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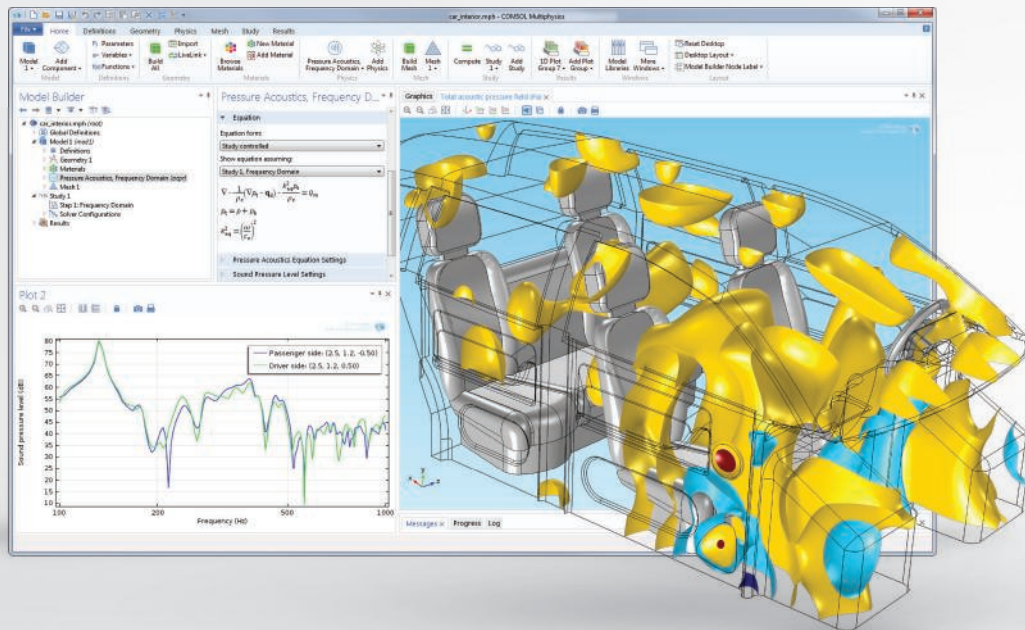
In this issue: Motors • Design Software • Fastening & Adhesives • Automotive Special Report



Building a driverless future

The next step in autonomous vehicles

ACOUSTIC ANALYSIS: This model simulates the acoustics inside a sedan and includes sound sources at the typical loudspeaker locations. Results show the total acoustic pressure field and the frequency response at points inside the cabin.



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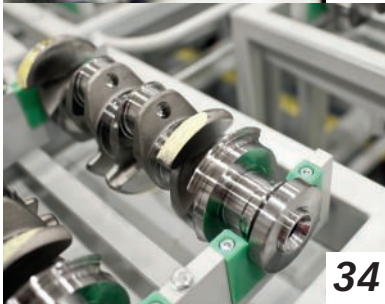
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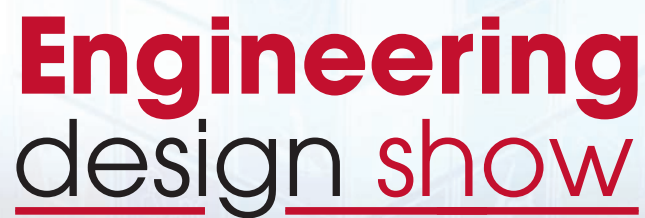
Design rights are a crucial, but little-understood aspect of IP. Here, Matthew Dick and Charlotte Musgrave of D Young & Co LLP explain.

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This month's challenge is to invent a doorbell that you simply cannot miss.

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An unhealthy situation



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

The recent report from the Institute of Mechanical Engineers entitled 'Biomedical engineering: advancing UK healthcare' makes a number of interesting points about the future role of engineers in medicine.

Among the report's recommendations was the call for the introduction of a Chief Biomedical Engineer to be appointed in every NHS trust to take responsibility for the equipment and systems in its hospitals. To be honest, perhaps the most arresting thing about this call (to my mind at least) was the realisation that such a post did not already exist.

Highly complex and sophisticated technology is everywhere in healthcare and that trend is not likely to reverse any time soon. The idea that there is often not a qualified person on hand to ensure its efficacy is genuinely alarming.

And yet the figures would seem to suggest this is the case. According to the report, 13,642 incidents relating to faulty medical equipment were reported in 2013 to the Medicines and Healthcare products Regulatory Agency (MHRA); leading to 309 deaths and 4,955 people sustaining serious injury.

These incidents vary from faulty pacemakers to faulty equipment like CT or MRI scanners used to diagnose patients. This equipment, or its unavailability, is also one of the major causes of cancelled operations.

Given this, it boggles the mind that engineers are not a mandatory and integral part of hospital trusts already. However, it is perhaps indicative of a wider problem that they are not.

My contention would be that the problem is that the term 'engineer' is not sufficiently widely understood for non-engineers to be able to ascribe certain responsibilities to them. Thus, when it comes to the planning, procurement, use and maintenance of high-value equipment, the idea that a highly-qualified engineer should be responsible for these things may not immediately occur. The simple reason being that the role of the engineer – his or her areas of expertise – is not clearly understood.

Certainly it would seem obvious that engineers should have a senior role in modern healthcare. What seems less obvious, though, is why anyone should need to make that argument in the first place.

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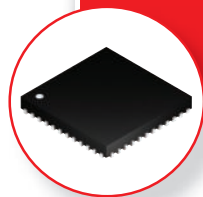
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With the increasing importance and complexity of technology used in hospitals, the Institution of Mechanical Engineers' new report *Biomedical engineering: advancing UK healthcare* is calling for urgent action to prioritise the role of engineers in the NHS, and introduce a Chief Biomedical Engineer in every NHS acute trust.

Boosting the number, as well as the influence, of engineers in the NHS would help cut the number of incidents caused by faulty medical equipment. In 2013, 13,642 incidents related to faulty medical equipment were reported to the Medicines and Healthcare products Regulatory Agency (MHRA); leading to 309 deaths and 4,955 people sustaining serious injury. These incidents can vary from faulty pacemakers to faulty equipment like CT or MRI scanners used to diagnose patients. This faulty equipment, or the unavailability of it, is also one of the major causes of cancelled operations.

As the technology used in hospitals becomes increasingly complex, the danger of

IMechE call for biomechanical engineers' role in NHS

improperly calibrated and validated equipment is also increasing. Indeed, there are huge implications to the mis-calibration of even basic equipment such as weighing scales. In 2008 a medical devices alert was issued warning of incorrectly calibrated weighing scales which led to a number of patients being given the incorrect dosage of medication. Furthermore 'equipment failure/unavailability' is cited as a major reason for cancellation of operations in NHS hospitals.

Dr Patrick Finlay, lead author of the report and chairman of the Institution of Mechanical Engineers' Biomedical Engineering Association said: "Government and the NHS need to take urgent action to prioritise the role engineers play in hospitals and trusts.

"Technology is leading to huge advances in healthcare, but this technology is dependent on the work of biomedical engineers who are inadequately recognised and in short supply in most hospitals.

"It is only with engineers that properly informed choices on these issues can be made in the best interests of patients and taxpayers.

"This report demonstrates some of the exciting ways engineers can revolutionise healthcare through, for example, new, low invasive treatments to sense, measure and manipulate the human body; or by developing novel ways of tracking and monitoring personal health through mobile phone apps.

But, in order to reap the full benefits that technological advances can offer UK healthcare and the NHS specifically, the people

who design, make, maintain and use these pieces of equipment need to be heard."

Biomedical engineering: advancing UK healthcare features key case studies from UK academia and industry in the areas of: regenerative medicine, medical imaging and robotics, cardiopulmonary engineering, orthopaedic implants, physiological monitoring, m-health and e-health, assistive technology, rehabilitation and independent living.

According to the report, the UK is one of the leading countries in academic research in the area of biomedical engineering and has an excellent record in inventing and researching new medical devices. The development of technologies such as m-health and e-health is also being hampered by a lack of international consensus on standards, practices and patents. The Institution of Mechanical Engineers therefore makes four key recommendations:

1. Every NHS acute trust should have a designated Chief Biomedical Engineer.
2. A single, dedicated funding programme for biomedical engineering research should be established in UK Research Councils.
3. Industrial and taxation policy should promote long-term investment in biomedical engineering to encourage domestic development and manufacturing.
4. International consensus should be pursued for global standards, a common device regulatory and approvals regime, and harmonisation of patent legislation in medical devices. Named UK leads should be agreed for these policy roles.

Maggie Philbin to present this year's BEEAs

Television broadcaster and President elect of the Institution of Engineering Designers (IED) and Maggie Philbin will be presenting the 2014 British Engineering Excellence Awards (BEEAs).

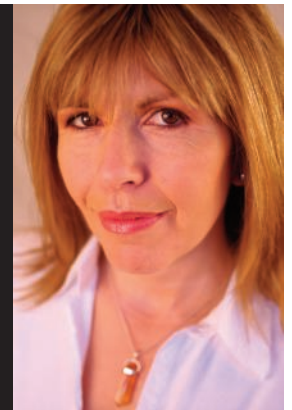
Ms Philbin has worked in radio and television for 30 years on a wide range of science, medical and technology programmes, with TV credits including *Tomorrow's World* and *Bang Goes the Theory*.

In November 2012 she was presented with the award for Best Outreach Work at the WISE Women of Achievement Awards for TeenTech, a social enterprise aimed at

encouraging young people to consider the wide range of career possibilities in science, engineering and technology.

In 2013 she was given the Promotion of Design Award by the IED and, as of this month, has taken over as the institution's new president.

"We are delighted to have Maggie on board to present this year's BEEAs," said Ed Tranter, executive director of Awards organiser Findlay Media. "Her extensive knowledge and passion for engineering and technology go hand in hand with what the BEEAs are all about, and we look forward to another successful year."

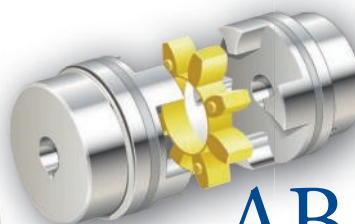




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FAST to take place at Williams Conference Centre



This summer's FAST Exhibition takes place at the fantastic venue of the Williams Conference Centre, Grove, Oxfordshire.

Not only will this venue house an exhibition featuring over 50 market-leading suppliers of fastening, bonding and assembly products and solutions and offer a range of free technical seminars, but visitors will also get the chance to enjoy an exclusive tour of Frank Williams' private Grand Prix Collection and Williams F1 museum, plus take a drive in one of two Formula One simulators.

The free-to-attend FAST Exhibition is the UK's only dedicated fastening, bonding and assembly show for design engineers, production professionals, senior manufacturing managers and fastener buyers. Established in 2005, this specialist event has proved to be an invaluable

resource for engineering teams from just about every area of UK industry. All exhibitors at the FAST Exhibition have a base here in the UK so you can be sure of instant and total ongoing support as well as experienced application problem solving expertise being readily available on your doorstep.

The FAST Exhibition also provides attendees with the opportunity to take part in four technical seminars by leading fastening, adhesives and bonding suppliers. Topics to be covered are: Innovative solutions for challenging assemblies by Bollhoff Fastenings; Curing adhesives, coatings and sealants with light by Intertronics; Advanced isolating materials for electrical and electronics assembly by Lohmann; and Why do bolted joints come loose and how can we prevent it happening? by Nord-Lock. Places on these seminars are limited and for pre-registered visitors only, so early booking is advised in order to avoid disappointment.

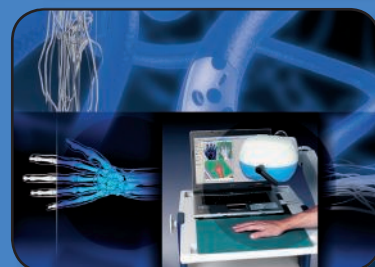
This highly popular exhibition is configured in the 'roadshow' style to deliver visitors the maximum information in the minimum of time. The focus is squarely on fastening, bonding and assembly in design and production engineering and on cost-reduction in any assembly-related activities for manufactured products.

Whatever sector you work in, if you are responsible for specifying, sourcing or purchasing fastening components, solutions and technology then this is a must attend event. Entry to the FAST Exhibition is free for pre-registered ticket holders only with VIP guests able to enjoy free refreshments on arrival. For full details and to register to attend the exhibition and to book your seminar places, visit the FAST Exhibition website.

www.fastenerexhibition.co.uk

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MACHINE INTERFACE BRINGS TECHNOLOGY TO LIFE

Designed following careful analysis of real applications and customer requirements, the new NA machine interface from Omron makes it fast and easy for users to implement dynamic, intuitive user interfaces that help boost productivity and minimise downtime by giving detailed real-time and historical insights into machine operation.

The new NA machine interface is programmed using Omron's unique and comprehensive Sysmac Studio development system, which covers all areas of automation, including logic, motion, vision and safety. This means that the NA machine interface can be programmed alongside the other automation system components, which speeds development and reduces programming complexity.

To further aid program development, the NA machine interface is provided with IAGs (Intelligent Application Gadgets) for common applications, which operate in a similar way to function blocks. Users can even develop additional IAGs to meet their own specific requirements, and full customisation of the way the machine interface operates is possible using VB.NET.

Also provided are pre-configured vector-graphic animated objects, such as tanks with cut outs to show levels and valves that show open and closed states, as well as graphics for basic machine parts, including winders, flow-wrappers, multi-head weighing units and many more.

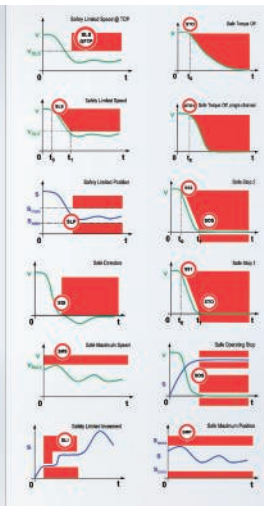
www.omron.co.uk

Modular mechatronic systems gaining momentum

With the ACOPOSmotor, B&R combines a servo motor and drive in one compact unit. Safety technology can also be integrated as an option. This gives developers more freedom when designing a machine and can save valuable space in the control cabinet.

The ACOPOSmotor is connected to the drive network using a hybrid cable. This cable includes all necessary power and signal lines and establishes the connection to the POWERLINK network. ACOPOSmotor modules come in three sizes with torque ranging from 1.8 to 12 Nm. If needed, an optional fan assembly can provide a performance boost of up to 100%.

In addition to the proven wired safety functions STO (Safe Torque Off) and SS1 (Safe Operational Stop 1), a network-based



ACOPOSmotor module variant will also be available in the future. This will allow users to access the following functions (as with the ACOPOSmulti): STO, SOS, SS1, SS2, SLS, SMS, SLI and SDI.

The ACOPOSmotor is fully

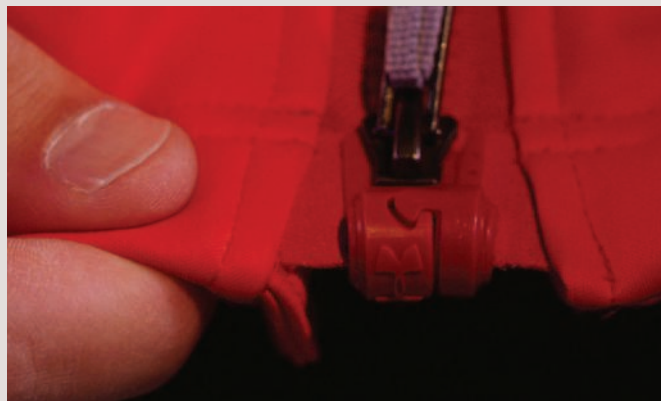
compatible with the ACOPOSmulti drive system. This makes it possible for users to select the best-suited servo drive for each machine without having to do any additional engineering work.

www.br-automation.com

Solution to last month's Coffee Time Challenge

The solution to last month's challenge to produce a better zipper that can be used one-handed comes from US based DNS Design. It has produced the Magzip, which uses small magnets that snap together the ends of zippers in exact alignment.

Magzip was originally conceived after a relative of designer Scott Peters, suffering from Myotonic Dystrophy, was having problems zipping up a jacket. He found that fundamental to the problem was the way zippers start, and set off on an easier method of bringing them together to allow zipping to start.



He, along with his mother and a neighbour, found magnets offered the best solution. Putting magnets at the ends of a zipper allowed the two ends of the zip to snap together and align properly. After many months of tinkering to get the design right, Magzip was born.

www.dnsdesignsllc.com

New and improved igus chainflex cables



igus has expanded its chainflex CF211 and CF111.D series of measuring cables developed for dynamic equipment applications. The cables feature an enhanced core and shield structure.

The CF211 has a PVC outer jacket, to allow a range of operating temperatures from -5 to +70°C; it is well-suited to applications in warehouse storage and handling systems, processing tools and packaging machines. The CF111.D features a halogen-free, flame-resistant PUR outer jacket and is designed for short travel applications. The CF113.D boasts a PUR inner jacket and bend resistant braiding of tinned copper wires with an optical coverage of 90%. This cable structure is ideal for use in fast handling, cleanroom and low-temperature applications down to -200°C.

www.igus.co.uk

Linear products benefit massage table

A linear actuator and motion products supplied by HepcoMotion has been used to create a sub-floor 'hidden' elevating massage table.

The project began when a local architect obtained consent for a new entrance sequence including gym and stairs at a private (listed) residence in London. He wanted a fully cantilevered 'floating' massage table that retracts completely beneath a secret panel in the gym floor.

"We liaised with the architect, discussing options, doing the groundwork and presenting concepts," says Kane Lothead, design engineer at meia.

HepcoMotion worked with meia to find a working solution that best matched the concept. By providing technical advice it was possible to arrive at an optimised solution that was within budget. HepcoMotion helped meia settle on Zimm screw jacks and Winkel bearing systems from the company's extensive range.

Based on the meia concept, motion had to take place in a number of stages. Firstly, the massage table and infill floor is lowered while the primary floor slides out of the way. Then, the infill floor raises up with the massage table and locks into place flush to the wooden gym floor. Finally, the heated massage table rises to a height of 900mm. From here the massage table height can be adjusted by the operator from the switch plate on the side of the table to a maximum of 1200mm down to 200mm with the infill floor locked in place.

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Driverless and autonomous vehicles are almost here. Paul Fanning takes a look at a UK project that could be on the streets in the next few years.

Once purely the preserve of science fiction, the driverless vehicle is increasingly a reality and there can be little doubt that it is coming to a street near you – and sooner than you might imagine.

The most high-profile example of an autonomous driverless vehicle is the Google car, which uses a combination of sensors and software combined with highly accurate digital maps to locate itself in the real world. A GPS is used, just like the satellite navigation systems in most cars, to get a rough location of the car, at which point radar, lasers and cameras take over to monitor the world around the car.

Google has also announced a project to create driverless transportation 'pods' that are designed to operate safely and autonomously without requiring human intervention. They won't have a steering wheel, accelerator pedal, or brake pedal because they don't need them," says Google's self-driving car project director, Chris Urmson, on the firm's blog.

But, while Google may be attracting the lion's share of the headlines, it is by no means the only kid on the autonomous block. There is any number of projects around the world exploring future transport technology. One of these is the UK-based LUTZ (Low-Carbon Urban Transport Zone) Pathfinder Project, which will see electric powered pods used in Milton Keynes next year.

Coventry-based RDM Group will make the futuristic LUTZ Pathfinder pods, which will be trialled next year, after being appointed by the Transport Systems Catapult (TSC), which is project managing the enterprise. RDM and TSC are now working together with Oxford University's Mobile Robotics Group (MRG) to create three electric-powered pods, which are part of the TSC's Low Carbon Urban Transport Zone (LUTZ) Pathfinder programme which is studying the feasibility of autonomous and on-demand vehicles.

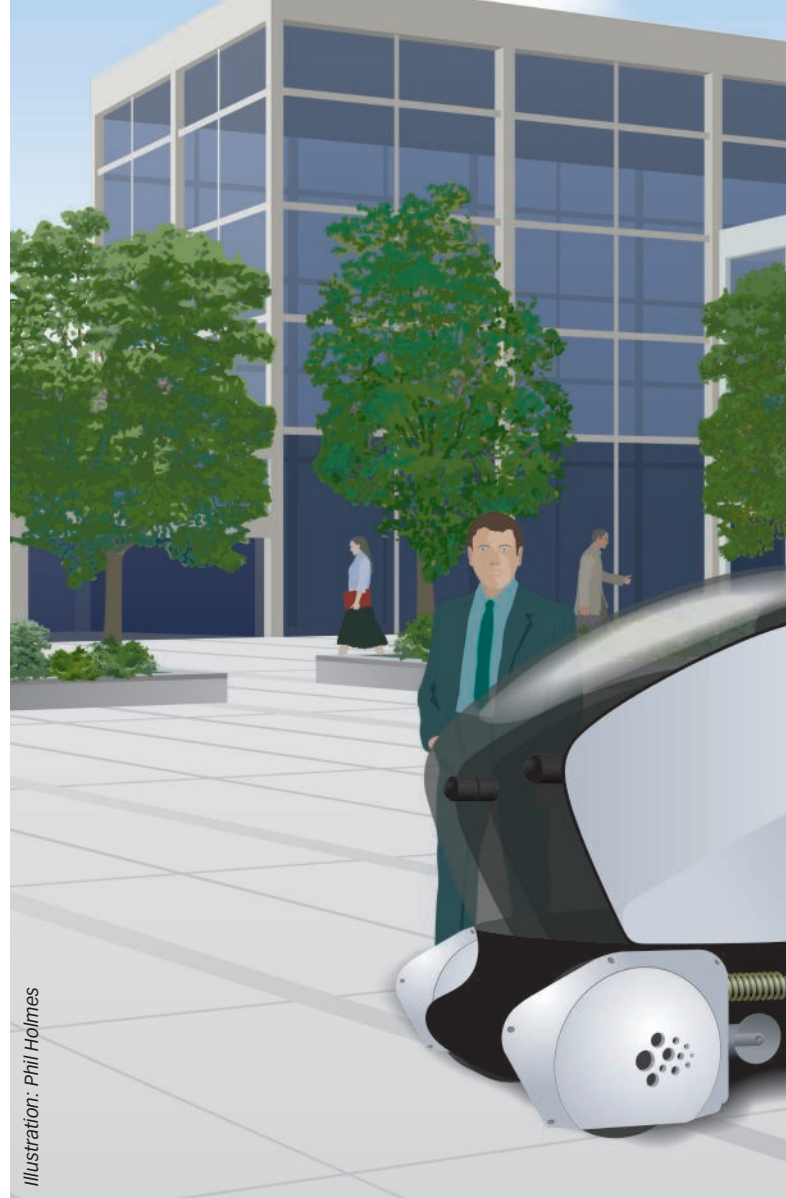
The self-driving pods will carry up to two passengers and with a top speed of around 12 kph (7 mph), the pavement-based pods are intended to increase the number of mobility options available to the public, while also reducing congestion and carbon emissions.

Once these trials are completed, the pods will be ready for testing in public on the pavements of Milton Keynes. With safety issues of paramount importance throughout the duration of the assessment programme, the three pods will continue to be manned by trained human operators.

Transport Systems Catapult programme director Neil Fulton said: "The LUTZ Pathfinder project will redefine how people think of 'driving', and therefore fits in perfectly with our mission to promote UK business growth in the field of intelligent mobility.

By mid 2017, it is planned that 100 pods that are fully autonomous will be running on pathways alongside people and will use sensors to avoid obstacles.

The Milton Keynes-based programme actually pre-dates the



Building the





Transport Systems Catapult, with the initial impetus having come from the Automotive Council and Cambridge University's John Miles, who began the initial work with Milton Keynes council to develop a project that could see up to 200 of these vehicles moving people around the city.

Before making such a massive investment, however, Milton Keynes Council was understandably keen to look at the economic case for the pods, the viability of the technology and how the pods would interact with people – and vice versa. The TSC was therefore approached to oversee the LUTZ Pathfinder programme's test phase, which will see three autonomous pods trialled on the pavements of Milton Keynes. During the test period, all of the vehicles will be manned by a trained operative who will be able to take immediate control of the pod if necessary.

The pods will be equipped with technology provided by Oxford University's Mobile Robotics Group and Fulton recently showed a video of the technology in action during a "test drive" of the navigation system around a university quad. Relying on left-side and right-side cameras for its primary data, the technology works by mapping out the environment in which it will operate so that subsequent journeys can be compared against a known 'norm'

Of course, there is a vast gulf between the theory and the practice and it doesn't require much imagination to visualise the huge range of problems potentially posed by the appearance of driverless vehicles on our roads. As part of a demonstration of the real world scenario that awaits the pods once they have been deemed ready for testing in public, the TSC has shown a film shot from a bicycle riding along part of the route where the pods will operate.

Challenges identified on just that short bike ride included: the pod

driverless future



Google's self-driving car

having to know how to safely avoid and overtake pedestrians; to correctly distinguish between genuine obstacles and irrelevant distractions such as empty carrier bags and other types of litter; to be able to navigate road crossings or car parks; and to deal with the potential confusion of things such as heavy shadows on sunny days, or the quick change of lighting conditions when driving through an underpass.

Says Fulton: "There's a distinct difference between our programme and some of the other autonomous vehicle projects, which are mainly road-based. I would say that taking the vehicles off the road and onto pavements actually intensifies the challenge, because of the increased interaction you have with people and obstacles,"

"So, on the one hand, you can see the technological challenges that we're facing, but there are many other challenges to consider on top of that, such as the regulation and law changes that will be required to get autonomous vehicles onto the market. There is also the question of liability insurance in terms of who takes responsibility for these vehicles

once they are out on the roads, or the pavements in the case of the pods.

The business of getting the vehicles to meet these technological challenges falls to the Oxford Mobile Robotics Group, which specialises in mobile autonomy. In addition to its work on the pavement-based LUTZ Pathfinder pods, MRG is applying its technology to the Oxford RobotCar project – which is working towards the first public demonstration of a low-cost, auto-drive navigation system on UK public roads.

The MBG has long been involved in the area of autonomous vehicles, having worked jointly with BAE Systems to retrofit two Bowler Wildcats with fly-by-wire control systems, high-performance computing payloads and sensors for estimating the local terrain, including lidars and cameras. The first of which is used by the BAE Systems Advanced Technology Centre as part of its autonomous systems research. The second is still used by the Mobile Robotics Group as part of its ongoing research into lifelong infrastructure-free navigation for autonomous vehicles.

Professor Ingmar Posner of the Mobile Robotics Group believes the project is not only useful in and of itself, but also represents a potentially crucial intermediate stage in the development of driverless vehicles. He says: "There needs to be an interim period between an autonomous vehicle being on a test track and being on an actual road, so having it as a pod in real complex environments is actually a very valuable thing. That's why Google are doing it and it's a crucial step towards autonomous cars."

"It's really important to see this in the context of our ultimate goal, which is an autonomous car," he says. "So if you think of an autonomous car going along at 100mph and trying to interpret its environment, that's difficult because perception is a really tricky thing to achieve and is also really expensive from a processing point of view. So to have an intermediate, real-world test-bed is ideal. So, rather than controlling where people walk, it's nice to be able to concentrate on a domain where you drive slowly (7-10mph), where there are real obstacles around you and you interact with those obstacles at those speeds."

Of course, the pods will run on pavements rather than roads, which throws up its own range of challenges. Says Professor Posner: "It is a less predictable environment than a road in some ways... for instance, it



Autonomous and driverless vehicles come in many shapes and sizes, including the shuttles used at Heathrow Airport (right)



is well understood how other cars behave, whereas mapping human movement is much more difficult."

And, according to Professor Posner, public acceptance is a bigger issue than some may realise. He says: "The bottleneck with this is not necessarily technology. The technology is getting better, but it's not quite there yet, but it is advancing at such a pace that legislation and the societal factors of it are having trouble keeping up with it... The whole thing is that it's a pilot project in a number of ways – not just in terms of the technology itself, but how people will interact with that technology."

One of the key details of the project is that it will be 'infrastructure-free'. In other words, it will run without relying on any external factors such as GPS. Says Posner: "GPS is not really that accurate and is too easily denied – in street canyons, for instance. That isn't to say that the technology that we have can't use GPS – it would be foolish not to use information if we have it. But the key point is that, while it may use it, it doesn't depend on it."

So how will it work? Clearly, it remains a work in progress at this stage, but much of the technology will be based on the MRG's existing 'Robot Car' platform. Posner explains: "The concept is very similar to that of the robot car whereby you have some sort of representation of the environment – like a map – which will have annotations in it in terms of where pavements are, etc. You then use features in the environment (such as local landmarks) to localise yourself within that environment."

The question of whether the robot 'learns' is a vexed one, but Posner

says this much: "In principle, we have solutions that allow us to do this (let it learn). But we're now at the stage where we are specifying the sensors for the first prototype pod. In our portfolio we have algorithms that allow us to do that and – as and when it is required – we will do that."

"In the context of the robot car project, one key part of the robot car project vision is that the robot learns about its environment as you drive. One key part of that vision is that you buy a car and, rather than it knowing where you're going and you push a button and it takes you there, it will actually just observe where you drive and after a while it will know enough to drive you."

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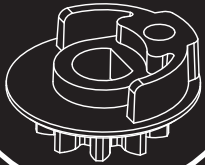
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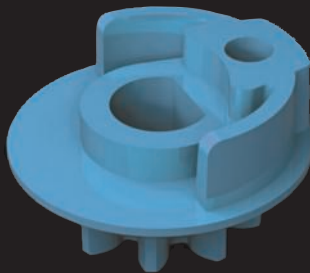
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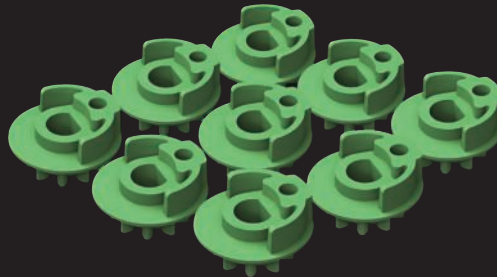
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CV

Jo Coleman is director of strategy development at the Energy Technologies Institute (ETI). Prior to the ETI she worked for Shell for over 20 years in a number of technical, commercial and managerial roles across the world. She is a Chartered Engineer and a Fellow of the Institute of Mechanical Engineers.

The Crown Joules

The UK needs to introduce new forms of energy storage says the woman responsible for the strategic direction of future energy technologies. Justin Cunningham finds out why.

Improving the ability to store energy has long been seen as vital in addressing the UK's CO₂ output. But, while energy security and the overall energy mix is a hotbed of discussion for mainstream media, the topic of energy storage – at the national scale at least – tends to come in and out of fashion. Indeed, a recent report by the Institute of Mechanical Engineers (IMechE) called it 'the missing link in the UK's energy commitments'.

"More value could be derived by increasing the UK's ability to store energy and there is no doubt its role must grow in the future," says Jo Coleman, director of strategy development at the Energy Technologies Institute (ETI). "But, there is no single solution. The challenges and opportunities are different depending on the region, the sector, and the network configuration. So there may well be many types of storage technologies developed that need to be effective in different roles."

The ETI is a public-private partnership between global energy and engineering companies and the UK Government. The aim is to bring together academia, industry and Government to accelerate the development of low carbon technologies, and ultimately decarbonise the UK's energy production and use.

"We hear a lot of focus on electricity, about the Electricity Market Reform (EMR), but for the UK in particular, there is a big challenge around decarbonising heat," says Coleman. "We see a big role for storage here, with a number of technologies already under development. There are considerable challenges, not least in reducing development and implementation costs, but there are also benefits. Over the long term there could be significant scope to reduce the overall cost associated with energy in the UK."

Despite its introduction nearly 10 years ago, the European Union Emission Trading Scheme (ETS) has not been as effective as many hoped in capping emissions and reducing CO₂ production. It means that low carbon technologies being developed to provide storage or system flexibility have to compete with gas fired power stations using open cycle gas turbines. Though gas turbines are relatively large CO₂ emitters, they are cost effective and one of the cleaner fossil fuel burning options.

"Energy storage can only start to play a role if we begin to see a higher carbon price or a situation where the storage technologies can help reduce the cost of energy," says Coleman. "We are working with companies that are developing technologies that could compete with gas turbines in the future, and that's exciting to see."

An example is Hampshire based Isentropic, which is developing a system known as Pumped Heat Electricity Storage (PHES). It purports to offer a cheap and efficient means of storing and recovering electricity, potentially on the industrial scale needed. The system works by

essentially transforming electrical energy into a temperature difference between two volumes of crushed mineral material. The system then recovers electricity from that temperature difference with a 'round-trip efficiency' of 72-80%.

The ETI has provided funding to develop a 1.5MW/6MWh electricity storage unit, a prototype of which should be completed in 2015. If successful a full scale unit will be deployed a couple of years later on a UK primary substation in the Midlands.

There is, however, another barrier to entry for storage technologies and that is the market structure itself. "There is no mechanism for storage operators at a distribution level to buy or sell electricity," says Coleman. "Current markets haven't dealt with the complexity of selling storage services across multiple parties and yet one of the places storage could be most valuable is where it can replace the upgrade of a distribution system to increase capacity."

"We hear a lot of focus on electricity, but for the UK there is a big challenge around decarbonising heat, and storage can play a big role"

The premise is that storage operators can buy electricity when demand from the grid is low and the cost of electricity is therefore low. This can then be stored until peak periods, when it can be put back into the grid to meet demand. In essence, the use of greater storage capacity within a grid could minimise the need for 'peaking power stations', which produce power when demand goes above the base load

normally supplied. The current system of 'use it or lose it' results in a higher base load than is sometimes needed to avoid black- or brown-outs. It could also make renewable energy systems more effective by storing the electricity produced.

"Building large-scale energy storage systems into distribution networks would have benefits in overall operational efficiency," says Coleman, "It does come with a cost, although storage systems do not need to be subsidised to be effective. What's needed is a change to energy markets, policy and regulation to better allow these technologies to come forward."

It is clear that there is no single solution when it comes to energy storage and that a range of technologies are likely to be needed at different stages throughout the energy network from the home, to the distribution network, and perhaps also in pre-grid networks.

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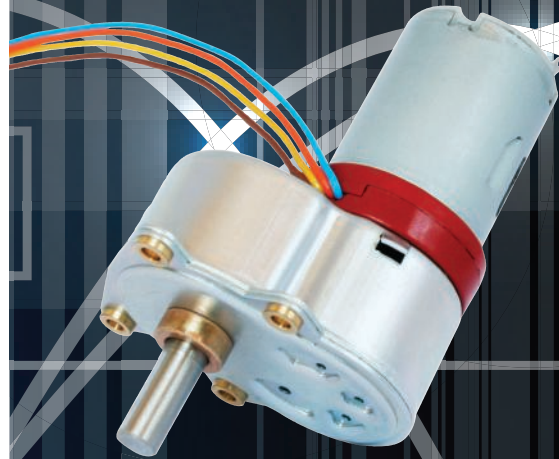
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Reacting to regulations

Material regulation and compliance is testing the ability of many companies to audit their supply chains and declare just what the components of their products are made from. Justin Cunningham finds out how some firms are handling the risk.

The management of materials has become vital for engineering businesses. One of the main reasons is the growing number of regulatory and environmental commitments that specify the declaration and often complete omission of some materials and substances.

Companies have had to source completely different materials and substances for products in some cases, such as the removal of lead solder or mercury, and have had to delve in to the supply chain to ensure that components and materials brought in are also compliant.

What is perhaps surprising is this information is not always to hand, or easy to get. In fact it can be spread across databases, sites and even countries. The difficulty of getting this data in place and managing it was highlighted by the Environmental Materials Information Technology (EMIT) Consortium.

The Consortium is made up by a number of large OEMs and material suppliers, and aims to guide Granta Design in the development of its materials database software, as well as using it to

address environmental issues.

During a recent seminar held at the National Physical Laboratory in Teddington, Boeing highlighted its efforts to capture and record materials data to accelerate its reaction to regulatory restriction on the materials and substances it may use.

"Getting our own information and data in place is a laborious and costly process when you consider the mountains of data," explains Peter Mezey, information technology and services manager at Boeing. "When you start to drill down and go to suppliers – and the suppliers to those suppliers – you end up with a lot of information that you need to verify and essentially audit."

Components and parts can be manufactured in almost any factory in any country. This makes it difficult for large OEMs to verify. For example, a spring manufacturer in Asia could use a certain chemical to clean parts, or a raw material supplier in Africa could source some precious metal from the Democratic Republic of Congo, which is soon to be banned in the US under the Dodd-Frank Act.

"So we need to know what our chemical composition is and what is our exposure," says Mezey. "For us it is about getting our heads around the data and then we can start to look at using it in the design phase. Some of our products can have a lifecycle of 80-plus years from the early design to recycling."

And here lies the difficulty of the task. It is a slow process that requires sifting the supply chain to find the exact materials and substance content of every part to a very accurate and consistent level. It affects Boeing's customers, who need to operate globally. Airlines need to be compliant with the regulations imposed in any given region in which an aircraft may land and it is up to Boeing to provide this data.

"Every time a new regulation or restriction pops up, we see three major drivers," says Mezey. "We see regulatory, contractual, and the voluntary phasing-out of certain materials and substances. But the amount of time we have to be compliant is getting shorter, while the number of new regulations coming through is only going to

increase. So this is a real business risk that could really have an impact if we are not able to act quickly enough."

This risk has seen materials database management expert Granta Design play an increasing role in helping large OEMs manage material data in relation to environmental regulatory pressure. Granta provides a central database to its users, which is regularly updated with validated reference information. It also allows firms to add its own data and information, as well as supplier data.

"Materials information is central to engineering organisations," says Professor David Cebon, managing director of Granta Design. "That information has use from CAD and PLM to procurement, supply chain management and production.

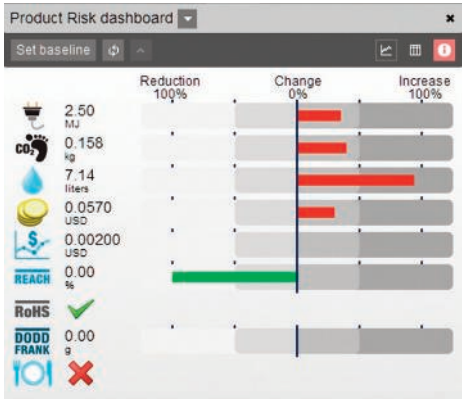
"That data on materials, processes, coatings, substances, legislation standards and specification needs to be identical and up-to-date across an entire enterprise. It's no good if a design office on the other side of the world specifies a material restricted in Europe because

they do not work there or because the part is not made there.

"The aim is to manage the risk to a company because of the substances and materials it uses. And that covers new and impending regulations or environmental restrictions for products, as well as things such as nano materials, which may or may not be restricted. But if they are, having this information in place will mean that the risk and disruption of compliance is minimised."

And this is key: once the materials information and data is in place, it allows companies to react much more quickly to new regulation so as to understand the risk earlier and to allow engineers to find alternatives or workarounds. It is especially advantageous in the early stages of the design process, where it is most cost effective to find alternatives.

But the advantages of having exhaustive materials data in place is not limited to regulatory compliance as Dan Williams, product management and marketing manager at Granta Design, explains. He says: "There are a lot of other risks that can be picked up and flagged early,



The integrated dashboard reporting on environmental impacts, restricted substance risk, supply risk, and cost

once you have this information in place. For example, selecting the wrong material, especially if its price is volatile, can have a big impact on the overall cost of a part. But it can also include anything from counterfeit materials to scarcity and shortages."

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FAST RESPONSE TO ENVIRONMENTAL, REGULATORY, AND SUPPLY CHAIN RISKS

The Granta MI:Product Intelligence Package looks to help engineering businesses optimise material usage in products while minimising environmental, regulatory, and supply chain risks. The software provides tools that draw on comprehensive, authoritative materials and environmental data in order to provide feedback and risk assessment within CAD environments or web browsers.

This risk assessment focuses on design and supports compliance reporting, and can avoid the need for time-consuming data research, for example, in gathering information from suppliers.

The MI:Product Intelligence Package runs on the GRANTA MI platform, the system for materials information management.

MaterialUniverse, one of many data modules available within GRANTA MI, provides property profiles for the full range of engineering materials and associated processes including thousands of metals, plastics, composites, and coatings.

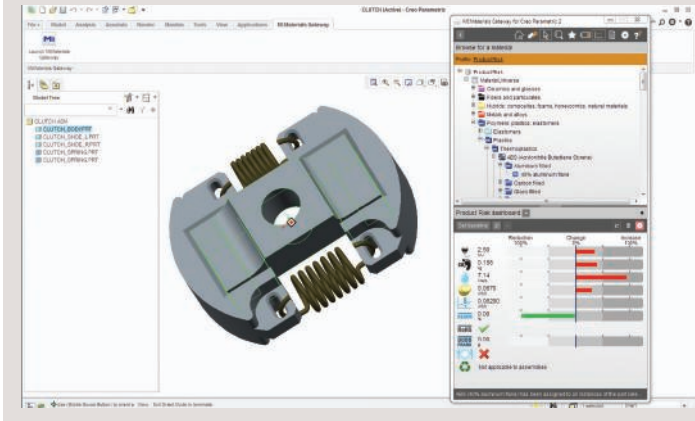
This list is augmented with regularly updated data on restricted substances and the regulation that impacts them, as well as flagging up material supply risks including obsolescence, price volatility, or use of conflict minerals.

MI:Product Intelligence tools enable users to search and browse this unique data resource, apply it to parts within a CAD model or Bill of Materials (BoM) to flag potential regulatory or supply problems.

Helping this is an integrated 'dashboard' provides a single view of product performance against risk factors including restricted substance content, lifecycle energy usage and CO2 footprint, and supply chain risks.

Materials Gateway 2.0, the second-generation integration technology enabling materials applications to be embedded within CAD systems (Inventor, CATIA, NX, Creo, and Pro/ENGINEER). CAD users will apply the new product intelligence tools to help optimise designs.

MI:BoM Analyzer is a web browser application that enables users to import and edit existing BoMs. Design teams use this application to test design concepts pre-CAD so product stewardship teams use it for fast analysis of in-production or 'legacy' BoMs, enabling them to identify and report on risks in its product portfolio.



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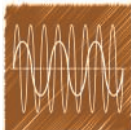
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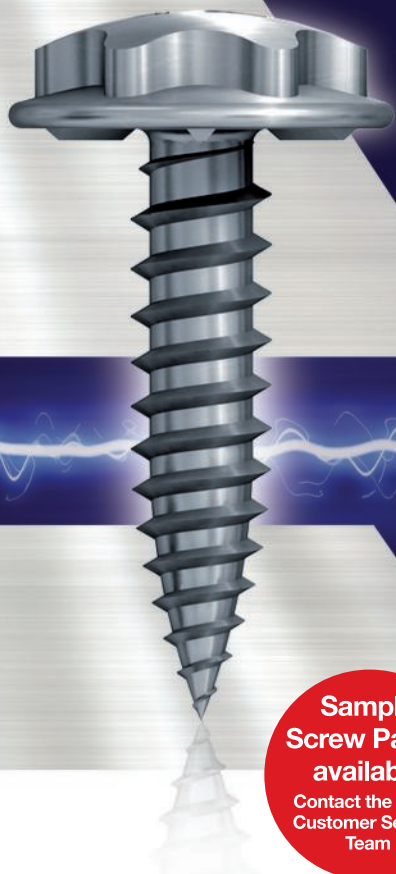
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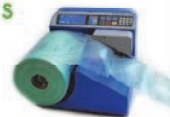
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Ceramic-to-ceramic method bonds faster

A new bonding technique will allow ceramics to be joined under demanding and pressurised conditions. Paul Fanning reports.

An innovative and powerful ceramic-to-ceramic bonding technique has been developed specifically for use in demanding, high-pressure fluid handling and vacuum applications.

Using a preparatory formulation applied to one or both faces of the parts to be joined, the bonding technique delivers high-tensile strength. The process is suitable for bonding both porous and fully dense ceramics, making it ideal for a variety of applications from fluid handling systems to diode pump lasers.

Internal testing of the new bonding technology has delivered impressive results, with a bond strength of 132 MPa and a force to failure of 130kN. Both of these figures represent a level of performance many times that of co-firing (7.7 MPa and 5.6kN in the same application) and adhesive bonding (5.4 MPa and 4.5kN).

Yannick Galais of Morgan explains: "The ability to deliver a high-strength bond has many benefits for customers. It results in a faster process than metallising and brazing and does

not require multiple, high-temperature processing steps. Morgan's bonding technique is also highly cost-effective. In-house testing has shown that the technique produces bonds which are just as strong as braze or metallised assemblies. This innovative bonding technology is also suitable for assemblies with complex joints, providing a strong bond even on applications with complicated geometry."

Ideally suited to pressurised applications, the technique can be used in fluid handling assemblies requiring leak-tight joints. It can also provide a hermetic joint with vacuum levels down to 10⁻⁸ mbar where electrical insulation or containment is required.

Internal pressure tests have shown that the joint can withstand pressures in excess of 25 bar (design dependant). Tightly-controlled tolerances and clearances allow Morgan's engineers to design systems in which a captivated rotor using this bonding technology can operate in a high-pressure environment. Such design features and technology open new opportunities for applications where pressure differential

principles are applied, such as desalination.

In other applications such as high-power diode pump lasers (DPSS), the bonding technology offers the possibility to design hybrid components, for example, combining reflective porous ceramic with a dense ceramic material. In such a hybrid construction, high-reflectivity Sintox AL is bonded to Deranox 995.

Sintox AL provides a good 'scatter' of the laser light thanks to its particle size which gives the material excellent microstructural control of defined porosity. The material provides a highly diffuse reflectance, behaving as a bulk reflector of the source of radiation by both reflecting and refracting light back into the cavity. Deranox 995 provides high strength and impervious properties for the cooling fluid.

The high mechanical strength of the Deranox 995 provides the structural rigidity needed to mount the diode stack and at the same time machined cooling channels in the dense material allow the cooling media to operate without any contact with the diode stacks.

www.mtcrugby.com.



RotaBolt aid for Divers

RotaBolt has been used on subsea pipelines and platform installations since the mid-80s and it wasn't long before the difficulty of checking for correct tension with heavy gloves surfaced as an issue. It was still possible to carry out the checks, but it presented challenges.

The RotaBolt 'Divers Wheel' offered the answer. The unique tool is a 'female' checking device which is manufactured to fit over the different sizes of RotaBolt indicator cap.

All 'Divers Wheels' are in-house calibrated to a specific resistance force before they ratchet. This force was derived from hundreds of physical tests measuring the force applied, on a torque meter, from the 'finger & thumb' grip applied by several different personnel. This ensured that the RotaBolt 'Divers Wheel' emulates the physical 'finger & thumb' grip operation which is a standard feature/check of a RotaBolt.

www.rotabolt.co.uk

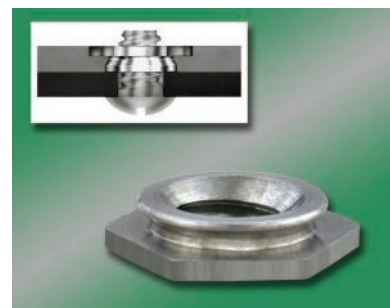
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New PEMsert Type F4 self-clinching flush nuts from PennEngineering offer ideal attachment solutions for stainless steel assemblies by providing load-bearing threads in thin stainless sheets without creating any protrusions on either side.

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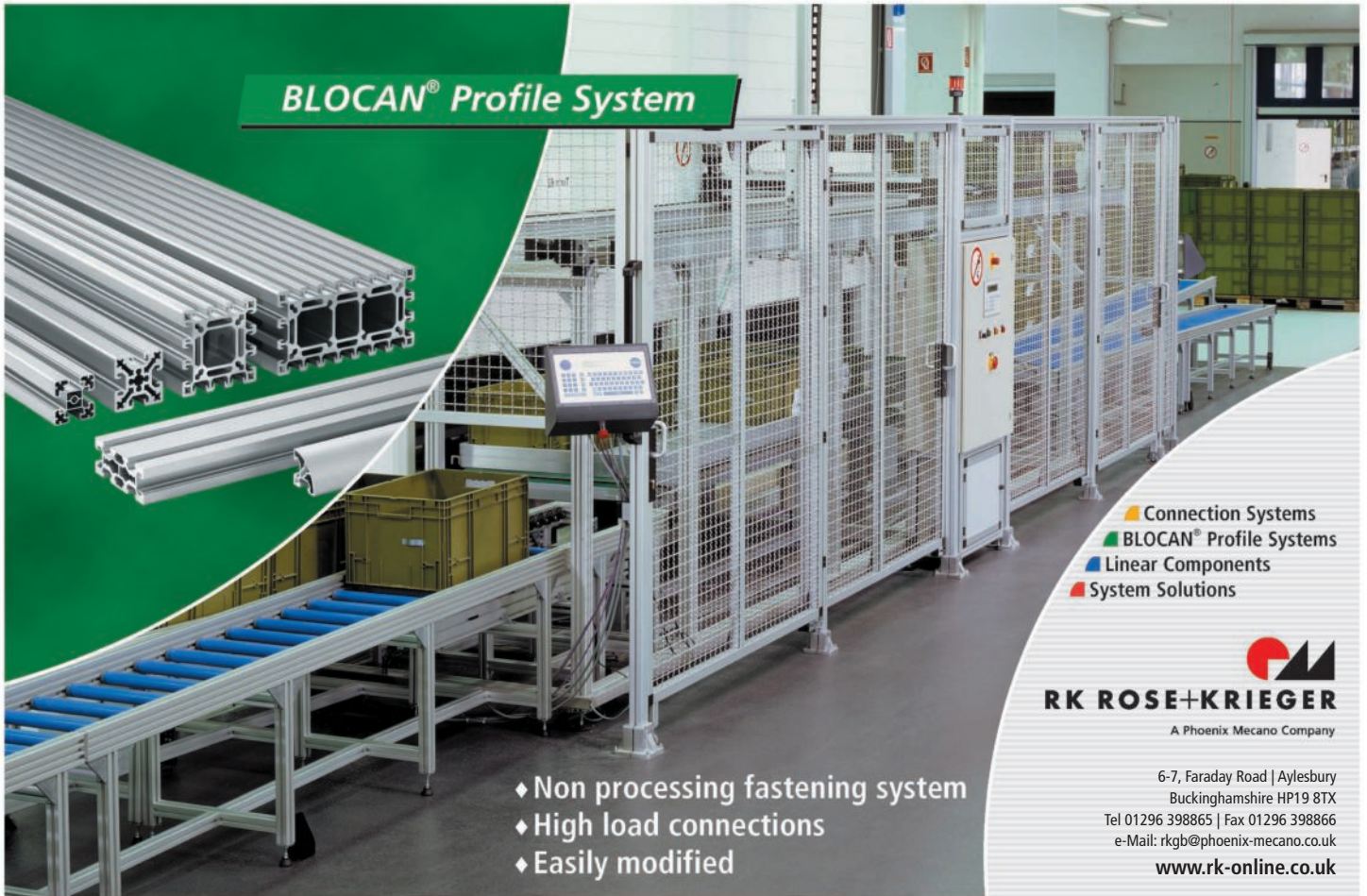
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Managing **RAPID** change

Infiniti Red Bull Racing's Innovation Partnership with Siemens PLM Software helps it win championships and brings benefits to other users. Justin Cunningham reports.

It is difficult to think back to the days whenreams of paper drawings consumed rooms, along with jumbled test results and random design concepts on loose sheets of paper. Even with impressive organisation, getting access to a given part or assembly drawing was time-consuming. It made capturing internal knowledge and ideas difficult to formalise, and often relied on long-serving senior personnel to fill in any blanks.

However, as the design process has gone digital, a host of systems and corresponding acronyms have been developed to make the process of accessing and organising design data quicker and easier. This enables firms to leverage data from across the entire business to drive the design process.

The accumulation of CAD, PDM, ERP, SLM and other business functions now broadly falls under the overarching system of Product Lifecycle Management (PLM). PLM goes well beyond design data and now delves into potentially every aspect of a modern engineering business. PLM is about capturing, utilising and leveraging data and knowledge from the entire business.

The concept of a data led business has had a

profound effect on efficiency and the way in which product procurement is carried out. It has encouraged much more of a systemic approach to planning, design, supplier collaboration, manufacturing processes and end of life considerations much more assessable and understood at the frontend. Indeed, this is driving overall capability, with less revision going back and forth as a result of improved understanding of other departments beyond the design office.

Fulfilling great expectations

To keep up with the needs of engineering businesses, Siemens PLM has set up a number of Innovation Partnerships with leading engineering companies to understand what the requirements are today and also to drive future developments. These include an impressive list of large, successful global engineering brands including Rolls-Royce and Infiniti Red Bull Racing.

"Different industries have different challenges and needs," says Neil Dunsmuir, vice president of EMEA marketing for PLM at Siemens PLM. "We need to ensure that our PLM system works for a

company like BAE Systems in managing, for example, a submarine that has 2 million parts and a lifecycle of 50 years, to a consumer electronics company that produces a new product in its millions, every six months, but has a lifecycle of only two years.

"So, Infiniti Red Bull Racing showcases us to industries that require that high volume of change in the design and release of products. As a Formula One team, it has to manage the pace of innovation and set that rate of change, very aggressively. And that also helps push us in terms of future development."

Though Infiniti Red Bull Racing may push the boundaries of Siemens PLM Software, it is keen to make clear that it uses the software only as intended and that it is exactly the same software that is shipped to customers worldwide.

Siemens' Teamcenter is, by its very nature, a highly configurable system designed to be effective in almost any sector and size of company. For Infiniti Red Bull Racing, that means its workflows have been configured to allow the rapid development of highly sophisticated parts. The ability to push design change through its



From the factory to the track: winning races is all about effective management of resources

business is a key part of its competitive edge.

"We need something very robust, that is able to perform at a fast pace and at a high level of complexity," says Al Peasland, head of technical partnerships at Infiniti Red Bull Racing. "Some weeks, we could be pushing up to a thousand design releases through our technical office but we manage that in pretty much the same way as any company using Siemens' Teamcenter software. So, where possible, we prefer to keep everything 'out of the box' in terms of the way we configure the software."

Even the performance of the workflows is something that is closely monitored by Infiniti Red Bull Racing to ensure that there are no bottlenecks and that any project work does not get stuck on an individual's desk for too long without being actioned.

"When a designer saves the final NX 3D CAD model, it goes into a Teamcenter workflow that is passed to various members of our team depending on the specific attributes set up by that workflow," says Peasland. "It depends how safety-critical the change is, what type of part it is, does it affect the electronics of the car for example, as different attributes trigger different workflows and how it is shared around the business for approval and sign off."

Indeed, it is not unusual for manufacture to be happening in parallel with the design of a part. However, within this rapid collaborative environment is the PLM digital backbone that enables tracking and control of work going on, from parts manufacture to its delivery to circuits around the world.

"We need to be able to monitor performance and track any design or project, so we know where it is and if it is on schedule," says Peasland. "So we need tools to support and drive that and make sure they are agile enough to work in parallel with a very fluid and dynamic workforce."

While Siemens PLM Software aims to enable, capture and manage innovation, it is a fine line between this goal and simply creating a highly laborious data entry task that actually begins to become a barrier to innovation happening in the first place.

"We need to make sure our products are moving at the pace that Infiniti Red Bull Racing

and our other users expect," says Dunsmuir. "It needs to be the Formula One team that is able to push the most design iterations through its business, as that's what wins and loses races over the course of a season. So, if we don't develop the software and innovate with the team, then we will actually become an inhibitor to innovation."

In almost every part of Infiniti Red Bull Racing is some element of Siemens' Teamcenter Software. In particular, access to Teamcenter Visualisation is common. This is a lightweight 3D CAD viewer that most people at Infiniti Red Bull Racing can use to view parts and assemblies, from mechanics in the pits to strategic management.

"We can share very rich data with anyone in the business, almost anywhere in the world," says Peasland. "That means mechanics can see the 3D data of the parts they are about to assemble at the circuit."

"Because of the open architecture of Teamcenter, it also ties into other systems very easily such as our ERP system and our part-living system. Some of these are written in-house, some are off the shelf items. So Siemens PLM Software has integrated with all these different aspects of the business and brought them all together. It really is our backbone as it reaches into almost every area of the business."

www.plm.automation.siemens.com
www.infiniti-redbullracing.com

Bringing a Formula One Car to Life

See Al Peasland, head of technical partnerships for Infiniti Red Bull Racing, talking about its partnership with Siemens PLM Software at the Engineering Design Show's *Eureka* Conference, at the Ricoh Arena, Coventry, on October 22nd at 10.15am.

Infiniti Red Bull Racing is the current Formula One World Champion, having achieved consecutive driver and constructor world championship titles for the past four years. Its race-winning performance on track is only possible with the dedication and commitment of a highly-skilled team, coupled with the latest in technology and systems. Get a behind-the-scenes insight into the fast-paced and exciting environment of Formula One design and procurement.

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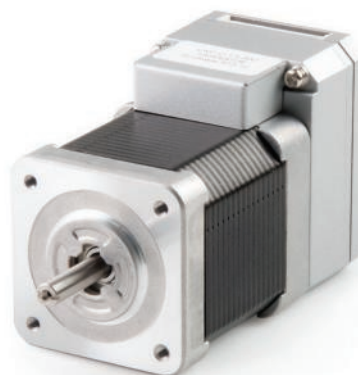
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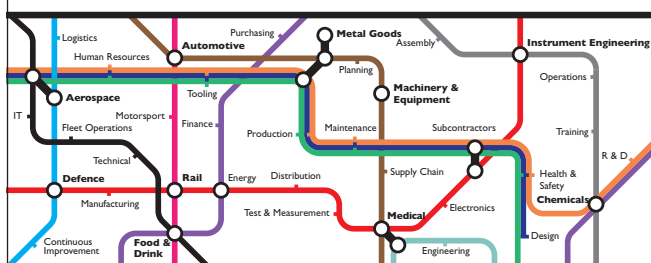
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Intelligent specification of drivetrain components can lead to improved integration and significant efficiency gains. Justin Cunningham reports.

Depending on the industry, environment and requirements of any given application, there are many different methods of transferring power from mains supply to machines. But no matter what the layout of the drivetrain, there will always be some solutions that offer smoother integration and better efficiency than others.

The recent introduction of IE3 has seen many more energy-efficient motors come to market. In reality, however, an efficient motor only plays a small part in the potential energy savings available to the system as a whole. Indeed, many industry experts are encouraging engineers to hand-pick components to maximise the energy efficiency during integration, as each stage of the drivetrain can offer efficiency savings.

Markus Kutny, permanent magnet synchronous motor (PMSM) product specialist for Bauer Gear Motor, says: "Energy efficiency is a hot topic across every industry at the moment, but without fully understanding all the components within the drivetrain, only a fraction of the potential savings can be realised."

Throughout the drivetrain, the potential energy savings available are approximately, 10% from improved motor efficiency, 30% via electronic speed regulation, and as much as 60% from the optimisation of the mechanical system.

"This highlights the fact that, while the current focus on energy-efficient motors is important, it's even more important that engineers don't lose sight of the other areas where improvements can be made," says Kutny. "Maximising the savings potential across each of the fields listed above is possible through smart specification of parts that focus on a combination of long-term reliability, low maintenance costs and the best energy efficiency possible."

Recent technological advances in motor design have allowed manufacturers to deliver radical improvements in energy efficiency. Added to the recent IE2 and IE3 regulation (and the future IE4 regulations) this means that most applications are already benefitting from improved electrical

More than the sum of its parts



efficiency.

A recent comparison test carried out on a Huber disc thickener at a water treatment works in Germany between a standard IE2 asynchronous motor and a Bauer IE4 super premium efficiency motor showed energy savings of over 40% is possible with the newest technologies.

Driving efficiency

With a great deal of attention being focused on improving motor efficiency and further IE classification rumoured to be on the way, most leading motor manufacturers are able to offer IE4 performance where required.

Bauer, for example, has developed a range of stainless steel IE4 motors for easy 'washdown' and even an ex-rated (flame- and spark-proof) solutions. With the increasing choice available, engineers are also having to consider purchase price, running costs and reliability as factors when selecting and sourcing motors, as well as

integration with other components.

"While motor efficiency and speed control currently enjoy the majority of media coverage, the fact is that mechanical optimisation accounts for the majority of potential savings in most existing drivetrain solutions," says Kutny. "In fact, the opportunities are so vast that we split it into two further sub-categories: Gear Technologies and Drivetrain Optimisation."

Other factors to consider for an efficient system include using a speed control device to monitor the output of the motor and regulate its energy use accordingly. This is well known to be a quick and simple way of increasing the efficiency of a system. Depending on the requirements of the application, there are many different control and monitoring concepts which may offer the best combination of cost and efficiency.

"Most leading manufacturers are able to offer

products with varying degrees of control and performance, all of which are extremely reliable," says Kutny. "However, it's always worth speaking to an expert to source a solution which will integrate best with the motor and other components, that you have specified."

Clearly, specifying the right gearbox design with optimised ratios to maximise efficiency is crucial. A well-specified gearbox can help to ease the load on the rest of the drivetrain simply by delivering better reduction ratio between the motor and the drivetrain. For applications which require accurate speeds, or high torque transfer, a bespoke design is always preferable as good quality manufacturers should be able to work with design team to develop bespoke solutions.

"Drivetrain optimisation is the last piece of the puzzle, but no

efficiency equivalent to the step-up from an IE1 motor to an IE4 in the same drivetrain. So the potential is very significant.

With such dramatic performance increases possible, end-users are increasingly seeking out manufacturers and suppliers that are able to offer integration support. Modern day technology means that engineering as a whole is quickly moving towards new levels of efficiency that were previously thought to be impossible.

"Not only does this help to cut end-users' running costs, it is making a real difference to the environment," says Kutny. "While individual technological advances are exciting, it's important not to lose focus on the energy-saving possibilities of the entire drivetrain."

www.bauergears.com



"Energy efficiency is a hot topic across every industry at the moment, but without fully understanding all the components within the drivetrain, only a fraction of the potential savings can be realised."

Markus Kutny



less important than the considerations that have come before it," says Kutny. "Once each aspect of the drivetrain has been specified, it must then be integrated into a machine with as much efficiency as possible. This requires an indepth understanding of the drivetrain as well as the specific demands of the given industry."

Bauer is working on a number of methods that can help further the efficiency improvement during the integration stage. An example is where it is using gearing to take over the bearing function. This helps to reduce the overall number of components, can offer improvements in

IE3 and specifying energy-efficient motors

IE3 motors are gaining significance as components for energy saving machines because from January 1, 2015, motors with a rated output between 7.5 kW and 375 kW shall comply either with efficiency class IE3 or IE2 if they are equipped with a variable speed drive.

Many companies are already able to offer motors with premium efficiency IE3 and they may even be beginning to supply super premium efficiency IE4.

The exceptionally high energy efficiency of these motor-drive packages derives from the virtually complete elimination of rotor losses and the optimised rotor design of the synchronous reluctance motors and optimised drive control.

Improvements in motor efficiency have been made possible thanks to new materials, better design and better manufacturing. Through the innovative design requiring no cage (and no permanent magnets) the rotor of the synchronous reluctance motor has virtually no losses and the rotor temperature is lower than that of conventional rotors with all the advantages.

A higher efficiency motor typically costs more than the motor it is replacing. However, the higher purchase cost is recouped by the power savings it makes during its operational life.

For example when working near full load a typical 11kW IE3 motor will be around 1.6% more efficient than an IE2 equivalent and might cost up to £200 more to buy. If the IE3 motor was running continuously, you'd save around 1,290kWh a year compared to the IE2 equivalent. With electricity costing 8p/kWh (including Climate Challenge Levy), this gives a £100 saving each year, paying back the additional investment cost in 24 months.

Flow meters are a commonplace fixture in the industrial market. Their versatility and broad spectrum of applications have meant that magnetically-inductive devices have become established as the standard and are available in many versions, while devices based on ultrasound and coriolis principles are also seeing increases in application.

Despite this, it remains the case that traditional flow meters have significant weaknesses and limits of application, therefore making the choice of a suitable device for the respective measuring task a challenge.

Clearly the ideal flow meter would have certain core properties. It needs to cover the largest possible measurement range and perform the measuring task reliably throughout the entire life cycle, without excessively high operating expense. Low-maintenance devices are necessary to reduce downtimes. If a measurement is furthermore required without moving parts, as in the case of impellers or permanently mounted units such as vortex flow meters, this currently necessitates very complex and expensive procedures such as Coriolis technology, or solutions that are limited to media with specific properties.

It is for these reasons that Burkert Fluid Control Systems developed what its product manager Volker Erbe describes as “a breakthrough in flow measurement” in the form of its new FLOWave technology.

FLOWave is based on Surface Acoustic Wave (SAW) technology. This uses wave propagation similar to that seen in seismic activities such as earthquakes. In the FLOWave sensors, the surface acoustic waves are excited on a pipe surface by a piezo-electric interdigital transducer specially developed by Bürkert for this purpose. As with an optical waveguide (e.g. a fibre optic cable), waves are sent on a zigzag path through the measured medium (fluid) using acoustic waveguide technology.

As stated, the main principle of this flowmeter is based on wave propagation forms similar to seismic waves, which start from an initial point of excitation and spread along the surface of a solid material. FLOWave uses at least four interdigital transducers which are located on the outside of the measuring tube and therefore have no direct contact with the liquid. Each transducer can act as a transmitter or a receiver.

These four interdigital transducers on the surface work together to achieve a more accurate



Not interrupting the flow

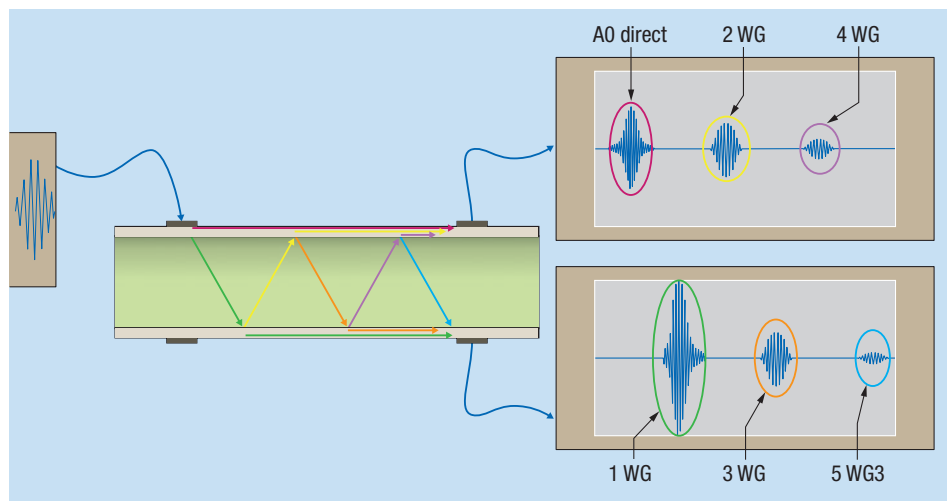
A flow metering technology that does not require the sensor elements to be in contact with the medium has been developed. Paul Fanning reports.

measurement. Sensor numbers one and four send waves with the direction of flow, while sensors two and three send waves in the reverse direction. The comparison of single and multiple waves through the liquid allows excellent measurement performance and evaluations concerning the nature and properties of the liquid itself.

Thus, one transducer emits the wave, part of which travels directly to the first receiver, part of

the same signal is transmitted through the liquid to the opposite side of the tube, where it splits again, with a proportion of the signal going to the second receiver and the remainder travelling through the liquid where the process repeats itself. Thus, a single excitation leads to a sequence of signals being received by two other transducers.

The absolute time for the wave to travel from



the transmitter to the receiver depends mainly on the tube diameter and the type of liquid. The difference between the time of propagation in the forward and backward direction is proportional to the flow. The analysis of all the signals and comparisons based on different criteria such as amplitude, frequency and runtimes, allows evaluation of the quality of the measurement, the existence of gas bubbles or solids as well as the kind of liquid.

The first and most obvious advantage to this technology is that none of the components come into contact with the liquid and there are no flow restrictions inside the measuring tube. Furthermore, the internal surface of the tube can be manufactured to the same surface finish as the rest of the pipeline, meaning that in terms of hygiene, cleaning and flow conditions, there is no difference to any other piece of straight pipe.

This measuring system currently provides very

accurate flow and temperature data and the technology will, in the future; allow density measurement to be used to determine the mass flow rate. The principles behind this design enable the flowmeter to work with a stagnant liquid and so reliable flow figures are available even for the smallest flow volumes. The technology also enables it to recognise quick flow changes reliably, which makes it suitable for fast filling processes.

FLOWave also solves many of the issues associated with some high-end flowmeters, such as system vibration in the plant, magnetic and electrical effects as well as the conductivity of the liquid - none of these factors have any effect on the accuracy or reliability of the flow measurements; plus, the SAW technology also has the ability to distinguish between laminar and turbulent flows, a feature that will be available later.

Not only does this revolutionary design come in a compact and simple design, but this flowmeter can also be installed in applications in any orientation without affecting performance. The initial design, Type 8098, will comprise an all stainless steel body in four sizes, DN15, DN25, DN40 & DN50, fitted with a clamp connection to meet hygienic standards.

The flow meters of the FLOWave series thus far are specially qualified for hygienic applications and for the flow rate measurement of water with low conductivity. Extensive field tests that have been underway for some time demonstrate the potentials of the new SAW technology. In further development and expansion stages the new technology will then be extended to all other relevant applications.

Burkert is now necessary to make the product line based on this technology available for use in applications with the highest possible benefits. In addition, there will be continued development of the line with respect to the range of applications and functions, with the ultimate goal of a multi-parameter unit with high-end functionality and performance. Parallel to this development, FLOWave will be enhanced to include application-supporting functions and will then be available as a multi-parameter flow meter.

Says Volker Erbe: "From the end of September, we will have data for volume flow, temperature and density. From there, we will have information on mass flow and then density and concentration. This will open up a range of new applications for the technology."

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Volker Erbe, Burkert Fluid Control Systems' product manager sensors



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Future proofing

The next generation of Jaguar Land Rover engines began with a clean sheet of paper. Since then, no stone has been left unturned in its efforts to meet the impending EU 2020 vehicle emission limits. Justin Cunningham reports.

Automotive high flyer Jaguar Land Rover, opened its doors last month to offer a glimpse of where it sees automotive technology going in the future.

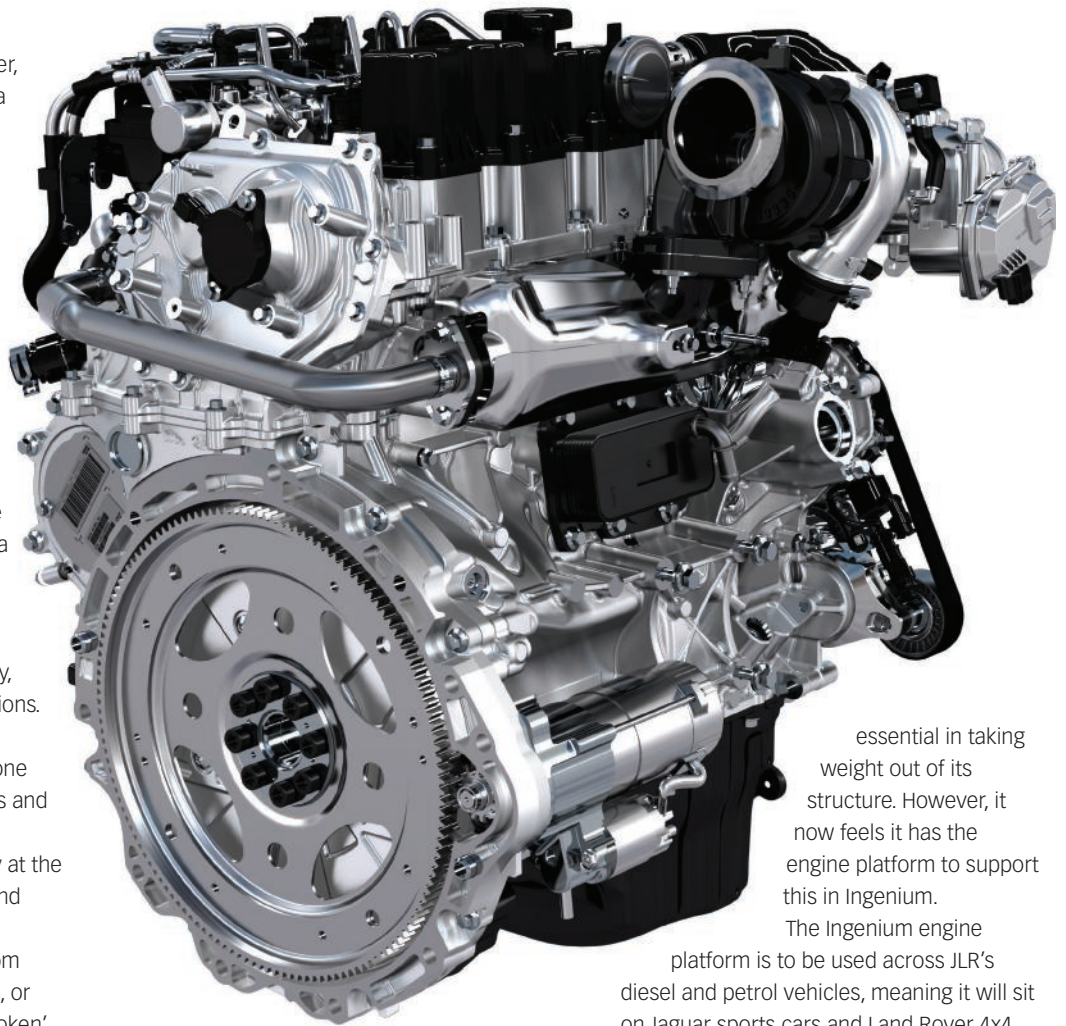
Its Gaydon Design and Engineering Centre is every bit world class and, like its automotive brands, it is careful to pay homage to the past while keeping an eye firmly on the future. Indeed, the building's roof sports a distinct aerofoil profile that reflects the site's former life as RAF Gaydon.

JLR has become a huge UK manufacturing success story since the recession in 2009. The company has gone from nearly being lost to history to being a showcase of British ingenuity and engineering that demonstrates that UK manufacturing can still be world class.

Like the rest of the automotive industry, JLR is particularly concerned about emissions. The tough European cap on average fleet emissions by manufacturer has hit everyone hard. But JLR which produces 4x4 vehicles and high-end sport cars is at a particular disadvantage, as its vehicles are generally at the upper end as regards fuel consumption and corresponding emission output.

This has not, however, deterred JLR from producing vehicles for the luxury markets, or persuaded it to develop a low emission 'token' vehicle as other manufacturers have done to bring down the overall fleet average emission output. Instead it is relying on ingenuity and engineering and is confident in doing so.

"Our target is a reduction in emissions from 2007 to 2020 of 45%," says Dr Wolfgang Ziebart, director of group engineering at Jaguar Land Rover. "The regulation depends on the size of the vehicle and what each individual car manufacturer is offering. In our case, we have to reduce emission output from 242g to 132g of



CO₂ per km. Currently, we are at 180g per km, so there is still a way to go.

"There is no silver bullet, but powertrain is a major contributor, probably 50% of the overall reduction. The second contributor is weight. The third is getting rid of – or minimising – all those other parasitic losses."

The company's investment in aluminium and the development of aluminium chassis has been well documented and one JLR has seen as

essential in taking weight out of its structure. However, it now feels it has the engine platform to support this in Ingenium.

The Ingenium engine platform is to be used across JLR's diesel and petrol vehicles, meaning it will sit on Jaguar sports cars and Land Rover 4x4 vehicles alike. It uses a modular approach and is therefore highly configurable depending on its role.

Engines can be mounted in both a north-south or east-west configuration, and may be used for all wheel drive, rear wheel drive or front wheel drive vehicles, as well as manual, automatic and hybrid transmissions.

And while the cylinder block will be the same, engines will use different oil sumps and engine mounts, depending on the vehicle.



Ingenium's modular design enables both petrol and diesel engines to share more common internal components than before. This is to reduce complexity and simplify manufacturing.

Paul Whitwood, chief engineer of engines, engineering and programmes at Jaguar Land Rover, explains: "We pretty much started with a clean sheet of paper not just from a design perspective, but also from a manufacturing perspective. So we had no constraints in terms of engine layout, engine size, engine capacity, and cylinder placement. They have all been clean sheets of paper for us to decide the optimum. And that has allowed us to really dial in what we need in every aspect.

"If we were working on an existing engine development, we might have a set of machine tools that only take a block of a certain length and width. We haven't had that constraint and it has helped us optimise this engine immensely."

The Ingenium engine follows the general trend of downsizing the capacity while beefing-up the turbocharger. The engines need to have the same amount of air forced through them in the new 2-litre configuration as the old 4 litre engines. Likewise, the exhaust gas recirculation (EGR) system has had to grow.

Downsizing the engine and making the turbocharger bigger means that for a Range Rover, for example, the 2 litre Ingenium engine

will produce the same horsepower and torque as the existing V6 3.0 diesel engine, but will weigh as much as 80kg less. This in turn leads to all sorts of other benefits.

"The engine is probably the single most dense part of the car," says Whitwood. "So the smaller it is, the better it is for overall packaging and design. So if you can deliver that, but have the same level of performance, it is a massive improvement.

"Weight is one of those key attributes that has so many knock-on benefits. If you get the weight out, you get improvements in emissions, fuel economy, handling, and then you also get cost out. It is a snowball effect. Downsizing the engine, all-aluminium construction and reducing friction together all have a huge benefit."

JLR's engine designers have also been able to utilise many component efficiencies to bring down the overall friction inside the engine by 17%. That leads to significant efficiency increases elsewhere, and also benefits driveability, as response is faster and low end torque tends to be better.

The company targeted all parasitic losses within the engine and engine systems. These included the use of roller bearings on the cam and balancer shafts which were previously machined-in bearing surfaces. In addition a

computer controlled variable oil pump saves energy by delivering the optimum amount of oil at all speeds, engine loads and temperatures. It also uses a similar principle of precise control over the whole operating range with the water pump, which adjusts the amount of coolant flowing through the engine, from none at start-up to gradually phasing in cooling to the cylinders and then the block as required.

Mark Heaton, a principal engineer for engine design at JLR, says: "It is finding that delicate balance between appropriate sizing and optimum friction. And a lot of the work is fine tuning these parameters.

"The camshaft roller bearing, for example, makes a big difference to the engine efficiency. You also don't need to pump oil on them as they just work on splash, so that reduces the size of the oil pump. Again, it's taking out parasitic loss and improving efficiency. It is

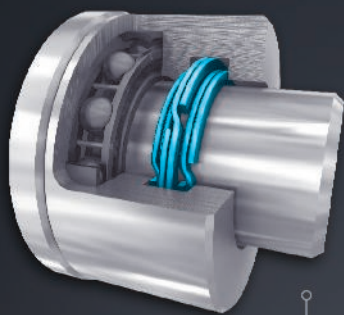


looking for any chance to save energy."

The result with all these individual savings and efforts by JLR is an engine platform that offers more saving than the individual sum of the savings. It now has the power train to accompany the lightweight chassis that will enable it to offer the kinds of efficiency gains that are being required.

"We will have no issue with 2020 and this is the engine to take us up to that point," concludes Dr Ziebart. "And if you add in to this plug-in hybrid technology, and all electric technology, like we plan to do, we'll be able to improve even further beyond that until we reach zero emissions."

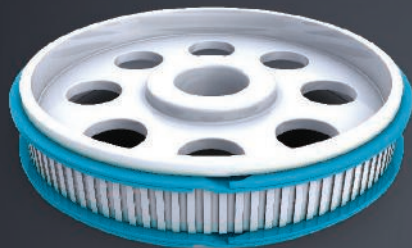
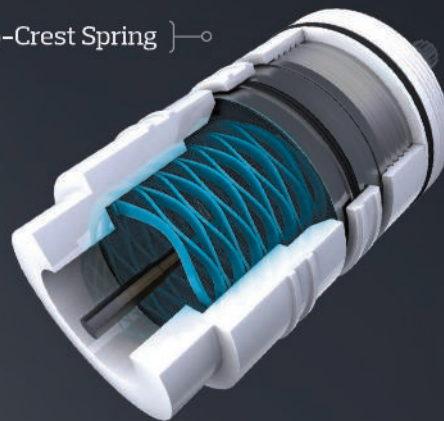
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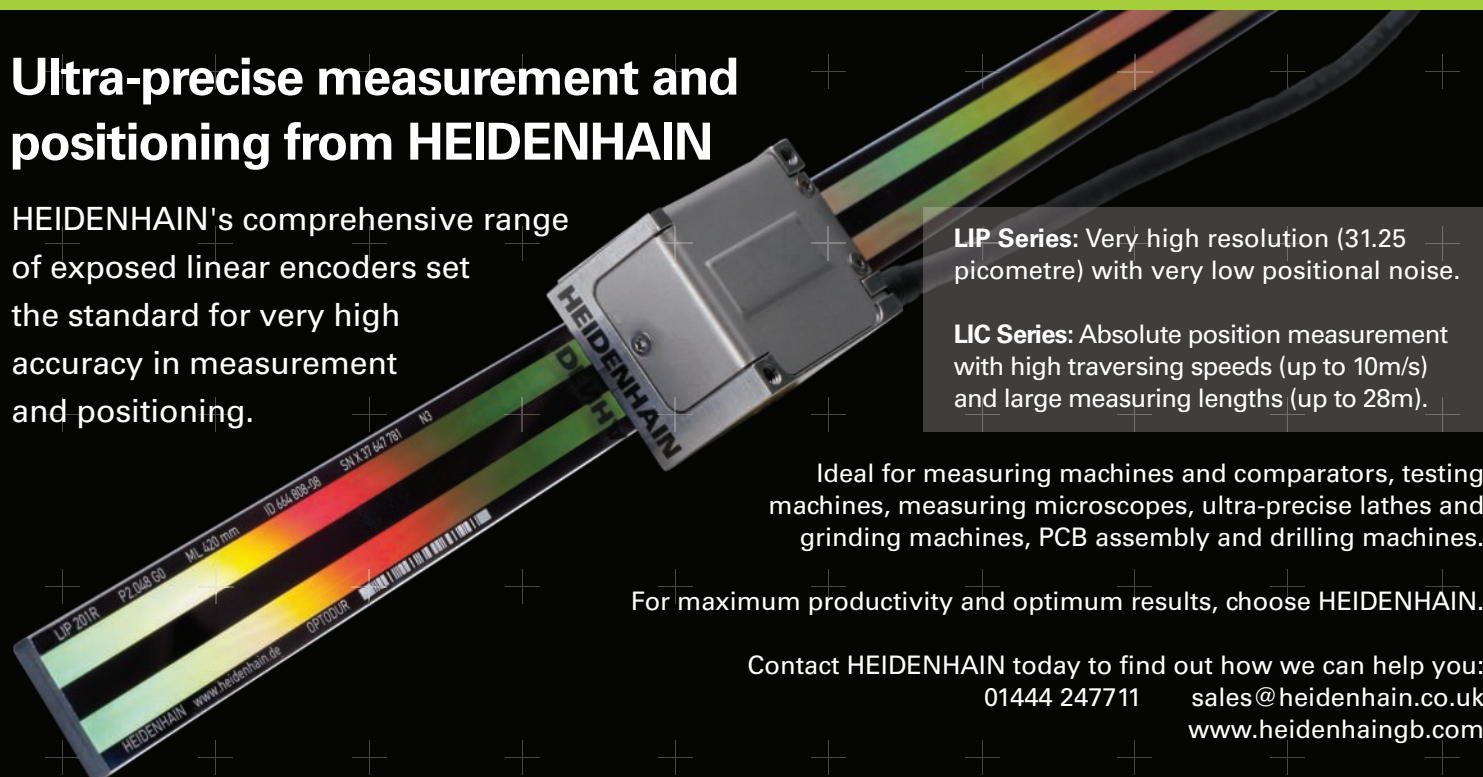


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Better by design

Design rights are a crucial, but little-understood aspect of IP. Here, Matthew Dick and Charlotte Musgrave of D Young & Co LLP explain.

To many of us, to think of 'design' is to think of a plan. However, legally speaking, a design is: "the appearance of the whole or a part of a product resulting from the features of, in particular, the lines, contours, colours, shape, texture and/or materials of the product itself and/or its ornamentation". In short, design rights protect the visual appearance of a product.

Other intellectual property (IP) rights protect the technology embedded in the product (patents), the brand name or logo of the product or company (trade marks) and any text, images or sounds associated with the product (copyright).

Design rights may well be the unsung hero of the IP world. Often overlooked, they are a cost effective weapon of choice when protecting the aesthetic appearance of products. Their commercial advantage is significant in terms of their low cost (when compared to patents for example), the speed in which they can be registered, and the length of their protection (up to 25 years – five years longer than a patent).

Registering your design

To obtain valid registration a design must be new (i.e. not the same as any design already available to the public) and have 'individual character'. The test for individual character is often the most contentious point if the validity of a design registration is ever challenged. It is subjective and requires that the design as registered produces a different 'overall impression' on the 'informed user as compared to designs already in existence at the time it was filed.

Getting it right – lessons from the courts

One of the most important cases that considered the question of individual character involved air fresheners. Specifically, did the shape of the Air Wick Odour Stop product



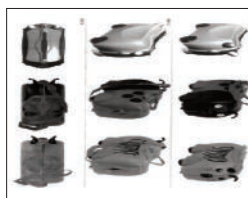
(right) infringe Proctor & Gamble's Community registered design for the packaging of Febreze (eft).

Initially P&G's design was considered valid and infringed. However, on

appeal it was held that that subtle differences between the two designs meant they produced a different overall impression on the informed user, so no infringement was found.

The case suggested that when assessing validity (for registration), a design should be clearly different from known designs, though when it comes to infringement, just being different is enough to avoid infringement.

More recently, the design of children's ride on suitcases were the source of legal debate. Magmatic's 'Trunki' and PMS' 'Kiddee Case' were compared in court. Initially the court held that Kiddee Case design shown below (middle and right column) infringed the Trunki design (left column), but on appeal this decision was overturned and no infringement was found.



The court noted that surface decoration and colour were important when considering the

overall impression created by the two allegedly infringing designs in question.

While design rights are accessible in terms of their cost and commercially valuable with regard to the strength of their protection, it is clear that registration needs to be robust and well-considered in order to get the broadest degree of protection. The judgments discussed above help us to better understand the features likely to be taken into account should validity and infringement of designs be assessed.

If you are interested in seeking design protection for any of your products or associated packaging and get-up, we strongly recommend speaking with an IP specialist.

Take the design test

How would you judge similar cases to the ones covered in this article? Validity of the designs on the left was challenged based on the earlier designs on the right. Which do you think successfully won their case?

For the answers see:

www.dyoung.com/designstest

Community design	Earlier design

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Saved by the bell?

We all know the grinding frustration of waiting in for an important delivery or service. Often one takes half a day off work because the company or tradesperson can only offer the vaguest of windows during which they may arrive, only for us to have to pop out into the garden or some other remote part of the house for five minutes and then miss their call.

In the UK alone, we are now purchasing approximately £3bn of consumer products online per week, meaning that nearly 1.5bn packages are sent out for delivery each year. The problem, of course, is that 35% of these packages do not reach the addressee – often because the courier calls and is missed, leaving only a 'We called but you were out...' message to signal their presence.

This is more than an annoyance, of course. The time lost by waiting in for deliveries that never come is time that could be spent working or undertaking some other fruitful activity, meaning that missed deliveries also have a negative effect on the productivity of the country – as well as wasting the time and resources of the courier company.

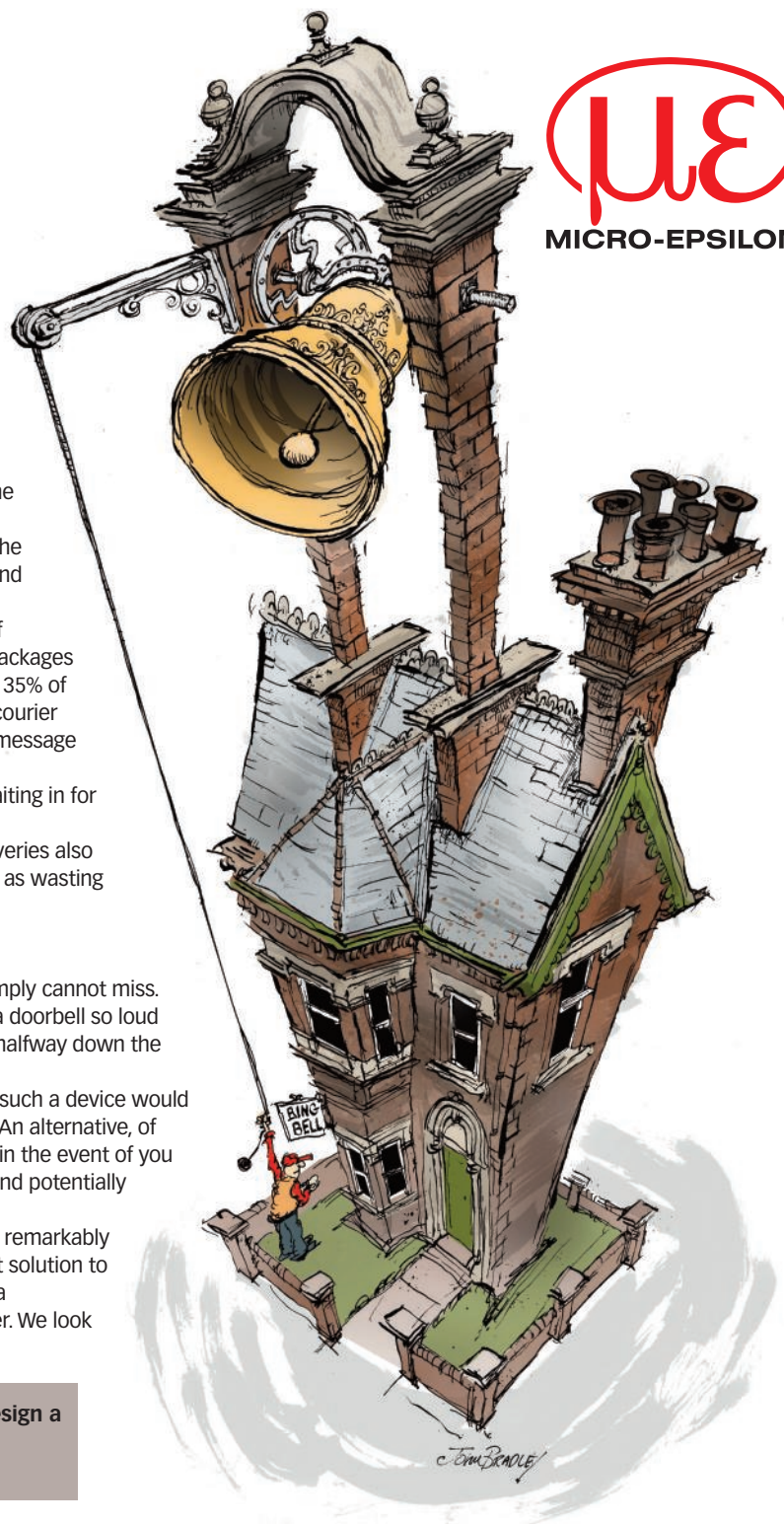
The Challenge

The challenge this month, then, is to invent a doorbell that you simply cannot miss. The question is how? The obvious solution, of course, is to make a doorbell so loud that you can hear it from anywhere in the house, garden or even halfway down the street.

Of course, this brings its own problems, as the decibel level of such a device would need to be a threat to one's hearing in order for it to be effective. An alternative, of course, would be for the courier company to contact you directly in the event of you not answering the door. However, this is time-consuming, costly and potentially fraught with problems (lost numbers, wrong numbers etc).

The solution we have in mind is one of those ideas that seems remarkably obvious when you hear it, but is nonetheless a simple and elegant solution to the problems outlined above. It is currently seeking investment via crowdfunding. However, there is nothing to say you can't do better. We look forward to finding out.

The answer to last month's Coffee Time Challenge to redesign a zipper that can be used one-handed can be found in our Technology Briefs section on page 10.



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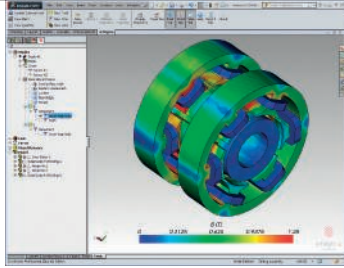
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Joystick Controllers

VDL Containersystemen gets Hooked on Heavy-duty Penny + Giles Joystick Controllers from Curtiss-Wright

Curtiss-Wright Corporation (NYSE: CW) has announced that its Industrial division is supplying Penny + Giles JC8000 joystick controllers to Netherlands-based VDL Containersystemen, a designer and manufacturer of container handling systems including hooklifts, skiploaders and cable systems.

VDL Containersystemen's 'Classic' control system for the hooklifts uses cabin-based air controls to operate the hydraulic main valve that drives the hydraulic cylinders. This allows the driver to operate multiple (but not simultaneous) functions, including the hooklift's sliding arm or sliding/tilting arm.



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