

EUREKA

THE MAGAZINE FOR ENGINEERING DESIGN

In this issue: IP survey • Energy harvesting sensors • Tidal energy • Engineering Design Show preview



The return of 'Made in Britain'

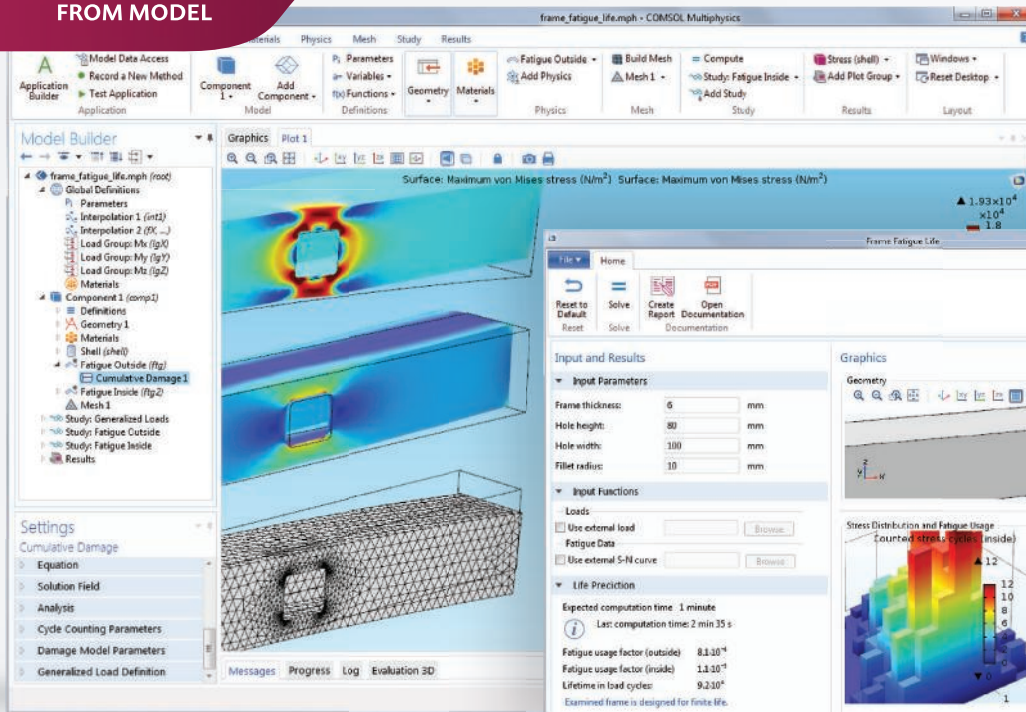
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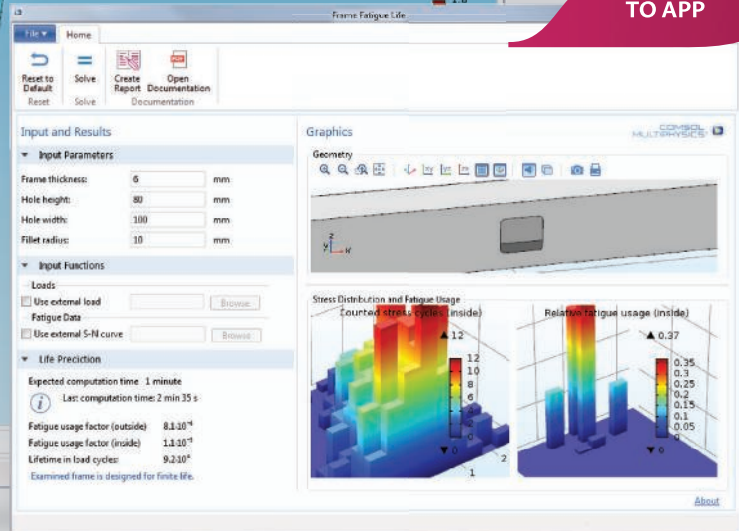
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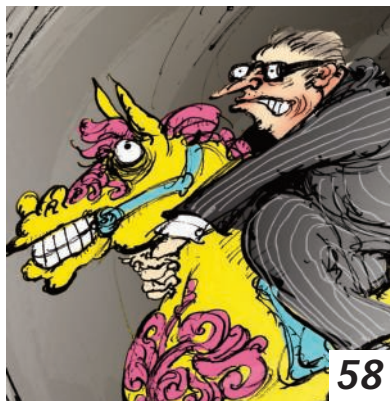
14



18



41



58

14 Cover story: UK NOT washed up!

Is it common sense or is it just repetition that makes the mantra 'we can't do that in the UK anymore' a self-fulfilling prophesy? One product covered by this is the washing machine, but UK design and manufacture of this humble product is once more about to become a reality.

18 Interview: Electric head

We talk to a former petrol head and ask why he decided to swap roaring engines for whirring motors, and what it's like to work within motorsports' radical new formula.

21 Software solves recruitment riddle

CAD is a common component throughout the design community, so why not use it to build new services?

25 Designers get electric sparks

The DesignSpark family of CAD software now includes a version for electrical design.

27 Good vibration for sensors

Increasing desire for real-time sensing has created a need for self powered sensors. So, is energy harvesting from the surrounding environment a viable possibility?

31 Robots rise where it's harsh for humans

Inductive encoders offer an alternative to traditional position sensors for the new wave of robotics that do the jobs too dangerous for mankind.

35 On track for bumper harvest

A tractor's life is not an easy one, but having tracks rather than wheels appears to be making life easier. However, designing them is anything but a straightforward task...

41 Tide has turned for renewables

A new design of tidal turbine is poised to dip its toe in Welsh waters.

44 20 Reasons to visit EDS

3D printing, sporting excellence, ethical production... there are plenty more reasons to come along to the Engineering Design Show 2015, but here is our top 20.

49 Surprises round every corner!

EDS will have a number of special exhibits that will inspire, entertain and intrigue. Find out here what to expect.

54 Survey: IP protection on the rise

Our IP survey revealed some interesting results. Anthony Albutt takes a look at them and addresses some of these IP concerns that were raised.

5 Comment

We are awash with British companies springing up, but not it appears, with the ability or backing to build our power stations.

7 News

New platforms and technology for 3D printing.

BEEAs 2015 shortlist revealed.

Driveless pod takes to the road.

Bus is first past the low carbon post.

Wind tunnel technology now caters for inflight gusts.

Designing cars in virtual reality.

Latest events and products from the *Eureka* website.

58 Coffee Time Challenge

Going underground: If you were given a free hand to redesign the Circle Line on the London Underground, what would you do? That is our 17 mile challenge this month!

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Making British energy



Tim Fryer, Editor (tfryer@findlay.co.uk)

An interesting observation from Pamela Petty, Managing Director of Ebac, was that her father John Elliot started out in business with the philosophy that if he could sell his products for more than it cost him to make them it was worth it. For all that it might be a simplistic philosophy, the company grew over the 40 years to the point where Petty is now guiding it into a new phase of designing and manufacturing washing machines in the North East of England, as discussed in our cover story this month (see p14). The company has clearly found a way of making a commercial case for buying its products, rather than a 'Buying British' mentality driven by a combination of civic duty and a perception of quality (often misplaced). But the battleground has shifted in this respect, and John Pearce, CEO of Made in Britain commented: "Being part of the community of manufacturers, our members are declaring a long-term commitment to skills, sustainability and the people they employ."

Employing British people, or rather people in Britain, and providing them with skills does, you would logically assume, result in a sustainable outcome. Why then does it make sense for a French company to build our next nuclear power plant using Chinese technology and money? The cost of Hinkley is estimated at £25bn – a huge sum of money that I appreciate would not go unnoticed in the country's coffers. But when the deal also ties us into decades of (potentially) vastly over-priced electricity, what is the country really gaining? The argument that we don't have £25bn and so we therefore need investment from overseas companies, ignores the fact that it still needs to be paid for. And the cost then becomes £25bn plus that company's substantial profit margin. So if nuclear power generation is considered the right way forward for a low carbon future, shouldn't we take the opportunity to use British companies and British engineers to provide an ultimately cheaper solution that also feeds into the notion of 'skills, sustainability and jobs'. Why not have energy that is made in Britain?

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NEWS



Free form of 3D printing

In a departure from existing additive manufacturing techniques, Arburg – a company associated with injection moulding equipment – has introduced a new additive manufacturing platform, Freeformer

The company believes the technology employed allows the platform to be more than just the prototyping tool that many other 3D printers are, answering the market trend for short product life cycles and the demand for both the production of high-quality parts as one-off items and the personalisation of mass produced parts. Moreover, the system is based on processing qualified standard granulates; the Freeformer and the Arburg Plastic Freeforming (AKF) process.

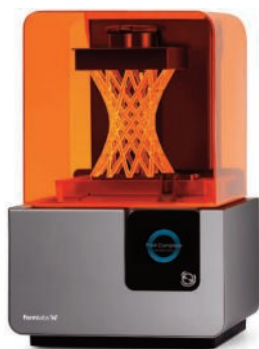
Martin Neff, technology consultant for the Freeformer, said: "Freeformer will make plastic prototypes a thing of the past. A key feature is the use of standard granulate polymer at cost of €3 per kilo – the incumbent specialist material can cost €300 per kilo, providing a strong argument for this machine. And Freeformer requires little prior training."

More information on the new machine will be included in the next issue of Eureka.

TECH BRIEF

Top of the form on the desktop

Form 2 is Formlabs second-generation desktop stereolithography (SLA) 3D printer. "Through building the Form 1 and Form 1+ we've learned that professional engineers, designers and creators need access to powerful, easy-to-use systems," said Max Lobovsky, co-founder of Formlabs. "We believe that this is the 'next wave' of the 3D printing industry: high resolution output with a simple user experience packaged in a desktop footprint. In many ways, 3D printing technology is following a similar path to the desktop computer. It started with mainframes, was adopted by the hobbyist and then evolved into the powerful desktop machines everyone uses today. The Form 2 represents the next wave of 3D printing technology."



Events

For more event details go to www.eurekamagazine.co.uk

Engineering design show

21 - 22 October

Engineering Design Show

Ricoh Arena, Coventry
Conference, workshops and exhibition – see preview starting on page 42

29 October

British Engineering Excellence Awards (BEEAs)

The Hurlingham Club, London
Awards ceremony celebrating engineering excellence

03 November

NI Days - London

QEII Conference Centre, London
Graphical system design technical conference and exhibition

04 - 05 November

Advanced Engineering UK

NEC, Birmingham
Advanced engineering trade show and conference

09 - 10 November

Innovate UK

Old Billingsgate, London
Conference, exhibition and networking event run by Innovate UK

10 - 11 November

TRAM UK 2015 Aerospace Conference

Rotherham
Conference and table top exhibition focused on transferring advanced manufacturing technologies to business leaders, managers and engineers

17 November

Industry Entrepreneurship Summit 2015

London
Summit for industrial entrepreneurs and investors



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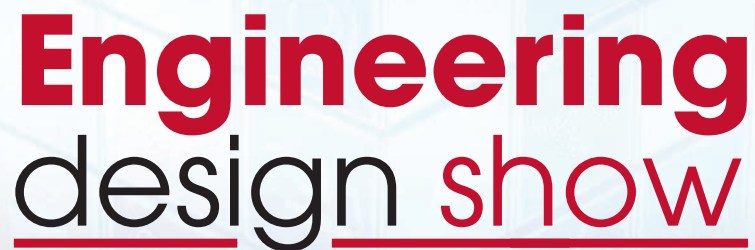
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BEEAs 2015 shortlist revealed

Having sifted through hundreds of entries and assessing every one, the judges have revealed the shortlist for this year's British Engineering Excellence Awards (BEEAs).

The BEEAs are now in their seventh year and the quality of entries continues to improve year on year. Although the Awards are inherently British, the judges were faced with some world-leading entries.

"Once again the calibre of entries for this year's awards has been exceptionally high and the judges have found it difficult to agree on the shortlist," said Phil Mayo, Chairman of the judging panel and MD of Premier EDA Solutions. "The strength of the shortlisted entries demonstrates all that is great about British design engineering. From innovative Start-Ups and clever Young Design Engineers to pioneering Materials Applications and world beating Design Teams, the entries continue to inspire and prove that the UK leads the way on the global design engineering stage."

The companies shortlisted in each BEEAs category are:

Consultancy of the Year

3form Design
Argon
ByteSnap Design
Drive System Design
Kinneir Dufort
Product Partners

Design Engineer of the Year

Mike Lawton	Oxford Space
Paul Pomfret	Xtrac
Richard Poulton	Navtech Radar
Bob Stevens	Ansible
Paul Thomas	Cupris
Martin Wallace	Steeper

Design Team of the Year

Drallim Industries
Electronic Temperature Instruments (ETI)
Industrial Design Consultancy (IDC) & Quantel
Navtech Radar
Optical Metrology Services (OMS)
Xtrac

Materials Application of the Year

3form Design	Novarix IC-eye
Diamond Hard Surfaces	Adm Adamant
	amorphous diamond material
Nylacast	Pipe in Pipe Spacers
Surrey NanoSystems	Vantablack
T-T Pumps	Ready Sump

New Product (Electronic) of the Year

Argon Design	Argon Streams
FTDI Chip	FT600 Series
Laird	BT900
London Underground	Train Monitoring System

RFEL	Ultra-Low Latency HD Video
	Lens Distortion Correction
TDK-Lambda UK	ZMS100-100W AC-DC
	Power Supply

New Product (Mechanical) of the Year

2-DTech	Advanced Graphene Process
Birley Manufacturing	Universally Accessible
	Toilet Module
Bollard Load Testing	Bollard Load
	Test Equipment
Delphi Powertrain Systems	F2
RDM Group	Driverless Pod
Steeper	bebionic Small

Small Company of the Year

Blu Wireless Technology
GWR Fasteners
LG Motion
Magna Parva
Physical Digital
Wideblue

Start Up of the Year

Cubik Innovation
Cupris Health
Oxford Space Systems

Young Designer of the Year

Jenna Allen	A-one+ Integrated
	Highway Services
James Chambers	Greentree
James Melrose	Welwyn Components
Cat Silva	Rotite Technologies
Dan Stamp	Kliklok International

The winners will be announced at a gala lunch at the Hurlingham Club, London, on 29th October. More information about the BEEAs and how to attend the event are at: www.beeas.co.uk



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Innovative monitoring solutions for safety brakes
89065

Machinery health monitoring in hazardous areas
89291

NEWS

First self-driving 'pod'

The LUTZ Pathfinder, the first of three electric-powered 'pod' vehicles, was unveiled outside Milton Keynes Central train station as part of a project to trial automated vehicles in pedestrianised areas.

The event marked the completion of the first project vehicle by Coventry-based manufacturers RDM Group, a project Eureka has been following (see August 2014). The two-seater pod was then delivered to Oxford University's Mobile Robotics Group (MRG) to begin the installation of the pod's autonomous control system.

Following the installation work, the pod will undergo a series of calibration tests at a private test track before returning to Milton Keynes for the start of the public trials. At that stage, the pods will be the first fully automated vehicles to be trialled on public pedestrianised areas in the UK.



Picture shows Eric Chan, principal technologist at the Transport Systems Catapult, unveiling the first LUTZ Pathfinder pod vehicle

"This was a very exciting day for everybody involved in the LUTZ Pathfinder project, because it signals the completion of the manufacturing phase and the effective start of the autonomous technology trial," said Transport Systems Catapult CEO Steve Yianni. "When you consider that there wasn't even a design in place for this vehicle less than 18 months ago, it has been a really quick turnaround to now have our first research vehicle ready to start work, and this has only been possible as a result of our successful collaboration with RDM, MRG and Milton Keynes Council."

Solution to last month's Coffee Time Challenge

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The challenge last month was to come up with a portable safety device that cyclists will use to get round the problem of commuting cyclists either having to cart their helmets around with them or, worse, not use helmets at all.

The solution, obviously, is to have a helmet that is smaller. Less obvious is how to achieve this while maintaining safety performance.

Our solution is called Morpher and it is a helmet that can be easily folded flat to be carried around, and equally easily unfolded for safe cycling. The range will be extended to cover other sports such as horse riding, skaters, snowboarders etc. Made from EPS (expanded polystyrene) it weighs just 250g and will retail for around £60. It contains around six different materials and has, according to the inventor, never been achieved before! For more details go to www.morpherhelmet.com

Although Morpher was our intended solution, another is just around the corner. After several years of development, a new company www.headkayse.com are trialling 'Beta' prototypes of a Patented EN-1078 qualified helmet. The helmet is soft, malleable, foldable, resists multi-impacts and will adjust to fit the majority of all head sizes.



TECH BRIEF

Designing cars in virtual reality

German startup, Rocket Data Intelligence, has presented software which can rapidly generate virtual cars and enable them to be experienced in



3D. Its Virtual Reality Content Machine (VRCM) takes CAD data and generates photo-realistic images and videos of vehicles.

Customers can now generate their dream car at home with their smartphone, tablet or computer and configure it the way they want. At the car dealer, Powerwalls or head mounted displays will allow a submersive experience of the customer designed car.

"Completely computer generated rendering in real time, at this quality, did not exist before, in the automotive industry, at this speed from CAD up to the completed visualisation," said Kubilay Topal, CEO of Rocket Data Intelligence.

The VRCM does not use a CPU for the rendering of visualisations, but draws on GPU Accelerated Rendering. "This method is not only much faster, but simple to implement, especially for dealers. As far as hardware is concerned, all that is needed to use the VRCM is a gaming PC," Topal explained.

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11

LONDON

World's longest 'power from shore' cable



ABB has won an order worth around \$90million from Statoil for a high-voltage cable system to supply power from shore to the Johan Sverdrup offshore oil field.

ABB will design, manufacture and install an 80kV extruded DC cable system with a capacity of 100MW to transmit power from the Norwegian power grid to the Johan Sverdrup offshore production facility. At around 200km in length, it will be the longest extruded submarine cable system to an offshore oil and gas platform facility in the world.

Bus risk takes low carbon award

Optare received the 'Grand Prix' award (winner of winners) for Outstanding Achievement in the 2014-15 Low Carbon Champions Awards, run by the Low Carbon Vehicle Partnership. Mitsubishi took the award in the Low Carbon Car/Van Manufacturer of the Year category.

The judges said that Mitsubishi's Outlander – which helped the company scoop the car manufacturer award – has been a game-changer, bringing plug-in hybrid technology to a 4x4 SUV, at a competitive price. Optare and Scania were joint winners of the Low Carbon Heavy Duty Vehicle Manufacturer of the Year Award. The judges decided to award both companies as their entries covered activities in different market sectors (Optare for buses and Scania for trucks and delivery vehicles).

Optare won the Grand Prix Award, according to the judges, in recognition of Optare's UK market leadership in electric buses and the significant commercial risks in achieving this position. Optare's buses have made an important contribution to improving air quality in UK towns and cities as well as reducing the well-to-wheel carbon footprint by over 50% in comparison with equivalent diesels.

Wind tunnel pioneers



A 1/30th scale model of an Airbus A350 fabricated in high grade steel and ready for a series of wind tunnel tests

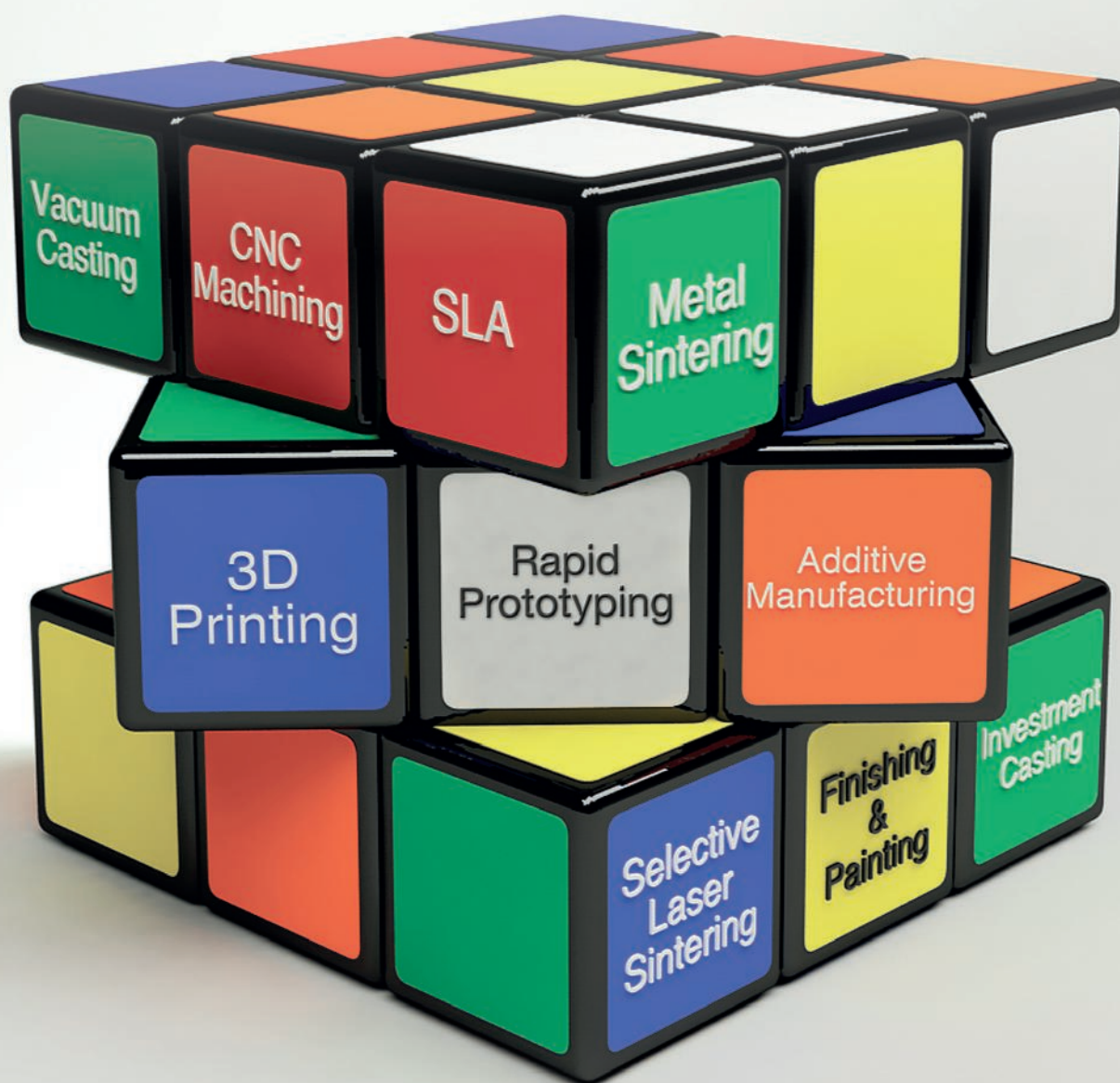
42 Technology and electronics manufacturer Briton EMS have joined forces to help the Aircraft Research Association (ARA) develop and launch an innovative new research tool for use within its high-speed wind tunnel in Bedford. The two companies have developed a sophisticated control system for ARA's new gust generator, the first of its kind in the world capable of simulating gusts at transonic, or cruising, speeds that are typically experienced by aircraft.

The new generator will help drive new research into improving understanding of how turbulence affects aircraft performance and is part of an investment at ARA in new systems and services, funded to the order of £9M by the Aerospace Technology Institute. The tool could help manufacturers to modify their aircraft designs or to develop systems to compensate for gusts, leading to smoother flights.

42 Technology and Briton EMS teamed up with ARA's in-house engineering team to design, manufacture and install the control system for the new generator. 42 Technology designed the system to link the generator's control desk with a network of 1800 solenoid valves, each of which needs to be opened and closed within 20 milliseconds to deliver the required gust profiles. The control system is housed in four two metre high electronics cabinets and was completed from initial design to installation in under two months.



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UK is NOT

“We buy three million washing machines every year in the UK and every single one of them was imported. I couldn’t get over that.”

Pamela Petty

Is it common sense or is it just repetition that makes the mantra ‘we can’t do that in the UK anymore’ a self-fulfilling prophesy? One product that would be covered by this would be the washing machine, but UK design and manufacture is once more about to become a reality, as Tim Fryer found out.

Migration of manufacturing is not always an easy thing to analyse. For very high volume, low value products it was obviously just a question of economies of scale and cheap labour, but it is less clear in other markets. Last year, for example, the UK made 1.5 million cars, a seven year high, and it was one of those stalwart British industries that only a few decades ago seemed to be in terminal decline. So why should the same not be true in other markets? Will we again see the rise of the computer and mobile phone markets? What about domestic appliances? And in particular washing machines?

Pamela Petty is managing director of Ebac, a company poised to reintroduce washing machines that will be both designed and built in the UK. The decision to go down this path was not without some soul searching. “It did make me think that I’d missed something fundamental - why had everybody moved out of the UK?” admitted Petty. “We’re talking about great companies, and if they couldn’t afford to

manufacture here with their buying power and big scale operations, then how could we?”

But further investigation did not clarify the situation, there was not one single reason. Some companies merged and then ‘globalised’, but there was little evidence of washing machine plants shutting down because they were not profitable.

What is more is that Ebac, founded by Petty’s father John Elliot, had forty years experience making dehumidifiers and more recently water coolers – the latter being introduced to provide seasonal balance to production of the former. “It was the perfect summer product to compliment our winter product,” said Petty. “We developed and patented a water trail system that provided a completely hygienic solution to sanitisation of the coolers and dealt with concerns about open reservoirs and bacteria growth. Our water trail system swapped as easily as a printer cartridge would swap, and that meant that the training was easy for the delivery drivers to do it.”

The company had grown both products to over 100,000 units annually. But during the 90s it was clear that change was needed. Petty said: “Eventually the industrialisation of cheaper labour markets hit us too, and we lost enough market share to hurt us. Though we tried to compete by becoming leaner, inevitably we had to re-think our survival.”

Various flirtations with white goods, particularly involving a Turkish freezer manufacturer, appeared to have hit the buffers when Petty attended a seminar in 2012 on Regional Growth Funds (RGF) – Government funding for private sector projects that will protect or create jobs. Plans for manufacture of fridge freezers were already on hand but

washed up!



further research showed that washing machines might be a better initial market. Three million are bought in the UK every year but none of them made here. A second attempt at RGF was successful - £1m was awarded towards capital costs and investment - with a plan to develop and launch a range of washing machines within 18 months.

Petty confessed: "I have to say, my plan was a little optimistic in terms of time. It's taken nearly double that,

although we have pretty much hit the budget cost for the base model and the production equipment and tooling. In my defence, we did in the middle of it all move a chest freezer production facility from John O'Groats to Newton Aycliffe [where Ebac is based]. When the business that made the much loved Norfrost brand of chest freezers went into liquidation in 2013, we bought that equipment which would at least give us a start in refrigeration which was part of the RGF application as well."

Making the switch to washing machines was not straightforward. "We had to learn everything, absolutely everything," claimed Petty. "The project was not as simple as a different application of existing technologies, things that we were familiar with. So we decided early on in the project to buy in the expertise. We bought the oscillating group and the software development for the wash programmes. We selected European manufacturers for critical components that we couldn't make ourselves, companies with a track record for these components."

There are more than 500 different washing machine models available in the UK and so in a bid to offer a complete range that would offer an alternative to the majority of them, a modular approach to the design was settled on. This has given Ebac complete flexibility to put together any combination of drum size, spin speed, motor technology, user control, energy rating and even colour. The first combinations will be aimed at the 'safe zone' - the highest demand sectors of the market according to surveys of consumers, retailers, staff, friends, family...virtually everyone is a washing machine user and has opinions about what they want from them.

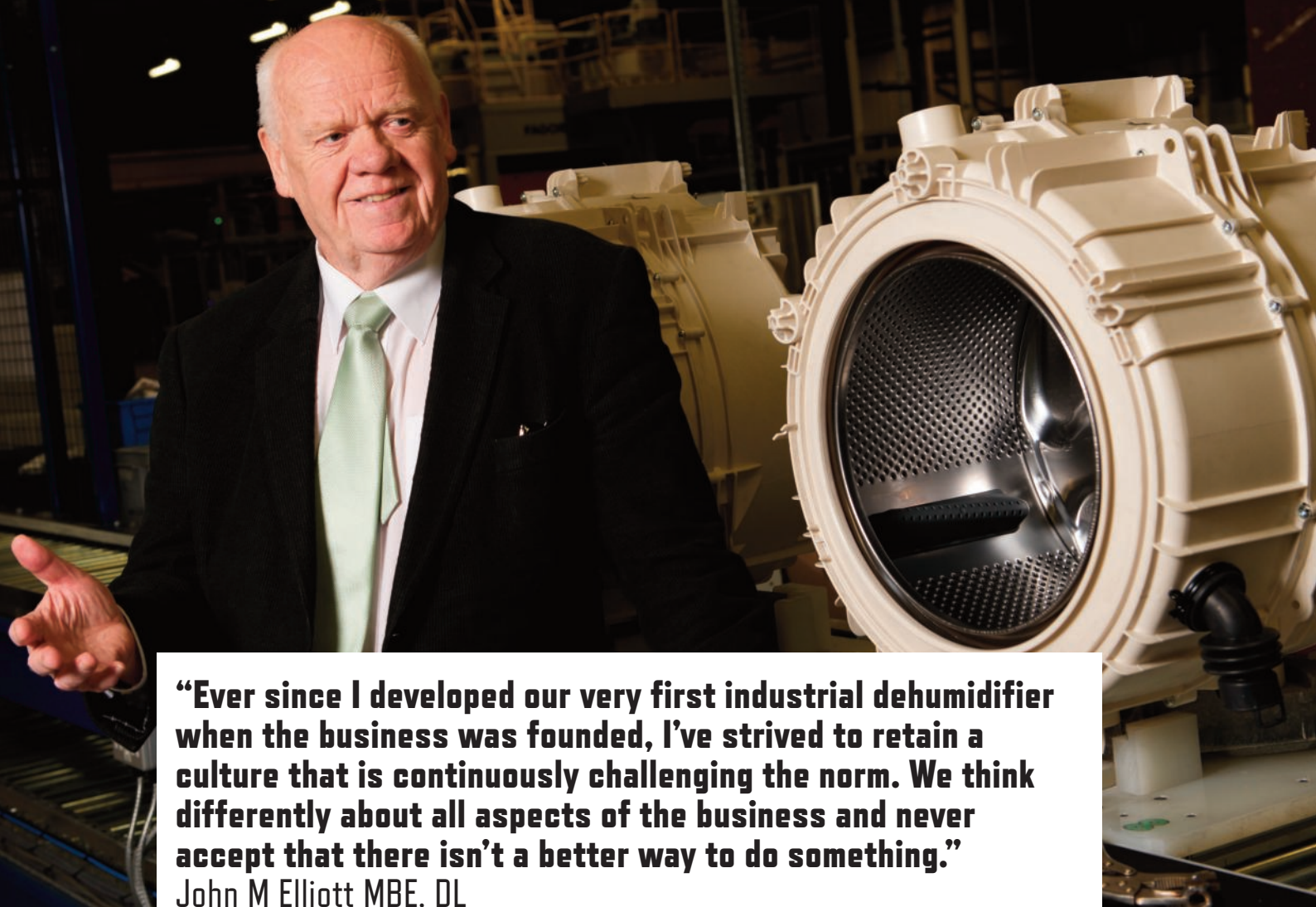
It was important to have something different to offer the market and

there are, initially, two niche areas that the company believes are worth exploiting. The first is technology driven - touch screens. These are entering the market but principally on top end models, so Ebac's range will include affordable touch screen options. The second niche, which Petty concedes is a bit of hunch, is to bring hot fill back to washing machines.

Acceptance for the touch screen idea was verified by an online survey, but Petty believes it is an idea that could be taken a step further. "We can combine it with an app so that we can actually help the visually impaired to do their washing without having to guess where the dial is and just randomly select programmes. Obviously all the gadget geeks will love that sort of thing as well!"

Hot fill is something that used to be commonplace in the UK. However it is perhaps a feature that is beneficial to UK users, but has been lost in the move to globalisation. In general manufacturers would rather make as few models as possible, so having cold fill only models are suitable for the global market. Here in the UK 80% of us heat our water using gas, which is approximately a third cheaper than electric heating, so it is actually cheaper to use domestic hot water than it is to use a washing machine's electric heater. If household water is heated electrically or even by solar heating, where hot water is essentially free, then it makes less sense to have the dual fill option. For the rest of us, dual fill is a more energy efficient way of heating the water in the first





“Ever since I developed our very first industrial dehumidifier when the business was founded, I’ve strived to retain a culture that is continuously challenging the norm. We think differently about all aspects of the business and never accept that there isn’t a better way to do something.”

John M Elliott MBE, DL

place and also allows shorter, less energy consuming, washing cycles. Ebac claims the cost of installing a hot water feed is typically ‘around a tenner’ and would rapidly be recovered by reduced operating costs.

Putting together a design team to develop the new range was largely taken from the existing in-house resources that had worked on the dehumidifiers and water coolers, although an additional designer was employed specifically to design the fabrication. The design team is made up of six design engineers and five technical support engineers. “The electronics and oscillating group expertise was bought in but apart from that we did most of it ourselves,” said Petty. “It maybe took us longer, but I do think that sometimes with a clean sheet of paper, you’re not burdened with kind of legacies of how things have been done in the past. Although we did re-engineer a lot, we stripped down a lot of washing machines in this project. The heart of the design is ours but we don’t constrain ourselves if we don’t have the expertise.”

The same is true for the manufacturing strategy. Petty said: “It’s a bit of a mix really. We make the casing and drum from scratch as we do all of the plastic components. But we don’t make the motor or the valves, nor do we make the glass door or the concrete weights. We don’t have a hard and fast rule about what we buy or make - we make the right commercial decisions for each individual project.”

The focus during the whole design process has been to obviously meet washing standards but also to meet the customer needs that were raised during the research programme, making washing easier and the machines last longer – most come with a five year guarantee. Petty observed: “Most of these features are very simple but because we use them every time we wash they have a lot of value to those using them.

Things like a liquid boat that keeps the detergent safe until the wash cycle when you need to pre-wash muddy clothes. A siphon to drain the tub when you need to clean the filter. A quick release button to remove the drawer for easier cleaning. Simpler dial and wash programmes. Our philosophy has been to save money, save time, make the laundry easier and give peace of mind with a good warranty - we call it washology.”

The biggest challenge for Ebac has been getting to grips with the testing standards and the time it takes to complete tests, something the team completely underestimated. In fact the launch of the machines, which had been intended to be this year is now planned for spring 2016, although some machines may be available in advance of the official launch. Petty explained the reason for the delay: “During testing we found an opportunity to improve the durability of a component and have now redesigned that part of the oscillating group. Unfortunately this means a tool modification that will take weeks and then we’ll have to test again - just to be sure that we haven’t made a change that has an impact elsewhere. We took the decision to delay the project and not risk a bad start.”

So does progress at Ebac represent a bounce back for British industry? Will the company pave the way for others? “I hope so, but I think it’s about thinking differently,” concluded Petty. “Whether we’ll ever attract the big brands back with the big factories, I’m not so sure. But I think when we look at things on a slightly smaller scale, and concentrate on that local market as well as what people want out of a product, rather than trying to have a one size fits all, then I can’t see why more can’t follow.”

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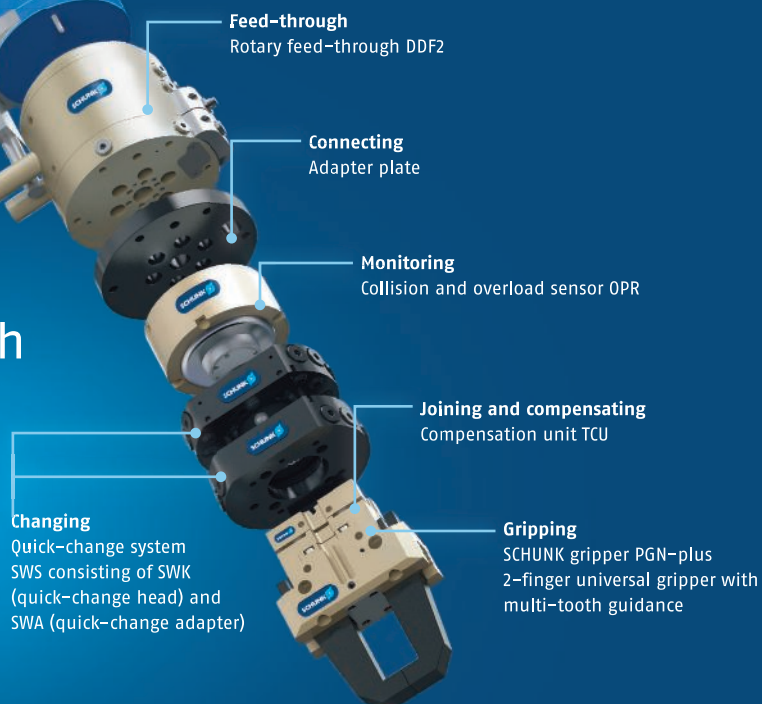
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Electric head

We talk to a former petrol head and ask why he decided to swap roaring engines for whirring motors, and what it's like to work within motorsports' radical new formula.

Justin Cunningham reports.



After a successful debut season, Formula E is set to become a regular feature on the motorsport calendar, after providing close wheel to wheel racing in city centres around the world. There is no getting away from the fact that many initially watched out of curiosity to see what kind of spectacle electric car racing would offer. However, as the season progressed it seems even hardcore motorsport fans were being won over, attracted by more than just the novelty of it all, with genuine interest in the cars and technology behind the pioneering race series.

So, to better understand why so many are making the transformation from petrol head to electric head, who better to talk to than the chief technical officer of the DS Virgin Racing Formula E Team, Sylvain Filippi, who has all the credentials to be in motorsport. He is the son of a former LMP1 driver, he himself had a stint as a racing driver, and he has worked throughout Europe for names including BMW and Mercedes-Benz. Things changed, however, when in 2007 he came to the UK to work for Frost and Sullivan.

"I was working exclusively on electric cars for three and a half years, and I just became fascinated and obsessed with them," he said. "I got a chance to drive a Tesla Roadster in 2008 on the track and realised what these things could do. So that's when I basically switched from being a petrol head to an electric head."

In many respects Filippi is a pioneer of electric motorsport. It was around this time that he put his own plans in place to develop an electric racing series.

"I thought of something called the EV Cup, which was an electric touring car series," he said. "I started to develop some prototype cars, and that's when I started to play with batteries, invertors and all these kind of things."

However, he was beaten to the chequered flag. In 2011 the FIA announced its intention to launch the Formula E championship. However, given his experience he was able to have a significant impact in shaping the initial Formula E regulations. But ultimately, it wasn't where he wanted to be.

"I knew all the technology and developments would be with the teams and not with the promoter," he said. "I got interest from Virgin,

who had the brand, but they didn't have anyone or anything that touched the tyres, so to speak. So I decided to do it, and here we are two years later."

And after a season of highs and lows, the Virgin Racing team won two of the eleven races with UK driver Sam Bird, and finished fifth in the constructors championship. Unlike the UK's strangle hold on Formula One, Virgin Racing is the only UK constructor in the Formula E championship, with competition from all over the world including China, the USA and India.

While the teams have the ability to tweak torque maps and alter the regenerative braking maps of the cars, essentially the first season saw all the teams using identical cars on new city centre tracks.

This threw up a number of surprises for fans and teams, alike. However, with regulations opening up for season two, Virgin Racing has developed the car and so has understandably higher expectations.

"We want to win this championship," he said. "We know we have improved our pace, we just don't know by how much compared to the other guys."

"In season two, the battery has the same dimensions, same weight, and the same cells, but it allows us to increase its power output. While the energy is the same, which means we're still restricted to 28kWh per car, the peak power is going up from 150 to 170kW. So, we have completely redesigned the rear end of the car including the motors, the inverters, the gearbox, differential, rear suspension... basically everything is new."

Many pundits have labelled Formula E as 'the future' with claims it could overtake Formula One as motor racing's most elite category in the next five years. While in pure race pace this remains doubtful, one thing is for sure, the series is aligning itself heavily with electric road car technology, and intends to speed up developments by acting as an R&D platform and technology accelerator. In addition, the marketing side of the series intends to change how people view electric cars and to make them more assessable, and desirable, to everyday people.

"Almost all series, especially Formula One, have extremely restrictive regulations to slow the cars down," he said. "For us, it's the other way round. We are restricted by the technology. At the moment, we don't know how to put more energy in the battery pack, given the weight and

"I drove a Tesla Roadster and realised what these things could do. .. I switched from being a petrol head to an electric head."
Sylvain Filippi,
DS Virgin Racing Formula E Team



the tight space constraints. If tomorrow we could have 40kWh in these cars in the same amount of space, we would do it.

"So for me, the key difference is that Formula E is here to really push innovation because we are not restricted by regulations. These cars will go quicker and quicker, year on year, and that is genuine technology progress, not just, for example, opening up the regulations."

Technology transfer is an area where Formula E is set to improve upon the current remit of Formula One. But it is also having a unique pull on those engineers that want to innovate, and become 'electric heads' themselves.

"I believe that people are mostly here in Formula E because of the innovation possibilities in the electric car," he said. "At the start of season four, I think you will have pretty much every major car OEM in this championship. They have to be because all car manufacturers will have to develop electric cars to meet emissions and engine targets. And in order to do that, they will need to develop electric cars - and quickly."

The future of the championship is likely to see cars developed that will become quicker over the course of a lap. But, given the fact that tracks are always tight street circuits, this is likely to only go so far. The real challenge for Formula E is the same as it is for car manufacturers - range. At the moment with races seeing drivers pit to swap entire cars, rather than tyres, and still lasting only 45mins, it is an area everyone is keen to improve upon.

"This is where there is real and direct relevance to the real world, answering what people want from electric cars," he said. "I believe this kind of technology is the best way to move people around on the ground. So my motivation is to promote electric cars and my way of doing it is to develop the technology within Formula E and the DS Virgin Racing Team."

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Software solves recruitment riddle

CAD is a common component throughout the design community, so why not use it to build new services?

Tim Fryer talked to one company that is taking this path.

One notable area of common ground amongst engineers, their customers, suppliers and the education system is the CAD environment they all operate within. There are realistically only a handful of these that have widespread acceptance and one of these is the Siemens PLM suite of software.

Majenta PLM is Siemens leading value added reseller in the UK and it has used its contacts throughout the engineering spectrum to weave together a community that can provide advantages to all parties.

The result is LNX (short for Links) and is best viewed as a triangle with the corner positions being filled by partnerships, education and placements.

Partnerships are three standout projects where Siemens (supported by Majenta) has been the core design environment. They are DAX sports cars, the Land Rover BAR (Ben Ainslie Racing) team that is striving to win the next America's Cup yacht race, and the Bloodhound Project that aims to break the land speed record.

Education covers the increasing penetration that Majenta PLM wants to achieve within higher education. Other software suppliers have blazed this trail before – Solidworks have been the most successful – but until now Siemens Solid Edge and NX have not had widespread use within academia.

And this leads on to placements, where the Majenta LNX aims to help its business customers get in touch with talented young engineers.

The headline partners – Bloodhound, DAX Sports Cars and Land Rover BAR – provide the pulling power for the LNX project

As head of Majenta's Education, Partnerships and Placements, Ash Curzon was a natural choice to manage the new LNX division.

Curzon admitted: "I suppose some of the reason [for launching LNX] is that 75% of our commercial customers struggle to find talented graduates."

'Talented graduates' in this context would include a working knowledge of Siemens PLM software as one of their talents. To ensure that this is an increasing pool, Majenta is putting more emphasis on what it has to offer universities.

Of the 128 British universities, Majenta currently has around 15 as its academic customers, but one of the targets of LNX is to grow that substantially. Referring to the Solidworks stronghold in this domain, Curzon observed: "There is nothing wrong with a dual CAD approach. If there are areas in other CAD software where they don't excel, maybe we do excel in those areas. And from a commercial perspective they equally need to see other benefits, which is why the LNX division is offering more than just software."

Five new universities have signed up to the LNX package for the new academic year, and Curzon aims to add a further 15 for the start of the 2016 intake. This package is not just selling a discounted licence; it includes a support programme that was devised for higher education use by the Universities of Ulster and Edinburgh in conjunction with Siemens PLM and Majenta. And support itself is not just for the



software, but can include completely non-software related issues presented through workshops and seminars.

"I get to demonstrate [to the students] right from the get-go that there is a wealth of opportunities out there," said Curzon. "If you are a graduate from a top university with a first class degree you will probably be looking at either automotive with JLR or Aston Martin, or pro-design with someone like Dyson or maybe marine with Sunseeker. But some people for whatever reason miss the boat and what I am trying to achieve, rather than let them drift off into something else like banking and finance, is show them that there are some really exciting well paid jobs in SME companies that you would never have heard of."

And, it works both ways. Gaining knowledge of the graduate pool, allied with extensive customer knowledge, puts Majenta PLM in the ideal role to be a recruitment agency, and this has become part of LNX division's remit.

Recruitment services

LNX will offer a range of recruitment services, ranging from filling a single vacancy to providing a full recruitment strategy. If the company – a Majenta PLM customer – is looking for that single employee, LNX will source that individual for a fee related to the starting salary, in much the same way as an ordinary recruitment agency would work. But there is one big difference, as Curzon explains: "An agency would not normally include specific training, whereas what we are

Majenta PLM to give workshop at Engineering Design Show

Majenta PLM will be hosting a workshop at this year's Engineering Design Show on 22nd October in Workshop Theatre 2 at 14.15 entitled, 'The Best Kept Secret in CAD'. This seminar will outline productivity benefits that can be achieved from combining history-tree based modelling and direct modelling. They will also discuss the modern methods of licensing CAD software and how accessible it can be to the wider audience.

saying is that it is rubber-stamped, that this graduate can definitely use the Siemens PLM software."

What is more is that the fees are approximately half of the industry norm of 20 – 30% of salary.

Working with students also gives Curzon and his team the advantage of finding out what appeals to the younger generation and how to reach out to them, information that LNX can pass on to those SMEs who struggle to attract top graduates.

Curzon commented: "They should be attending the employment fairs that are run at the beginning of every year, bringing some of their coolest, most innovative products and an engineer that they have recently taken on, or a graduate that they have recently been involved with because that allows them to see the journey. They also need to be making more noise in more appropriate areas like social media. Don't use the standard recruitment methods, maybe instead of having a telephone interview have a Skype interview, get them in groups for assessment days and that sort of

thing. So, it is bringing out a graduate attraction procedure, for want of a better expression. This is particularly valuable to SMEs because they get to then keep the information and the procedures that have been given to them, and they can use that for the rest of their graduate, or any form of attraction, campaign moving forward.

"I don't want to go down the traditional route of advertising a job, getting 100 applications and then filtering through them. I want to go and work on a much more bespoke – and I hate this expression – but 'boutique' way of doing it. So you tell me what you need and I go and find it for you."

Conclusion

Recruitment is of course only one strand to the LNX objectives, and is the aspect of most direct use to Eureka readers. It is interesting to see how the project develops, with a software supplier using its penetration into the education system and the pulling power of high-profile projects to provide value to the engineering sector.

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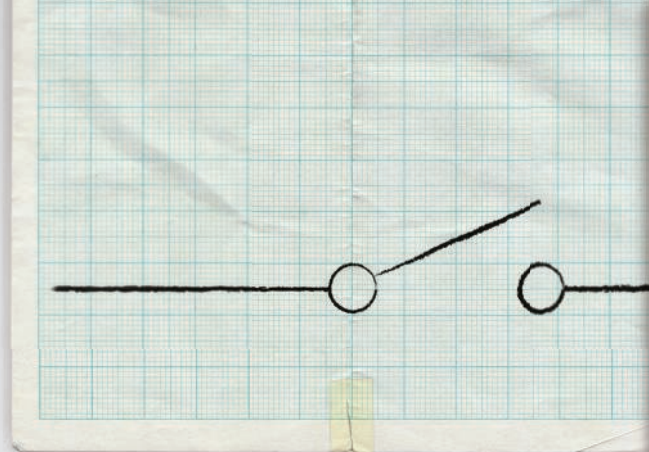
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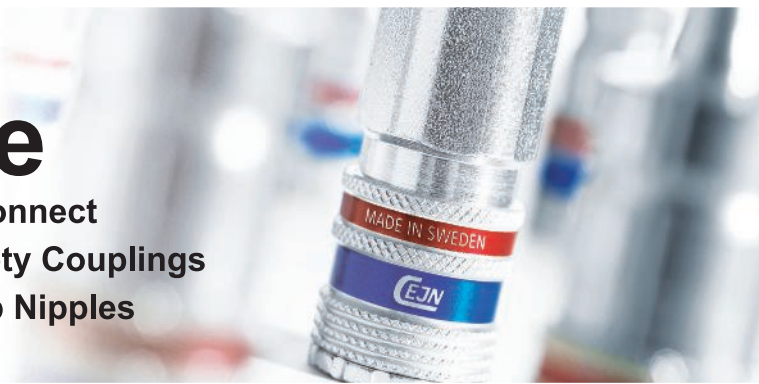
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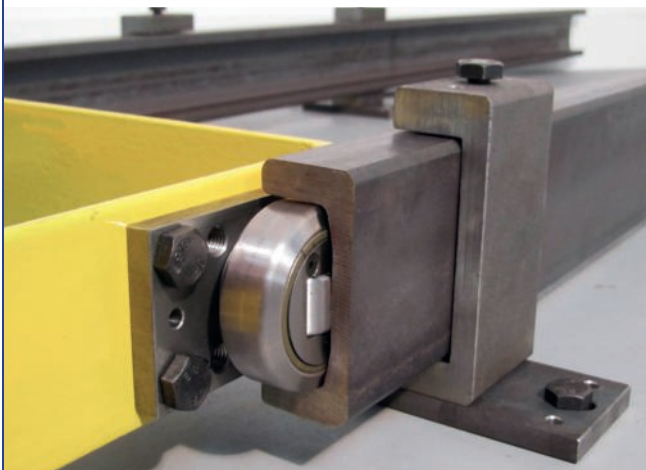
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Designers get electric sparks

The DesignSpark family of CAD software now includes a version for electrical design.

Tim Fryer reports.

Two years ago RS Components launched its DesignSpark Mechanical software package. Since then, it has already been downloaded and activated 175,000 times. It's a success that the company hope to replicate with the third member of the family, DesignSpark Electrical.

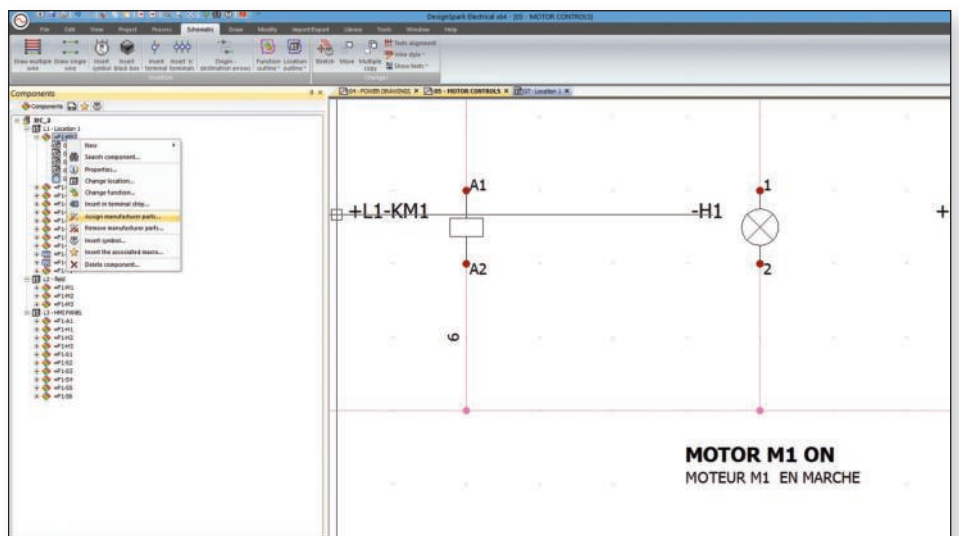
Peter Smith, applications manager for automation & control at RS Components was bought into the company two and a half years ago at the inception of the DesignSpark Electrical project. He commented: "Existing CAD packages were both high cost and complex – even the learning time is prohibitive."

The concept behind the DesignSpark software, launched with DesignSpark PCB back in 2010, is that it should be free, easy to learn and easy to use. It can be an alternative to other commercial CAD packages or sufficiently intuitive to be used by novices. The PCB package has 230,000 activations to date.

From its own research, the company believes that approximately two thirds of designers are not using electrical design packages. What's more, the complexity of those that are used means development times are slow and results are often inaccurate.

As with the other DesignSpark packages, all users need to do is register as a member of the community and then download the software for free.

Unlike other CAD packages that require the user to build up their own product libraries, DesignSpark Electrical gives users a start-up library of 250,000 parts with what Smith described as 'robust and verified' data on each one. 85,000 of



these are in the RS Components portfolio, which has the advantage of availability checking and easy ordering, and it also includes 80,000 parts from Schneider, which is a launch partner for the project.

In this age of multinational design teams, one interesting feature is that all information can be displayed in two languages (with a current choice of 14), which could be ideal, for example, if a design team in the UK is outsourcing manufacture overseas.

Other interesting highlights include real-time cross-referencing to assure design validity throughout the design process. There is also a very neat device for automating tasks such as device and wire numbering.

Smith claimed his customers will, "save hours a day from these two features alone."

Another feature is automated report generation and also the ability to create accurate 2D panel layouts so that the right cabinet can be selected for the project.

These may be tools that are incorporated in other electrical CAD packages, but these packages come at a cost both in terms of time and money.

Smith added: "You will get the same outcome [using DesignSpark Electrical] but less complexity. There is nothing, or not much, that other packages can do that ours will not be able to."

Beyond the introduction of this Electrical package, the DesignSpark family is evolving, and the second revision of the Mechanical package is underway with release planned for next year.

But, it will not stop there. Mike Brojak, technical marketing manager for RS, concluded: "Our ultimate goal is create a suite of engineering software across the board, so there is something applicable to whatever the engineer is doing at any given time."

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"Our ultimate goal is to create a suite of engineering software across the board, so it is applicable to whatever the engineer is doing at any given time."

Mike Brojak,
RS Components

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Good vibrations for sensors

Increasing desire for real-time sensing and condition monitoring has created a need for self powered sensors. So is energy harvesting from the surrounding environment a viable possibility? Justin Cunningham finds out.

It's something all of us have experienced. You pick up the phone and suddenly nothing. The screen has switched off and you've run out of battery. It's as frustrating as it is annoying. However, for remote monitoring systems and embedded sensors this annoyance becomes a costly maintenance procedure, as batteries need to be changed and charged, with routine scheduling.

For this reason, the Energy Harvesting Special Interest Group (EHSIG) was set up, which aims to develop techniques to harness energy from the ambient environment. The alternative term 'energy scavenging' is often used and describes various methods of capturing thermal and kinetic energy from the surrounding environment to power small autonomous sensors.

Dr Alex Efimov is energy harvesting lead at the Knowledge Transfer Network (KTN), a non-profit organisation established and funded by Innovate UK to build better links between science, creativity and business. He has been involved with the EHSIG since its inception. He said: "The boundary we set for something to be considered 'energy harvesting' is anything under one watt of power, so that means solar panels

aren't considered the same thing.

"The idea behind energy harvesting is that it will one day replace batteries all together in low-power applications. No one really likes batteries as they are consumable. You have to replace them, and that all has a cost. The cost of replacing batteries is often way more substantial than the actual cost of the batteries themselves."

Yet, in practice, batteries are commonplace as engineers know what it is they are getting in terms of controlled electrical power output. Energy harvesting, however, is the polar opposite. Power can vary greatly and is reliant on external inputs and the environment. As yet it has not found a great deal of practical application.

"It is difficult to find a common denominator and come up with a single energy harvester that works for every application," explained Efimov. "There are different technologies and perhaps you might combine them to answer a specific need. This is where designers and system integrators are very important, as they know how to put it all together. But, building an energy harvesting business out of that is difficult, as there are so many energy harvesting technologies that fit many applications."

Bucking this trend is Southampton based Perpetuum. The company commercialised a vibration harvesting system in 2004 to power vibration and temperature sensors placed on train bogies to monitor a number of parameters from bearing wear to excess heat in the brakes. It has allowed a move to real-time condition monitoring and proactive maintenance.

The wireless sensor nodes completely do away with batteries, and instead use a patented electromagnetic-energy harvesting mechanism to convert mechanical energy produced by vibrations on the train into electrical energy. This, in turn, is enough power for wireless sensor nodes that measure a variety of key parameters. This data is then transmitted to a train maintainer or engineer where it can be put through comprehensive analytics and assessed.

The configuration has proven to be a reliable fit and forget solution. Indeed, the operational life of the energy harvesting part of the device is over 100 years, and the sensing nodes themselves 20 years. The data that is captured can be communicated over a long range through GPRS transmissions.

Justin Southcombe, commercial director at



Perpetuum, said: "Our energy harvesters have enabled continuous and reliable power in this highly aggressive environment while making retrofitting an overnight task. The resulting condition information we create drives down costs while increasing safety and performance of the railway."

The device gives engineers thousands of daily snapshots that enable a long term view of the condition of the track and train. Any deterioration in the track can be seen as a trend in the data much earlier, predicting maintenance, rather than reacting to an urgent requirement. For example a driver might feel a bump from stray ballast on the rail meaning a crew will have to assess the track for damage. Instead, the trending data might show if all passing wheels felt the bump, and have progressively done so for the last week, or if it was just the leading wheels.

Ideal application

While probably the leading example of a commercialised energy harvesting sensor system, it is by no means the only one to have been developed. A team of engineers from Cambridge University are in the process of deploying a self-powered wireless sensor network to monitor the Forth Road Bridge in Scotland.

The team from the Cambridge Centre for

Smart Infrastructure and Construction (CSIC) has designed vibration energy harvesters that again convert the ambient vibrations of the passing traffic into electricity, to allow numerous sensors placed on the bridge to monitor key parameters on the long-span suspension bridge.

The 2.5km Forth Road Bridge, which connects Edinburgh and Fife, now carries far more traffic than it was originally designed for; about 25 million vehicles a year and nearly ten times the number it carried when it opened in 1964. As a result the increased strain needs to be monitored on a continual basis.

Dr Yu Jia and Dr Ashwin Seshia developed the vibration energy harvesters based on a phenomenon known as parametric resonance, which amplifies the vibrations. It means the devices have the potential to harvest significantly more energy from vibrations than previous designs, and vibration data collected from the Forth Road Bridge during a field investigation is now being used to optimise the harvester further.

Professor Campbell Middleton, co-investigator at CSIC, said: "As energy harvesting improves and the amount of energy available to power sensors increases, new radio technologies will emerge with even lower power requirements. We may be approaching the point at which a vibration powered wireless sensor network, with no need to change batteries, becomes a reality."

Future trends?

The Internet of Things has been a popular topic for engineers as sensors, data capture and then transmission on a mass-scale begins to be implemented. However, the power requirement for many devices and applications is still holding many potential ideas back. Changing batteries, or even charging them, is simply not viable if intelligence in everyday items on the scale that is proposed by many is to become a reality. The Internet of Things needs autonomous sensors that harvest enough power to capture and transmit data, to be rolled out on the scale that many proponents are claiming.

"The temperature of the human body is 36°C, let's say ambient temperature is on average 20°C," explained Efimov. "That is a pretty small temperature gradient so you can only reasonably produce micro-amps and fairly small voltages, and that is not a huge amount of power."

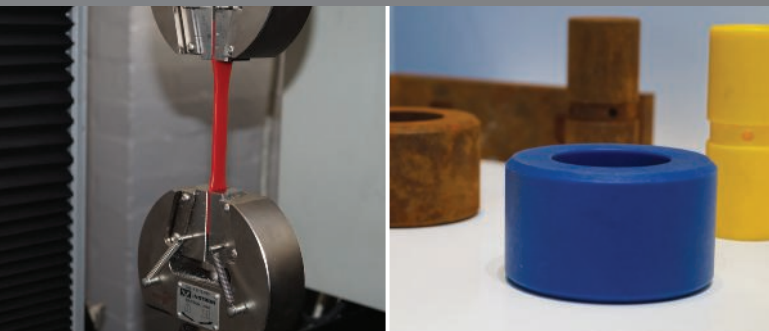
The same goes for vibration harvesting and solar energy harvesting – despite the potential, it is difficult to produce significant quantities of power. So for some time to come, it is unlikely that mobile phones or even wearable health monitoring electronic devices will be able to be self sufficient. "The real value proposition is replacing batteries in small sensing networks; minimising cost, by not having to service them," concluded Efimov.

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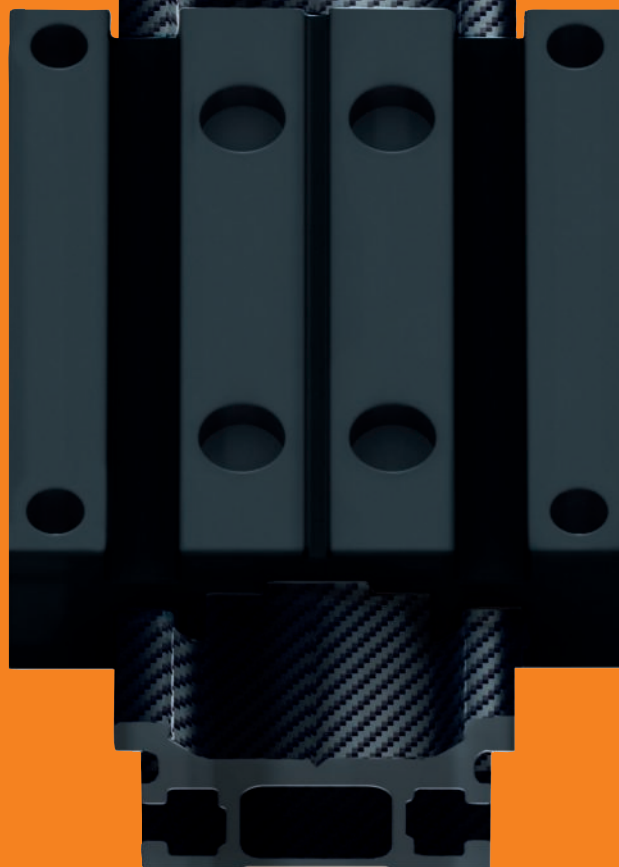


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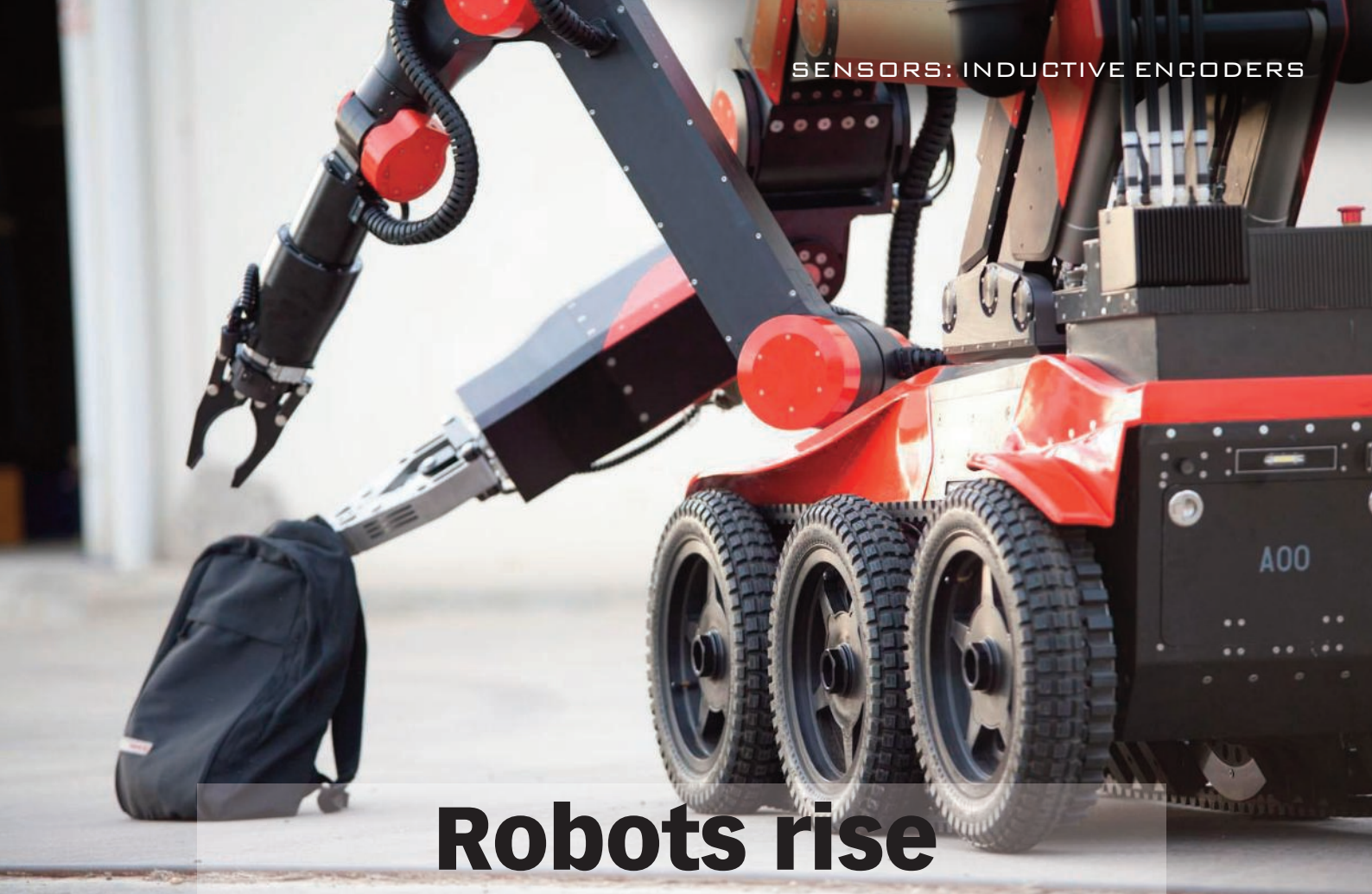


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Robots rise where it's harsh for humans

Inductive encoders offer an alternative to traditional position sensors, and that is set to benefit a new wave of robotics that are on the rise, as Mark Howard explains.

Thirty years ago pundits were heralding a new age of industrial automation, forecasting huge numbers of robots in our factories and workplaces. These forecasts have proved to be overly optimistic because they were based on an assumption that robots would quickly replace large numbers of humans in repetitive, low skill jobs. Instead, a more accessible and cost effective solution was found in low-cost labour in the Far East. Although many forecasts have been wrong, we are now seeing very real signs of a massive, wide ranging, new era for robotics which will have a profound impact on industry and society. The leading edge of this new era of robotics is not in applications aimed at replacing people, but rather with robots cooperating with humans to do jobs that are either, difficult, impossible or dangerous. Examples include space exploration, bomb disposal, remotely operated underwater vehicles, fire-fighting, nuclear plant maintenance and

(Above) Rise of the machines: rather than replacing people on the factory floor, robots are being used to do jobs impossible or dangerous for humans

decommissioning, chemical spill clear-up and the rapidly emerging areas of defence and security automation where robots are already playing an important role in intrinsically hazardous operations.

This new wave of robotic applications has become ripe for commercial exploitation because key technologies now have viable price-performance points. These include high-performance, compact batteries and motors; compact, low-cost, high-resolution electro-optics; powerful but inexpensive microprocessors; easy to use wireless communications and, last but not least, accurate and reliable non-contact position sensors.

A common theme in these new applications is that the operating environments are harsh.

Generally, a harsh environment is one which has one or more of the following: high or low temperatures, thermal cycling, conducted or radiated electromagnetic noise, aggressive chemicals, submersion in liquids, ionizing radiation, extreme shock, prolonged or severe vibration, extreme pressures, pressure cycling or potentially explosive atmospheres.

Such environments are not new. Indeed, for many years engineers have developed systems for use in the aerospace, military, and oil and gas sectors that operate reliably in such conditions. The traditional choice for position measurement in these industries has been inductive sensors such as linearly and rotary variable differential transformers (LVDTs & RVDTs), resolvers and synchros. This type of position sensor typically uses transformer principles, constructed with precision wound spools of copper wire which are influenced by a moving inductive target such as a magnetically permeable rod or rotor. They are



generally unaffected by foreign matter, shock, vibration or extreme temperatures. These traditional inductive sensors have a long and successful track record of reliable and safe operation in harsh environments, but they are often too heavy, bulky or expensive for robotic applications. Space constraints are common in modern robotics and although the total volume of a traditional inductive sensor may be acceptable, they are often the wrong shape to fit in or around other robotic components such as motors, gears, slip-rings and wiring harnesses.

Compared to price insensitive industries, the traditional choice of position sensor for robotics has been the optical encoder. These devices work by shining a light onto or through an optical disk or grating and determining position from the resulting light signal. Optical encoders have many advantages and in benign, indoor conditions, optical encoders offer a compact, low-cost, easy to use and accurate option. However, they are often not sufficiently robust or reliable in harsh, outdoor environments because of their susceptibility to foreign matter, limited operating temperatures and relatively low resilience to shock or vibration. Foreign matter such as dirt, swarf, grease (even greasy thumbprints from maintenance or service operations), oil, fluff or water – notably condensation – can cause failure because it interferes with the encoder's optical path. This can cause the sensor to stop working

or, worse, report its position incorrectly. An incorrect position signal can be much more problematic than no signal as it may cause the robot to move in unexpected, dangerous or damaging ways.

New generation robotics in harsh environments are increasingly turning to a new breed of position sensor. They are based on the same basic physics as the traditional aerospace and military inductive sensors but combine many of the benefits of optical encoders. They are generally referred to as 'incoders' for obvious reasons. Rather than expensive and bulky transformer constructions, incoeder technology uses laminar constructions whose printed, conductive tracks take the place of spools of copper windings to form the transformer field constructions. This new generation of encoder is generally as robust as their traditional, inductive counterparts whilst offering the compactness, ease of use and accuracy of optical encoders.

An inductive encoder has three main components: an electronics module, a moving target and a stationary antenna. The electronics module receives power from the host and supplies an AC signal to the antenna so that it forms a local electromagnetic field. The target disturbs this field, depending on its position relative to the antenna. In turn, the disturbance is sensed by the antenna and the electronics

module outputs a signal proportional to the target's position relative to the antenna. The target and antenna are both made from printed, laminar components, typically <1mm thick. Importantly, the electronics module need not be adjacent to the antenna, allowing the electronics to be placed in a relatively benign environment compared to the antenna and target, which are able to withstand the harshest of environments.

The new inductive encoder technology is lightweight, non-contact, low power, shock and vibration resistant and, once encapsulated or conformably coated, is unaffected by immersion in liquids. Also key to the growing success of this new technology is that it can be formed in to a wide variety of shapes and sizes. Since the main components are printed, the tooling and engineering cost for a new, custom shape or size is modest. Sensing formats include rotary, linear, 2D and even 3D geometries to suit the host's



requirements and space constraints. For example, bearings, drive shafts, slip-rings or cables may need to be passed right through the space where traditional sensors might sit.

Sensing distances typically range from 1mm to 2m in either length or diameter. For example, the image below shows an unusually shaped, 50mm linear position sensor which has been designed to fit within the space constraints of an existing mechanical housing and shaft arrangement. Since these new inductive encoders are non-contact devices, they do not wear out and so need no periodic service or maintenance.

Inductive encoders are already in service in a wide range of demanding and harsh environment applications including military and civil aerospace, petrochemical process controls, marine controls, industrial automation and medical equipment.

Mark Howard is general manager of Zettlex UK

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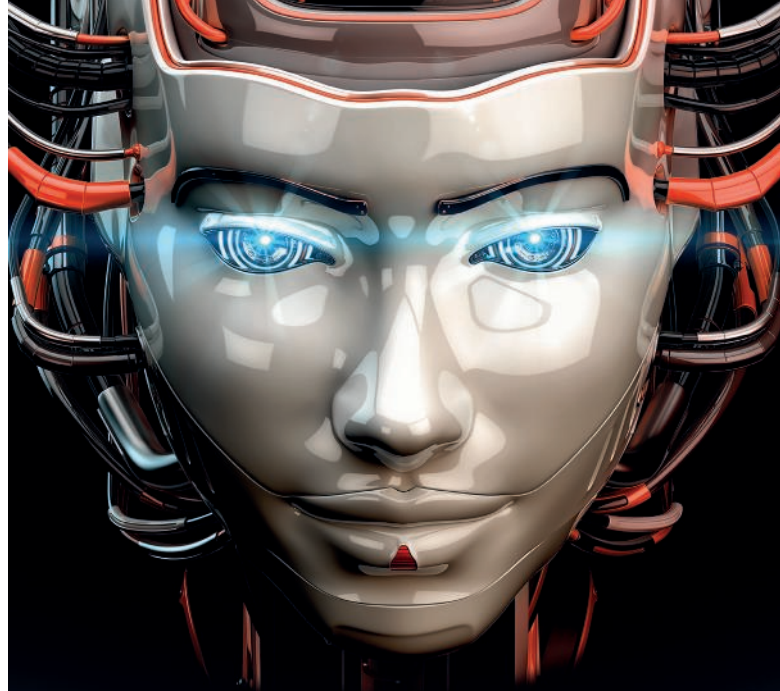
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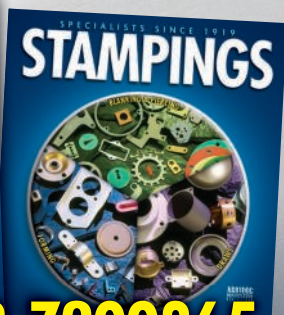
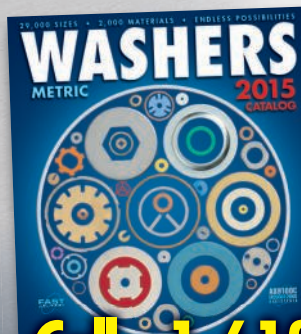
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On track for bumper harvest

A tractor's life is not an easy one, but having tracks rather than wheels appears to be making life easier. However, designing these tracks is not a straightforward task as one manufacturer found out.

When Sly Agri, the UK specialist agricultural machinery manufacturer, was looking for a set of bearings that would assure reliability in the field, with constant knocks, shimmies and shakes and whole load of mud thrown in, without any maintenance, head engineer Toby Kilham turned to igus for advice. Kilham turned the finished track system from a conceptual idea into a working product in just two months.

Tractors have been on tracks for years; the first rubber tracked tractor came about in 1986. Since then there has been a growing tendency towards tracks over tyres, to help minimise deep soil compaction. Soil compaction is a major problem within farming and, with larger, heavier machinery being used, there can be some serious damage to the fields which can be costly to put right and have a huge impact on crop yields if not done. The irony is that the tractor might weigh anything from 12 - 20 tonnes. The grain cart, on the other hand, can weigh close to 50 tonnes, when fully laden - over twice the weight of the tractor, yet traditionally the carts are not on tracks.

"We already had a lot of experience

servicing and maintaining these rubber tracked machines, so the logical route was to develop our own undercarriage to go onto other machinery," said Kilham. Sly Agri first conceived the idea of the single trailed track system back in 2011. At this time the engineering design was only in conceptual form with no prototype to build and test. Last year, however, the company was approached by Perard, the French agricultural machinery manufacturer. It initially

wanted Sly Agri to supply it with a track and some rollers to enable it to build its own, but soon realised it was unable to hit the target build cost. Perard asked Sly Agri to design and build a track system; this was in April and it wanted delivery in June.

"Bearing in mind, at this stage, the design was fairly conceptual and not into the required detail to carry out its function," continued Kilham. "The next two months were a coffee

fuelled blur, from my perspective - trying to finalise the design, check the loading, co-ordinate the integration onto the grain cart chassis, as well as arrange manufacture of all components at local machine shops."

EU regulations mandate brakes on trailers and, to make contour following much better in the field, an integrated suspension. "From our experience of seeing the US track machines, we knew that without a suspension it would crack and shake itself to pieces in a few seasons," explained Kilham. "The idea of our system was to prevent that from happening, by cushioning the impacts from rocks and ruts. We use hydraulic cylinders with accumulators and have a

Coffee fuelled blur: Toby Kilham (left) and George Sly, MD of Sly Agri, went from concept to delivery of a track system for a grain cart in just three months





number of pivoting points in the system, which is where the igus bearings are used."

Before choosing bearings, Kilham did look at the obvious choice of metal bronze bearings and using grease, but due to the high level of maintenance required, it wasn't an option.

"Usually the person driving the chaser tractor is young and often isn't concerned too much about maintaining the machinery, perhaps only greasing once a week instead of daily," he explained. "During harvest season, time is of the essence and, quite often, tractors are brutalised. I know this because I am a farmer's son and I've seen machinery treated badly; as an engineer, I have sympathy because I know how much effort is required to try and make them bullet proof!"

Sly Agri had experience working with igus on the cultivator side of its business. The plastic bushes suited this application because they are easy to install, require no maintenance and, although much smaller, have to deal with similar conditions.

Kilham highlighted that product selection and using the online catalogues and download tools were of particular use: "As a design engineer, I can simply grab a 3D model and drop it into the

About the track system

The track system is a standalone undercarriage that can be mounted up to almost any chassis and effectively transfers the weight on the machine onto the ground in a far more controlled manner than tyres. The deep compaction on the soil is greatly limited, saving costs and improving yields. The system also rides smoothly over bumps and ruts due to the multiple pivoting nature of the suspension.

It is designed to operate at speeds of up to 40kph with loads of up to 50 tonnes and uses 18 pivoting axles in total over both sides to follow the ground and absorb the loads. There is a main central shaft, which gives the overall front to rear pivoting motion, with front and rear frames that can oscillate along with double-acting bogeys that move in the lateral and longitudinal directions to reduce point loading on the system and make the machine ride much smoother.

It was an engineering challenge to ensure all the components were capable of this loading in the types of conditions they would experience - often submerged in water and running all day long means good seals and resistant bushes are required.

CAD programme in minutes, rather than having to create parts from dimensional drawings. The information is also very clear on hole-sizing, etc. Also, when we gave Paul Smith, who is our local igus representative, the information on loading, frequency of oscillation, etc., we got all of the bearing life calculations back very quickly, which was what we needed given the time constraints - letting the experts do this takes a significant risk away from us."

All bushes were from the iglidur range, which

was recommended for the application to prevent the ingress of water and dirt. "On stripping down after the season, the condition of the bearings was almost as good as new - that's after a few hundred hours of constant abuse," noted Kilham.

Sly Agri's next challenge is to implement power assist steering using hydraulic motors to enable the track system to drive itself, or at least assist the tractor.

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Additive manufacturing - building better products

From the step change experienced during the mechanisation of the 1700s to the total transformation that took place during the 20th Century, our manufacturing sector is today undergoing what many are citing as the next industrial revolution.

Digital technology has and continues to transform nearly every aspect of our lives, from ordering shopping and planning journeys through to everyday communications and online banking. The introduction of digital technologies into our design and manufacturing sectors has not just moved the goal posts, but it's cut them down and burnt them. With the introduction of CNC machining capabilities, highly accurate and often intricate parts could be digitally designed in three-dimensional CAD packages, then quickly and consistently manufactured over and over again.

In applying this technique to the design and rapid production of moulds for injection moulding, designers and engineers could quickly turn their ideas into real prototypes and when companies such as Proto Labs brought these technologies together with highly advanced proprietary software to automate and speed-up the process even further, the era of rapid prototyping and production was born.

This capability has meant that, in an ever-more demanding global market place, companies can see their products evolve much faster than before and with lower capital investment being required – responding to changing customer demands and often extending a product's life. With the ability to prototype using real-life components, design issues can be ironed out and products launched quickly, enabling companies to stay one step ahead of their competitors.

Product development can now be much more innovative than in previous decades, with all components designed, tested and well proven ahead of launch. This of course puts a lot of pressure on the prototyping process, but with

the recent advances and automation mentioned earlier, the technology is more than capable of meeting these needs.

Up until relatively recently, the main choices for rapid prototyping have been confined to CNC machining and moulding techniques. With the advent of additive manufacturing - or 3D printing to use its more common name – the opportunities for prototyping and low-volume production of parts with incredibly complex geometries has arrived. Although these systems have been around for a few decades, their capabilities have reached the point at which they are not only accurate enough, but also cost effective to be used as a front-line technology.

Laying down micro-fine layers of material such as plastics or metals, intricate components can be created by additive manufacturing, including features that would otherwise be impossible to machine or mould. The capabilities of the various methods available have come on in leaps and bounds, with one of the most accurate systems, stereolithography additive (SLA), being able to work to layers of around 50 micron (0.05mm) thick - which is a fraction of the thickness of a human hair.

With such a fine resolution, technologies such as SLA can also produce very smooth surface finishes, meaning that minimal finishing is required for most components. Typically, material choices for Proto Labs' SLA system have a similarity to Polypropylene or ABS providing a wide range of characteristics for the prototyping process and the ability to add additional

finishes to meet the needs of the product's required aesthetic qualities.

This highly-accurate method is vastly superior to the commonly found fused depository modelling (FDM) systems that are widely used by hobbyists. In comparison, the entry-level FDM systems typically have a layer thickness of 127 micron (0.127 mm) compared to the micro-fine resolution of SLA that can produce parts with an layer thickness of 50 micron.

Smart Prototyping

Smart prototyping, as it has been coined, is now using additive manufacturing techniques to produce the very first prototype components. Importantly, they can use materials such as plastics and metals to closely match the mechanical properties and appearance required in the production components, meaning that they are identical (or very close) to the real thing. Being able to produce small quantities of such components quickly and very cost-effectively is revolutionising the product development process.

With their 3D CAD models at the ready, designers and engineers can quickly create virtual assemblies of their components for further evaluation and testing.

Once satisfied that they are on the right track, the data from individual parts can be uploaded into the automated systems such as that offered by Proto Labs, where high-powered arrays of computers analyse the data and determine its suitability for manufacture, produce an almost instantaneous quotation – breaking down the design layer-by-layer to provide the set of instruction for the SLA machines to work from.





If it's a product destined for mass production, then the smart prototyping route will enable designers and engineers to extensively test their product before taking the next steps towards creating full production moulds. Quite often, initial low-volume production runs can be produced by additive manufacturing, or in the case of different materials being needed, rapid-turn moulding services can be used as a short-term bridge (up to 10,000 units) before the transition to high-volume production runs is required.

Once introduced into the market place, customer feedback may well necessitate further design iterations, making the use of additive manufacturing techniques a vital tool in the earliest stages of a product's life.

Manufacturing the Impossible

As alluded to earlier, additive manufacturing techniques can create intricately complex geometries that would often be impossible to mould, including features such as internal channels and holes that would be unreachable by end mills, or entire assemblies printed as one single piece.

One consideration when designing parts that

will be produced with additive manufacturing is that many of the normal considerations for moulded components no longer apply. Aspects of the design such as draft, radii and uniform wall thickness are not as critical, but, should the production method eventually transition to injection moulding, then design changes may well be required.

Production

As with rapid-turn moulding services, additive manufacturing techniques such as SLA can prove to be surprisingly cost effective and delay or even fully negate the need for production tooling.

In applications where heavy use of customisation is prevalent – such as medical and dental – additive techniques are streets ahead of all other techniques. With the shift towards higher levels of consumer choice and the ability to customise products, additive techniques are going to play an ever-increasing role.

When looking at mass-produced consumer goods, then traditional machining and moulding techniques will continue to have the edge, but the use of additive will help lower the costs of development and speed up route to market.

Choosing Suppliers

When selecting a rapid prototyping or low-volume production partner, anyone can claim to be the fastest, but what's important is to be the most consistently fast, whilst also being able to maintain the very highest level of quality.

At Proto Labs, we not only have an advanced and fully-automated process controlling the various manufacturing technologies of additive, machining and moulding – but a team of experienced engineers that are at hand to ensure that customers are helped at every stage. If their proposed design is not suitable for the chosen manufacturing technique, quite often, Proto Labs' engineers will have already created adjustments to the design and sent them back to the client for consideration, along with a detailed quotation within hours.

To find out more about additive manufacturing and how it can revolutionise the prototyping process contact Proto Labs on +44(0)1952 683 047 or visit www.protolabs.co.uk where there are a selection of white papers and additional design resources available for free download.

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The DeltaStream prototype sitting on Pembroke docks

At any given point in the future it would be impossible to say with any degree of certainty how strong the wind or how much sunshine there will be. Renewable energy dependent on these uncontrollable natural elements is therefore impossible to calculate or rely on. At that same given point we will know exactly what the state of the tide will be and, within a certain error margin, the flow it is producing as it goes through its lunar-induced cycle. Why then has this entirely dependable resource been left relatively unplundered in comparison to its solar and wind counterparts? Basically it is more difficult and more expensive. Beyond the pressure and corrosion in the underwater environment, the costs of installing and maintaining subsea installations has proven to be prohibitive in the past.

Sitting on the Pembroke docks (at the time of writing) is DeltaStream, which is one of a number of embryonic projects aimed at turning the tide in favour of tidal energy. DeltaStream is a prototype device by Tidal Energy that is designed to generate up to 400kW from the tidal flow in Ramsey Sound off the southwest Welsh coast.

Tide has turned for **renewables**

Tim Fryer reports on a tidal turbine design that's about to dip its toe in Welsh waters and perhaps usher in a generation of submerged renewable energy projects around the UK.

Although the reason it is still above and not below the water is down to a wait for the commercial pieces to fall into place, which they hopefully will do at the tail end of 2015, having this 200 tonne device ready for action on the quayside is a demonstration of why other forms of renewable energy harvesting are easier to progress than tidal turbines.

"You tend not to put anything underwater till you're pretty confident it's going to work," said Peter Bromley, engineering manager with Tidal

Energy. "So we have to invest a lot more time upfront doing the development, rather than trying things to suck it and see."

Designing the device started with an understanding of tidal flow. The site at Ramsey Sound is interesting. There is a reef of rocks called the Bitches that go out across the channel, which have the effect of accelerating the water from the south to the north, so the flow in that direction is much faster than in the opposite direction. They also make this northwards flow more turbulent



and an 80m trench, along with surface-breaking rock structures, mean the site is complex in terms of flow and therefore an ideal spot to put the prototype through its paces.

An ADCP (Acoustic Doppler current profiler) was used to measure water velocity at different heights in the water column to give a profile of the conditions at any stage of the tide. Unlike wind turbines that have to operate, or be protected from, wind conditions from calm to gale force, the undersea conditions are far more predictable, but there can be factors such as storm surges, waves and weather systems that will add a small amount of variability.

The strength required of the device can therefore be calculated accurately and the design driver becomes more about fatigue – the cyclic loading over its 25 year projected working life.

But the first thing most people will notice looking at the picture of the DeltaStream is that the turbine's blades are not as long and slender as those in a wind turbine. "The main thing is that the energy density underwater is much greater than in air - water is approximately eight hundred times as dense as air," said Bromley. "But we get

much more energy for a smaller rotor disc, hence the stubby nature of our blades. But actually, our blade design is an even stranger shape compared to a lot of our competitors', and that's specific to the performance of our rotor and what we've done with our speed control patent that we hold."

The DeltaStream waiting to take the plunge is fitted with a 12m rotor, with an upgrade path using 15m and 18m versions on the cards. Bromley explained: "The important thing that you're working on as a designer is the Tip Speed Ratio, and that's a ratio of the speed of the tip versus the flow of the water coming into the rotor. That's important, because it drives the pitch angle of the blade." It also means to have an optimal Tip Speed Ratio a larger rotor rotates slower and a smaller one faster – approximately 12rpm for the 12m rotor in this case. The 15m rotor will rotate at 10rpm to produce the same generating capacity. The 18m would be slower still although it is likely that larger generators will be fitted so that the capacity and rotor speed can both be increased.

Rotor diameter of 18m seems a realistic size limit at the moment as bigger rotors would require deeper water and that typically means that the tidal flows tend to be less strong. But in the case of DeltaStream there is also the issue of 'thrust control', as it is a lightweight, gravity-based system. From an engineering perspective, driving piles down into the seabed is obviously the most robust solution, but it is also both costly and has considerable environmental impact. Having a system that is gravity-based (i.e. it sits unanchored on the seabed) gets round these problems and also makes it easier to redeploy or decommission.

Dealing with the highest flows, harvesting a competitive amount of energy and keeping the gravity-based structure stable was therefore a challenge to Bromley. He explained: "The way we deal with it is we have a large rotor, but we allow the rotor to over-speed once we get to a rated power, with the aim being that we hit rated power as early as possible in the tidal cycle. The particular thing about our blade design is that not only does it cap power production, but at that point, by over-speeding, it actually reduces the coefficient of thrust. This limits the thrust on the whole device, which is important as there's a theoretical maximum thrust the device can take before it starts moving on the seabed. We want to keep well below that."

The original design for DeltaStream is for a three turbine device, one turbine mounted on each corner giving maximum energy capture for a single installation. Bromley said: "With this first unit we decided it was more pragmatic to only put in a single turbine. So if there were any issues with the drivetrain or the nacelle or the rating design, we at least only made the mistake once rather than three times."

However, most components are standard with varying levels of marinisation. The generator is actually designed for mining applications and would normally sit within a water jacket for cooling. "However, we've got plenty of water," observed Bromley, "so we've just removed the water jacket, allowing it to cool in the seawater."

It is unlikely to overheat off the Welsh coast this winter!

www.tidalenergyltd.com

The danger to marine mammals

One area of environmental concern surrounds the potential damage to marine mammals. However, there seems little evidence to support these concerns. A report on the subject by the Natural Environment Research Council in 2013 concluded: "Our understanding of the potential impacts on marine mammals from wave and tidal devices is developing, yet a large degree of uncertainty still surrounds the impact of these devices."

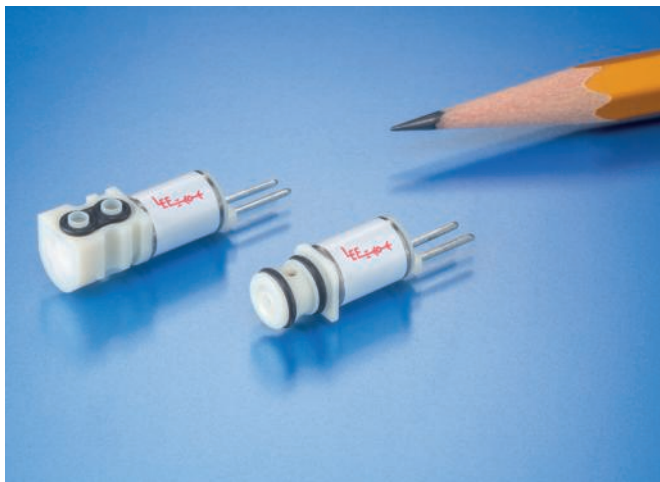
This sums up that there may or may not be a problem but it will be difficult to provide

evidence either way. Bromley added: "The reality is we know very little about what goes on underneath the surface of our seas, especially the mammals and creatures that live there. And so it makes it very difficult to quantify that risk."

"Real experience from units in water is that there has been no known collisions or marine deaths directly attributable to a marine turbine. These creatures are not stupid. Seals, dolphins, porpoises - they're very intelligent animals, very aware of the environment that they're in and they've got a great capability to avoid things."



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are reading
this you are at
the Show
already. So
here is a quick
guide of what
to see, and
why.**



Be inspired:

Attend the first conference session on Day 1 to hear about the UK's entry in to the America's Cup and how a world beating (hopefully) racing yacht is being created to bring the trophy to Britain for the first time ever.

Keep up with materials trends:

Attend the various workshops on metal replacement by polymer alternatives, and learn just where engineering plastics are being used, and why they are proving so popular within traditionally metal industries... perhaps be persuaded to make the move yourself!

TV series 'Speed' that sees Guy Martin make numerous world record attempts, aided by engineering nous.

Multi-material techniques:

Hear from the experts about what techniques are being developed to help the implementation of multi-material assemblies and the joining of many different materials in a single product.

Be wowed:

Walk through the Tunnel of Innovation and take a look at some of the most impressive products and technologies currently being used by UK industry.

why it sees the series as a milestone to the future of motor racing.

Get networking:

Take plenty of business cards! Build business relationships at the show, find new suppliers, distributors and technology partners to take your business and ideas forward.

Get 3D printing:

A number of machines will be producing products during the show. See the process for yourself and discover how it's being leveraged by companies to produce end-products.

...THE ENGINEERING DESIGN SHOW

Discover flexible automation:

Visit the Cambridge Consultants stand to see a robot in action that offers a flexible and automated manufacturing solution for those that don't have a repeatable product but could benefit from automation.

Discover the future of aerospace:

Find out about the 'cyclo-gyros' that could usher in a new generation of UAVs and even manned air travel, as well as the next generation airship being developed in Bedford and also the technology behind Solar Impulse.

Become ecological:

Rolls Royce will give a talk on the importance of eco-material management and how engineers can apply more sustainable design techniques.

Get cost reductions:

Explore workshop sessions and talk to companies about how to reduce the cost of assembly and manufacture, and how to engineer cost effective products without compromise elsewhere.

Hear from record breakers:

EPM Technology will give a comprehensive talk on the work it has done with Channel 4 for the

Enter awards:

Have a look at this year's finalists for the British Engineering Excellence Awards in 'the Hive', see what it takes to be considered excellent... and find out how to enter next year's awards.

Discover big data:

Find out what big data actually is, how to get it, why it is important, and why it is set to revolutionise what you do.

Explore electronic possibilities:

With the growing need to incorporate electronic components in to products to make them 'smart', this is the place to discover what the possibilities are and how to implement them.

Get exposure!

Find an editor (Eureka and other trade media are all present) and tell them about your innovations. This is your chance to tell the team what you are up to and to get potentially featured in the magazine.

Discuss the future of motorsport:

Williams (F1) Advanced Technology will give a talk on the work it is doing with Formula-E and

Get simulating:

No longer a tool for the experts. Talk to vendors and attend workshop sessions to see why simulation is a must for design engineers.

Set challenges, get solutions:

Walk around the 6000m² exhibition hall and talk to over 200 expert companies with engineers on hand to talk about your upcoming projects.

Be ethical:

Attend the workshop by the Institution of Engineering Designers about the responsibilities that designers should employ to ensure that products are ethically sound.

Be creative:

Get creative by looking at Coffee Time Challenges that have featured in the magazine and the products these have spurred. Could you do better?

Headline sponsors





A line-up unique to us...

While the show calendar may be busier than ever, the *Engineering Design Show* has developed somewhat of a cult following. Those that have attended before, tend to keep coming back. And the reason in many cases is its quality conference programme. See below the impressive list of names and topics that you will only find in Coventry this Autumn.

The show has been designed around the needs of today's engineers. The editors here at Eureka have put significant time and effort in putting together a compelling conference programme that can't be found anywhere else. We've brought together cutting edge companies and asked them to present on a number of different topics and issues important to today's engineers.

Here is the full conference programme:

Eureka Conference Programme - Day 1 (21st October 2015)

- 09:15** Engineering success in the America's Cup
Andy Cloughton, Chief Technical Officer, Land Rover BAR
- 10:15** Automotive - how a small company competes and beats the big guys
Daniel Poon, Alliances Manager, Romax Technology
- 11:15** D-Dalus - getting off the ground
Meinhard Schwaiger, General Manager

and Inventor, and *David Wills*, Vice President of Research and Development, IAT21

- 12:15** Engineering in isolation - The battle to control infection
Mike Phillips, Design Development Director, Renfrew Group
- 13:15** High-performance engineering - Achieving world records
Graham Mulholland, Managing Director, EPM Technology
- 14:15** The Airlander, the world's biggest aircraft: key design features
Chris Daniels, Head of Partnerships and Communications, Hybrid Air Vehicles

Eureka Conference Programme - Day 2 (22nd October 2015)

- 09:15** From F1 to low CO₂ road cars to Formula E - a cycle of Williams battery development
Ian Cluett, Head of Programmes and

Commercial, Williams Advanced Engineering

- 10:15** Making Solar Impulse light enough to fly
Dr.-Ing. Hubert Ehbing, Director Processing and Application Technology, Covestro (formerly Bayer Material Science)
- 11:15** "Whole System Design" in the eCar sector
Dr Nicolas Sergent, Powertrain Architect, Riversimple
- 12:15** Materials management for industrial eco-design
Andy Clifton, Manager - Sustainable Development, Rolls Royce
- 13:15** Embracing the world of innovation
AJ van Bochoven, Head of innovation strategy and process, Cambridge Consultants
- 14:15** Cube Sats: The changing face of 21st century satellite technology
Dr Helen Meese, Head of Engineering in Society, IMechE

The co-located Electronics & Embedded Design Shows attracting multi-disciplined engineers

A significant part of the Ricoh Arena is taken up by the Electronics Design Show and Embedded Design Show. These co-located shows have become hits with 'generalist' design engineers, which tell us they are increasingly being asked to take on electronics design work during projects. Electronics is also an area increasingly being used to leverage innovation and increase functionality.

Find out how to utilise the latest electronics technologies by walking around these shows and talking with exhibitors about what the possibilities are, and how they are being exploited.

In addition, the New Electronics conference programme looks to discuss many of the upcoming industry wide trends including the Internet

of Things and the move to 5G mobile communications. The full two day programme will explore the issues and trends important to both industry experts as well as the more generalist design engineer looking to do more in the field of electronics.

The Electronics and Embedded Design Shows are also run in conjunction with a number of workshops that, like the Engineering Design Show, will cover the more technical and practical aspects of the design process such as reducing thermal loads, board level design as well as security.

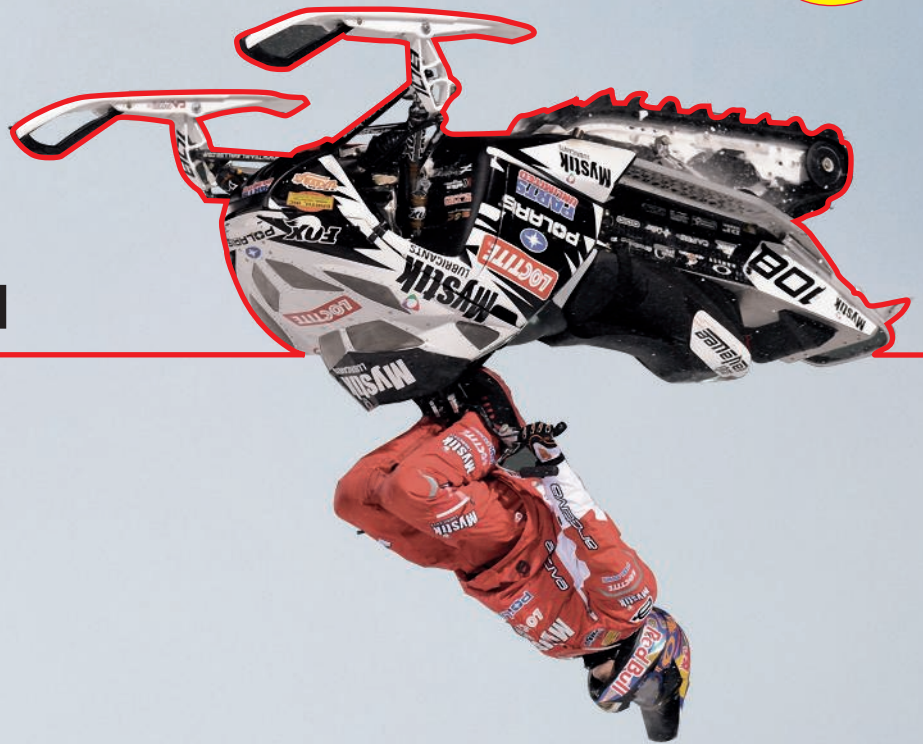
The full conference and workshop programme is available online at: www.electronicdesignshow.co.uk

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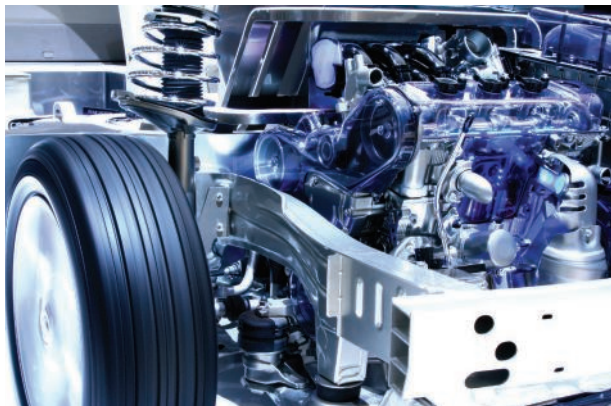


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Surprises round every corner!

While the Engineering Design Show is an exhibition, it is far more than just an exhibition. As you will have read on other pages, in this issue and last, there is a huge amount that can be learnt at this event through the conferences and workshops. However, there is also much to enjoy and inspire. Some of this will come through the conference programme, like the engineering behind the America's Cup bid for example, or perhaps on the vast array of exhibitors stands, but there will also be exhibits scattered around the event that are well worth a look. Tim Fryer unveils some of these features

So what are you going to be able to see? New for this year will be the Innovation Tunnel and pride of place within it goes to the record-breaking tandem bike used by Guy Martin in his TV show, Speed. Also in the Innovation Tunnel will be a selection of Coffee Time Challenge solutions from the last year.

INNOVATION TUNNEL:

Record bike in tandem >

Manufactured by Derby-based composites firm EPM Technology, and designed by the same team that produced Chris Boardman's gold-medal winning bike at the 1992 Barcelona Olympics, the tandem bike became a record-breaker on Guy Martin's Speed, as Martin and Jason Miles aimed to achieve the greatest distance ridden on a tandem in 24 hours. With a target of 505 miles, Guy Martin teamed up with 24-hour solo mountain bike racer Jason Miles for the record-breaking challenge.

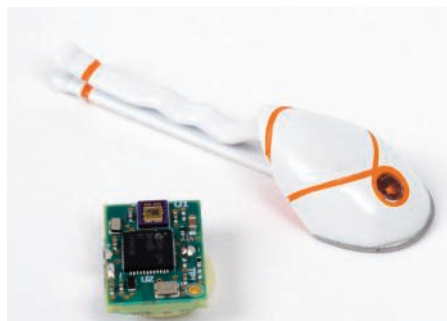
The choice of a recumbent trike as the record attempt vehicle brought its own set of problems, such as getting food and water into an enclosed bike, and staying cool whilst pedalling in what is effectively a moving greenhouse. Visiting delegates to the Tunnel of Innovation at this year's show will be able to see up close the ingenuity and design that produced a solution to these issues that faced Guy Martin and his team.



Coffee Time Challenge

One of the popular regular sections in Eureka is the Coffee Time Challenge. Sometimes, the solutions to these challenges have not yet been

made, while others may be too small or too big to be able to show at EDS. However, here is a small selection of solutions taken from the last year, all of which will be on display in the Innovation Tunnel.



< Safe in the sun

While most of us in the UK have not needed to worry too much about overdosing on sun-exposure this year, it remains an issue that more and more people are conscious of. But how do you get the right amount of sun for your skin type? Cambridge Consultants devised Solitair to address this need. It is a combined sensing device and smartphone app that combines skin

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type and environmental conditions to make sure you get healthy doses of Vitamin D without frazzling in the sun.

Light from gravity >

Cheap reliable lighting shouldn't be too much to ask for, but one in five of the world's population live in poverty and without electricity, burning dangerous kerosene lanterns for light. Surely there is a better way? Gravity Light uses a raised weight to convert potential energy to kinetic energy into light. Unlike a wind up torch it does not need constant attention – each lifting of the weight lasts for two hours.

Energy from everything

What happens when all batteries are drained and you need to fire up your phone or laptop? USB battery packs exist but they require charging in advance and when they are drained they remain so until they are reconnected to the mains. This is where Hydrobee comes in. It is a one-stop-shop renewable energy harvester which is about the size of a bottle of water. It can harvest energy from water (tap, stream or tides), solar, bicycles and carts, hand cranks and thermal sources.

Rainwater Pump

Water has the habit of being in the wrong place at the wrong time. While there is not much anyone can do to stop deluge or drought, could there be a better way of managing water without adding to environmental problems by using excess energy to do so. Our solution to this conundrum came from Water Powered Technologies who devised a Hydromentum – a 'zero energy rainwater recovery system'. A whole system would be too large for the Innovation Tunnel but the most innovative part, the papa zero energy pump, will be on display.

INNOVATION ZONE:

Air curtains for hospital bed >

It's often said that engineers save more lives than doctors, and we have one exhibit that can demonstrate how. There is an urgent need to tackle the threat to humanity posed by emerging infections. The close shave with the recent strain of Ebola and constantly mutating flu's are only a couple. Vaccines provide incremental protection



to these but what about AMR's - Antimicrobial resistance? At the moment the pharmaceutical industry is not financially attracted to produce alternatives or new antibiotics, which is where engineers and designers can play their part. We have a pioneering design of hospital bed on show that features an air curtain that can keep such nasties at bay. It will be discussed at the Eureka conference (21st October, 12.15pm), but the actual unit will be in the Innovation Zone.



Throw and go drones >

Based upon a unique form of cyclogyro propulsion, the D-DALUS aircraft could eventually revolutionise the way we travel. This disruptive technology has faced considerable opposition from established aircraft designers, initially facing scepticism and even ridicule from scientific and academic institutions. However, IAT21 (the company behind the project) has flown several demonstrators of varying sizes, and following a detailed two year multinational European Project designed to validate the capability of the cyclogyro, the company is now taking the concept into a new phase by constructing a hybrid rotorcraft, or Compound Helicopter, with over 60% more efficiency than conventional helicopters, as a stepping stone towards the eventual development of a passenger craft. The full story will be recounted in the Eureka Conference (October 21st, 11.15am) and a demo video will be played in the Innovation Zone.



Through-metal communications

The oil and gas industry relies on complex data to improve recovery and profitability, and to protect people and the environment. Often this involves transmission across long distances or through physical barriers.

Sometimes a wired solution for communicating this data isn't feasible – in long-term monitoring of abandoned subsea wells, for example, the monitoring of pressure and temperature in various well annulus. The industry is currently pushing the limits of what is possible using conventional communications – but new approaches are needed.

Cambridge Consultants specialises in novel communications and one of these is to take the transmission of data through metal. Conventionally this would be considered near-



impossible but Cambridge Consultants has been able to demonstrate useful data rates being transmitted and will be able to discuss the technology in the Innovation Zone.

Colourful coatings ^

Plasma-sprayed ceramic and metallic coatings are coming through that protect components against the effects of heat, wear, abrasion and corrosion and, far from being dull, are now available in a range of colours! The developer of this technology is Zircotec who say it can be applied to a broad range of different materials including metals and composites, and is already proven in F1.

Lateral thinking

Operators of oil and gas fields are always on the lookout for better ways to monitor the fluid flows in oil wells – as this information is crucial for maximising reservoir productivity. Cambridge Consultants will demonstrate how it has used its expertise in radio frequency sensors and downhole engineering to identify techniques to detect and locate water breakthrough – critical in reservoir productivity - using a distributed sensor suitable for horizontal wells.

Smart Adaptive robots >

Robot technology has been around for a long time, and robots are amazingly good at doing the same thing over and over again within a



controlled environment. Where they struggle is doing 'not quite' the same thing, over and over again. Cambridge Consultants will have a live robotics demonstration showing how its industrial sensing and control team has combined high-powered image-processing algorithms with low-cost sensors and commodity hardware to allow 'soft' control of robots when the task is not rigidly defined. The system is capable of handling objects for which no detailed CAD model exists – a necessary step to using a robot with natural objects where, although each object shares some characteristics, they are not identical.

Airlander – the world's largest aircraft ^

There will be few more impressive sights than when the Airlander takes to the skies next year. This hybrid aircraft, the world's largest, combines the natural buoyancy of a traditional airship with some of the aerodynamic features of an aeroplane. More information about the aircraft and

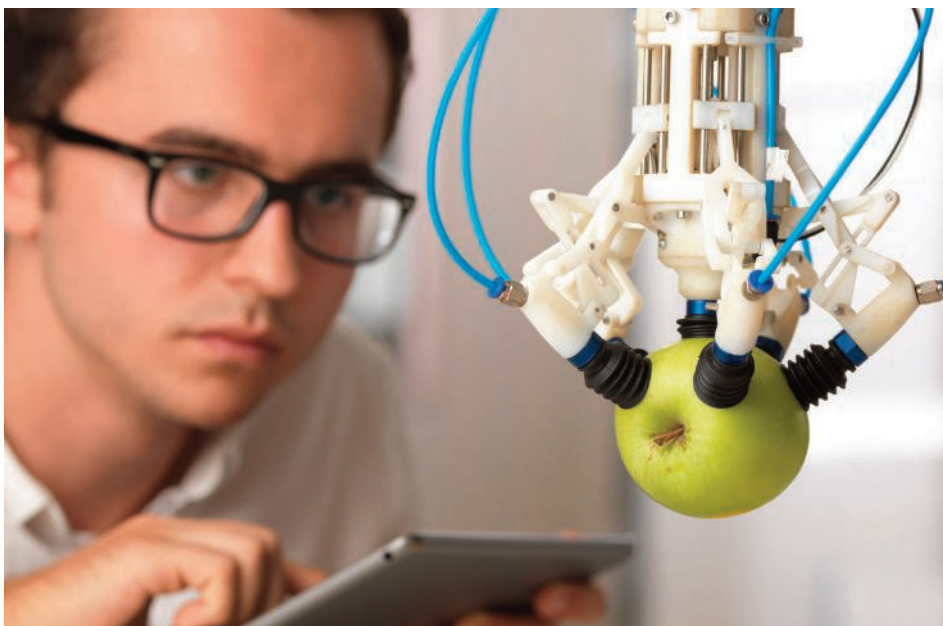
it's design will be presented at the Eureka Conference by Chris Daniels, Head of Partnerships and Communications at Hybrid Air Vehicles. His talk will take place at 14.15 on 21st October. Visitors can see a scaled down model on the Innovation Zone.

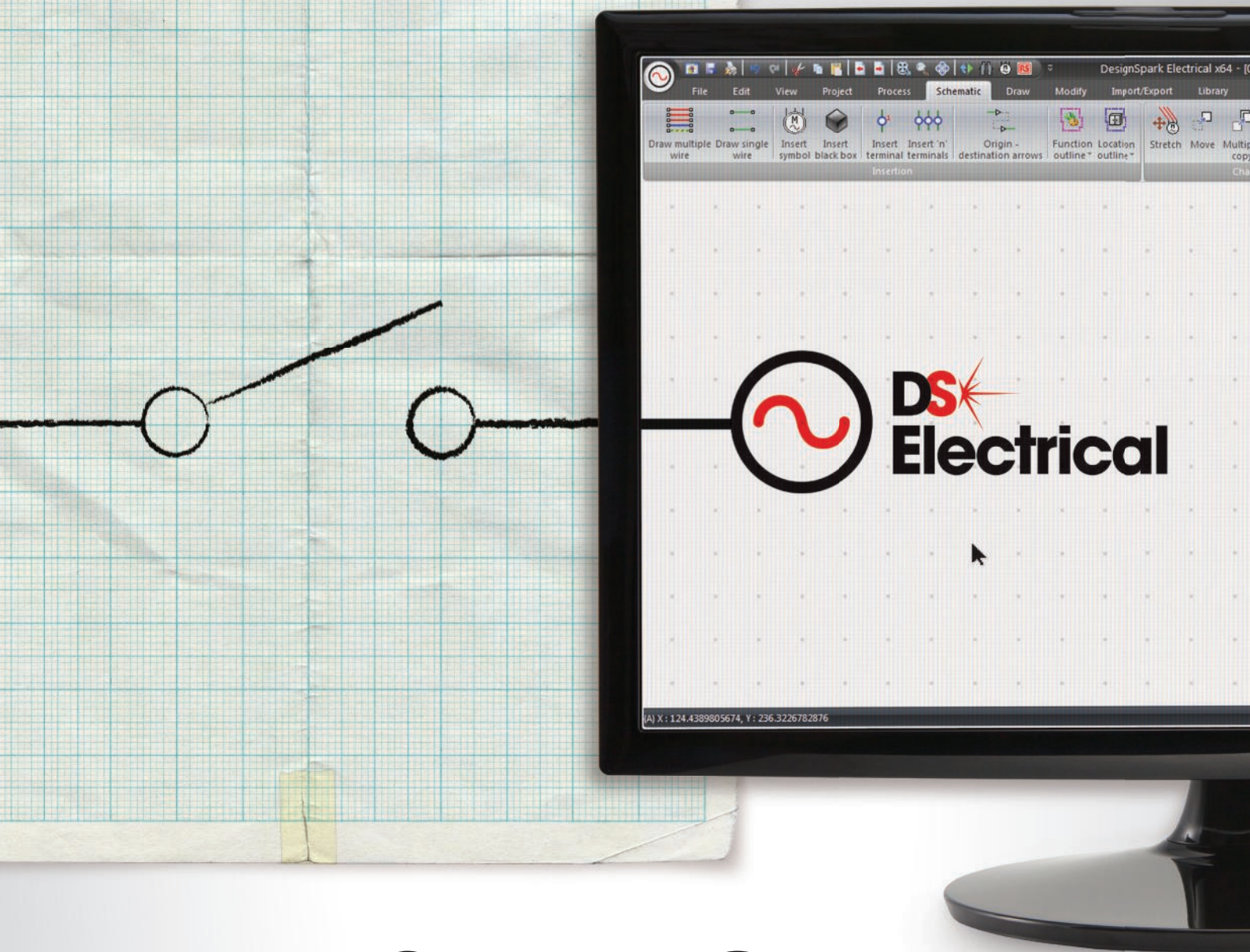


british engineering excellence awards

The BEEA Hive!

The place where the BEEAs gather! This area will give details of all the shortlisted companies for the British Engineering Excellence Awards (BEEAs), a week ahead of the awards ceremony itself. The gallery represents much that is at the pinnacle of British engineering, from outstanding individuals and teams, to break through companies and game-changing products. For more information visit: www.beeas.co.uk





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IP protection on the rise

Many readers will remember that we repeated our annual survey exploring views and experiences of intellectual property (IP) earlier this year. Anthony Albutt takes a look at the results and addresses some of these IP concerns

Key findings this year

The percentage of respondents who actively assess their business' IP position on a regular basis still remains quite low at around 50%. This may be because of the spread of business sizes responding to the survey, with larger companies being more likely to monitor and assess their IP position.

There has been a 10% increase in the number of respondents who believed that their business' intellectual property was properly protected at 53%. This compares with the remaining 47% reporting either that they did not know or that they believed their IP was not adequately protected.

An impressive 91% of respondents (virtually the same as the last survey) claimed that they understand what IP they possess and a figure of 85% for respondents who understand the importance of IP to their business.

Exploitation also remains largely static at 53% who believe their business adequately exploits their IP assets.

Respondents to the survey also provided valuable insight into the reasons for their scores and many highlighted their worries and concerns.

What is worrying you?

There remains a trend in the statistics that shows that whilst a large number of businesses actively monitor and protect their R&D investment using intellectual property rights (IPRs), and indeed some exploit it in the form of licensing, there remains a lot of skepticism as to just how IPRs can help SMEs.

There were four concerns cited by the respondents to the survey that stood out most prominently in the results. These were, in no particular order:

- the perceived costs involved in IPR protection;
- the speed of the system and the time burden on small businesses;
- loss of technology or know-how through staff loss; and
- put bluntly: China

Over the three years that we have conducted the IP survey, time and cost in particular, have repeatedly been cited in the results. This year the volume of respondents who had experienced issues with staff taking technology away and who had concerns over China were very surprising.

We will deal with each one as follows.

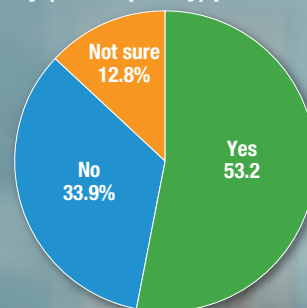
Time and cost associated with IPRs

Readers of our articles over the years will know that we have tried to dispel some of the misunderstandings about IP rights and in particular the costs of obtaining the monopoly that the right patent protection confers. There is no escaping the fact that it will be expensive if you are seeking an international patent portfolio. However, in the UK obtaining a patent is normally good value, not least because the government fees are incredibly low. Aligning your patent application carefully with your commercial interests without seeking to claim too much of a monopoly can radically reduce the time and cost to obtain a UK patent. See our earlier articles (they are all on the Eureka website at www.eurekamagazine.co.uk/design-engineering-features/ip-advice/) or visit the D Young & Co website for further information.

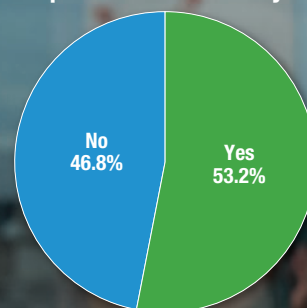
Losing technology or know-how through staff losses

This concern featured prominently in this year's results. Some examples of the problems

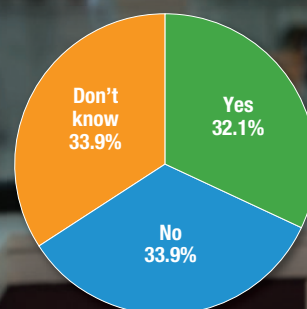
Do you consider your firm's IP to be fully (or adequately) protected?



Do you believe your company exploits its IP effectively?



Has your company ever undertaken an IP audit?



respondents had faced included:

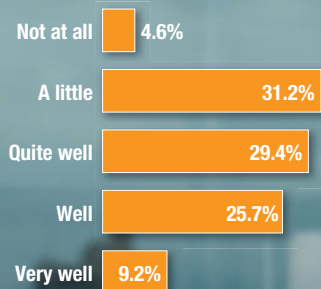
- Contracted designers working for competitors;
- Suppliers selling bespoke machinery to competitors
- Key R&D staff leaving and taking know-how technology with them

Each of these issues can pose significant problems to a business. A detailed analysis is beyond this survey report but in short the following should be borne in mind:

Consider your contracts with external suppliers and designers carefully and ensure that they include suitable intellectual property clauses. It is very common to require that any designer or sub-contractor assigns any rights to intellectual property generated through the contract to your business. Failure to comply would then be a breach of contract.

A word of caution: having obtained rights from external designers, if you then decide not to register them (for example in the form of a

Do you believe you understand the issues relating to IP



Further detailed information is available in the Knowledge Bank or by contacting a Partner at D Young & Co LLP. Both can be found at www.dyoung.com.

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patent) you do not have a monopoly right to prevent others using your technology, including the designers.

The same applies to suppliers you may be cooperating with to modify or re-design existing machinery to your specific requirements. Again, make sure your contracts include suitable protective clauses.

What can you do to negate the danger of staff taking technology when they leave?

One option is to ensure that the contracts of employment your staff work under include suitable and appropriate restrictive covenants. However, such covenants can be interpreted narrowly by the courts making it difficult to prevent ex-employees continuing to work in your technical field.

Another option is of course to protect it yourself. Patent law in the UK clearly states that an invention made in the normal course of employment is the property of the employer. This

means you have the right to apply for the monopoly of, say, a patent. It follows that if you have a granted IP right you can seek to stop a competitor infringing your rights, irrespective of who they employ.

However, this comes at a price and as we have seen again from this year's survey results many small businesses are reluctant to spend money seeking protection in this way.

China....

By far, the most frequent concern facing respondents is the perceived dangers posed by Chinese companies. This includes concerns relating to manufacturing in China and more specifically Chinese companies copying products and importing them into domestic markets.

Stories of the extent to which Chinese companies copy products are widespread in the press. One such case was illustrated in a previous article by D Young & Co in a recent issue of

Eureka magazine entitled 'The China Syndrome'.

Many companies design in the UK and manufacture all or sub-components of their products in China and stories such as Land Rover's paint a very dismal picture of the IP situation in China.

This particular situation arose because of the very narrow scope of registered design protection in China. Is the same true for patents?

In short, no. China has come a long way in the last decade in terms of patent enforceability. The country now has more experienced courts which hear intellectual property cases and the preconception that the Chinese companies always win has been eroded.

However skeptical you may be about patents in China, the unfortunate bottom line is that if you do not register your rights you have no power at all to stop competitors or indeed suppliers from copying your products there (other than possible contractual agreements or goodwill).

Ok, but what about the cost?

One solution is to look at the cheaper patent option in China. You can save money and still obtain some protection in China using a basic patent called a 'utility patent'. This is not assessed in the same strict way a normal patent is and is much cheaper to file and secure. These patents are far narrower in legal scope but they do have a number of advantages, most notably speed and cost. In fact this has been a preferred route for many cost conscious Chinese companies seeking to protect themselves in their own market.

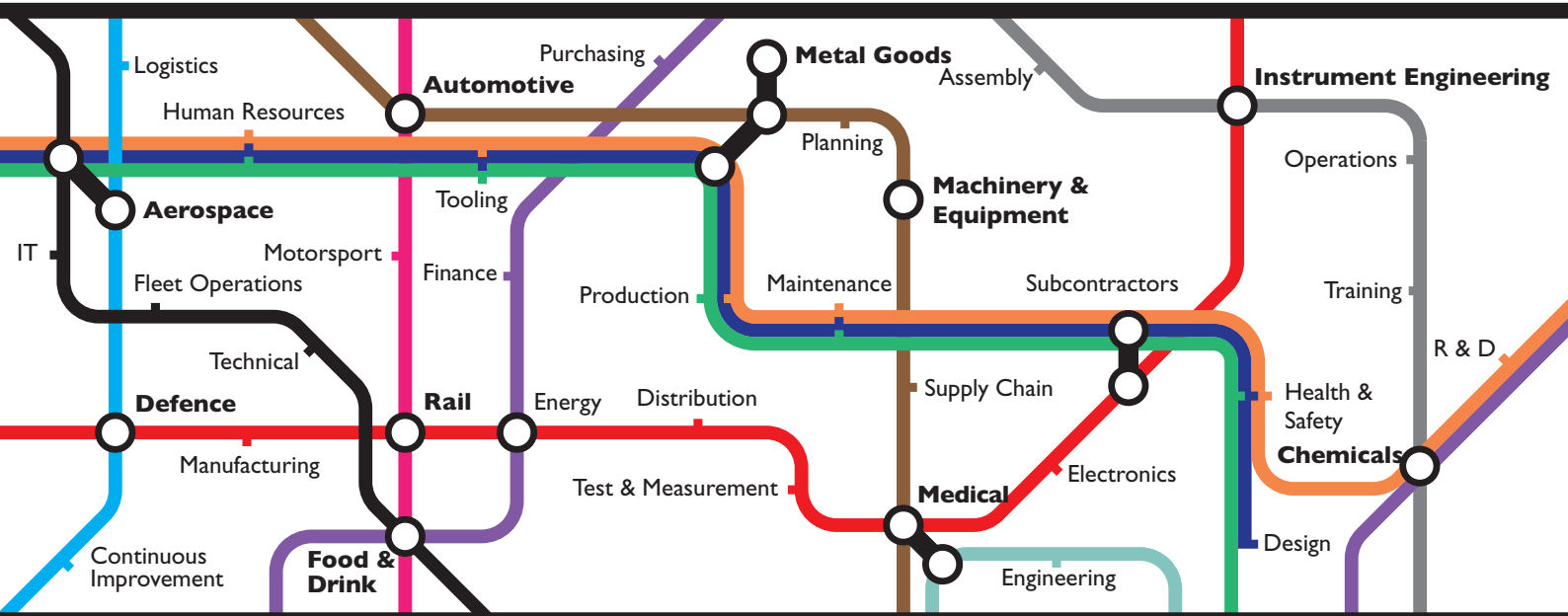
A common thread readers will have seen through our articles is that you should remember that your IP is an asset of the business. If you do extend your IP protection to China, remember that you have the same opportunities there to license or sell your technology in return for a royalty or lump sum.

If you decide not to proceed in China you still have the option of selling your right to apply for a patent there. So, how about selling your right to the highest bidder and let competing Chinese companies have the fight through their own courts using the IP you sold them? 'Made in Britain' applies to IP too....

Once again we were grateful for the volume of responses provided to the questions we posed.

Anthony Albutt is a partner at D Young & Co

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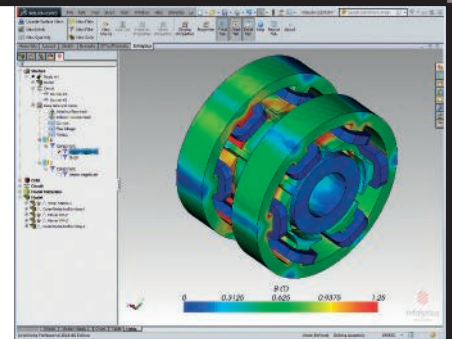
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Underground station discombobulation

We are going big this month, very big. 17 miles in fact, which happens to be the length of track that makes up the Circle Line in the London Underground. If you are a regular traveller on this line, in fact on any of the Capital's underground lines, you will know that at certain times of day it can be horrendously busy, and the joy of travelling – particularly commuting – is rarely seen lighting up the faces of your fellow passengers. 114 million passengers travel the Circle Line every year and the majority of them would probably welcome a better user experience. This month's challenge is inspired by an architecture firm who looked at the problem and have come up with a solution. It has imagined a scheme whereby travelling on the Circle Line is altogether a more enjoyable and efficient experience.

What would you do?

You are restricted only by use of the existing tunnels everything else is fair game. Change the seating, the trains, the way the trains operate – it is up to you, your engineering expertise and your imagination. The solution would need to be at least as safe as the existing system and ideally would be at least as fast – currently the eight trains (maximum at one time) on the Circle Line travel no faster than 20mph.

Next month we will reveal the idea from the architectural company, but if you have a solution that is inspired or just entertaining, please send it to tfryer@findlay.co.uk, or visit the Coffee Time Challenge section of the website and leave a comment.



The answer to last month's Coffee Time Challenge, to come up with a more portable cycling safety device than the standard helmet, can be found on page 10 of this issue.

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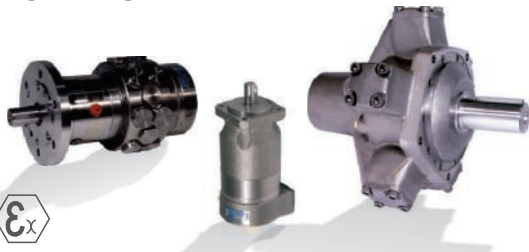
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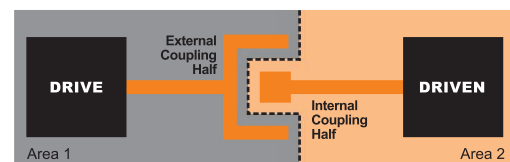
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