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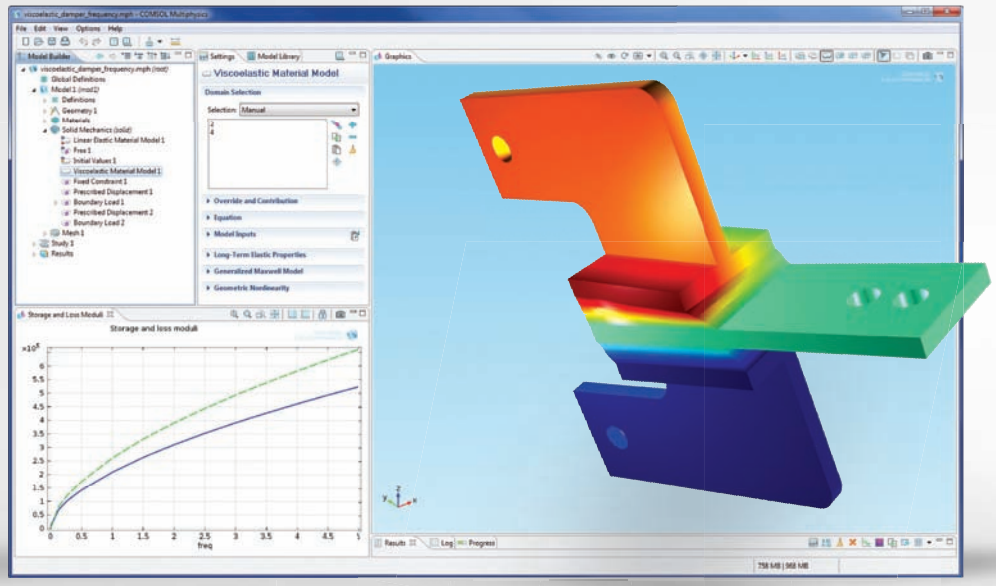
The next step

Can bionics supersede the wheelchair?

STRUCTURAL DAMPING: This model performs a structural analysis of a damper made from a viscoelastic material. The picture shows the displacement in one axial direction (color plot), while the shape plot illustrates the overall displacement. The graph shows the extent of the variation of the viscoelastic moduli with frequency.



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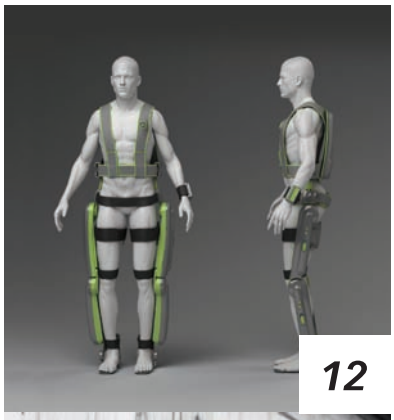

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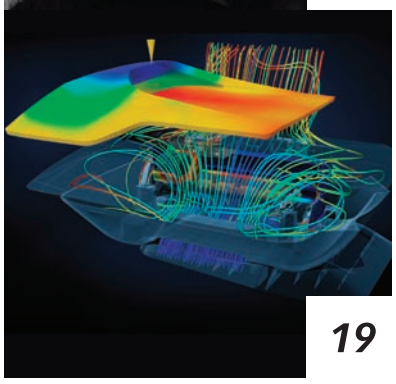

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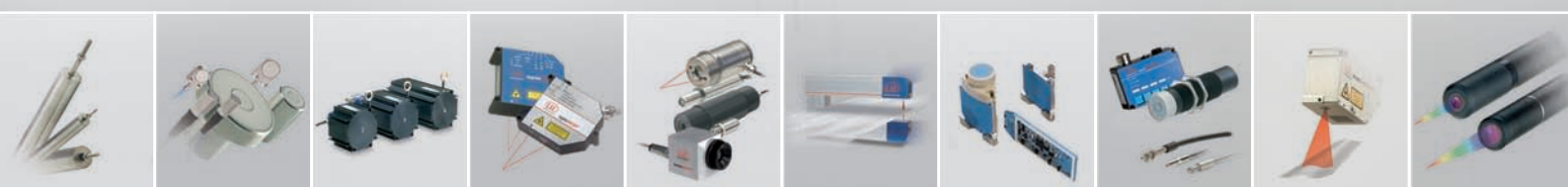

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Avoiding the 'unsung hero' trap

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

There is little doubt that high-profile engineering projects inspire engineers. Indeed, only a few issues ago, we carried an interview with James Godman of AgustaWestland, who cited Concorde as a major factor behind his choice of career.

With this in mind, during the week I write this, I will be attending the test firing of the Bloodhound 1,000mph car's rockets in Cornwall. This is a project that is to some extent predicated on the mission to inspire young people to appreciate the engineering that, it is hoped, will safely transport this vehicle and its occupant 12 miles in just 120 seconds, shattering the land speed record along the way.

This concentration on inspiring young people is highly laudable, of course and *Eureka* wishes the Bloodhound project every success. However, the fact that it is even necessary for the Bloodhound project to have to emphasise the importance of top-class engineering to its success is a big part of the problem. Surely this should be taken as read?

To take another example, this summer's Olympics were, by any standards, a triumph. However, if asked, I imagine few people would list engineering as one of the key reasons for its success. Yet it clearly was. The Olympic Games were among the biggest engineering feats undertaken in the UK since the Second World War and their success was largely due to engineers. But how many would make that association?

It is tempting to think that it is always the fate of engineers to be unsung heroes. Does the argument that a sign of good engineering is that you don't notice it mean engineers are condemned to obscurity? The only way to avoid this fate is for engineers, whenever there is something to shout about, to make the most of every opportunity to do so. For this reason alone, the Bloodhound project should be applauded.

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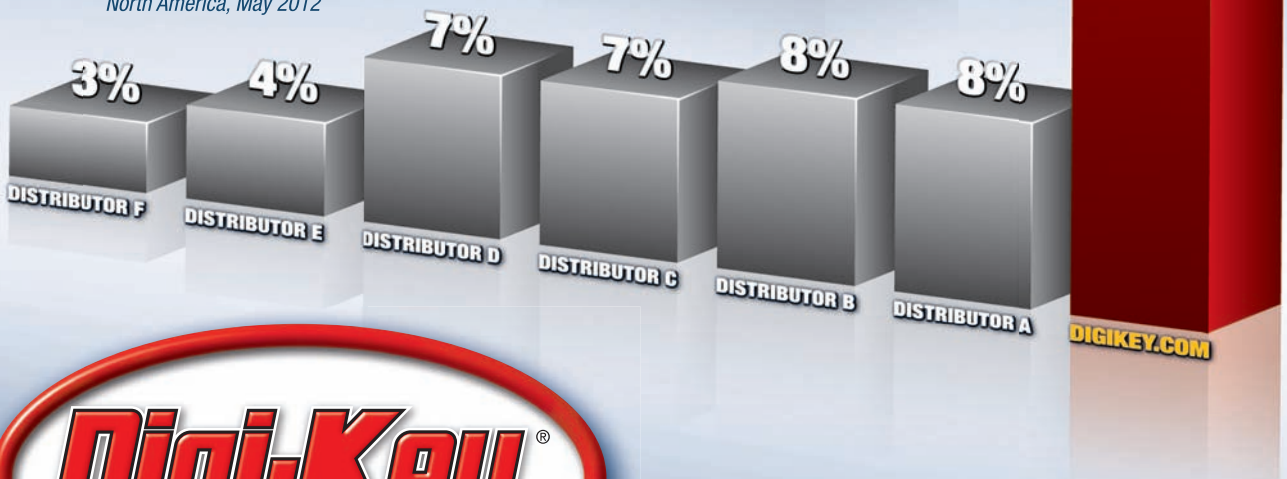

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Encourage jobs for the girls, says Semta

Lynn Tomkins, UK operations director of Sector Skills Council Semta, has expressed the need for businesses to give women confidence in typically male-dominated industries: "The science, engineering and manufacturing talent pool is shrinking demographically, so employers need to look at maximising the potential of women – an untapped resource," she said.

While approximately half of the overall UK labour market is made up of women, research from The Institution of Engineering and Technology reveals that of the entire UK engineering workforce only 4% of technicians and 6% of engineers are female.

Says Tomkins: "Even when women study engineering at university, fewer of them than men progress into industry careers. Despite similar career expectations on graduating, six months after finishing their studies just 39% of female graduates have engineering jobs compared to 50% of male graduates. Yet companies are reporting difficulties in recruiting suitably skilled staff and the sector needs to recruit 82,000 new scientists, engineers and technologists by 2016."

'Jobs for the boys', a new report led by UCL Engineering, Katalytik and Oxford Research and Policy, and funded by HE STEM, found it may be a question of confidence. When students were asked to evaluate their own technical skills 59% percent of men believed they had what employers needed, compared to 45% of women surveyed. However, a higher percentage of women than men graduated with firsts and 2.1s. And employers reported that women performed as well as men in the recruitment process.

Semta's own research found that a lack of female role models and gender specific training were key issues for women working in engineering and manufacturing. So Semta has developed a programme to support women's career development and nurture new female talent.

The action-oriented Career Advancement and Progression Programme helps women in any role in male-dominated industries to analyse their current position and to identify individual career objectives. In addition to equipping participants with relevant skills and confidence to tackle specific gender behaviour traits, the programme also helps businesses to understand and address possible organisational barriers to their female employees.

www.semta.org.uk/advance

Ultra-light sensors monitor flight of the bumblebee

Cambridge-based sensors specialist Zettlex has successfully built position monitoring devices light enough to track bumblebees in motion.

The company – which usually makes position and speed sensors for armoured fighting vehicles, industrial robots, oil and gas installations, radar systems etc – says it thought the enquiry was a wind-up.

"At first I thought it might be one of my pals playing a practical joke, but when we found out more about the bumblebee hive application, we were very keen to be involved," states general manager Mark Howard.

Local bumble-bee researcher Nik Sargent was carrying out research on hive activity and needed to monitor and count the bees as they entered and left the hive.

"There was a big problem with traditional sensors – they were simply too big and bulky. However, Zettlex's technology was so light and sensitive it could easily be activated by a bumble-bee," says Sargent.

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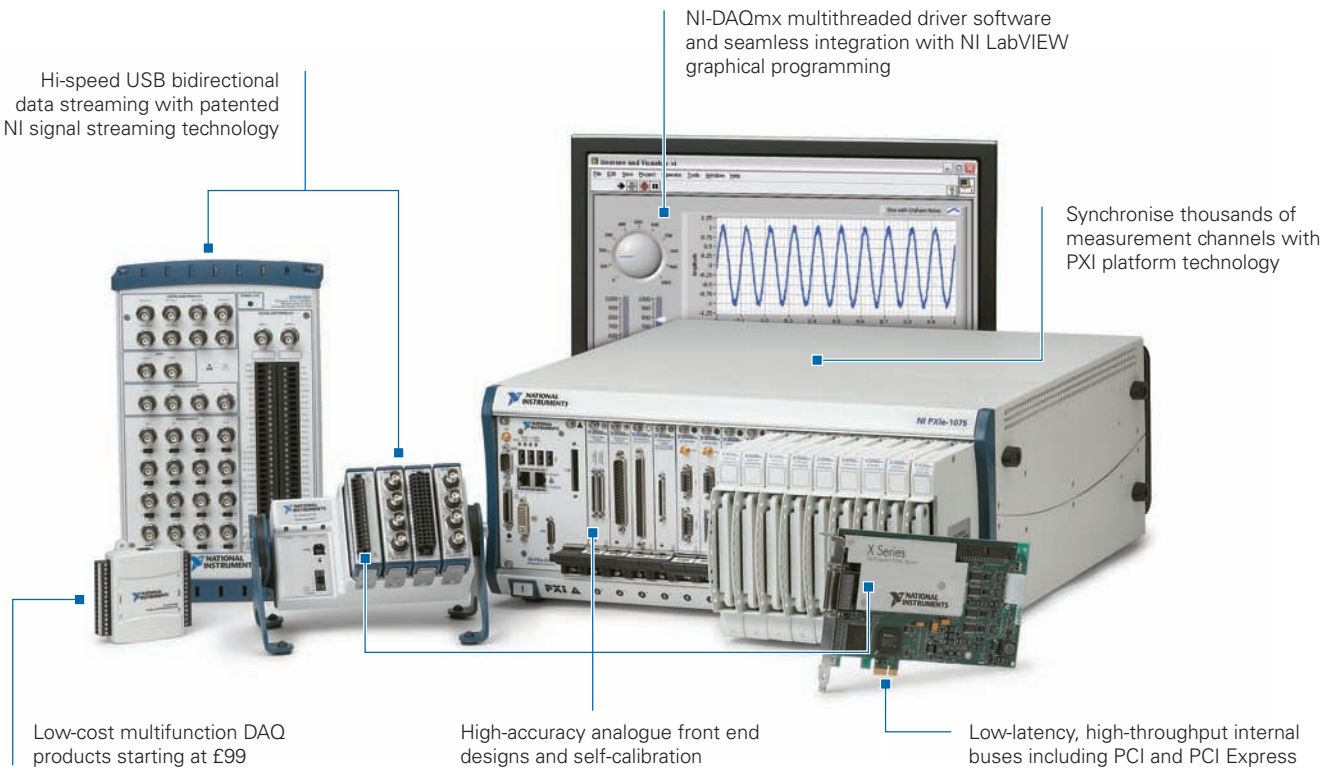

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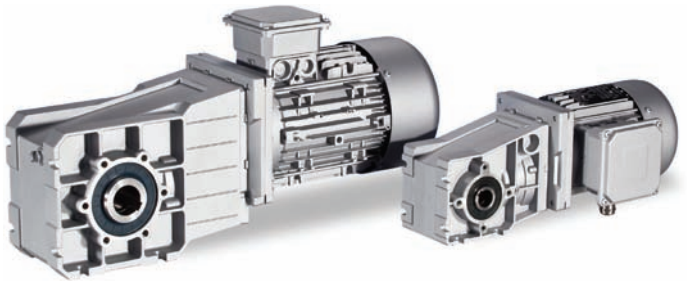
Bevel gearboxes replace worm gears

Lenze GKR bevel geared motors are designed as replacements for worm geared motors and offer massive savings in energy costs. The extra purchase cost is paid back in only a few months of continuous running as the efficiency improves from 50-70% up to 96%. These geared motors are available for motor powers from 60W to 7.5kW with output torques up to 450Nm and ratios up to i = 76.



The GKR bevel range actually contains two gear stages. The first stage is a helical gear with a small ratio. Then, contained within the cast housing is a bevel output gear stage with case hardened steel teeth. Modular options to aid mounting include male or hollow shafts, foot mounting and single or double flanges.

There are three areas where the bevel gearbox shows clear advantages over worm designs. First the backlash is low at typically 10 arc minutes. This makes them suitable for accurate positioning tasks and they can be combined with servo motors. Secondly the low backlash is maintained as the wear rate is insignificant over normal lifetimes.

The third advantage is the high efficiency, which is a constant at 96% irrespective of ratio.

www.lenze.com

PUMP BEARINGS DELIVER 50% MORE

NSK's recently introduced range of high performance angular contact bearings for industrial pumps has an optimised internal design that contributes significantly to lower running costs, allows downscaling of components, and saves energy by extending maintenance intervals. The optimised design delivers up to 50% more bearing life compared to standard angular contact bearings, and an improvement in basic dynamic load rating.

The new design of the high performance angular contact bearings has optimised all key areas of the bearing construction. Basic dynamic load has been improved by approximately 13%, by reviewing ball diameter and optimising the internal design of the bearing rings and cage. As a result, bearing life has been extended by approximately 50 % in comparison with standard angular contact bearings.

The improvements in overall bearing design also extend to the bearing cage. By improving the shape and guiding method of the copper alloy cage, the space between the rings and cage has been optimised.

www.nskeurope.com

More than a quick fix

Loctite 3090 will fill gaps up to 5mm, a unique capability in the world of superglues. It cures through the volume and won't run out of the joint in the absence of perfect face-to-face contact or if there are any surface imperfections. This is an ideal workshop or general maintenance adhesive and can even be used to encapsulate a delicate component or part; once it has hardened it can be machined and polished. Loctite 3090 is also good where low bloom is required.

The gel consistency of the two-part, Loctite 3090 enables it to be easily worked into an area for maximum stress distribution. The product provides instant adhesion between most materials, including porous substrates like wood and fabric. It can also be used on low surface energy plastics when pre-treated with Loctite 770 Polyolefin Primer.

www.loctite.co.uk

Solution to last month's Coffee Time Challenge

The solution to last month's Coffee Time Challenge to come up with a way to remove water that has soaked in to electronic devices that have been dropped in to water comes from Lancashire based Rescuetec.

Its resealable, multilayer aluminium foil pouch provides a complete barrier to moisture. Inside is the Rescuetec recovery sachet containing a specially formulated compound that acts like a 'magnet to water'. The sachet is an exclusive Rescuetec product and allows both moisture and water vapour to pass through easily into the compound, while retaining the material securely inside. The Rescuetec compound will aggressively pull in water and water vapour from whatever contents are sealed into the foil pouch.

The pack also contains an indicator strip, which shows how much moisture is still present and measures the extraction from 40% relative humidity down to zero. In laboratory tests, devices cannot be properly recovered until the levels are well below 10%. The Rescuetec product is highly effective at these lower levels, thereby ensuring it removes as much of the moisture as possible before attempting to restart the device. The Rescuetec compound is up to 700% more effective than rice and up to 300% more effective than silica gel at these levels.

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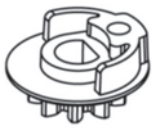

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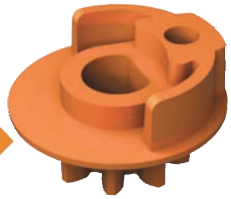

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Think small on compressors

Specialist in temperature control systems technotrans is introducing chillers using the world's smallest and lightest rotary compressor into the UK. This move follows its parent company's purchase of Termotek, a specialist supplier of laser cooling systems, last year.

The Aspen miniature compressor used in the chillers comes in two designs, a 1.4cc or 1.9cc format and with variable speed control, from 2100 to 6500rpm. They are available in 12V, 24 V or 48V electrical power versions. The Aspen systems have been tested for use with R134a and R404 refrigerants although other low pressure refrigerants or refrigerant blends may perform well but are not yet verified. Both versions of the Aspen compressor use polyolester oil (POE) as a lubricant.

In addition to the compressor, the chiller units use a central control that measures and monitors all inputs and outputs, including temperature, ambient conditions dependant fan speed control, conductivity measurement, hours of operation and general chiller status. As well as the intrinsic benefits of system control, this facility coupled with the company's P900 test and measurement tool can be especially beneficial for companies working with clients who like to monitor and record environmental impacts such as energy usage.

www.technotrans.co.uk

Position sensor offers comprehensive options

BEI Sensors' new Model 9660 Hall Effect rotary position sensor is a great choice for demanding harsh environment angular measurement applications across all areas of industry. Available in the UK from Variohm EuroSensor, the versatile IP67 rated sensor is available with 24 standard electrical angles through 0° to 360° and seven termination options including flying leads, Metri-Pack, AMP and Deutsch connectors. Both single or dual redundant outputs configured as voltage, ratiometric, PWM and current combine with input voltages that include 5 VDC, 9..30 VDC and 15..30 VDC.

The 9660 sensor is compact, with a mounting area of just 51 mm x 37 mm and a height of less than 35 mm. The non-contacting Hall Effect technology returns an extremely long working life, and suits the most arduous shock and vibration conditions. With an operating temperature range of -40°C to +125°C, the sensor is aimed at applications from general industrial measurement to harsh environment use such as steering and pedal positioning for construction, agriculture and mining vehicles, marine steering and speed control, wheel and throttle position feedback for material handling, and valve positioning for process control.

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'Better by Design'

Bionic exoskeleton

A powered exoskeleton with the capacity to transform the lives of paraplegics is now available for UK users to take home. Paul Fanning finds out more.

It is a truism to point out that the ability to walk is one that most of us are fortunate enough to be able to take for granted. However, if anything is likely to cure one of complacency about this ability, it is an appreciation of the sheer engineering difficulties posed by any attempt to replicate this seemingly mundane activity mechanically.

This fact is starkly brought home by the ReWalk, a lightweight, powered exoskeleton that allows paraplegics (those paralysed from the chest or waist down who are more usually obliged to use a wheelchair) to stand, walk, and take stairs themselves. Worn around the legs and torso, the device works using a combination of motion sensors, electric actuation motors, sophisticated control algorithms and real-time software running on on-board computers – all controlled by a wristband.

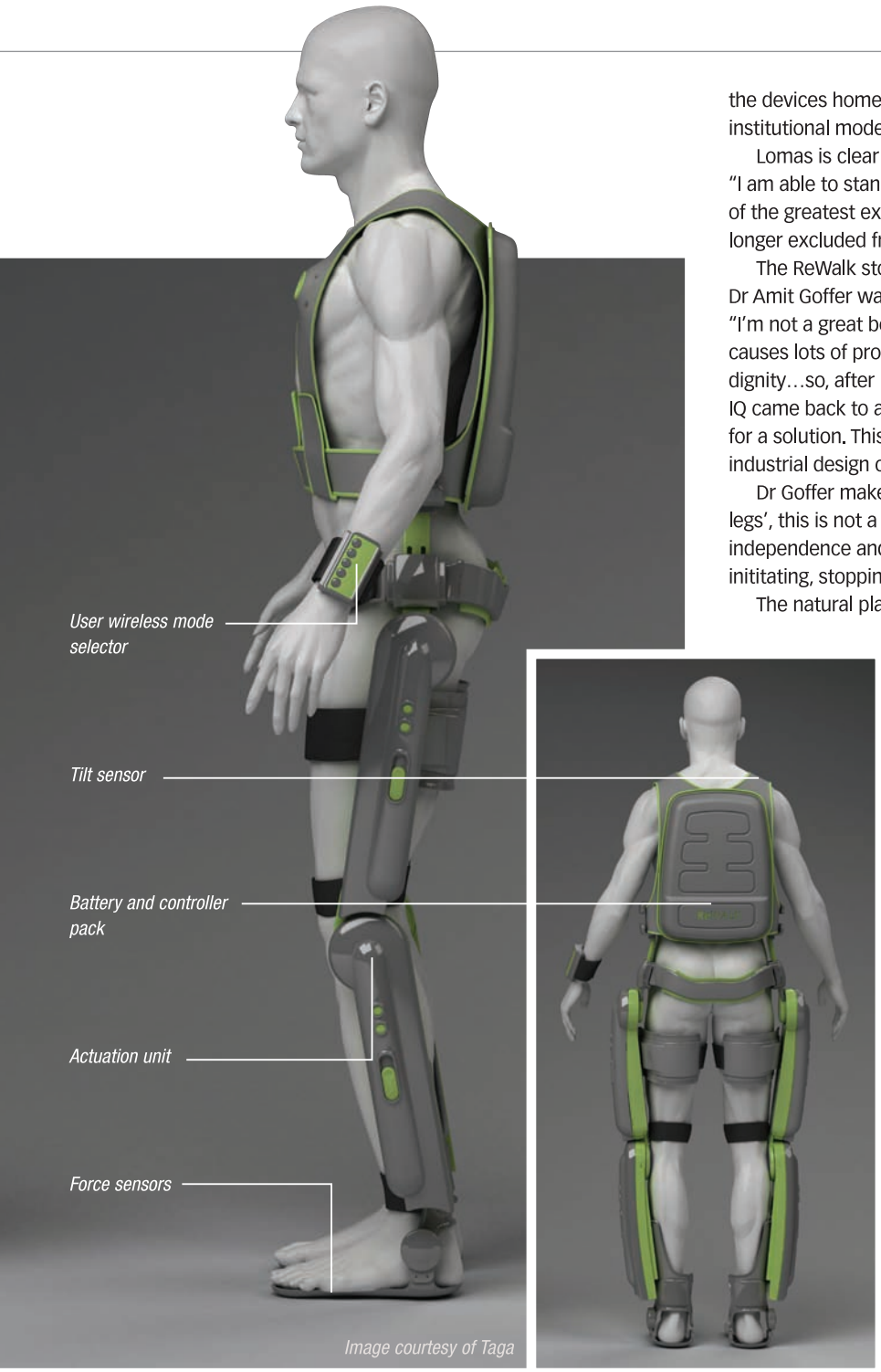
The wireless control unit allows users to choose modes for walking, sitting, climbing and descending stairs. There are four servomotor units in the knees and thighs. These power gears and levers to drive additional motors that bend the joint and feed back information on the angle through which it moves. Each servomotor is controlled by a microprocessor governed by a small central computer that is carried with batteries in a backpack.

Claire Lomas, who used ReWalk to complete the course of the London Marathon

While it is not new, the device has recently been given particular prominence by Claire Lomas, who used it this year to complete the course of the London Marathon, a feat which also saw her given the honour of lighting the celebration cauldron in Trafalgar Square before the 2012 Paralympics.

A former event rider and chiropractor, Lomas suffered a riding accident in 2007, which left her paralysed from the chest down. Refusing to accept that a wheelchair was her only option, she saw a video of the ReWalk system on the internet. From there, she viewed the system at an exhibition and went on to use it at the East Yorkshire-based Cyclone clinic, where she went on to train for the Marathon. She has now become the first person in the UK to take one of

transforms lives



the devices home (it having previously only been available in an institutional model).

Lomas is clear that the impact the device has had on her life, saying: "I am able to stand, walk, talk to my friends and family eye-to-eye…one of the greatest experiences is to be able to stand at a bar – I'm no longer excluded from any social event."

The ReWalk story began in Israel in 1997, when mechanical engineer Dr Amit Goffer was left tetraplegic by a road accident in 1998. He says: "I'm not a great believer in wheelchairs. Confinement to a wheelchair causes lots of problems, with the biggest one being the loss of dignity…so, after my accident, when I stopped all my medicines and the IQ came back to an acceptable level, it was natural for me to go looking for a solution. This solution eventually became (with the help of industrial design consultancy Taga) the ReWalk system.

Dr Goffer makes it clear that, despite media references to 'robot legs', this is not a robotic device, but instead one that offers the user independence and autonomy. "The person must be in charge of inititating, stopping and setting the device," he says.

The natural place to start, he felt, was with powered exoskeletons. This was an area that had seen considerable investment and research from the US military for the Augmented Performance Human Being (Supersoldier) programme to allow soldiers to perform beyond normal human limits or abilities. One of the outcomes of this was the HULC (Human Universal Load Carrier) developed at Berkeley for Lockheed Martin, which in turn gave birth to a rehabilitative device for healthcare called eLegs (exoskeleton lower extremity gait system). However, ReWalk is the first system of its type to be available for individual use.

At the heart of the ReWalk system is a tilt sensor. This serves to sense shifts in the wearer's balance by, for instance, showing their desire to take a step forward. This then triggers the suit to mimic the response that the joints would have if they were not paralysed. Says Dr Goffer: "The user shifts the crutches forward and the tilt sensor 'feels' the tilt of the device and then triggers the forward step – but only one step. The user then has to move again to trigger the next step. The user is therefore in control of every movement, but shouldn't have to think too much about the walking itself – it should come naturally. This also solves any safety issue. If there is no tilt, the device reverts to a standing position."

Although it requires the use of crutches, Dr

Goffer is at pains to make it clear that they are very much a part of the overall design, offering not only support, stability and safety, but also a very important facet of the walking process. He says: "The crutches are necessary because they give so much for nothing. Giving up the crutches is a very complicated problem because it means replacing so many muscles that are simply not there."

Safety, of course, is a major consideration in the overall design of the ReWalk. Says Dr Goffer: "Your users are in a wheelchair or handicapped and you cannot therefore offer a device that is not 100% safe. If ithat means getting to market a year later, then so be it."

A number of features exist to ensure this level of safety. For instance, when climbing stairs, the user must press 'Acknowledge' on the control unit to ensure that their feet are in the right place or adjust their position using the crutches. Only then can they press for the next step. Another consideration is the need to avoid any damage to the user's legs when reverting to a standard position when there is no tilt sensed. "The software is aware of the centre of gravity of the individual and the situation of the legs," says Dr Goffer. There is also a 'soft mechanical' obstacle in the gearing system designed to activate when it encounters undue resistance.

In the event of a catastrophic failure in the system such as a wire getting cut, the device is designed to return the user to a sitting position. However, it is clearly important that it does not do this too precipitously, so the device defaults to what Dr Goffer describes as "a graceful collapse" or "baby fall" that slowly brings the user to a sitting position, giving them ample time to seek assistance or make other necessary adjustments.

Also key to the system's value is its long battery life. This was a key element in the design as far as Dr Goffer was concerned, as it is his goal that the system becomes a replacement for wheelchairs as opposed to merely being used in addition to them. For this to be the case, the system obviously needs to be able to function for a full day. "My drive was to create a device that works from morning to night and can then be charged overnight," he says.

The original device used a heavy gel/lead battery. Subsequently, lithium ion was used for the main battery and lithium polymeric for the auxiliary battery. The main battery was originally 2.4 Amps/hr, while the more up-to-date system is 2.8 and the next, according to Dr Goffer, will be 3.1 or 3.2. Eventually, he believes, fuel cells will be used to power the device.

The ReWalk allows users to stand, walk, sit and even climb and descend stairs

Much of the early research for powered exoskeletons came from military applications such as Lockheed Martin's HULC (Human Universal Load Carrier)

A bitter irony of the ReWalk in its current incarnation is that its inventor cannot use it. This is because he is tetraplegic and lacks the requisite upper body strength. However, he makes it clear that he does not intend that this should be the case in the future, saying: "This is only the beginning of the device's development. What about tetraplegia? What about quadriplegia? Hemiplegia? What about Multiple Sclerosis? Children? The list goes on and on."

Dr Goffer is also refreshingly frank about what he perceives to be the shortcomings of the device at the moment. "My nature is that I'm never satisfied in terms of engineering," he says. "For instance, the wrist-based wireless remote control was bulky and I changed it to this watch-type device. I don't like that either because it's awkward, so I'm looking at introducing more intuitive control systems such as buttons on the side. I'm also looking at speech control.

"The more advanced one we're selling for personal use is still in my opinion too bulky," he continues. "It should be possible to wear it easily and it should be faster – and that's where we're going. Ours is currently the fastest one around at 2.5km per hour, but we want to get that up to 4.5km/hr. It's also a very bulky device. The footprint of the device is huge at the moment. But that is going to change."

For all these criticisms, however, the ReWalk nonetheless remains a remarkable device that is genuinely capable of transforming wearers' lives. On this, Dr Goffer has the final word, saying: "Limited mobility is a daily struggle involving loss of self-esteem and dignity… Our mission is, by changing their status from a wheelchair user to a crutch user, to change the life of the user dramatically."

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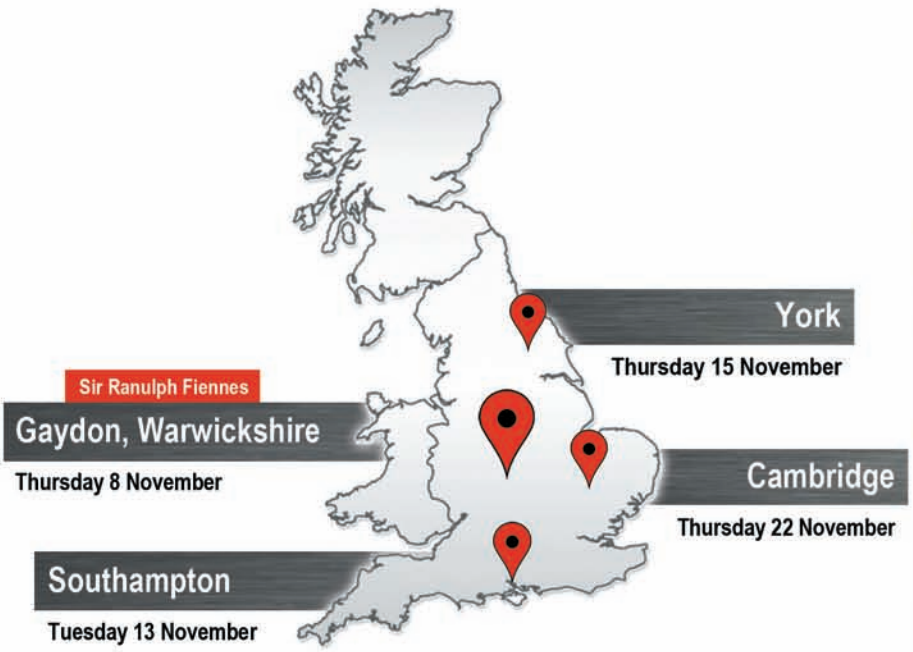

The launch of SolidWorks 2013 heralds the 21st release of SolidWorks. This year Solid Solutions have pulled out all the stops with breakout sessions, competitions, the chance for you to explore SolidWorks 2013 and more *What's New* than ever before.

"The World's Greatest Living Explorer", Sir Ranulph Fiennes, will be making an inspirational presentation at the Heritage Motor Centre in Warwickshire on Thursday 8 November. Reserve your place now to avoid disappointment as numbers are limited.

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An eye for design

Gus Desbarats has been designing and directing award-winning, commercially successful, innovation, continuously, for the last 28 years, for some of the world's top brands. In 1999 he founded TheAlloy, a leading, employee-owned, design consultancy undertaking product, interaction and service design as well as innovation strategy.

Desbarats advises and speaks frequently on why and how organisations can use a human-centric 'experience led' innovation approach to achieve better results, especially when the technology and value chains are complex. He will be speaking at the event as chairman of British Design Innovation, to highlight the need for a stronger voice for Industrial & Service design in the UK and to promote the role the BDI is playing to raise the profile and perceived value of all the designers in this space.

Bridging the design gap

Industrial designers and design engineers need to work together, but do not often do so well, according to Gus Desbarats. Paul Fanning reports

Gus Desbarats believes that the UK's engineers have a major shortcoming, which he sums up as: "Human behaviour is not taught in engineering school." Coming from a leading industrial designer who has spoken widely about the strained relationship between engineers and industrial designers, this could easily be taken as yet another manifestation of this long-standing friction.

This would be a misconception, however. Not least because Desbarats is an engineer himself, having gained a degree in mechanical engineering in his native Canada before coming to London to train in Industrial Design at the Royal College of Art (he also has a degree in Systems Engineering from Imperial College).

These qualifications have taken Desbarats to the top of his profession. He is chairman of leading product design company The Alloy, as well as being the chair of trade body British Design Innovation and having acted as an advisor to the Government on technology.

He is thus better placed than most to pronounce on the gap he feels exists between engineers and industrial designers and to bemoan its impact. While he concedes that design is his first love and that studying engineering was largely a means of ensuring he was "taken seriously" in his desire to design cars, he nonetheless remains proud of his engineering training, proudly drawing attention to the 'pinky' ring commonly given to Canadian-trained engineers on graduation.

Desbarats believes that the root of the misunderstanding between designers and engineers lies in a fundamental misunderstanding of the two roles and how they need to interact. "The biggest problem we face," he says, "is when the R&D or engineering team we're working with doesn't see presentation as being something of value – they see it as a necessary evil. Therefore, they want to get someone to 'draw them a picture' and then get out of the way."

He accepts that designers are as much at fault as engineers in this mutual misunderstanding, citing a tendency in the past by certain designers to be "primadonna-ish". He says: "There are certain practitioners who would like you to believe that they are the geniuses and that's just not a professional model and doesn't work in good companies, but the caricatures are still lingering."

He describes the result of this friction as: "So you have the twin problems of engineers who don't value design and designers who don't respect the risks that they own. Sadly, there are too many of both in this country."

Clearly, then, Desbarats' company TheAlloy sets out to work in a very different way. He says: "We have one or two degree-qualified engineers, but what we do is teach people to understand the engineering risks they control: space; cost; understanding how a tool is made; understanding about undercuts, volume, stress and all these things. I believe that you don't need a full engineering degree to manage engineering risk."

One of the key roles played by the industrial designer, believes Desbarats, is to help the client manage human and aesthetic factors early in the process to ensure a commercially successful end product. "This," he claims, "is the bit that engineers struggle with. What we do is not deterministic: there are no equations we can run to predict the future. But what we do is run a continuous series of very rapid prototyping experiments. Because people react so positively to the superficial, you can show it to them before you engineer it and know that they will like it. This is where industrial design functions as risk reduction. It's crazy to go off and engineer something without testing how people are going to react to it."

"He accepts that designers are as much at fault as engineers in this mutual misunderstanding"

This, he believes, is where many design projects fail. "Most innovations fail not because they don't hit their goals, but because they don't set the necessary goals in the first place," he says. This, he claims, is a lesson he learnt from his experience designing the body for the Sinclair C5 in the early 1980s, saying: "I had to work around the package I had, so I sculpted the forms, made it look modern, but the fact was that people were sitting at a very low eyeline height in a very exposed position – just not a way in which you're comfortable on a road. The psychological novelty and discomfort of the eyeline and the seating position was enough to kill that concept right from the start. I love [Sir] Clive [Sinclair] to bits and he's a great man in many ways, but he just had some real blind spots when it came to human behaviour."

This failure to connect between the engineer and the designer has, Desbarats believes, had a negative effect on British industry for many years. Indeed, he cites it as a key reason why many brilliant British technologies have not succeeded commercially. He says: "We need to get the message across to British manufacturing: we're creative, you're creative, but we have different skills. Let's work together to get a good end result."

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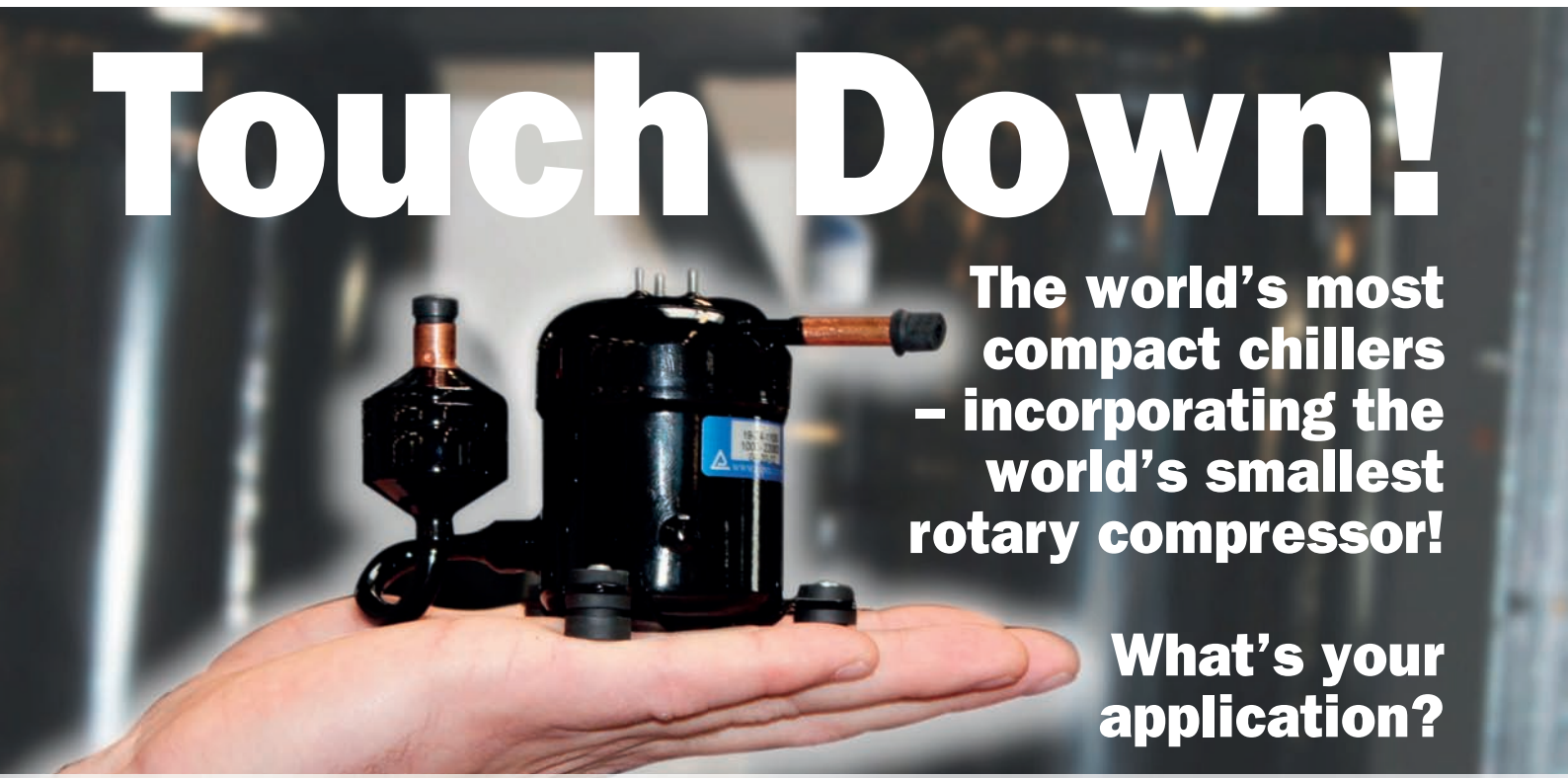

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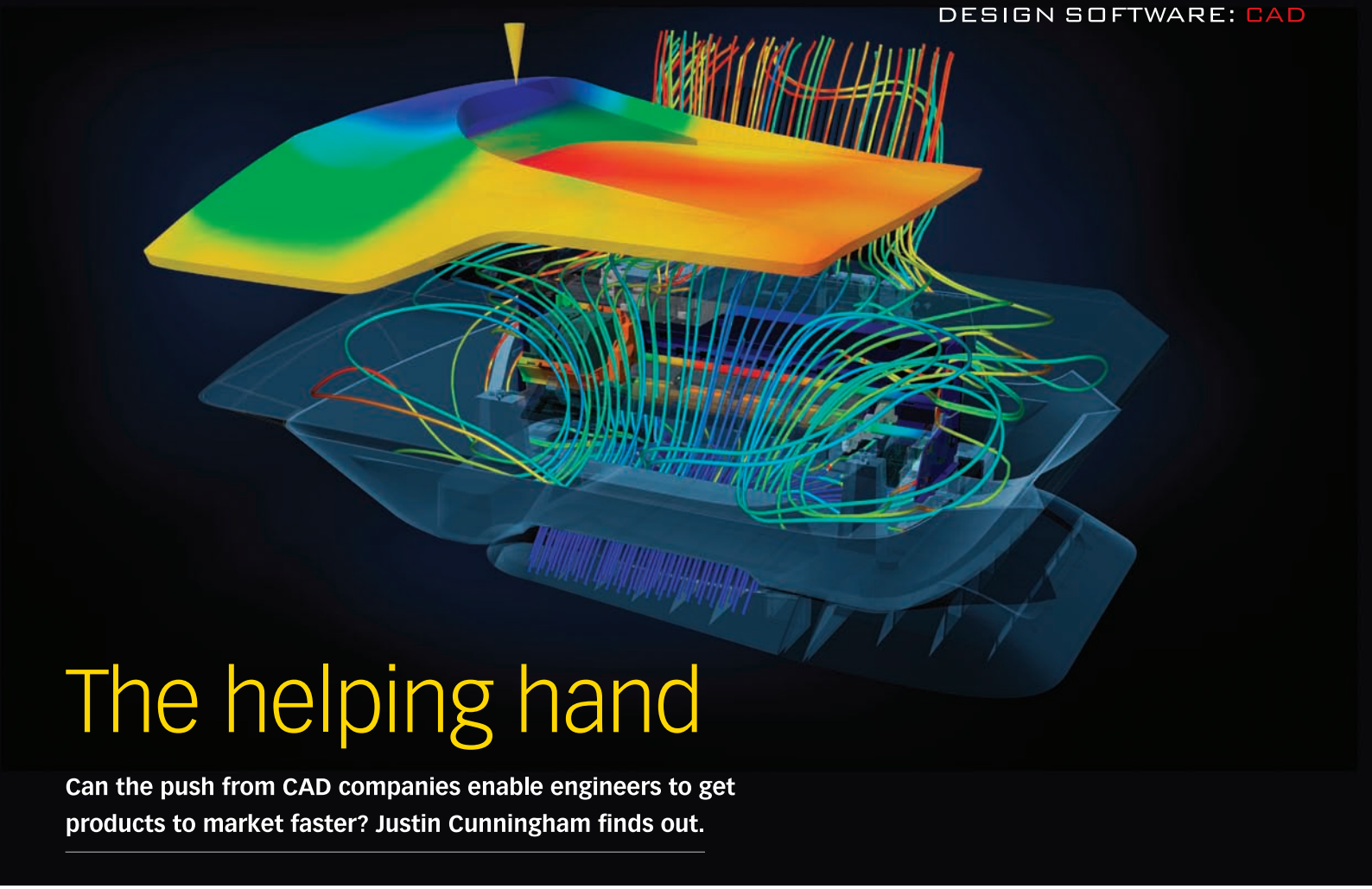


The helping hand

Can the push from CAD companies enable engineers to get products to market faster? Justin Cunningham finds out.

With only three months to go until the New Year, the CAD companies are already talking about what is on offer for 2013 and just what users can expect.

Autodesk has made the recent announcement that it is putting its simulation capability on the web. This is now available to users and 2013 will no doubt see an increasing quantity of its CAD and PLM portfolio migrate to the cloud.

"It is a change in our business model," says Erwin Burth, head of simulation sales EMEA at Autodesk. "Cloud-based technology is changing the way we provide our services to customers and also how we get paid for delivering those."

Delivering services over the cloud has no doubt many advantages. For starters, it means that provided there is sufficient bandwidth, almost infinite computing power is available. For simulation or renders that can take days on a desktop, this has obvious advantages.

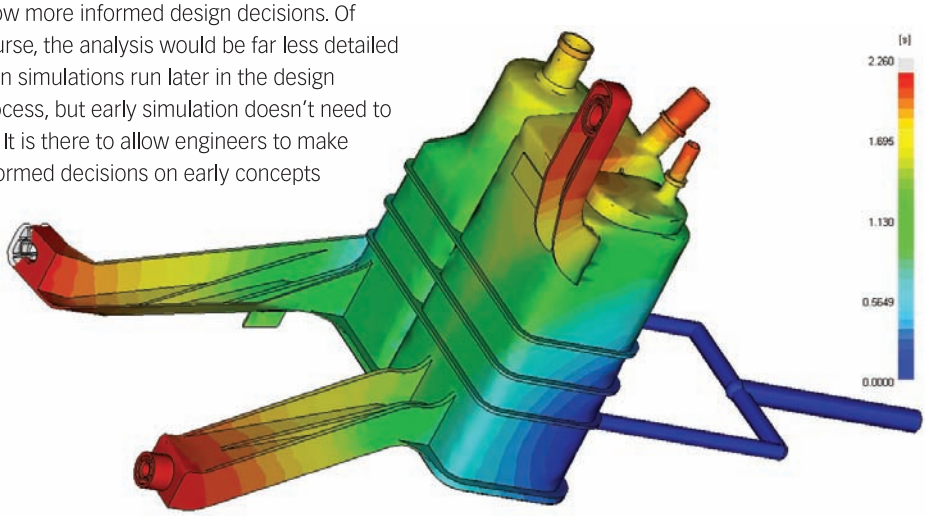
There is also usually a trade-off between computational time and accuracy, and working on the cloud helps alleviate this. It also means software upgrades can be instant, feedback on problems are not lost and it makes the bond between the user and CAD provider more tangible and perhaps more robust.

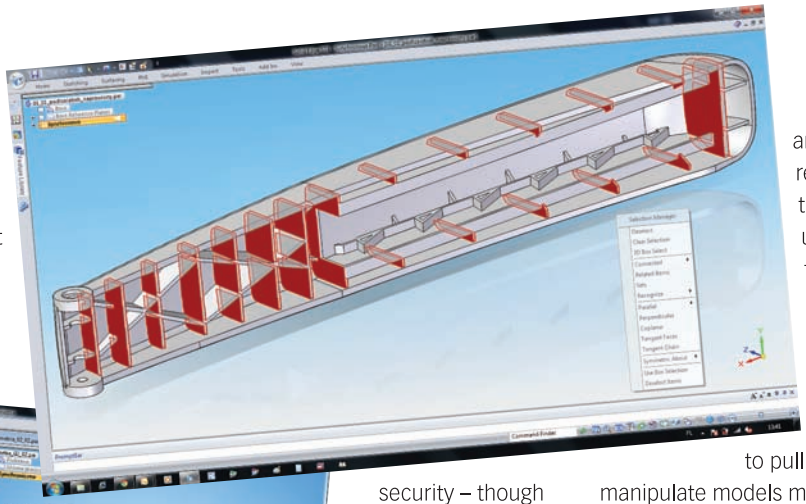
One of the key things Autodesk wants to achieve by offering simulation online (dubbed 'Simulation 360') is to bring the power of tools like CFD and FEA much further forward in the design process. One of the advantages of faster analysis is that multiple scenarios can be assessed at the same time.

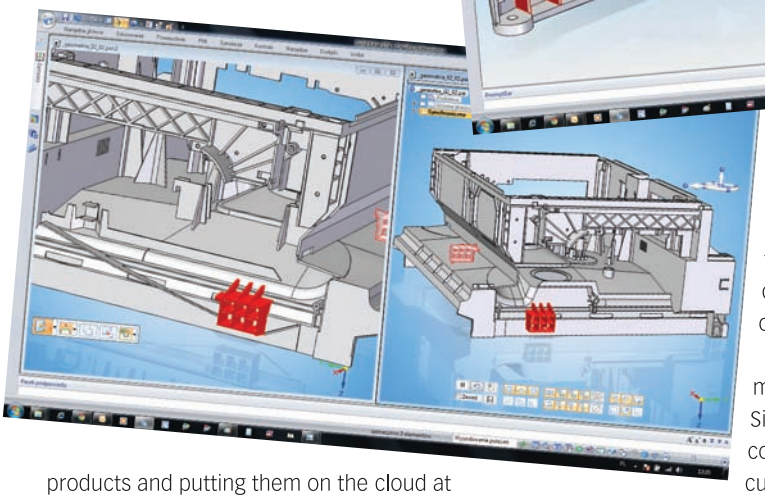
Applying this to conceptual design means multiple initial concepts can be analysed to allow more informed design decisions. Of course, the analysis would be far less detailed than simulations run later in the design process, but early simulation doesn't need to be. It is there to allow engineers to make informed decisions on early concepts and is not meant to replace the 'heavier' simulation that normally comes later. It is about empowering more users with simulation tools, not moving the process all together.

"Simulation software is often used by specialists, is not easy to use and can take days to run," says Burth. "Our strategy is to remove these barriers and give access to simulation to more generalist designers and engineers."

The company is also keen to note that this







approach is not about offering 'lite' versions of its software online as Jonah Normand, simulation sales for Northern Europe at Autodesk explains. "A lot of the time if you are looking for a low-cost solution, you also look at a low-functionality solution," he says. "But, we are taking our fully-featured simulation products and putting them on the cloud at an access point that is accessible for both small to medium sized businesses as well. It is not CFD or FEA lite, it is everything within our portfolio."

Changes that need to be done after detailed design work has happened are often both costly and time-consuming. Autodesk aims to give engineers who don't necessarily have FEA and CFD experience the ability to run some initial analysis and hopes this can highlight weak areas or thermal hot spots, for example, so they can be identified and reworked much earlier.

The ultimate aim of all this is to compress the design cycle to make it more accurate and get products to market faster. By empowering more engineers with these tools, it is hoped that more informed decisions can be made, and ultimately better products result.

The idea of having specialists on one side of the desk and engineers on the other, passing each other work that might have to be done overnight or perhaps even take a couple of days is something Autodesk want to show as being unnecessary when users have the ability to utilise services in the cloud.

There are criticisms, however: the biggest one being security. Autodesk says it keeps no data from the simulations whatsoever and that security – though often a concern of customers – needn't be. Ultimately, time will tell if customer concerns are warranted or not.

The other CAD giant making waves is Siemens PLM. It is continuing to get its customers to better utilise its products and shorten the design cycle. Siemens PLM software is immensely powerful and it boasts some tremendously large, multinational, customers to its name. One of the problems it continues to have, however, is actually getting users to exploit its capability fully.

Siemens, arguably, has a much broader portfolio of software on offer which falls under two umbrellas: its PLM function and its design engineering function. Though Siemens is not considering hosting its services on the cloud, it has been busy ensuring that its CAD and simulation offerings are what designers want. So what has the company done to help efficiency and productivity?

"We needed to get out of the way," says Karsten Newbury, a senior Vice President and general manager of Siemens PLM mainstream engineering software. "People have become so used to focusing on the tool and that is all wrong.

"The number of IQs that are tied up in doing history trees is outrageous. Smart people should be worrying about building a great product, adding value, finding solutions and what something should look like. Not worrying that if they make a change to the model it might break something."

Many of the big CAD and PLM giants have recognised in recent years the need to simplify the usability of software to free up engineers time to create. As a result, Siemens has developed a tool that, it claims, is intuitive. Its Synchronous Technology allows users to pull and push geometry and manipulate models much more freely.

There has been a lot of talk within the CAD industry, generally, about direct manipulation of models, though Siemens say this is not quite the same. Newbury describes Synchronous Technology as 'intelligent direct modelling'.

"We've made great strides with Synchronous," he says. "It makes it a lot more fun and easier to get excited about products when you are not worried about managing models and data. You are thinking about great designs, engineering, and products."

Since its launch, Synchronous modelling has been periodically improving and has moved away from the history based approach which proved difficult and time consuming to manage and change. Rather than creating a feature tree, it allows users to push and pull geometry in a much more free and open manner. However, one of the problems and the difficulties with direct modelling, generally, is if there is a hole in a part and the outside geometry is manipulated, the holes may distort, move, or perhaps not move at all.

However, Synchronous Technology uses all kinds of clever algorithms to look at a model and establish 'design intent'. Siemens claims this means the designer does not have to worry about having to redraw existing geometry to change one part, or that the model will do things that are unwanted.

"Imagine a wheel," says Newbury. "If you change one wheel, then it can be a big effort to change all four by direct editing. Imagine if you have four wheels and five assemblies. That is a huge amount of effort to change. We've had customers literally go from days to hours and hours to seconds in terms of changing geometry. The benefits can be huge."

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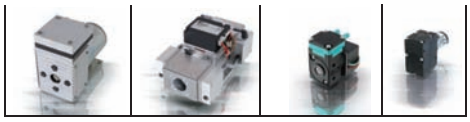

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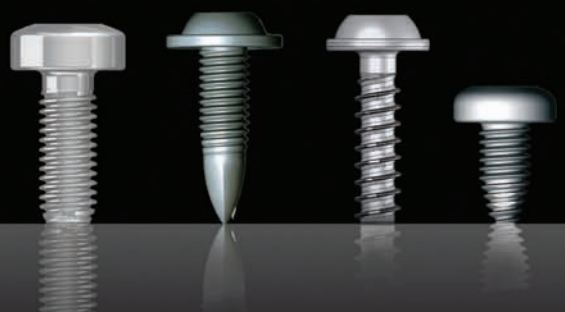

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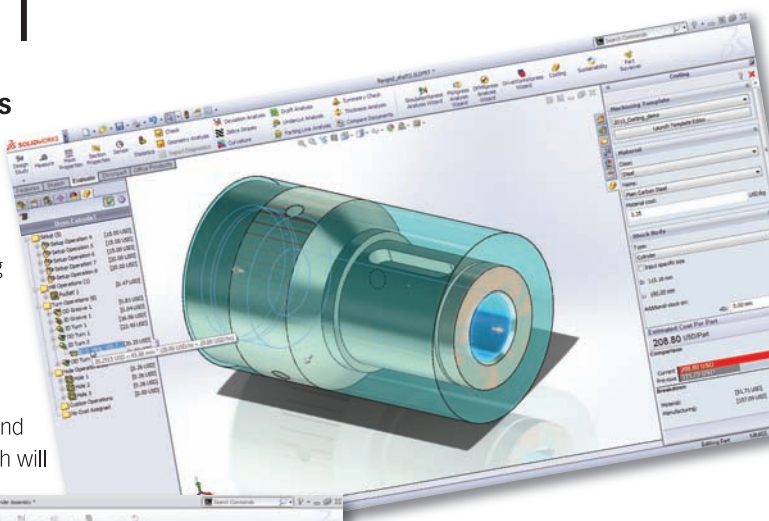
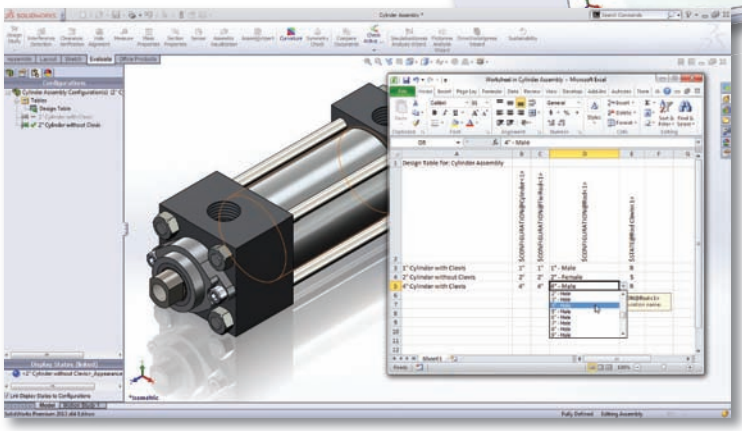
Update aims to simplify 3D design

With SolidWorks 2013 now released, Paul Fanning reports on some of the package's new features.



The newly-lauched Solidworks 2013 offers a number of interesting features that are likely to pique the interest of users. Indeed, many of these 200-plus changes (90% in fact, the company claims) have been driven directly by user requests.

One of the developments that Solidworks is most keen to trumpet is Conic sketch, which introduces the ability to create smooth transitions between existing geometries using true conic surfacing rather than borrowing spline curves from surface modelling programs. Using the new conic sketch feature, users are now able to create complex or hybrid models faster using surfaces, make a parabola, ellipse, or hyperbola tangent to existing geometry. In addition, this feature allows use of rho value for more precise control, while bridge curves between existing geometry can easily be created without using splines.



Also new to SolidWorks 2013 is an Intersect button, which allows the addition or removal of geometry without sketching. This can be used on a variety of surfaces, solids, and planes. Where there is an intersection of multiple objects, the user can specify what volume to keep and what to discard. Given that this previously required two or more steps, this is clearly likely to save considerable amounts of time.

Another new modelling feature of SolidWorks 2013 is the ability to use patterns with varying dimensions. This quickly creates variations of pattern instances with expanded SolidWorks patterning capabilities. This allows the user to select any feature dimension for variation and to override individual instance dimensions, thereby saving time and reducing the number of features.

Further features of SolidWorks 2013 include simulation sub-modelling and incremental meshing, which will allow users to perform precise simulation analysis for specific areas of large and complex models more accurately, faster and more efficiently. Meanwhile, Network Rendering for PhotoView 360 helps save time with faster rendering of photorealistic images by networking multiple computers to share the computational load.

Although perhaps strictly more of an administrative tool than a modelling one, the Dashboard function in SolidWorks 2013 is also of interest. Designed for CAD managers, administrators and all those tasked with monitoring system performance, the Dashboard will provide a comprehensive view of software performance, crash frequency, possible causes, and workstation statuses. Similar to a network administrator's system monitoring window, (albeit configured specifically for SolidWorks installations) This helps simplify management and troubleshooting of multiple SolidWorks users within a company from a single aggregated view. The Dashboard will be hosted on the SolidWorks Customer Portal and controlled by password.

To address the dispersed nature of most design teams, SolidWorks 2013 clearly aims at optimising collaboration with improved connectivity, enhanced viewing capabilities and expanded sharing of designs and data. Thus, it includes previous release interoperability (in other words, the ability to open SolidWorks 2013 files directly with SolidWorks 2012). This enables users to work more efficiently and improve collaboration and file exchange, reducing delays and easing the transition to the latest release.

SolidWorks Enterprise PDM workflow means that the routing documents and contacting of users is more efficient, while DraftSight/SolidWorks Enterprise PDM Integration facilitates access to DWG files within SolidWorks EPDM from the DraftSight user interface, and leverage 2D into the design process.

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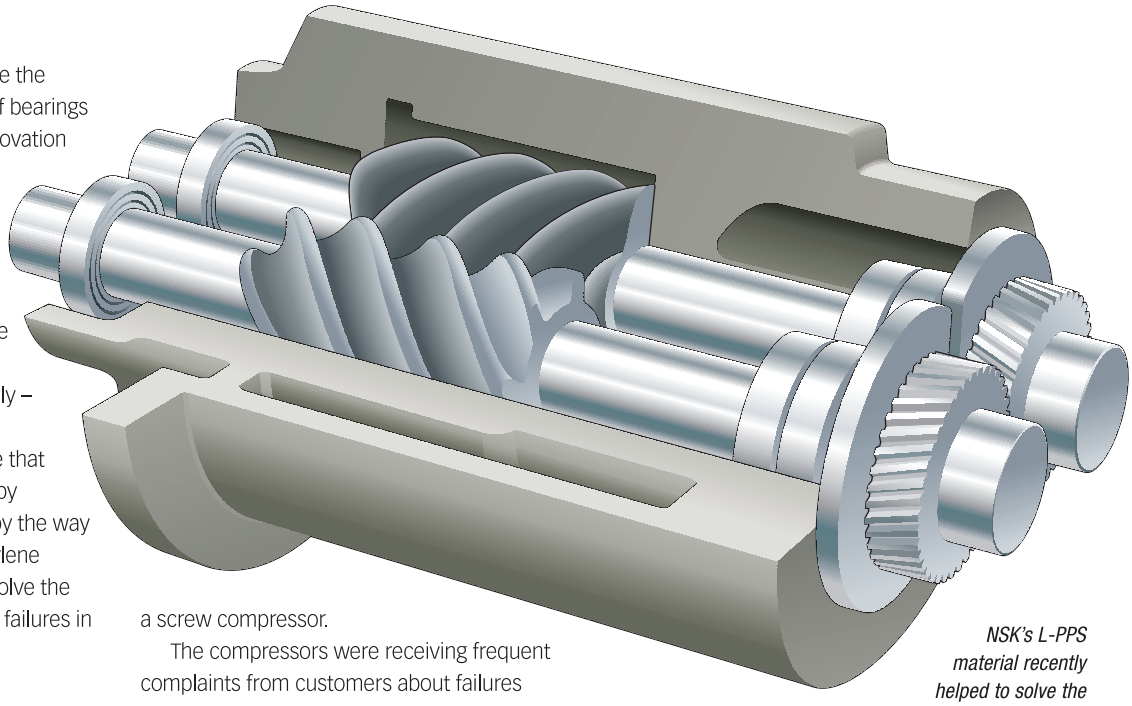
Coatings optimise bearing performance

With coatings playing an ever-larger part in improving bearing life and performance, Paul Fanning looks at some of the latest materials and applications.

The constant requirement to improve the performance and life expectancy of bearings means that this is an area in which innovation is frequent. However, the fundamental shape and dimensions of bearings do not alter often – not least because of the need to ensure that they are standardised. For this reason, the tendency is for innovation to take place either in the materials from which the bearings are made or – more commonly – in their coatings.

Quite how significant the difference that can be made to bearing performance by coatings can be is amply exemplified by the way in which NSK's L-PPS (linear polyphenylene sulphide) material recently helped to solve the problem of heat-induced bearing cage failures in a screw compressor.



NSK's L-PPS material recently helped to solve the problem of heat-induced bearing cage failures in a screw compressor

NKE's SQ171E coating can be used for standard or special bearings in wet or corrosive environments

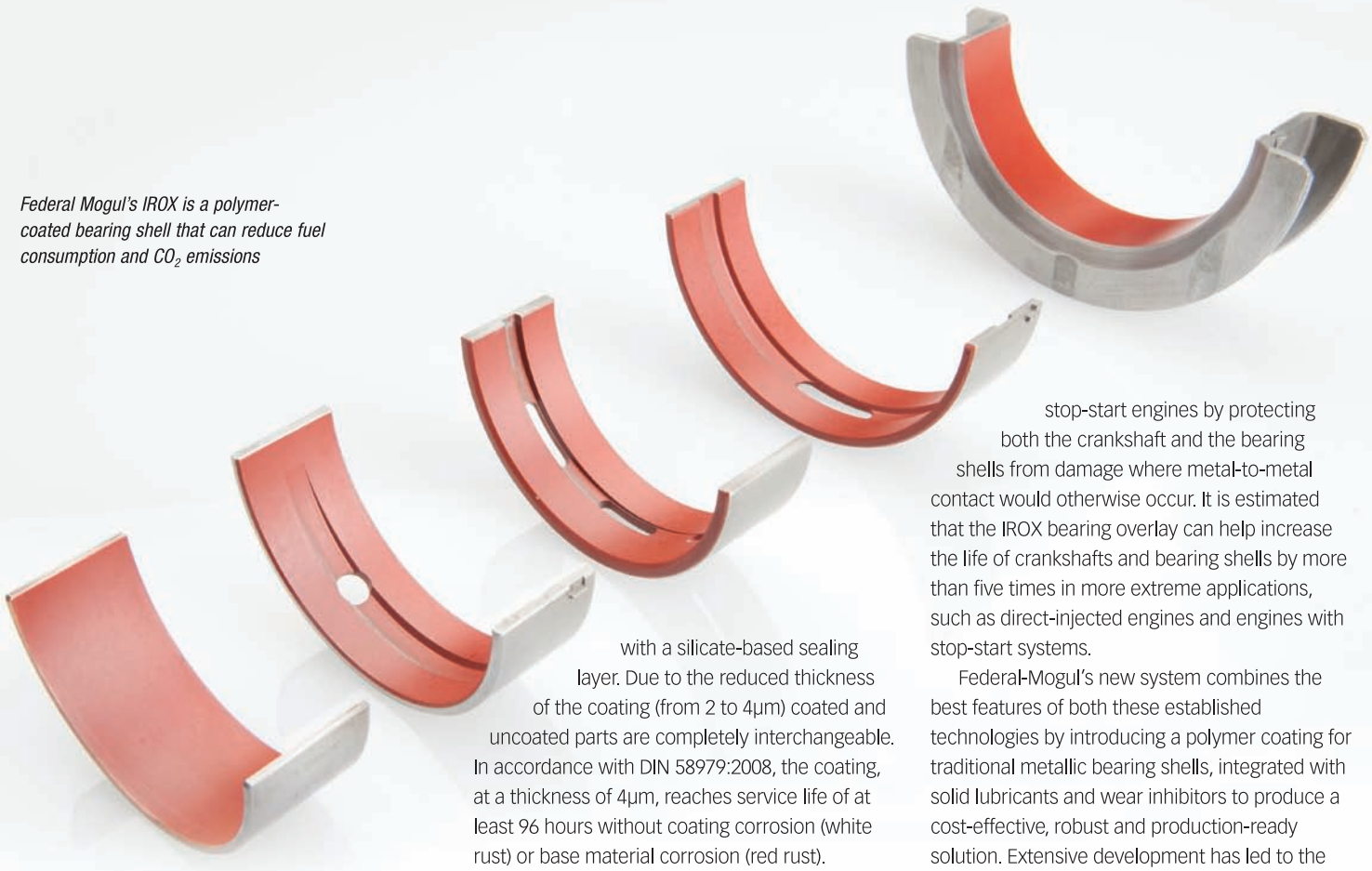
The compressors were receiving frequent complaints from customers about failures resulting from damage to the bearings. On closer inspection and analysis, the bearings showed the failures were caused during continuous 'hot' operation above 70°C.

NSK found the bearing cages were manufactured either from brass or polyamide and it was these materials that were failing prematurely. The brass cages exhibited stress corrosion cracking, while the operation of the polyamide cages were impaired by lubricant at high operating temperatures.

After examining the failed bearings, NSK recommended the use of bearings with cages made from L-PPS material. L-PPS was developed by NSK using a special manufacturing process and it has enabled bearings equipped with L-PPS cages not only to offer greater performance and life, but to provide these benefits at a competitive price to both brass and PEEK.

The problem experienced is not uncommon for screw compressors, which are facing an ever increasing demand from customers for trouble-free, longer life with fewer overhauls and maintenance. In addition to the greater load-carrying capacity and improved lubrication capability demanded from bearings, other key requirements are thermal and chemical stability.

L-PPS is a glass fibre reinforced plastic designed for high temperature use, at up to 190°C. The material also has a high level of chemical resistance and thermal stability.



Federal Mogul's IROX is a polymer-coated bearing shell that can reduce fuel consumption and CO_2 emissions

Bearings equipped with L-PPS cages also offer greater load carrying capacity and have much improved lubrication capability.

Although initially developed for compressor bearing applications, the advantages of bearings employing L-PPS plastic cages are applicable in other applications where high temperature and/or special conditions exist.

An instance of the efficacy of bearing coatings in corrosive environments can be seen in NKE's new SQ171E coating. This is even thinner and provides longer-lasting protection against corrosion than the previous version. The coating protects bearings and components in applications including material handling, agricultural machinery, chemical and pharmaceutical industries as well as compressors and pumps.

The SQ171E coating can be used for standard or special bearings as well as for all metal parts that are exposed to wet or corrosive environments. Indeed, it can even be used machined surfaces. The coating provides protection against water, condensation and slightly alkaline or acidic cleaning agents. Compared to uncoated components, parts coated with SQ171E have a significantly longer service life.

As an additional option for even more effective protection, the coating is also available with a silicate-based sealing layer. Due to the reduced thickness of the coating (from 2 to 4µm) coated and uncoated parts are completely interchangeable. In accordance with DIN 58979:2008, the coating, at a thickness of 4µm, reaches service life of at least 96 hours without coating corrosion (white rust) or base material corrosion (red rust).

The SQ171E coating has been tested with the neutral salt spray test method in accordance with DIN EN ISO 9227 NSS. The passivation does not contain hexavalent chrome Cr (VI) and is therefore compliant with the RoHS directive. The company also claims that, compared to stainless steel, the SQ171E coating is more cost-effective, yet offers better anti-corrosion protection.

In automotive applications, coatings can also have a massive impact. This is particularly the case as the drive for increased engine efficiency places demands on crankshaft bearings that require new designs and materials applications. The lubrication conditions at start up are very different from those that exist during high-speed, high-load operation. While solid lubricants or dry bearing materials are effective at preventing metal-to-metal contact at low running speeds, these conventional solutions are not suited to higher speeds, which require journal bearings with a generous lubricant supply.

To this end, Federal-Mogul has expanded the performance capabilities of engine bearings by developing an innovative polymer-coated bearing shell that can reduce fuel consumption and CO2 emissions by withstanding mechanical loads produced by heavily boosted engines. Called IROX, the new technology addresses the lubrication challenges associated with frequent engine restarts found in hybrid and other future stop-start engines by protecting both the crankshaft and the bearing shells from damage where metal-to-metal contact would otherwise occur. It is estimated that the IROX bearing overlay can help increase the life of crankshafts and bearing shells by more than five times in more extreme applications, such as direct-injected engines and engines with stop-start systems.

Federal-Mogul's new system combines the best features of both these established technologies by introducing a polymer coating for traditional metallic bearing shells, integrated with solid lubricants and wear inhibitors to produce a cost-effective, robust and production-ready solution. Extensive development has led to the identification and optimisation of a number of key parameters, including layer thicknesses, substrate material specification, resin binder properties, curing conditions and functional additive specifications, and a number of patents on the technology.

The IROX bearings have an overlay that is a PolyAmideImide polymer resin binder containing a number of additives dispersed throughout the matrix. These additives provide a variety of properties to the finished coating, such as wear resistance, mechanical strength, thermal conductivity and in their ability to safely envelop loose abrasive particles).

Test results have shown a dramatic improvement in life compared to both conventional shell materials and state-of-the-art competitors. Typical bearings with aluminium overlays show significant wear after 100,000 stop-start cycles. However, the new generation of engine systems requires 250,000 to 300,000 cycles. However, claims Federal Mogul, in comparison tests where conventional aluminium overlays showed 100 microns of wear and lead-free bronze showed up to 50 microns, those with the IROX overlay still looked like new with a measurable wear of just a few microns.

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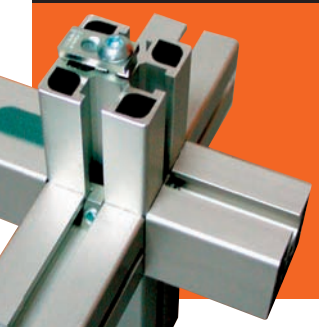

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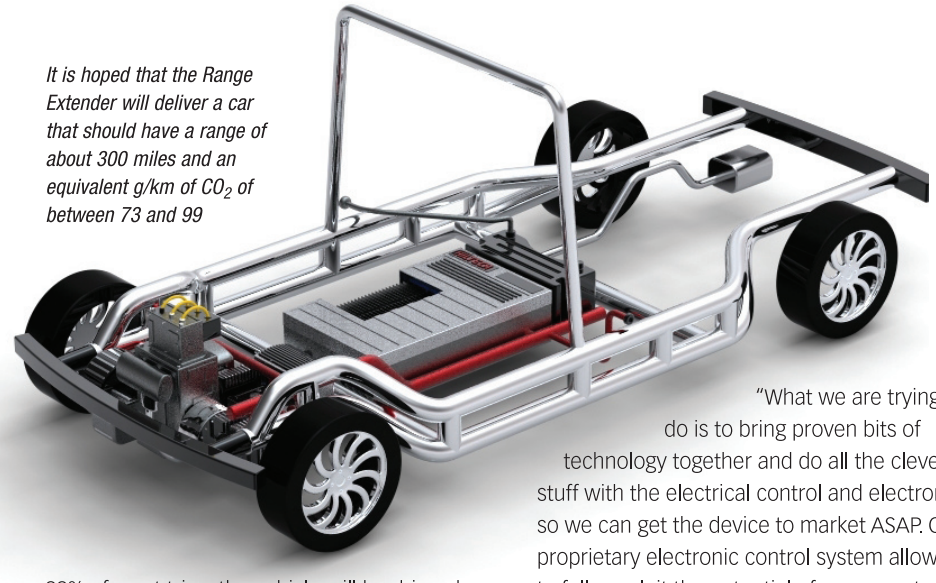
Anxiety management

Justin Cunningham talks to the UK company using an internal combustion engine to 'hybridise' electric vehicles and remove range anxiety.

Electric vehicles (EVs) are increasingly being used, but at the moment they remain restrictd to niche applications on inner city roads. In part, this is because EVs have two main barriers to entry: cost and range. As far as cost is concerned, it is hoped that, with higher volumes, purchase cost will come down. This in turn will help to introduce EVs in to the second hand market, which will be when they really start to hit the mainstream.

However, none of this can happen if EVs do not address the fundamental problem of range. Admittedly, research shows that most roundtrips cover under 100 miles, which is just about within the range of most of today's EVs. However, some journeys are longer. And most people will not pay more to get less. People want more and that means a range in the region of most internal combustion engine cars.

Northampton-based Hyperdrive has come up with an interesting take on the problem, flipping the notion of a hybrid on its head. It has introduced a small internal combustion petrol engine that plugs in to the battery system of an existing electric vehicle. Known as the Range Extender, the system is designed to turn on during longer journeys, to charge the batteries. However, for the shorter journeys that make up 99% of most trips, the vehicle will be driven by its electric system. It has already been installed on a demonstration electric vehicle, the Avid CUE-V, with promising initial results.

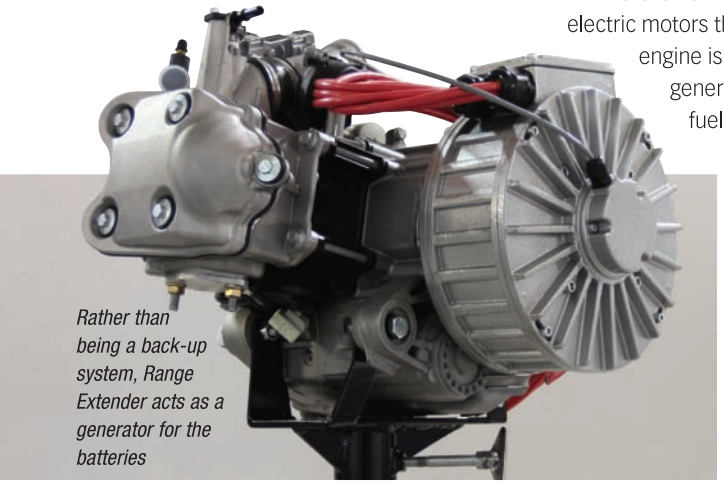


It is hoped that the Range Extender will deliver a car that should have a range of about 300 miles and an equivalent g/km of CO_2 of between 73 and 99

"We started with an open mind and considered many quite radical ideas," says Chris Baylis, managing director of Hyperdrive. "These included two-strokes, rotaries and gas turbines as well as more traditional solutions. Each one was evaluated against a pragmatic list of requirements that included cost, refinement, weight, emissions and risk."

There is no link between the engine and the electric motors that drives the wheels. The engine is purely there to act as a generator for the battery system. The fuel tank is also significantly smaller than normal cars as well, likely to be around 15-20 litres on a D-segment family car. The result, it is hoped, will be a car that should have a range of about 300 miles and an equivalent g/km of CO_2 of between 73 and 99.

"The engine has been carefully selected for this application," says Baylis.



Rather than being a back-up system, Range Extender acts as a generator for the batteries

"What we are trying to do is to bring proven bits of technology together and do all the clever stuff with the electrical control and electronics so we can get the device to market ASAP. Our proprietary electronic control system allows us to fully exploit the potential of near constant-speed operation to deliver greatly improved power density."

Hyperdrive's Range Extender is based on a single-cylinder, water-cooled four-stroke engine that has been selected for its low cost and optimisation for the unique usage pattern of this application. The 60kg unit delivers 15kW at 5,000rpm, sufficient to allow the vehicle to cruise at 60mph without depleting the batteries.

Baylis believes this system offers the highest energy density of any comparable system on the market today and further development will allow for a substantial reduction in the size and weight of the battery pack and of associated systems such as cooling and power electronics. The cable-free design integrates LiMnCo Pouch Cells with Hyperdrive's Battery Management System in a scalable, modular design that can also be supplied for other chemistries.

"If you commuted to central London, you could drive in with Range Extender and then switch to total EV mode for the Emissions Zone and Congestion Charge," says Baylis, "so there are different ways you can use it. It can scale up and down, so has potential to be used on all sizes and types of vehicles."

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Filler/breather assemblies for top or side entry, magnetic core and drain plugs and fixed thermostats for high temperature sensing complete the range.

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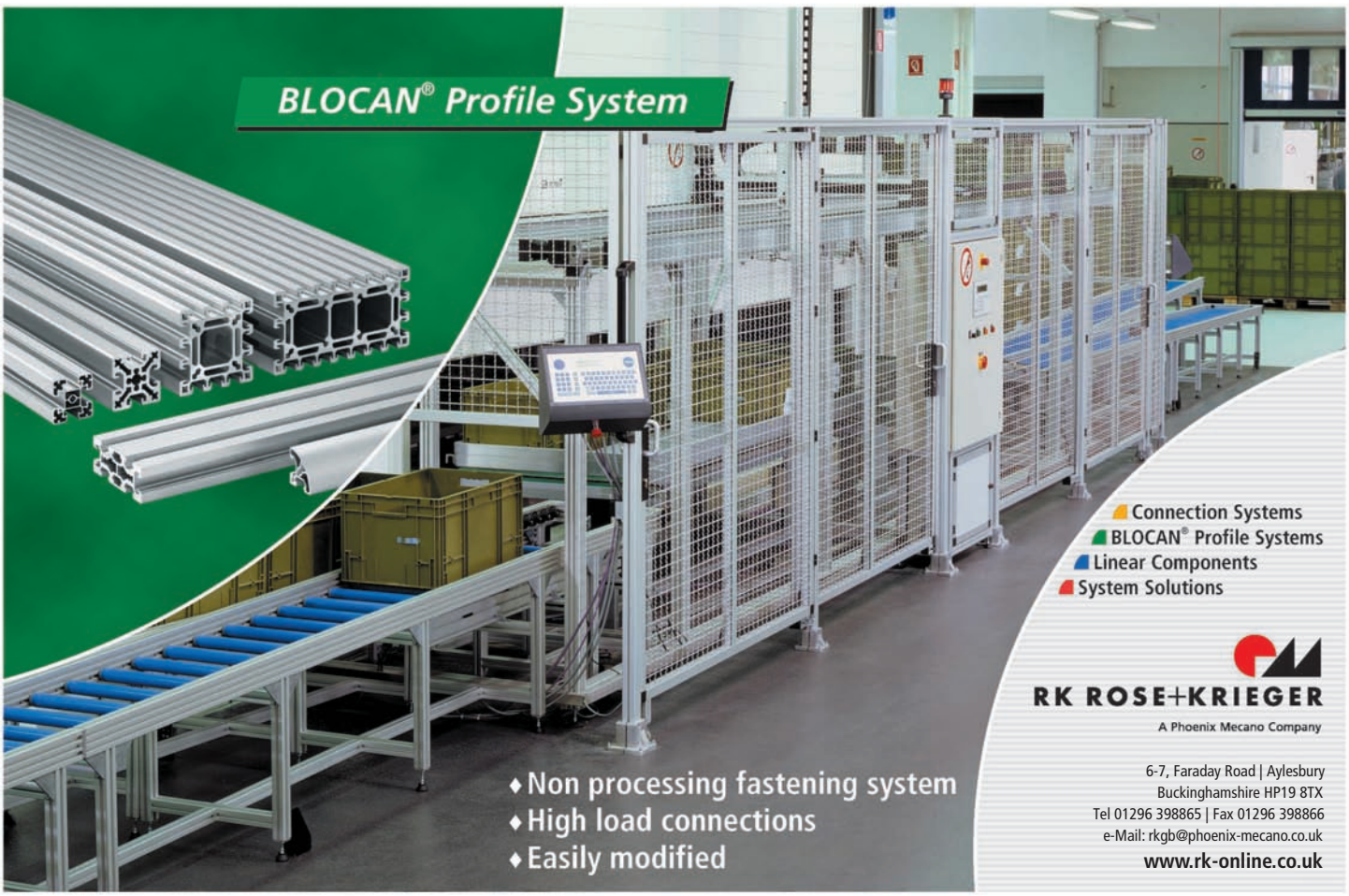


Fresh ideas open up new potential

Despite being mature technologies, there is still plenty of innovation to be found in the hydraulics and pneumatics sectors. Justin Cunningham reports.

Hydraulics and pneumatics are often viewed as fairly mature industrial components with application, rather than technology, standing out. Nonetheless, some recent innovations are worthy of note.

The first comes from the US-based Technetics Group, which has introduced a weight-saving composite overwrap accumulator designed specifically for reliable, lightweight and maintenance-free applications.

Accumulators ensure there is sufficient hydraulic pressure when it is required. In turn this allows pumps to be smaller, which is a key factor in the modern drive for weight saving, particularly in aerospace applications.

Typical applications for Technetics accumulators come from the aerospace industry and could include flight control actuation systems, propeller pitch control, braking, and control surfaces. Similarly, they could be used by the oil and gas industry for applications such as blowout preventers (BOPs), where instant hydraulic actuation is critical to safety.

Weighing in at approximately 1.5kg, the Technetics Composite Overwrap Accumulator is 66% lighter than an equivalent high-strength steel accumulator. The weight reduction is

achieved by applying a carbon fibre overwrap to the outside of the accumulator's metal liner. The carbon fibres can stand the same internal pressures and loadings compared to a metallic vessel, but at a fraction of its weight.

The accumulator uses Technetics' proven Belfab edge-welded metal bellows, which are available as either titanium, for specific critical applications, or stainless steel. Belfab bellows are long-lasting, and are tested to withstand 10 million full stroke cycles.

Unlike accumulators that use bladders, or pistons and 'O' ring seals, the Belfab bellows are hermetically sealed, meaning that periodic services such as replacing charge gas are not required. This makes the accumulator ideal for difficult-to-access airframe locations and long-term space applications.

Another innovation comes from JBJ Techniques in the form of its low-noise, low-pulsation gear pump. The teeth profile of the gear within its Elika pump eliminates air encapsulation, which can be a significant cause of noise and vibration. This reduces noise by an average 15dBA compared to conventional equivalents.

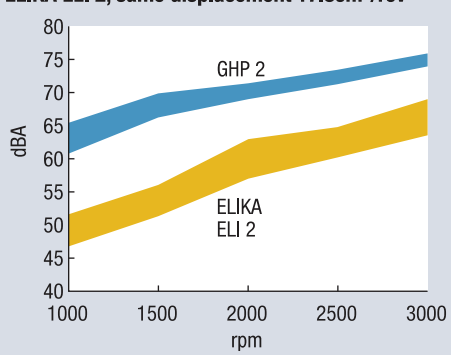
The pump's configuration minimises internal leakage, making it suitable for work operations at low speeds and high pressures. Also, due to its wide rotational speed range, large working pressure, and viscosity bands the new pump is suitable for a wide range of applications.

Dubbed the ELI2, it has a displacement range between 7 and 35cm³/rev, a maximum operating pressure of up to 300bar, and is easily interchangeable with the standard group of two gear pumps. Its helical gear ensures its continuity of movement and the low number of teeth and shape of the profile significantly reduces pressure oscillations and vibrations during operation, reducing the noise of the hydraulic system. Axial forces induced by the helical teeth are balanced in all conditions by the axial compensation system in the pump cover.

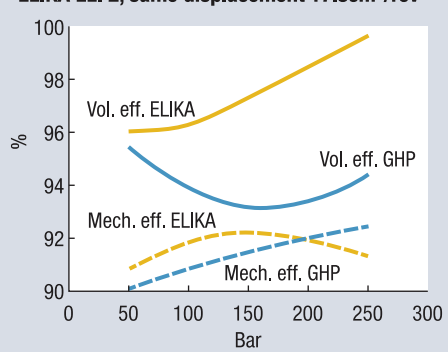
Specific compensation areas in its flange and cover are insulated by special gaskets and reinforced with an anti-extrusion allowing free axial and radial movement of the bushings. In this way, internal leakage is reduced, ensuring good volumetric and mechanical pump performance as well as proper lubrication of the moving parts.

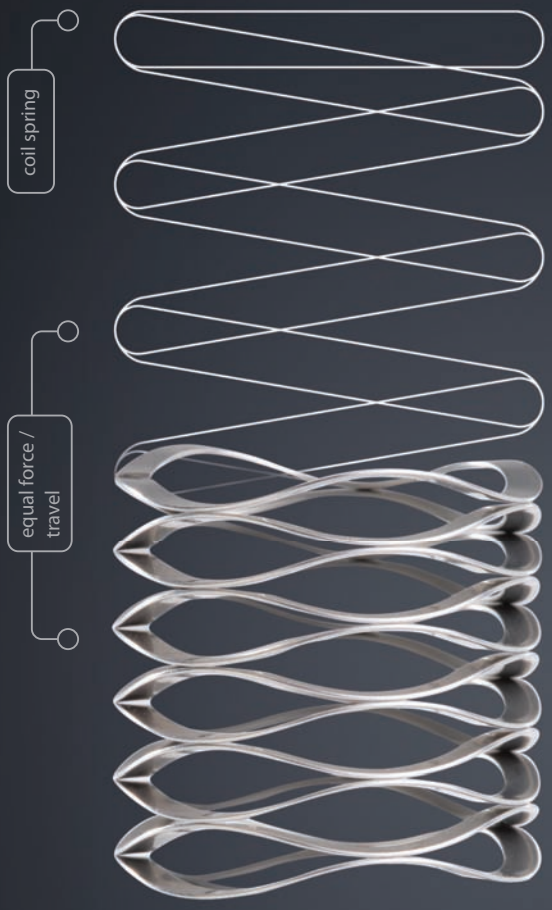
www.techneticsgroup.com
www.jbj.co.uk

Noise pump comparison [dBA] Marzocchi GHP2 ELIKA ELI 2, same displacement 17.8cm³/rev



Efficiency pump comparison [%] Marzocchi GHP2 ELIKA ELI 2, same displacement 17.8cm³/rev





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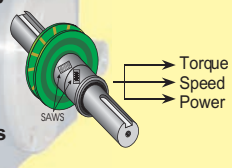

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Hydrogen cells make the leap

Fuel cell-powered electric vehicles are here and will be in showrooms from next year. Paul Fanning looks at a British company that is making this happen.

The traditional, cynical line about hydrogen fuel cells is that hydrogen is the fuel of the future…and always will be. However, one company that definitely does not subscribe to this philosophy – indeed is doing more than most to prove it wrong – is Loughborough-based Intelligent Energy.

Formed from a spin-out from Loughborough University, Intelligent Energy is a leading power technology company with some of the most advanced PEM (proton exchange membrane) fuel cell stack technologies available in the world today. Each features class-leading power densities and robust metallic construction, novel cooling and water management, plus proven durability lifetime test performance. What is more, all of these technologies are proprietary to the company.

Rather than simply being a derivative of conventional architectures adopted elsewhere, Intelligent Energy's PEM fuel cell technologies are – it claims – unique. They are more compact and far simpler than conventional fuel cell systems and are easily integrated within a diverse range of applications. Developed over a period of 20 years, its proprietary systems have won worldwide acclaim.

Integrated humidification and innovative cooling (without the need for secondary coolant circuits or external humidification) reduces the component count within the stack, and eliminates much of the conventional balance of plant, resulting in power generation systems that are compact and highly reliable, having been tested over many thousands of hours of operation.

Full power can be achieved from these systems almost instantaneously at room temperature. The company's 7 series power systems, for example, take less than 60 seconds at –25°C. In fact, Intelligent Energy has successfully started such systems from as low as –40°C and continues to improve and innovate in this area.

Proton Exchange Membrane (PEM) fuel cells are the most versatile of all fuel cell types. This versatility is due to their high power densities, modular construction, relatively low operating temperature (between 40°C and 100°C) and the solid polymer electrolyte. PEM is considered to be the most promising of fuel cell types for mass market application and is being developed for stationary, portable and vehicle markets.

PEM technology offers a number of advantages that make it suitable to a very wide range of applications. For instance, because the cells contain a solid (rather than liquid) electrolyte, they are less sensitive to shock and vibration than other fuel cell types and thus better suited to portable and motive applications.

PEM fuel cells also have a higher power density than all other fuel cell types and therefore can be more compact. As a result, they are more suitable for applications – such as automotive – where lower volume and weight are critical factors. In addition, because PEM fuel cells operate at relatively low temperatures (typically 80°C and lower), there is less need for exotic materials, making PEM cells more suitable for mass market applications.

Another factor that particularly suits PEM fuel cells to automotive applications is that they are able to vary their output quickly to meet shifts in power demand and are suited for applications where quick start-up and high power quality are required.

Intelligent Energy developed the ENV (Emissions Neutral Vehicle), a purpose-built, fuel cell-powered motorcycle

Far from being a pipe dream, if Intelligent Energy has its way, hydrogen fuel cell-based cars will be a fairly common reality on our streets as little as a year from now. Indeed, thanks to the efforts of the company, a number of vehicles are already there.

The suitability of its technology has seen Intelligent Energy at the forefront of some of the more striking applications of hydrogen fuel cells in this country. One of the most high-profile of these took place when it led a consortium dedicated to introduce zero emission fuel cell electric taxis to London. This involved the use of PEM-based powertrains into TX4 taxis from the London Taxi company. These fuel cell and lithium battery-powered electric hybrids provided a 250-mile driving range while retaining all the passenger and luggage space of a conventional London taxi.

The five hydrogen fuel cell-powered taxis provided by the HyTEC (Hydrogen Transport for European Cities) project were used during this summer's Olympics to transport VIPs, having been fuelled at Air Products' hydrogen fuelling station at Heathrow airport.

The company also developed what it claimed to be the first purpose-built fuel cell motorbike. Called the Emissions Neutral Vehicle (ENV) first appeared in prototype form in 2005 and was powered by a 6kW 48V motor, with energy supplied from Intelligent Energy's 1kW hydrogen fuel cell.

Building on this knowledge base in the area of two-wheeled vehicles, Intelligent Energy has gone on to establish a joint venture company with Suzuki called SMILE FC System Corporation, to develop and manufacture air-cooled fuel cell systems for a range of industry sectors. The joint venture also includes a non-exclusive license agreement that gives Suzuki access to Intelligent Energy's class-leading fuel cell technology for its next generation of environmentally friendly fuel cell vehicles.

In 2011, this agreement resulted in the Fuel Cell Burgman Scooter became the world's first fuel cell vehicle to achieve European Union Whole Vehicle Type Approval (WVTA). Equipped with Intelligent Energy's air-cooled fuel cells, the Burgman is able to offer a range of over 200 miles between hydrogen refills – each of which takes less than five minutes.

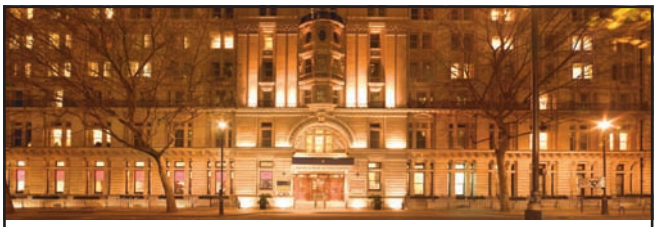
The most recent development for Intelligent Energy has been the announcement of a partnership between the company and international engineering consultancy Ricardo. The companies are to work together in applying their respective expertise in advanced low carbon vehicle engineering and fuel cell power technology platforms. The new partnership will provide customers with a fully integrated design, engineering and implementation capability for fuel cell electric vehicles.

The two companies have a proven track record of successful collaboration in engineering and development programmes and believe that their combined capabilities will provide significant synergies in the delivery of successful fuel cell electric vehicle projects. Intelligent Energy's proprietary fuel cell power technology platforms are targeted at production automotive as well as stationary power and consumer electronics applications. These fuel cell technologies will be the initial focus of the collaboration between Ricardo and Intelligent Energy, which remains non-exclusive on either side but with each partner regarding the other as a preferred supplier.

Speaking about this partnership, James Batchelor, managing director of Intelligent Energy's Automotive Division made it clear that the company believes its technology will see it at the forefront of fuel cell cars in years to come, saying: "Our cost-effective and scalable systems and platforms have already proven themselves across our target market sectors and we are increasingly asked to deploy our high-efficiency, zero-emission powertrains into vehicle and fleet trials, ahead of automotive market commercialisation."

www.intelligent-energy.co.uk
www.ricardo.co.uk

Intelligent Energy's PEM fuel cell-powered London taxis were introduced during the Olympic Games this summer



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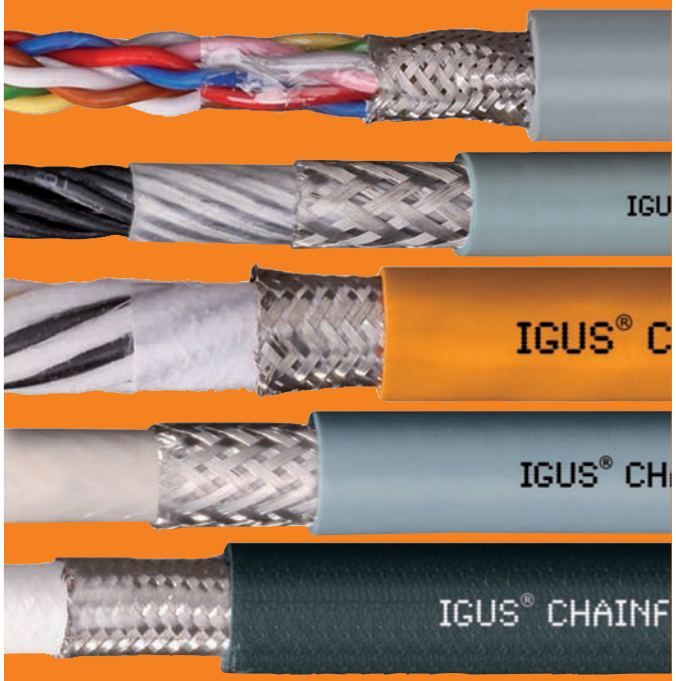

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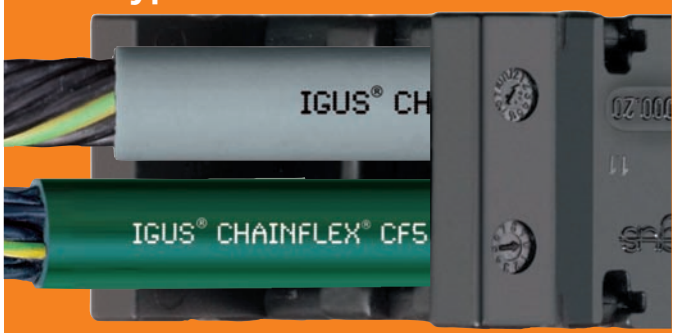

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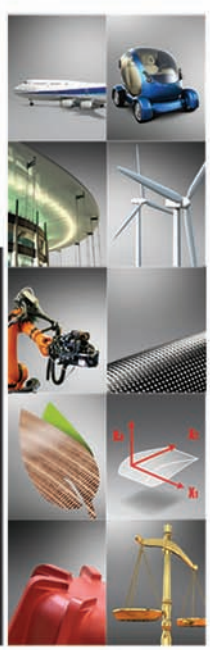

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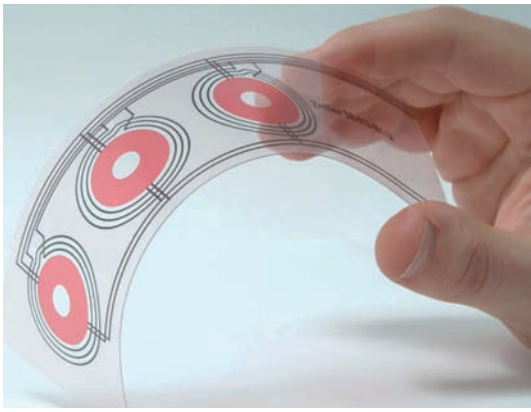
Inductive advantage

What are the benefits to be gained by using inductive sensors? Justin Cunningham finds out.



The recent surge in the number of capacitive sensors has been largely driven by the use of touch sensors for touch screens. Capacitive displacement sensors work by measuring the change in capacitance and essentially detect the presence of a finger, so act as a push switch. Capacitive techniques can, however, be affected by temperature which changes resistance and causes a disturbance to the position measurement.

Inductive sensors, on the other hand, use alternating current to 'induce' a current to flow in an opposite direction in a second conductor allowing position and speed to be measured. But, unlike capacitive methods, inductive techniques are much less affected by foreign matter such as water or dirt, and temperature fluctuations which can cause a problem. These are negated by using multiple receive coils to calculate the position from the ratio of the received signals. This robust, reliability has meant that inductive sensors are used in areas where harsh conditions are common such as defence, aerospace, industrial, and oil and gas sectors.

However, though a superior sensing technique, it is yet to really be used by the mainstream. The reason is traditional inductive sensors use a series of wound conductors or spools which must be wound accurately to achieve accurate position measurement and achieve strong electrical signals making them bulky, heavy and expensive.

To overcome this, Cambridge-based Zettlex's technology, uses printed, laminar constructions rather than wound spools to allow the same inductive principles to be used. This means that the coils can be produced from etched copper or printing on a wide variety of substrates such as polyester film, paper, epoxy laminates and even ceramics.

The printed constructions can be made more accurately than windings and offer improved measurement accuracy at a lower cost, bulk and weight while maintaining the stability and robustness of the inductive technique.

Since inductive techniques work at greater separation distances than capacitive techniques, this allows the principle components of inductive position sensors to be installed with relatively relaxed tolerances. This helps to minimise the cost of both sensor and host equipment and enables the principal components to be encapsulated to withstand very harsh local environments such as long-term immersion, extreme shock, vibration or the effects of explosive gaseous or dust-laden environments.

Electromagnetic noise susceptibility is often cited as a concern by engineers considering inductive position sensors. The concern is misplaced however, given that resolvers have been used for many years within the harsh electromagnetic environments of motor enclosures for speed and position control.

Though some engineers are confused between capacitive and inductive position sensors, as both use a non-contact technique to measure position, the underlying physical principles are very different with each technique suitable for particular geometries and applications. However, Zettlex believes many of the disadvantages of using inductive sensors can now be overcome, and that they offer a better solution to capacitive sensing technology.

www.zettlex.com

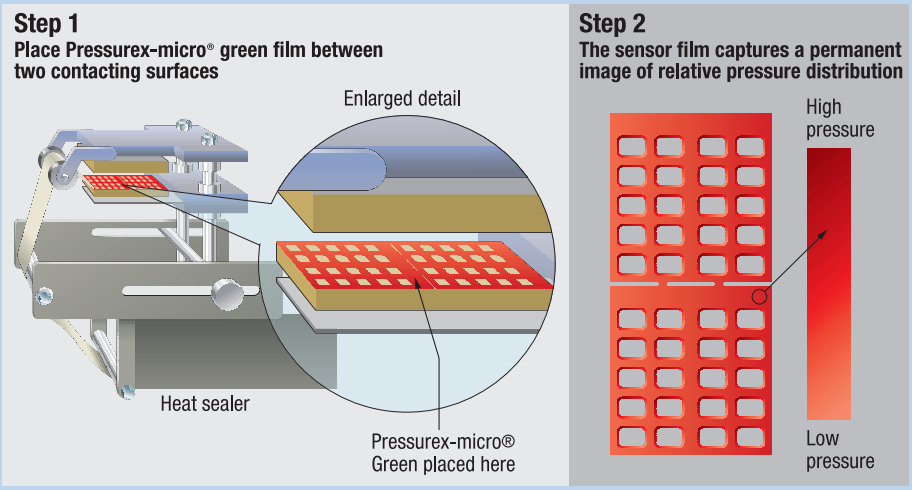
Film in colour

A 'low-tech' pressure sensitive film has been introduced by US based Sensor Products. Its Pressurex-micro Green (PMG) is a tactile surface pressure mapping sensor film and can yield both high-resolution and visual detail for fast, accurate surface contact stress analysis.

PMG comes on a roll and can easily be cut with scissors to the desired sizes and shapes required for an application. The thin 8mm film can be adhered to bolted interfaces, impressions between rollers or lamination presses and provides a colour changing visual indicator to reveal the surface contact force between any two surfaces.

The colour change is instantaneous and permanent, the more intense the colour the higher the pressure. The rolls are consumable and ready to use out of the box with no training, setup, electronics or instruments required.

www.sensorprod.com



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Sensing technology ensures safety

Autonomous Guided Vehicles or AGVs are now a common sight in factories and warehouses. Here, Paul Fanning looks at some of the technology used to make them safe.

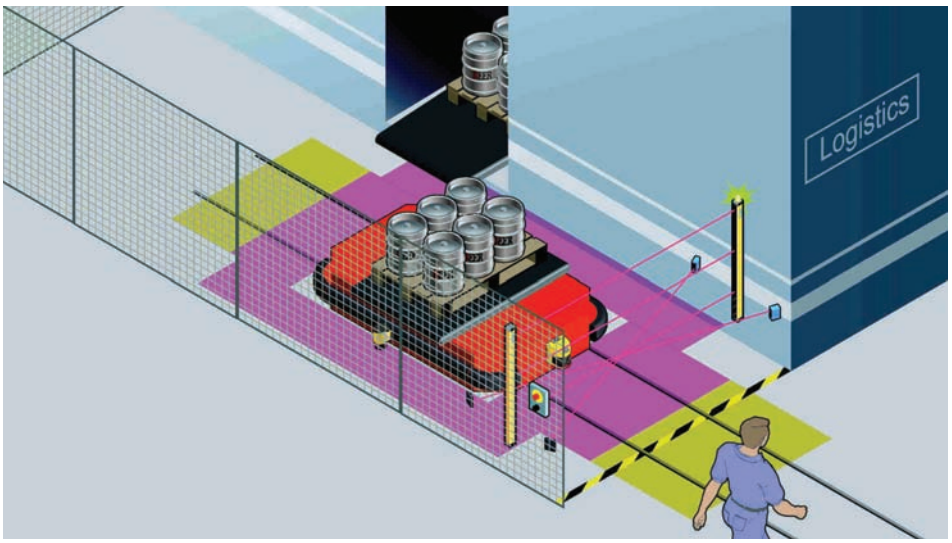
The sight of Autonomous Guided Vehicles (AGVs) travelling unaided around a factory is one that takes some getting used to. However much you remind yourself that these devices are safe, it nonetheless remains unnerving to see them travelling at reasonably high speed with no human beings controlling them.

Step too close to one, however, and you will immediately see how it is that these vehicles can work at such speeds in close proximity to vulnerable human bodies. They will stop long before there is any likelihood of them hitting a person. The reason for this is the increasingly sophisticated array of anti-collision sensors with which they are equipped, having achieved safe, non-contact detection of personnel in the path of moving vehicles travelling along complex paths and production layouts.

Prior to laser techniques, contact bumpers physically detected obstacles by deformation and activated an associated mechanical switch. The approach speed of an AGV therefore had to be limited to the impact force required to activate the collision detection system before it could cause harm.

The introduction of the laser scanner immediately allowed the AGV to travel faster as it was a collision prevention system which could detect oncoming obstacles way before impact. Thus the AGV could travel faster, increasing its hourly load capacity and ensuring safety.

Seb Strutt, senior product manager at Sick UK, explains: "Safety laser scanners scan their surroundings in a fan shape and measure distances using the 'time-of-flight' measurement principle[whereby the sensor assesses the distance from an object based on the time taken for a light pulse to be returned]. As soon as a safety laser scanner detects an object in the pre-programmed hazardous area, it switches off the OSSD (Output Signal Switching Device) causing the vehicle to stop. Warning fields can be also defined so that objects are detected before reaching the hazardous area."



Laser scanners on mobile vehicles usually have three zones configured to. If a pedestrian enters the outer zone, a warning alarm may be sounded, in the middle zone the vehicle may decelerate and in the inner zone only would an emergency stop be triggered.

Developments in scanner technology have continued and scanners now have detection ranges allowing safety fields up to 7m. Multiple fields up to 64 zones can be configured to provide high-performance and flexibility for complex vehicle paths as the AGVs turn and change direction to follow their routes.

The ability to integrate laser scanners with other sensing technologies can also be a major advantage. In particular, laser scanners have the ability to safely measure the speed of a vehicle via inputs from encoders fitted to the vehicle. Based on the measurement, the detection field is automatically adjusted.

As technology has developed, the size and power requirements have reduced, allowing application of the technology on to much smaller guided vehicles. One such example is the compact machines developed by the UK's largest AGV manufacturer, JBT. JBT's guided vehicles are used in hospitals, manufacturing plants and warehouses and minimising vehicle size can be very important for customers who want to minimise the aisle widths.

Inevitably, this concept now extends beyond AGVs and can be applied to transfer cars and shuttles as well as complex access control applications where field switching is required. Equally, the technology can be applied to new machines as well as being retrofitted to existing ones.

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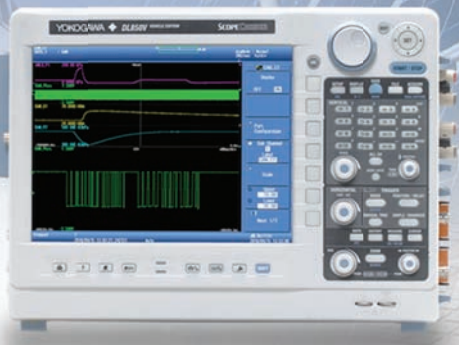

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Material demand drives show growth

The Composites Engineering Show takes place at the NEC Birmingham on the 7th-8th November. Here, *Eureka* offers a foretaste.

Increased demand for high-performance, lightweight materials is being reflected in the growth of the 2012 Composites Engineering Show, according to organisers.

Building on the success of last year's (2011) Composites Engineering show, held at NEC Birmingham, the 2012 event promises further significant growth and to again bring together all sides from this rapidly expanding technology sector, around the event which will this year be moving to Hall 1 at the NEC on 7-8 November, 2012.

Ian Stone, managing director of show organiser UK Tech Events comments: "Year on year we are seeing very strong growth in both the volume of speciality exhibitors from the UK and overseas as well as expanding and more diverse industry attendee groups." With the show seeing major growth in both its footprint and the number of exhibitors, the 2012 composites show floor is already attracting a major influx of new international and domestic exhibitor names, including: Azelis Composites; AIM Composites; LAMILUX-Heinrich Strunz; PECOLIT Composites; Matrix Composite Materials; Axson Technologies; Ipeco Composites; Zotefoams; Natural Performance Materials; Cygnet Integrated Solutions; Mirka (UK); Cutwel; Permabond Engineering Adhesives, Hydromar, Engis UK and Intrinsys to name but a few.

Organiser UK Tech Events believes demand for high-performance composite materials is growing at an "unstoppable rate" and that this is reflected in the show's growth

With an increase in international exhibitors signalling a growing desire to reach the UK's developing composites market, plus a high proportion of repeat exhibitors increasing stand space for larger displays, it is likely that the show will see total composites exhibitor numbers reach 200+, representing an impressive 35% growth.

Stone continues: "The demand across product design and development teams for lightweight, high performance composite materials solutions is growing at an unstoppable rate and the show is, uniquely and importantly, positioned to showcase the diversity of composites materials, design, processing and fabrication capability as well as supporting infrastructure available to harness for the successful execution and delivery of current and future composites engineering programmes"

Reflecting the growing importance of the show as the UK composite industry's biggest networking and technology transfer opportunity, CompositesUK, headline industry partner for the event, will in 2012 host its annual Composites UK awards alongside the event on the first evening, acknowledging key advances and innovation made by UK companies over

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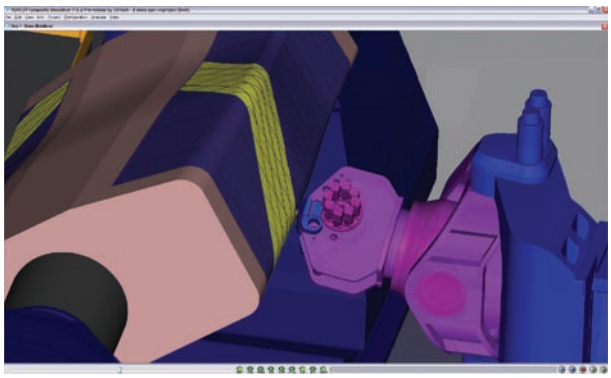


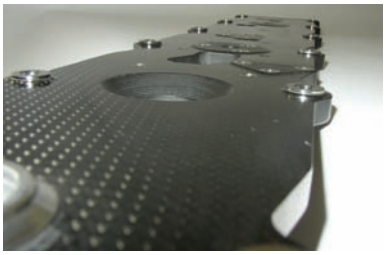
the past 12 months.

Supporting the 2012 awards, the show floor is to feature a showcase of award nominated composites engineering excellence with supporting project insight presentations, as part of the two day open forum programme. Furthermore, CompositesUK is again committed to hosting a selection of on the show floor open technology sessions, drawing on expert contributions from across the industry in processing innovations, new technology and developing applications.

In parallel will again be the daily 'UK composites industry overview' sessions hosted by Composites UK. These will highlight advances in and priorities for UK composites capability, crucial 'by sector' market outlooks, skills outlook and latest developments in the UK's composites industry support structure – including the launch of the UK Composites Hub, the UK's integrated infrastructure support harnessing the collective resources of the National Composites Centre (NCC), Composites Skills Alliance , and CompositesUK.

Dr Sue Halliwell, Secretary for CompositesUK observes: "Over the past few years, Composites UK has worked closely with Composites Engineering to promote and raise the profile of the UK Composites industry and ensure the show continues to develop and grow to reflect our homegrown capability and expertise. The 2012 show promises to be bigger and better than ever and sends a clear statement that the UK composites industry is open for business."

As part of Advanced Engineering UK group of events, one of the fastest growing B2B industry events in the UK, the 2012 Composites Engineering Show will again co-locate alongside the UK Aero Engineering show, providing perfect synergy, given the enormous importance of the aerospace composites market in the UK. This was reflected in 2011 with excellent numbers of attendees from major players including Airbus, GKN, BAE Systems, Bombardier, EADS Astrium, GE Aviation, Rolls-Royce and Honeywell.



Furthermore, 2012 sees the introduction of the UK Automotive Engineering Show into the Advanced Engineering UK group of events. This addition will support a further exciting synergy, driving an exponential rise in the numbers of volume, niche and motorsport engineering teams attending the show and building on the already impressive 2011 Composites Show automotive and motorsport sector attendance.

This event saw attendees from the likes of Toyota, Honda, Ford, BMW Group, Team Lotus, Mercedes GP, Red Bull, Williams F1, Bentley Motors, Force India, Aston Martin, MIRA and Ricardo, to name but a few. Stone summarises the importance of this co-location: "Automotive is one of the crucial growth sectors for the composites industries with lighter weight and increasing performance advantages being sought by both volume and niche vehicle manufacturers alike, not to mention the burgeoning ultra-low carbon vehicle development community."

The group of events is further consolidated with the UK Plastic Electronics show and the integrated Wind Power Engineering showcase, providing yet more strategic profile into a key vertical composites market. Stone continues: "With three of the most important vertical markets occupying the same networking space as the Composites Engineering Show, the business development and technology transfer opportunities are infinite."

With an attendance approaching 7,000 in the 2011 group of events, and an anticipated 9,000-plus attendees for 2012, the Composites Engineering Show is bracing itself for another record turnout and to consolidate its credentials as a meeting point for all sides of the UK composites industries.

www.compositesexhibition.com
www.advancedengineeringuk.com

The Composites Engineering Show will cater for a range of industries

A new evolution in bolt security

Nuts and bolts are often seen as trivial hardware, however a joint with a design flaw, or worse - a joint that fails, can and will cause serious consequences, not only in terms of costly down-time but also worker safety.

New technologies and demands are continually creating unique design challenges. Designers need to take into account things such as thick surface coatings to fight corrosion, new sandwich composite technologies, and many more. Joints increasingly need to be able to withstand stresses from multiple fronts.

There are two main reasons why bolts fail: spontaneous bolt loosening (rotation of the fastener) caused by vibration and dynamic loads, or slackening of the joint (no rotation of the fastener) caused by settlements and relaxation.

Solutions that are currently available on the market tend to address only one of these two challenges, offering either a locking system or an elastic system to secure the bolted connection. Critical application design has involved trying to figure out which – spontaneous bolt loosening or slackening – will have the biggest effect on the joint, and choose a solution to handle that single problem. It is a difficult compromise to make, especially as both potentially cause application failure.

As an innovative organization, it became **Nord-Lock's** goal to design a system that eliminated customer's insecurity when choosing a solution for loosing joints. The system needed to be effective against dynamic load, vibrations, settlement and relaxation all together. Utilizing a unique multifunctional design the new **Nord-Lock X-series washer** offers the highest security against both spontaneous bolt loosening and slackening. Combining Nord-Lock's unrivaled wedge-effect solution (to prevent spontaneous loosening) with an exceptional spring effect (to compensate for loss of preload due to slackening) the new **Nord-Lock X-series washer** gives you a total security option for those situations in which there can be no compromise.
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What's all the fuss about keeping inventions confidential?

Eureka has partnered with leading intellectual property law firm D Young & Co LLP to offer guidance on how to protect IP. Here, D Young senior associate Carina Badger looks at the issue of confidentiality.

Crucial to the success of a patent is that the product or process claimed by the patent is inventive and the invention is not part of the 'prior art'. This means that the invention must not have been made available to the public before the priority date. For most countries in the world, this is the date on which the patent was originally filed at the applicable patent office. Even if granted, a patent can later be found to be invalid. Indeed, this is a typical counter-argument when patent owners bring infringement proceedings: the alleged infringer claims that the patent isn't valid anyway and does its best to find evidence that the invention was in the public domain before the priority date.There have been a number of court cases in which patent owners have invalidated their own patents because a premature public disclosure was made about the invention.

Accordingly, it is absolutely essential that you do not disclose your invention outside company before you file for the patent. Examples where people have 'slipped up' and potentially invalidated their own patents include:

- releasing marketing materials;
- testing the market before launch, discussing plans with customers or giving them prototypes;
- publishing an article disclosing the invention;
- revealing the invention on television;
- discussing the invention in a pub with friends.

Why is the 'prior art' important?

The benefit of a patent is that it gives the owner an absolute monopoly right: there is no need for the patent owner to prove the alleged infringer even knew about the patent when enforcing it. In return, patent law places strict restrictions on what is patentable. As Mr Justice Laddie said in Pfizer Limited's Patent: "Patents are not granted for the discovery and wider dissemination of public material and what is obvious over it, but only for making new inventions" ([2001] F.S.R. 16).

It is important to remember that different rules apply in different territories. For example, in the US there is a 'grace period' in which an inventor can disclose the invention and then wait up to 12 months to file the application. This is not the case in the UK. Also, for something to be part of the prior art, it need not thave been widely disseminated. In theory, scribbled comments in the margin of a library book could be 'prior art'.

Confidentiality: legal steps

Many of these issues can be avoided by ensuring that everyone who comes into contact with the invention or is involved in discussions about it, is bound by a confidentiality agreement. UK patent law exempts from the 'prior art' any disclosures made that breach confidentiality obligations.

English law does impose confidentiality obligations in various situations even if there is no written contract, although it can be difficult relying on unwritten obligations. For this reason, ensure that confidentiality agreements are clearly set out in writing and that the relevant individuals sign up to whatever practical security measures the business may have in place. These should include:

1. **Information:** There should be a clear definition of the confidential information to be protected. The disclosing party will want to ensure that this definition is as broad as possible and should include any works derived from the confidential information.
2. **Obligation:** There should be a clear obligation to keep the information secret and to use it only for certain purposes explained in the agreement.
3. **Consideration:** in English law, for a contract to be enforceable there must be consideration. This could be a nominal amount (e.g. £1) or something of monetary value such as a customer's feedback on a new prototype. Without clear consideration, the contract may be invalid.
4. **Duration:** A disclosing party will typically want the duration of the contract to last as long as the information is confidential. The term should usually be for a minimum of five years. If the application is published its contents will cease to be confidential from that date, but if the patent application is withdrawn before publication, a period of five years typically provides scope for the prospective applicant to re-file the application.

Confidentiality: practical steps

In addition to confidentiality agreements, businesses can take practical steps to establish and maintain confidentiality. For example, ensure that information is disseminated on a need-to-know basis and that documents are marked confidential. Also, restrict physical and electronic access to areas where confidential processes are stored, conducted or developments are being made and give employees practical guidance on keeping information confidential (eg taking precautions when using laptops in public places).

For more information, please contact Carina Badger, Senior Associate, on:
Tel: 020 7269 8550
Email: CXB@dyoung.co.uk www.dyoung.com

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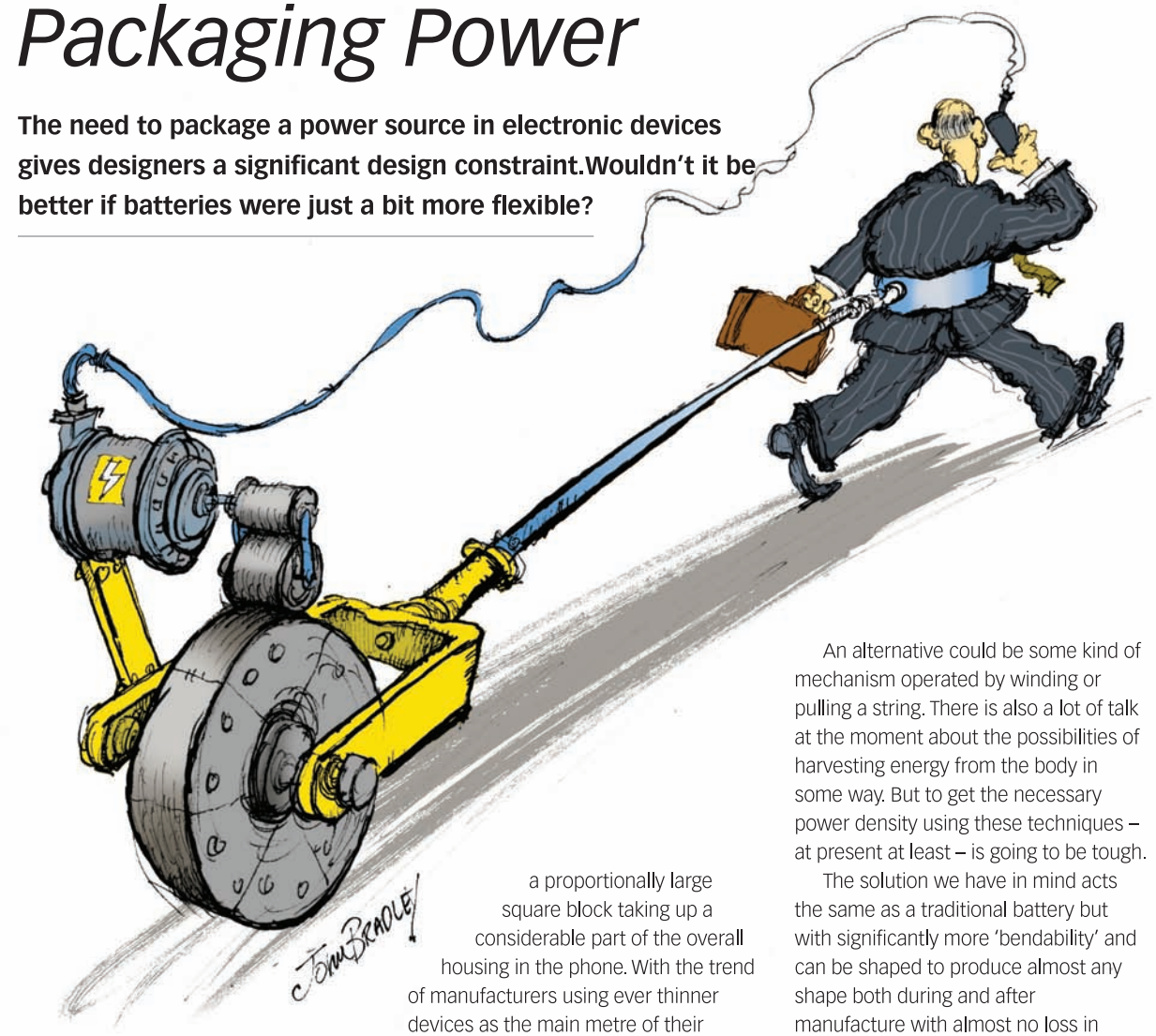
Packaging Power

The need to package a power source in electronic devices gives designers a significant design constraint.Wouldn't it be better if batteries were just a bit more flexible?



The demand for portable electricity is abundant. From mobile phones to music players, we are used to having power everywhere we go. This need is largely met at present by the use of the many different types of available batteries.

Batteries have changed quite a bit in recent years from being disposable off-the-shelf items to the modern, integrated, rechargeable lithium ion batteries we know today. Though both are popular, neither is ideal for designers that have to package vast amounts of hardware around them.

The need to incorporate either disposable or integrated batteries within an electronic device places limitations on the design. Despite improving massively over the last ten years, most mobile phones for example – if you can open them up and get to it that is – have a proportionally large square block taking up a considerable part of the overall housing in the phone. With the trend of manufacturers using ever thinner devices as the main metre of their technical prowess, it places a significant constraint on design possibilities.

The Challenge

The challenge this month is therefore to come up with a better way of packaging the power storage/supply of mobile electronic devices. It is not so much a case of trying to downsize batteries, or increase their performance, but more one of allowing them to be packaged more easily and flexibly inside electronic devices.

Alternative chemistries could potentially yield greater power storage potential, but this is a massive area of global research being driven by some of the world's largest automotive and chemical companies... so we can hardly expect *Eureka* readers to solve this one on their coffee break. Or, can we?

An alternative could be some kind of mechanism operated by winding or pulling a string. There is also a lot of talk at the moment about the possibilities of harvesting energy from the body in some way. But to get the necessary power density using these techniques – at present at least – is going to be tough.

The solution we have in mind acts the same as a traditional battery but with significantly more 'bendability' and can be shaped to produce almost any shape both during and after manufacture with almost no loss in discharge performance. Removing the limitation of rigidity could open up entire new markets and possibilities to electronic device designers.

The solution is fairly simple and rather elegant. When you see it you may consider it obvious. In the meantime, see if you can come up with a solution.

• Don't want to wait for the answer? Visit www.eurekamagazine.co.uk to see the solution now

The solution to last month's Coffee Time Challenge of how to dry out electronic devices can be found in the Technology briefs section on page 9

Adhesives

Health and Safety Engineering Adhesives

Henkel, the global market leader in engineering adhesive technology, has introduced another 'world first' – the Loctite Health and Safety range that covers the lion's share of applications.

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Aluminium Van Roof Racks

Autorack Launches Aluminium Van Roof Rack

Autorack Products Ltd, the van racking systems and van roof rack specialists, has designed and launched the all new heavy duty aluminium 'Van Roof Rack' with Sapa Profiles UK.

Using an aerodynamic cross-bar profile, Autorack Products Ltd has created an attractive, effective new product with their aluminium Van Roof Rack which minimises wind noise and drag. Produced in the UK and extruded by Sapa, the van roof rack has a sleek design and matches strength with aesthetics. Autorack has been in the industry for over 20 years and believe that this is one of the strongest and most heavy duty roof racks available on the market.

Prior to launching this product, Autorack distributed other suppliers' products but were encouraged by their positive experiences with Sapa Profiles to develop and manufacture their own range of van accessories. Using Sapa's extensive aluminium profile knowledge and working closely with Sapa's team of design engineers, Autorack began designing the Van Roof Rack.

With Sapa's help, Autorack already has other van accessories in development using aluminium extruded profiles. Using the same aerodynamic cross-bar profile, Autorack is launching a range of high-quality Van Roof Bars aimed at professional tradesmen. Variants of the roof rack will be available to cover approximately 70 per cent of the light van range within 12 months.

George Kamperis, Managing Director of Autorack Products Ltd comments "We have received a first class service from the team at Sapa; they have proved to be invaluable in the development of this new venture for Autorack".

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INTELLIGENT POWER CONTROL – **MICO**

Safeguarding machine up-time

MICO distributes 24V DC circuits over either 2 or 4 channels, monitors currents and switches them off safely in case of a fault.

Each channel has an adjustable current range and offers secure fault-latching or manual override.

Via an integrated bridging system, MICO can be extended and structured as required.

2 channel version

4 channel version

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