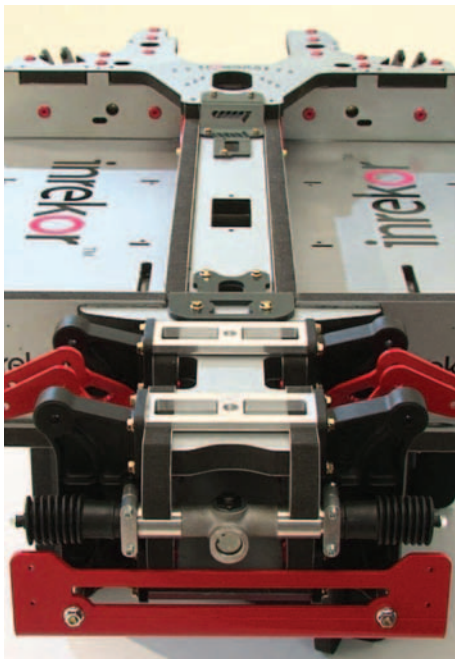
Lightweight panels prove flexible

With the ability to take 300kg away from a car chassis and potential for many applications, Inrekor is making waves. Paul Fanning reports.

The imperative to drive down vehicle weight (and thereby carbon emissions) has been a key goal, particularly within the transportation sector, for many years. The reasons for this are obvious enough, since legislation, environmental concerns, economics and common sense all demand lower carbon usage and, while alterations to engine technologies can achieve lower energy consumption, those alterations are extremely expensive to develop. Much cheaper and easier, therefore, to reduce weight from the vehicle's body.

Naturally, this has led to a great deal of innovation in terms of the materials used within vehicles – not least in chassis manufacture. However, for every advantage, there is often a disadvantage, be it the expense of carbon fibre or high investment in capital equipment or simply unsuitability for high production runs.

Inrekor, however, has been developed to combat these problems. A lightweight structural panel that can be used cost-effectively to build a chassis, Inrekor involves a core of ARPRO expanded polypropylene plastic foam manufactured by JSP coated with adhesive then bonded between two thin sheets of aluminium, after which the adhesive between the two faces is cured. Once these two-dimensional panels have been manufactured, they are then bonded together to form a three-dimensional chassis.



Its inventor Stuart Morley describes Inrekor as "a 2-D panel creating 3-D structures"

Describing the technology, its inventor and Inrekor's technical director Stewart Morley says: "It's a 2-D panel creating 3-D structures. That's the thing with Inrekor: we started with structures rather than from a material point of view. It's a technology, not a material, but the materials involved are critical"

The fact that this is a joint venture with JSP is evidence of quite how critical the materials are. JSP's ARPRO material was chosen for use it the panel because of its cost and the ease by which it can be moulded, as well as its energy absorption and insulation. Says Morley: "When we found ARPRO, it fitted all the aspects of the core that we wanted. We use different densities and thicknesses of ARPRO to create the tensility we want."

This potential for flexibility is something that differentiates Inrekor from alternative

technologies. Not only are the sheets of ARPRO available in different densities, the skins can also be made from different types of metal or even composites. Says Morley: "There's total flexibility there. You can obviously have stainless steel on one skin and aluminium on the other – so it's totally flexible. In essence, it's a bespoke panel. Everything starts with the customer's design criteria. We ask them simple questions: Are they interested in weight reduction, cost reduction or performance? That then develops the style of design."

Freddie Page-Roberts, Inrekor's sales director, says: "We're not trying to control the design in any way. It's an academy approach. Where we're dealing with companies with significant design departments, we're working with them and they're getting used to the technology and will then take it on themselves."

Morley agrees, saying: "When our customers start seeing the benefits, it starts to migrate into other parts because the engineers apply themselves. We are learning as much from our clients as we're teaching them about Inrekor."

Because the cores are created separately, it is possible to design what Page-Roberts calls "intelligence" inside it. This intelligence can take the form of air ducting or, in the case of one of the company's recent products, a lightweight chassis for recreational vehicle that incorporates much more insulated storage space.

Says Page-Roberts: "Obviously, if you do too much of that sort of thing, you're going to weaken the structure. Nevertheless, it gives you the ability to nest in various things. You have to keep checking that the structural integrity remains intact, but providing you don't have a linear break through the whole panel – which is going to create a structural failure. "

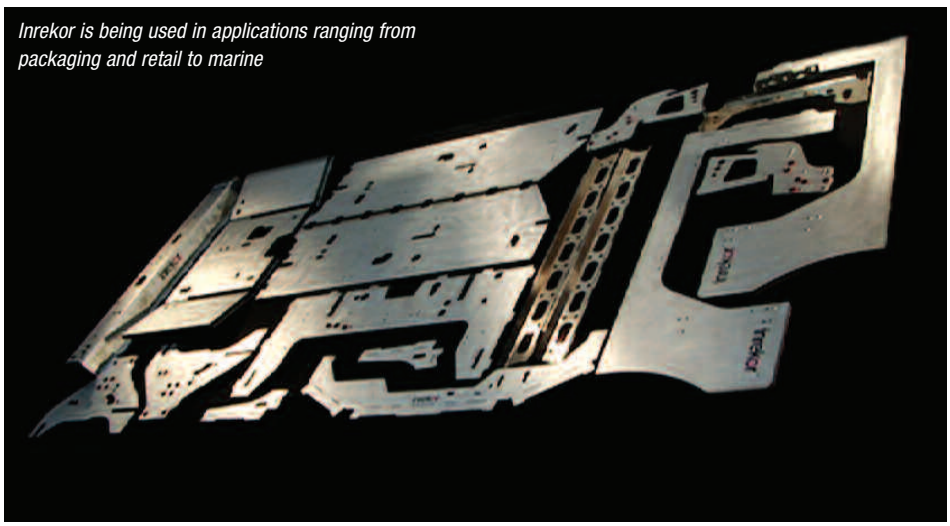
One of the patented aspects of Inrekor is the jointing aspect of it, where the glue is injected the glue into the pocket to achieve a really good mechanical bond. Because joints bonded with adhesives are usually stronger in compression, shear and tension than in peeling and tearing, Inrekor has also patented several methods of designing the structures of the tongue and grooves in the panels, including the use of bespoke apertures inside them that it claims create anchor points that prevents peeling and tearing from occurring. Each panel uses tongue-and-groove joints that interlock with one another, a design feature that guarantees a large surface contact area between each panel, ensuring that the panels bond effectively when assembled.

Another benefit offered by Inrekor comes in the fact that it cuts down on Bill of Material costs. In one instance where it is being used for seat backs, it is reducing the bill of materials by over 90%, reducing the number of materials being used from 19 to one. This has serious cost implications, says Morley: "Every part on your Bill of Materials is €10,000 in archiving costs for an automotive OEM, so if you reduce your BOM, that already represents a significant saving."

While the automotive and transportation sectors have been the main focus for Inrekor up to now, they are far from being the only areas the company is looking to exploit. As Morley puts it: "No-one makes any money in automotive apart from the taxman. The biggest earner on any car is the Government."

Currently, Inrekor is being used in applications ranging from packaging and retail to marine and even in a helicopter flight simulator. According to Morley: "Inrekor is non-specific in its application and non-specific in its USPs, because it can adapt to the client's needs. Anywhere where carbon is sensitive or weight is an issue, it has a potential application."

www.inrekor.com
www.jsp.com
www.arpro.com



Inrekor is being used in applications ranging from packaging and retail to marine

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JEC Europe: Open For Business

With Europe's biggest composites exhibition taking place at the end of March, Paul Fanning offers a preview.

JEC Europe – Europe's largest composites exhibition – will open its doors in Paris, Porte de Versailles, on 27-29 March 2012.

The JEC Composites Show is the only trade show that unites the global composite industry: an indication of the industry's commitment to an international platform where users can find a full spectrum of processes, new materials, and composite solutions. The Show presents a diversifi ed and well-balanced offering from more than 1,120 exhibiting brand names, with 75% from abroad and 25% from France.

The steady growth of the composite market is grounded in the innovation of its players and customers. In a decade, the sector has managed to structure itself around regional, national and international clusters, strategic alliances and research centres. The innovation processes at work in the composite market will constitute the main topic at JEC Europe 2012 conferences and trade show. According to JEC Group President and CEO Frédérique Mutel: "The worth of the global composite market went from €38 billion in 2000 to €72 billion in 2011. We are expecting growth worldwide.

There will be more than 1,120 brand names exhibited at JEC Europe 2012

"At an average 6% per year increase, the market will be worth €91 billion by 2015. Thanks to a large number of remarkable cooperative associations, the composite industry has been able to innovate and increase its capacities in markets where composites are already well established, like marine or

construction. For other sectors, specialised clusters have accelerated the penetration of composites, for example with the use of composites in aircraft structures rising from 35% to 50%. In the automotive sector, transnational value chains are leading to profound changes in areas like structural parts or under the hood parts, such as carbon body frames, or nanotubes in the energy storage systems of electric cars. The list is long."

This year's country of honour is the United Kingdom, promoting one of Europe's most innovative composite industries. Composites UK, Composites Skills Alliance, UKTI and The National Composites Centre (NCC) are working together to coordinate a greater UK presence at the 2012 JEC exhibition. The aim of this is to raise the profile of the UK composites industry and demonstrate to the international

This year's country of honour at JEC Europe will be the UK, allowing UK companioes to raised their profile

market that the UK is 'open for business'.

Composites UK is co-ordinating a large UK pavilion showcasing expertise from UK organisations over 200m2 of floorspace. We are currently looking to extend this to enable more companies to participate and meet the overwhelming response. In addition to the pavilion, over 30 other UK companies are taking individual stands at the show. UKTI TAP grants are available to support exhibiting SME companies and encourage growth in export opportunities. The forum sessions, innovation showcase area and technical sales sessions will further demonstrate UK capability.

The UK ambassador has been invited to present the JEC Innovation

ICS Innovative Composites Summit

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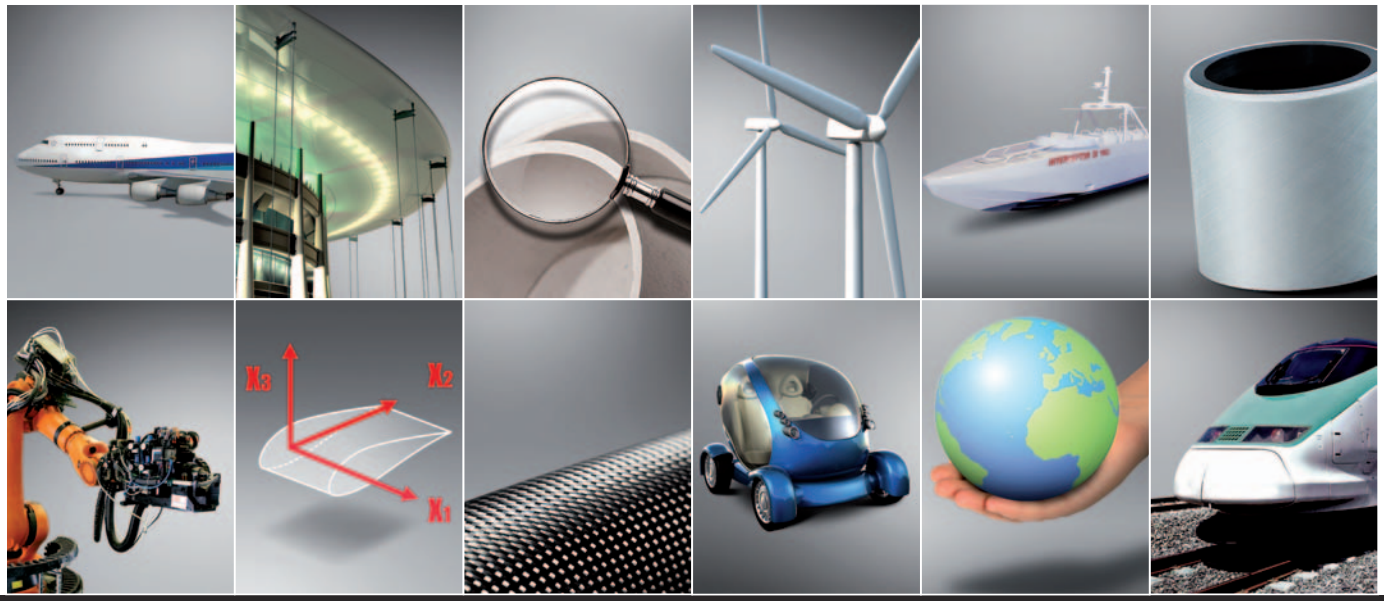

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Awards and to be guest of honour at the evening reception on Tuesday 27th March.

Companies sharing the pavilion will include: Composites UK; National Composites Centre; Composites Skills Alliance; British Composites Society; Farecla; Surface Generation; SGS Carbide (UK) Ltd; BW Cutters; Aptec; Amber Composites; Andpak; Green Marine; Norco NCCEF.

Automation will be a focus of the exhibition. It is a broad field that includes things like equipment, software, and the integration of manufacturing steps. The most significant advances over the past decade have occurred mainly in North America and – especially – Europe, which has the highest automation rate: 83% compared to 70% in Asia, to take one example. JEC provides a lot of scope for these processes. All the global manufacturers of equipment, robots and carbon fibre placement heads come to the JEC trade show, and are one of the chief attractions for aerospace and automotive professionals.

JEC Europe 2012 will also host the I.C.S. (International Composites Summit). The I.C.S. program gives a preview of all the new trends in composite applications. By providing a forum for a hundred or so of the international composite industry's key players, I.C.S. fosters dialogue between the academic, industrial and final user sectors. The forums and conferences are based on case studies and lectures by internationally renowned specialists in research, design, development and production, specifically mass production. The content is economic, technical and technological. This exchange of experience and strategic information serves to better prepare our industry for tomorrow's challenges.

Another highlight of the event will be the JEC Innovation Awards. This programme awards prizes to the best composite solutions in several user sectors such as aerospace, environment, automotive, building & construction, civil engineering, transportation, wind energy, materials, etc.

By paying tribute to innovative products and processes covering all aspects of the global composite industry, the past fourteen presentations of the JEC Innovation Awards have established the event's role as detector and promoter of innovation. This top innovation programme (created in 1998) aims to identify, promote and reward the most innovative composite solutions in the world, as well as encouraging companies and their partners in their pursuit of composite innovations, and facilitating their public exposure, thereby contributing to the development of the composite industry.

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READER INTERVIEW

BLAIR HUTTON, DESIGN AMBASSADOR, INSTITUTION OF ENGINEERING DESIGNERS

Q How did you get into engineering?

A It goes right back to my father having been a fairly traditional sort of engineer first of all with P&O and then with Babcocks. I knew I had the maths and physics acumen, but I wasn't convinced that that was what I wanted to do. I enjoyed using the creative and artistic side of my head and I thought that meant I wanted to be an architect/ I spent a week in an architect's office drawing a garage and that really didn't do it for me, so I thought there's got to be something out there for me. I then learned what engineering really meant and did product design engineering at university.

Q How did your career develop from there?

A I did a number of work placements as part of my university course and one was with Ford, which got me into the automotive industry. I then got a jobn with Jaguar when I graduated.I worked there in total for about six years. Originally I was in 'rag and fluff' interior trim engineering - dealing with all the bits of the car that you touch and interact with. I did that for about a yearor so and then applied for a job in special vehicle operations. That was fantastic working alongside the production line on all the really bespoke jobs where customers would come to us with a blank chequebook and ask for their car customised. Normally in a company that size you get a certain amount of red tape, admin and protocol, but being in this satellite group effectively gave us the ability to plunder resource from main product development while avoiding a great deal of that.

From Jaguar, I moved on to Dyson, where I was for six years or so. I was heavily involved with the James Dyson Foundation, which involved a lot of ambassadorial work, which in turn has led to what I'm doing now.

Q What interesting projects and technologies have you worked on?

A We produced the cars for the 'baddie' in the James Bond film 'Die Another Day' - customised and styled green XKRs. Another project that was interesting – although not my personal favourite – was having to produce a car for Clive Woodward after England won the Rugby World Cup. They picked the only Scotsman in the office to do that. I'm still in counselling about it!

Q What does your current role as design ambassador for the IED entail?

A I was originally chartered through the IMechE, but during my time at Dyson, my role became less mechanical and more design focused, so the IED became more relevant for me. I became a member and when this role arose and I took a bit of a leap of faith to take it.
The role is different every day. I speak to all sorts of audiences from those sort of gnarled cynics you find at engineering companies to university students or even schoolchildren. I will then go on to discuss professional registration and why it's still a contemporary and relevant thing to do. So it varies tremendously.

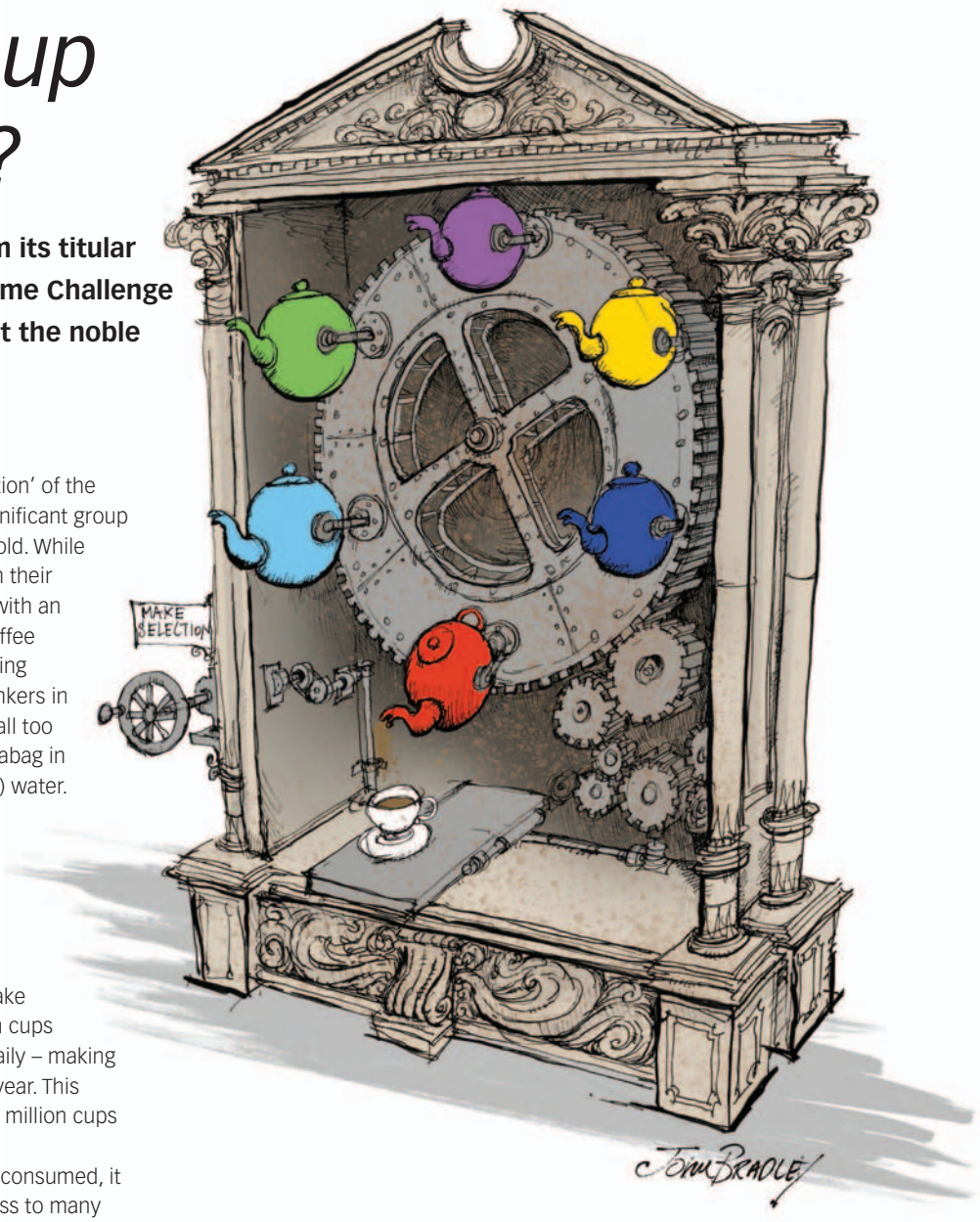
Q What advice can you give to younger engineers just entering the industry?

A At the moment, that's actually an easy question to answer. I think the key thing is that there are great career prospects out there. The Government is at last seemingly acknowledging that and all these apprenticeship schemes are popping up.

Perhaps even more importantly, there are these huge engineering projects now: HS2; Bloodhound; the Olympic Park; Norman Foster's airport in the Thames Estuary. All of these projects are going to need thousands and thousands of engineers to actually make them work. There will be jobs out there for young engineers and they will be exciting jobs. In terms of advice, it pays to think initially about what sort of engineering they want to get into, but don't get hung up on that. Also, try to get as much work experience as you possibly can and get into the habit of drawing your ideas as much as possible to allow you to visualise it and more importantly as a means to communicate your ideas.

Your cup of tea?

In a departure from its titular tradition, Coffee Time Challenge this month looks at the noble art of teamaking.



In the UK's 'coffee revolution' of the last decade or so, one significant group has been left out in the cold. While coffee drinkers have seen their options increase hugely, with an ever-widening array of coffee shops offering a bewildering variety of coffees, tea drinkers in such establishments are all too often presented with a teabag in pot of hot (but not boiling) water.

This situation seems particularly strange given that, for all the inroads coffee has made in the UK of late, this remains resolutely a nation of tea drinkers. The statistics make this clear, with 165 million cups of tea being consumed daily – making a total of 60.2 billion per year. This compares with a mere 70 million cups of coffee consumed daily.

Also, of the tea that is consumed, it is a source of great distress to many tea purists that 96% of it is made in bags. Tea made from leaves, they argue, is infinitely superior to its bagged counterpart – albeit less convenient.

It would seem logical, therefore, to introduce a means whereby tea drinkers can be offered the same gourmet experience as is available to coffee drinkers these days – offering loose leaf teas of varying types prepared properly and to some degree to their taste.

The Challenge

The challenge this month, then, is to devise a machine that can replicate the coffee drinker's premium consumer experience for tea drinkers. It should be fully programmable, allowing the consumer to specify not only the leaf, but also the intensity of the tea flavour and even factors such as the relative bitterness. In other words: to identify the independent variables that impact flavour, and how to separately manipulate them to deliver each consumer's ideal cup.

Ideally, this solution should also be faster than traditional tea brewing – a process that is traditionally supposed to take four minutes – in order to improve customer throughput in a retail context.

The solution currently only exists in prototype form, but is being publicised by its inventors as the answer to many a tea drinker's prayers. However, that is not to say you could not do better.

The solution to last month's Coffee Time Challenge of how to improve on adhesive tape can be found in the Technology Briefs section on page 12

Adhesives

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Protecting our workforce and environment through ever tightening health and safety rules has a double edge. Of course it's in everyone's interests but for those whose job it is to evaluate the suitability of hazard-labelled products against process needs and company policy, tougher legislation means a lot more work. The quick fix is to select products that are free from hazard labelling. But in reality, are they as effective as their counterparts whose constituents require them to display health and safety symbols? In the case of the health and safety range from Henkel, the answer is a resounding yes. The company first introduced its Loctite 2400 and 2700 threadlocking products a short time ago but now these formulations have been joined by others with similar credentials. As a result, Henkel is unique in its ability to offer a comprehensive range of hazard-label-free engineering adhesives that cover the lion's share of applications.

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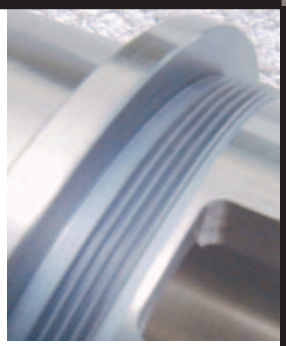

Stainless Steels and Titanium are both prone to galling and seizing. WS2 is a very low friction dry lubricant surface treatment, developed by NASA for use in deep space. It has been shown to provide a very cost effective solution, preventing both problems on threads and other sliding surfaces.

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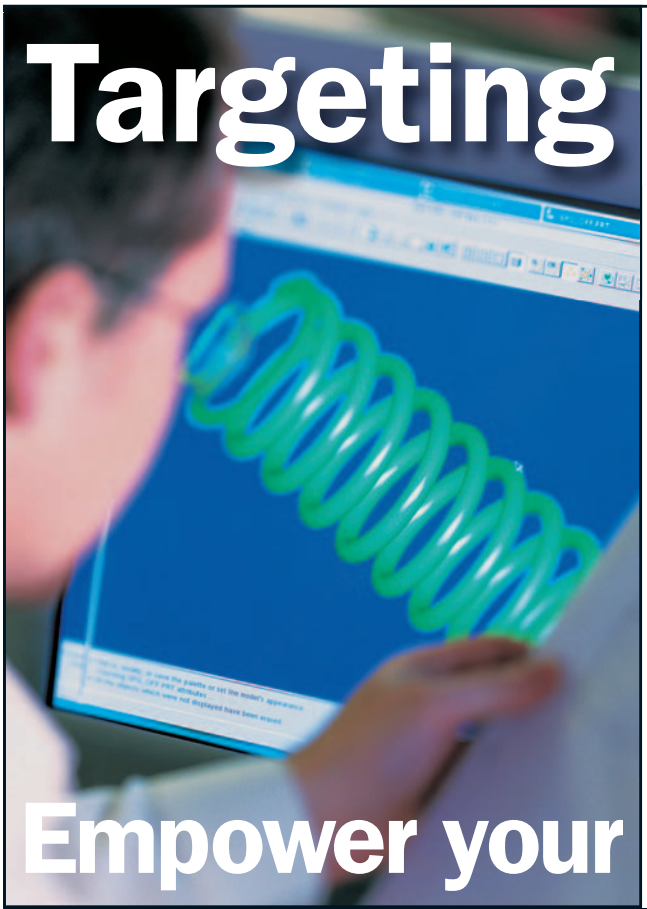

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Mechanical (Thermal) Design Engineer

Location: Colchester, Essex
Type: Permanent
Salary/Rate: circa £40k-£50k

This international company specialises in the design and manufacture of commercial and custom designed industrial computer boards for critical embedded applications. They have offices in the USA, UK and China, as well as a worldwide distributor network.

You will work closely with the electronics and board layout engineers at all the different stages of board development, for both rugged and more benign environments. The design team operates in a small company environment, which means most designs are completed by an individual engineer. As a result, each engineer rapidly becomes involved with all aspects of the product design and development. Short design timescales are an important part of the development strategy, which also result in engineers being involved in many different product designs quite quickly.

For full details online, enter reference: JS3104

Fatigue & Damage Tolerance Engineers

Location: Bristol, Somerset
Type: Contract
Salary/Rate: £25-£40 per hour

This company currently has a requirement for F&DT Engineers for contract work in the Bristol area. There may also be an opportunity in Southampton. The roles are to start asap and the contracts will initially be for six months' duration. Candidates must be able to obtain BS assurance.

Experience:
- F&DT
- Aerospace Industry Experience

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For full details online, enter reference: JS-FDTENG-872

Product Development Engineer

Location: Essex
Type: Permanent
Salary/Rate: £28k per annum

To support Autonnic's growth through new product development, the company is seeking a skilled and experienced engineer who will report to the MD. Autonnic Research is a world leader in fluxgate technology, and is situated in Tollesbury, Essex. This reputation has been built on its continuous worldwide supply of fluxgate sensors and sub-systems, unrivalled understanding of the technology, and a commitment to quality, reliability and engineering support for marine and robotic guidance systems. For further information about Autonnic and its products, go to its website.

The Task:

- To cover all aspects of engineering the company's fluxgate components and sub-system modules, including electrical, software and mechanical design
- To liaise with the company's customer base, providing applications development engineering and bespoke designs, as required.

For full details online, enter reference: JS/AUTONNIC

Mechanical Design Engineer – Hydraulics

Location: West Midlands
Type: Permanent
Salary/Rate: £27k-£35k per annum

A specialised design and manufacturer of hydraulic components, based in the West Midlands, is looking for a mechanical design engineer to come on board to join the team. This company's products are widely used in a variety of industries, from Subsea to Industrial, and this role is for a creative individual, with an attention to detail!

Candidates must have:

- BEng in Mechanical Engineering or similar
- Proven experience in a mechanical engineering role
- 3D CAD experience

Advantages: Experience with hydraulics

This role involves working in a team to create and problem-solve products from the company's range. You will be communicating closely with other departments to ensure products are completed on time. You will be working on technical support, as well as listening closely to customer requests and feedback on products.

For full details online, enter reference: qkCvaEn

Mechanical Design Engineer - Special Purpose Machinery

Location: Leicestershire
Type: Permanent
Salary/Rate: £30k-£37k per annum

This company is going through rapid expansion and so is looking for a mechanical design engineer to complement this. Here is a great opportunity for an all-rounded Mechanical Engineer to come on board and work full lifecycle on new product development and technical support. A very varied role for an engineer, who will not get bored!

Candidates must have:

- Experience in mechanical design positions
- Experience working on machinery design, bespoke machinery or high speed machinery
- Proficiency in 3D CAD (preferably Solidworks)
- AutoCAD.

This role involves working from concept through to onsite assembly. You will be working with a team of four on new product development, as well as working from a customer specification.

For full details online, enter reference: qkCudbg

CAE Applications Engineer

Location: Coventry
Type: Contract
Salary/Rate: Negotiable

Tools & Technologies are responsible for all aspects of the CAD, CAM, CAE and PLM toolset: development, deployment, usage and support. Currently, the Tools & Technologies team is deploying a next-generation, Windows-based set of tools across the business, including simulation lifecycle management (SLM).

The Role:

- Working across multiple disciplines in a project-driven environment
- Working with business to architect solutions
- Managing projects that implement SLM tools within the next-generation toolset.
- Developing and deploying methods with SLM tools to integrate CAE processes into the PLM system.

The Person – the ideal candidate will demonstrate:

- A broad understanding of CAE process
- Thorough project management skills
- Experience of executing CAD or CAE activities within a PDM-managed environment.

For full details online, enter reference: qkCv9KE

Analogue/Digital Electronic Design Development Engineer

Location: London
Type: Permanent
Salary/Rate: £20k-£24k per annum

Medical electronic instrumentation company, a pioneer in its field undertaking research, design and development, requires analogue/digital electronic design development engineers, with a first class honours degree in electronics.

The successful candidates should be highly motivated, with excellent communication and organisation skills, having the ability to work under pressure. They must also be experienced in instrumentation development at board level:

- Analogue & Digital Circuit
- FPGA
- VHDL
- PCB design
- High Speed digital design
- Microcontroller Programming
- Matlab software development for 3D image reconstruction

Responsibilities are in all aspects of development.

For full details online, enter reference: JS/MALTRON

Electronics Engineer

Type: Permanent
Salary/Rate: £35k-45k per annum

The job requires a highly motivated person, with excellent communication and organisation skills, the ability to work accurately under pressure and to take a creative approach to problem solving. The successful applicant will form part of a small team specialising in the design, production and development of electro-mechanical equipment and process. Applicants should have relevant qualifications and an enthusiasm for travel combined with a current drivers licence and passport.

Duties include:

- Design electrical circuits for control systems to meet customer performance specifications
- Design control cabinet layouts to international standards
- Design and write PLC and HMI control system software.

Experience

The candidate will be expected to have used an AutoCAD-based electrical computer aided design package. Must be experienced in Siemens PLC and HMI design software

For full details, email: info@cemco.com

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