www.eurekamagazine.co.uk May 2016

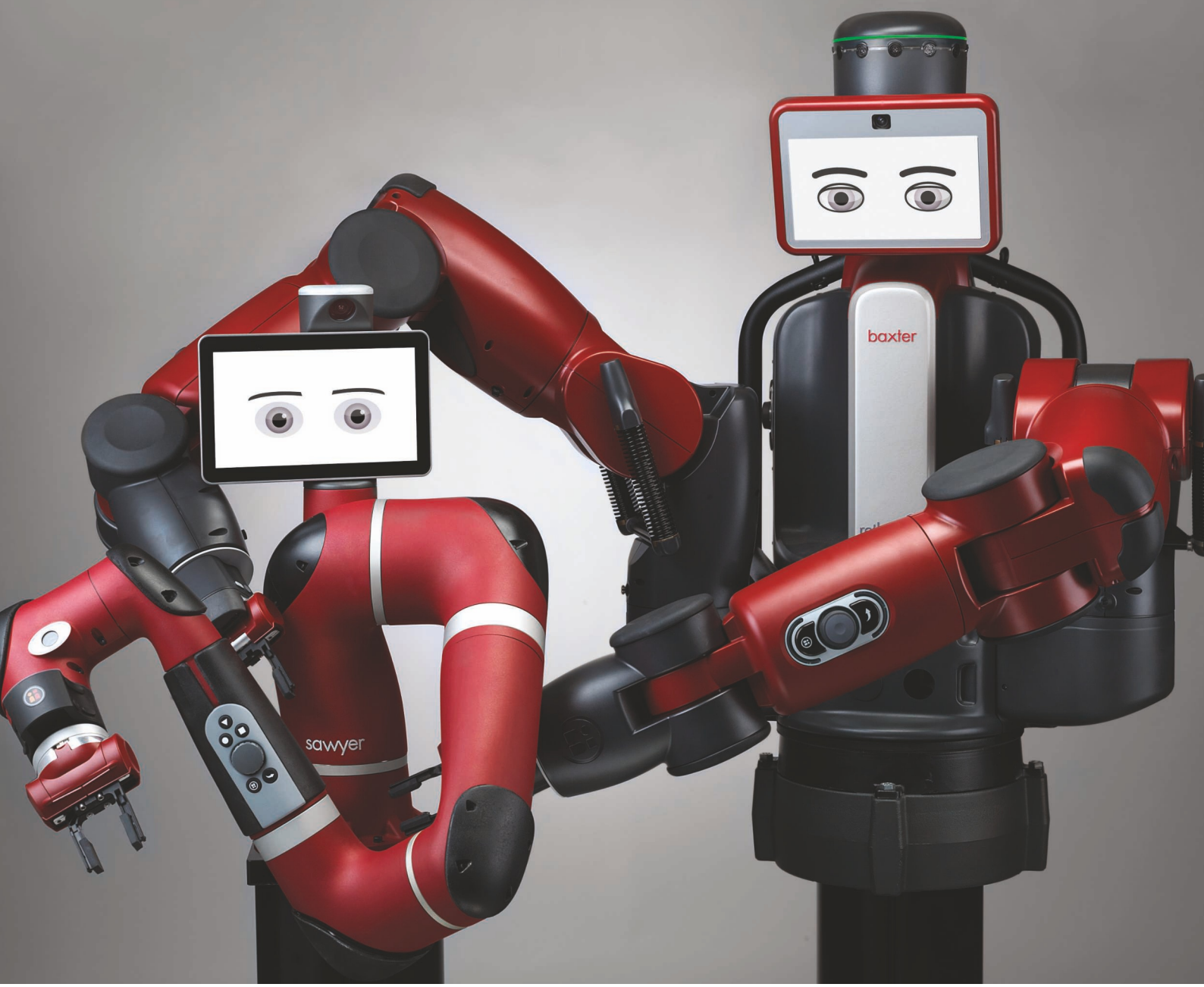
EUREKA

THE MAGAZINE FOR ENGINEERING DESIGN

In this issue: Extreme measurements • True cloud-based CAD • Counterfeit parts • Rapid prototyping

Meet the *COBOTS*...

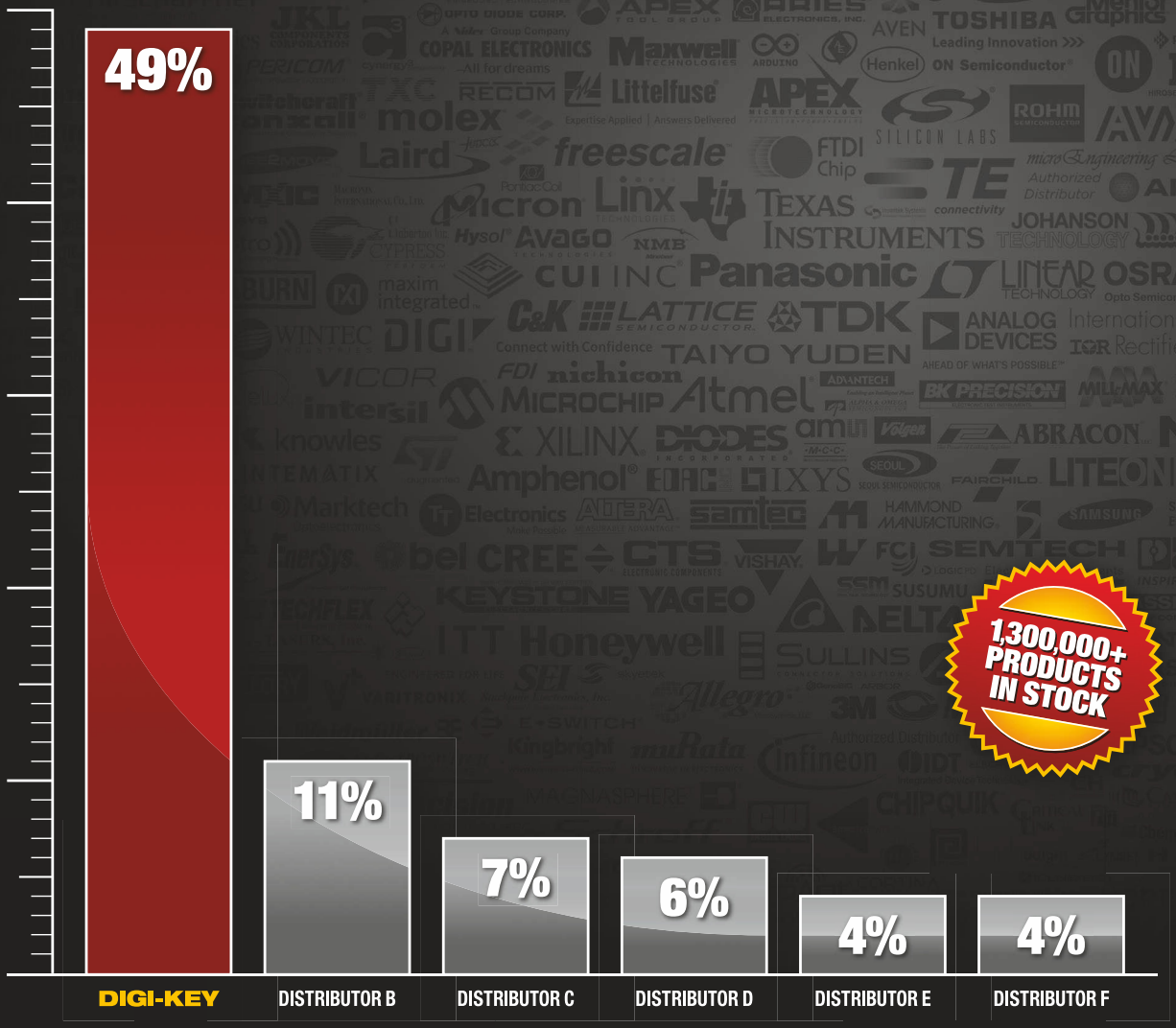
Your future co-workers



BEST OF CLASS: BROADEST OVERALL PRODUCT SELECTION

Source: AspenCore 2015 Design Engineering and Supplier Interface Study

FREE SHIPPING ON ORDERS OVER £50*



0800 587 0991 • 0800 904 7786

DIGIKEY.CO.UK

Digi-Key® ELECTRONICS

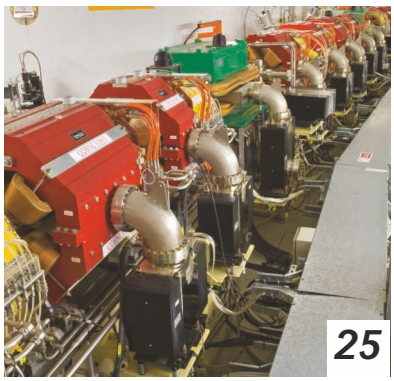
4.8 MILLION PARTS ONLINE | 650+ INDUSTRY-LEADING SUPPLIERS | 100% AUTHORIZED DISTRIBUTOR

*A shipping charge of £12.00 will be billed on all orders of less than £50.00. All orders are shipped via UPS for delivery within 1-3 days (dependent on final destination). No handling fees. All prices are in British pound sterling and include duties. If excessive weight or unique circumstances require deviation from this charge, customers will be contacted prior to shipping order. Digi-Key is an authorized distributor for all supplier partners. New product added daily.

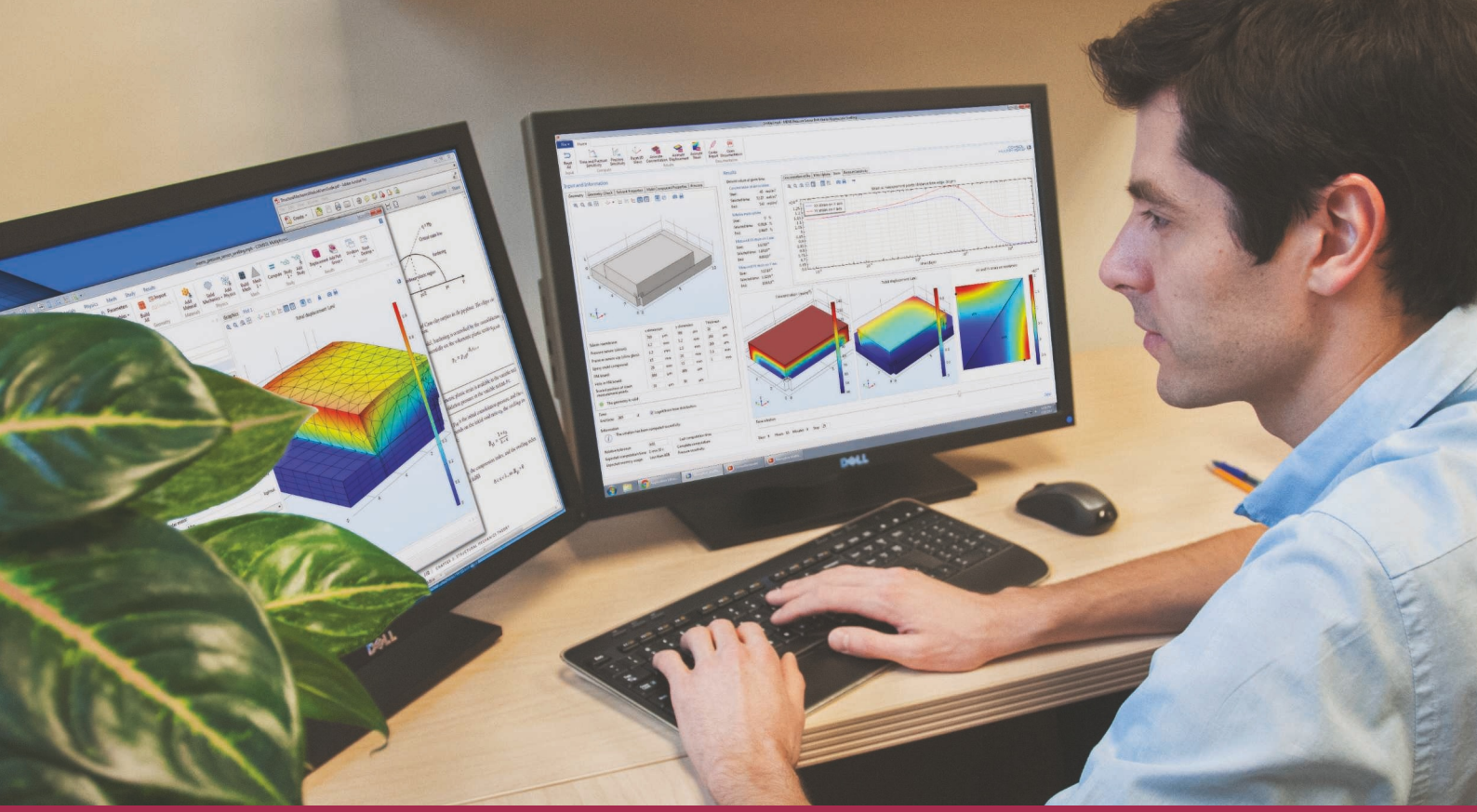
ecia MEMBER ecsn member CEDA

CONTENTS

May 2016 Volume 36 Number 5



www.eurekamagazine.co.uk



MULTIPHYSICS FOR EVERYONE

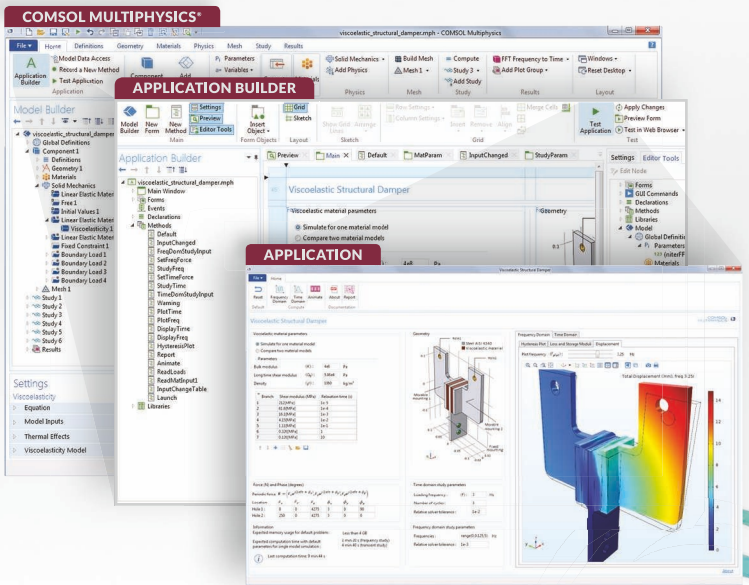
The evolution of computational tools for numerical simulation of physics-based systems has reached a major milestone.

Custom applications are now being developed by simulation specialists using the Application Builder in COMSOL Multiphysics®.

With a local installation of COMSOL Server™, applications can be deployed within an entire organization and accessed worldwide.

Make your organization truly benefit from the power of analysis.

comsol.com/application-builder



COMSOL

Editor
Tim Fryer
tim.fryer@markallengroup.com

Technical Editor
Justin Cunningham
justin.cunningham@markallengroup.com

Editorial Assistant
Tom Austin-Morgan
tom.austin-morgan@markallengroup.com

Group Editor
Graham Pitcher
graham.pitcher@markallengroup.com

Art Editor
Martin Cherry

Technical Illustrator
Phil Holmes

Advertising Sales
01322 221144

Sales Manager
Jez Walters
jez.walters@markallengroup.com

Deputy Sales Manager
Simon Bonell
simon.bonell@markallengroup.com

Sales Executive
Paul Thompson
paul.thompson@markallengroup.com

Production
Heather Upton
heather.upton@markallengroup.com

Circulation Manager
Chris Jones
chris.jones@markallengroup.com

Publisher
Luke Webster
luke.webster@markallengroup.com

SSN-0261-2097 (Print)
ISSN 2049-2324 (Online)

Eureka (incorporating Engineering Materials and Design and Design News) is free to individuals who fulfil the publisher's criteria. Annual subscriptions are £81 UK (£118 overseas or £153 airmail).

If you change jobs or your company moves to a new location, please contact **circulation@markallengroup.com** to continue receiving your free copy of Eureka.

Origination
CC Media Group

Printed in UK by
Pensord Press Ltd

Published by
MA Business,
Hawley Mill, Hawley Road,
Dartford, Kent, DA2 7TJ
Tel: 01322 221144
www.eurekamagazine.co.uk

Slow approach to Brexit

Tim Fryer, Editor (tim.fryer@markallengroup.com)

If there's one thing that we can thank David Cameron for, it is not delaying the EU referendum any longer. While there has not been too much evidence of business activity slowing down as a consequence, there is undeniably a sense of cautious uncertainty hanging over the engineering sector.

Recent unemployment figures showed a rise of 21,000 in the last reported quarter (December to February) – the period in which the ear-bashing and arm bending around Europe was at its height, as Cameron aimed to renegotiate our EU membership terms. Perhaps this was the period when the realities of a change in our relationship with the EU started to materialise. Not the factual realties of course – such is the nature of this campaigning trail, the facts are difficult to distinguish. It will only be when we look back with hindsight in future years that we will be able to have some idea about who was telling the truth, and who was scaremongering.

In the June issue of Eureka, which will land on readers desks a fortnight before the poll, we will attempt to filter out some of the hyperbole and look at what the EU outcome might mean for engineering companies in the UK. In the meantime we are stuck in this period of cautious stagnation.

In its own right, this does not make much sense, as when we all wake up on June 24th nothing will be different from the previous day in terms of projects, customers, suppliers etc. Yet for the last eight years we have lived in a world when all economic activity seems vulnerable to any negative influence. So when manufacturing output, employment and other key indicators come out for this spring, don't be surprised if they show a returning pessimism that, until recently, the engineering sector had all but shrugged off. Whatever happens on June 23rd, at least it will be behind us!

ABSSAC

PRECISION MOTION SINCE 1982

SHAFT COUPLINGS

Your Flexible Friend

FLEXIBLE SOLUTIONS

FLEXIBLE COUPLINGS | **FLEXURED U-JOINTS**

Does your rotary application design demand unusual shaft attachments or perhaps the design requires a higher degree of angular offset than the standard flexible shaft coupling can deliver?

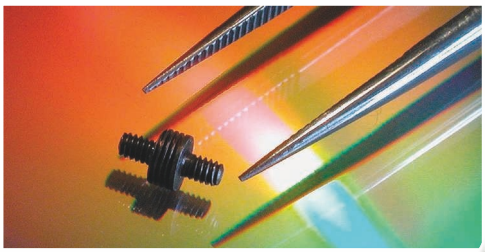
Perhaps your application needs to transmit more torque, but you cannot change the physical envelope size of the existing shaft coupling?

These questions are nothing new to Abssac, who have been solving such problems for over 30 years with its unique specialist Heli-Cal beam product. As the originators of the product, the ability to adapt into applications where simply others can not follow provides the end user with a means to help solve rotational challenges, without the cost burden normally associated with special or bespoke made products.

By utilising flawless production techniques, the single piece construction totally eliminates any form of friction wear within its design, whilst also ensuring a zero-backlash and no torque loss operation.

The Heli-Cal product, is determined by six major characteristics:

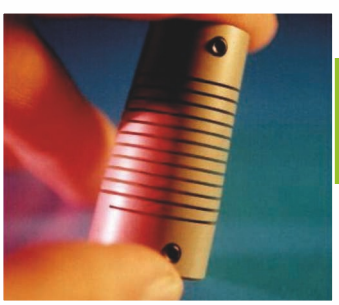
1. The shaft coupling outside diameter
2. The shaft coupling inside diameter
3. The coil thickness
4. The material used
5. The number of coils in the flexure area. i.e. more coils more flexibility
6. The number of coil starts i.e. single, double or triple start



Endless Possibilities

Did you know that Abssac has just supplied a fully functional 3mm diameter shaft coupling for a medical application. Using a left and right handed thread shaft for attachment the coupling could accept up to 1 degree of angular offset rotating up to 10,000 rpm. The same customer is now looking at a double start flexure with a 1.5mm outside diameter produced in titanium.

Chris Cattle at Abssac says, "When you consider the Heli-Cal couplings capability as a shaft coupling and then add this ability to integrate the design engineers own end attachment ideas, you have a formidable product combination that other coupling manufacturers cannot supply"



By altering these characteristics; torque capacity, angular and parallel misalignment capabilities, can be modified to suit specific specifications and or requirements.

Tel: 01386 421005 : **Email:** sales@abssac.co.uk : **Web:** www.abssac.co.uk

NEWS

Solar Impulse conquers the Pacific

Solar Impulse has completed its most perilous leg to date, successfully navigating the Pacific Ocean from Hawaii to San Francisco, California.

Pilot Bertrand Piccard successfully landed Solar Impulse 2 at the Moffett Airfield on 23 April 2016 after taking off from Hawaii, 2810 miles away, on 21 April. It was the first time the solar powered aircraft has flown in nine-months, following the five day world record flight last year between Japan and Hawaii, which led to the onboard batteries overheating.

The team has also picked up several world records including distance, speed, duration and altitude in the electric aeroplane category, and altitude in the solar aircraft category.

On landing Piccard said: "It is more than an airplane: it is a concentration of clean technologies, a genuine flying laboratory, and illustrates that solutions exist today to meet the major [environmental] challenges facing our society."

This completes the ninth leg of the Round-The-World Solar Flight that will continue onward to New York, Europe or North Africa and finally Abu Dhabi where it took off from in March 2015.

Tesla increases UK charging network

Electric car manufacturer Tesla has announced it is to expand its charging station network throughout the UK and Europe. The move mirrors current expansion plans happening in the US. It will see chargers for Tesla electric vehicles installed in a number of hotels, restaurants and shopping centres.

The move addresses concerns that charging infrastructure is not be able to cope with the expected rise in electric vehicles over the next five years. While owners can charge vehicles at home, range anxiety remains an issue to larger vehicle uptake. It's become an increasingly pressing issue that Tesla has felt the need to address with direct action.

Tesla claim it's 'Destination Chargers' can add 58miles to a vehicles range per hour of charge, which it also says is better than public charging points. The work will start in the coming months with updates on locations available on Tesla's website, under its Destination Charging map.

Events

25 May
eWON MAC FlexThink Conference 2016
National Motorcycle Museum, Birmingham

14 - 15 June
PDM Plastics Event 2016
Telford

25 June - 01 July
UK Robotics Week 2016
Across the UK

28 June
Industry 4.0: The Next Industrial Revolution conference
The Exhibition Centre, Liverpool

28 - 30 June
Additive Manufacturing Europe 2016
RAI, Amsterdam

06 - 07 July
Manufacturing & Engineering North East 2016
Metro Radio Arena, Newcastle

14 - 15 September
Low Carbon Vehicle Event 2016
Millbrook, near Bedford

21 - 23 September
Experience Composites – powered by JEC 2016
Augsburg, Germany

28 - 29 September
TCT Show + Personalize
NEC, Birmingham

04 - 05 October
3D PRINT 2016
Lyon Eurexpo, France

19 - 20 October
Engineering Design Show 2016
Ricoh Arena, Coventry

Problem solving by design

Spirolox® Retaining Rings in their various different forms, solve problems for design engineers in many applications and numerous industry sectors. TFC Product Manager Simon Ward answers some typical questions customers pose when considering these products.

Why would I consider using one of your Spirolox rings in place of a conventional circlip?

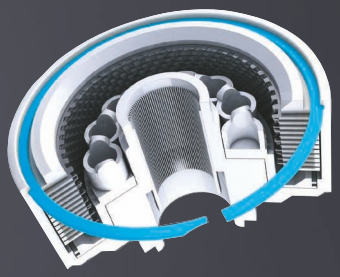
The most significant features of our Spirolox Retaining Rings are that they have no ears to interfere with mating components during assembly thus making assemblies neater and more compact. In addition, since there is no gap, you are provided with a full 360º retaining shoulder of a uniform section. Spirolox rings are manufactured by edge coiling flat wire to precise diameters, this process requires no special tooling, so bespoke designs and/or special materials can be economically produced within short lead times.

How do I assemble the Spirolox Rings?

Spirolox rings are available in two basic types, internal or external and assembly could not be simpler. Unlike a circlip, they do not require special pliers; you can simply open the coils by hand, insert one end of the ring into the groove and then wind the ring into place by pressing down around the circumference until the entire ring is securely located into the groove. For higher volume applications we can provide design assistance for simple plug and plunger tooling to suit both manual and more automated processes.

What materials and finishes are available?

Spirolox rings are available as standard in carbon spring steel and 302 or 316 stainless steel. For more demanding applications where temperatures are a concern or where the rings are operating in a corrosive environment, more exotic alloys may need to be used. In these cases TFC can offer several different grades of Inconel, Elgiloy, A286 stainless steel and Hastelloy. Other applications may demand "nonmagnetic" materials such as Beryllium Copper or additional processes such as passivation or cadmium plating.



Your catalogue seems to limit sizes to around 10 inches or 250mm, can you manufacture larger diameter rings?

The unique edge-coiling method of manufacture means we can produce retaining rings in excess of 2000mm diameter and there is no special tooling required.

Although you have extensive standard ranges, my application is going to need a special design, what can TFC offer?

Our standard ranges have been specifically designed to cater for the majority of applications, but we are often called upon to develop bespoke designs. This includes special materials, specific diameters or ring sections, and additional features such as "special ends" "balancing" or "locking features". By utilizing our vast selection of stock wire sizes and over 35 years of experience with these products we can readily design and manufacture to suit your application.

TFC have a team of engineers available to discuss in more detail these and any other questions regarding the Spirolox products. Tel 01435 866011 or e-mail sales@tfc.eu.com with any further questions you may have.

NEWS

Maglev record smashed

The US Air Force's 846th Test Squadron has beaten its own world record for train based magnetic levitation (maglev) speed. Two years ago the unit set the record at 510mph, but recently reached 633mph by shooting a 907kg sled down a near-frictionless track.

The squad used powerful magnets to steady the sled on a track that's just 640 metres long. Incredibly, this allows sufficient time to accelerate the sled to its top speed and then decelerate it back to zero.

In order for the magnets to work properly, liquid helium cools them to 4K. According to the 846th, this ensures the smoothest ride possible.

"It's a few months of preparation," said 2nd Lieutenant Natalia Ocampo, the rocket sled project manager for the launch. "We all work really hard to get the procedures very clear and step by step. Then everything seems to go very smooth."

The 846th engineers have already started looking for ways to go even faster by redesigning the sled and looking at lightweight materials. The squad's motto is "Go Mach 10". Mach 10 involves hypersonic speeds of up to 7680mph.

As well as military applications, the engineering can be used in mass transit systems. There are already three high-speed maglev rail systems in Japan, China and South Korea, with more in development. The fastest commercial train currently in operation in Japan has a top speed of 375mph.

Mitsubishi in fresh emission scandal

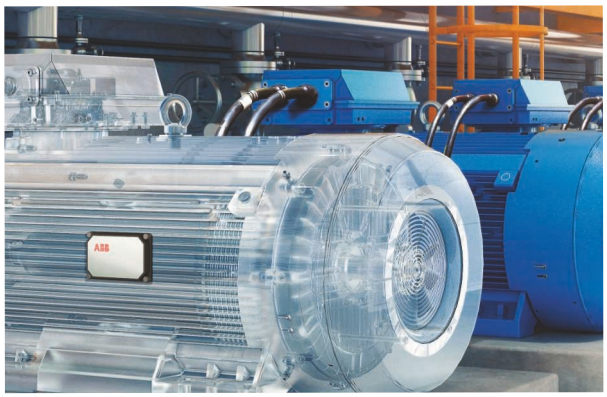
Car manufacturer Mitsubishi has reignited industry emission worries after it admitted to 'improper' testing of its vehicles. The test procedure that's been called in to question dates back to 1991, and includes the manipulation of rolling resistance.

Many industry pundits were raising eyebrows after posters advertising its Outlander Plug In hybrid claimed 147 miles per gallon. However, real world results were significantly lower, with some reporting between 60 to 70 mpg.

In a statement, the company said: "[We] conducted testing improperly, to present better fuel consumption rates than the actual rates; and that the testing method was also different from the one required."

NEWS

ABB unveil smart motor revolution



ABB's latest sensing technology is said to transform simple motors into intelligent machines that tell you when they need servicing. Smart sensors have been used to attach directly to the motor supply information regarding operating and condition parameters, via wireless transmission.

The sensor technology is said to offer plant operators potential savings on maintenance and repair, and will also help engineers utilise the Internet of Things, Services and People (IoTSP) for millions of motors. The IoTSP is ABB's concept for enabling its customers to take advantage of the opportunities of digitalisation. The smart sensors wirelessly transmit the data via encryption protocols to a secure server where they are analysed using special algorithms and stored on the cloud in encrypted form.

BEEA's entry opens

beea
british engineering excellence awards

Entry for the 2016 British Engineering Excellence Awards are now open. The 2016 categories are:

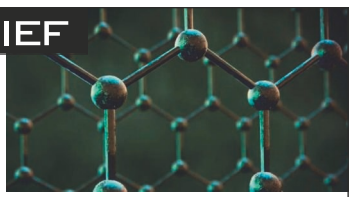
- Consultancy of the Year
- Design Engineer of the Year
- Design Team of the Year
- Green Product of the Year
- Materials Application of the Year
- New Product of the Year (Electronic)
- New Product of the Year (Mechanical)
- Small Company of the Year
- Start-up of the Year
- Young Design Engineer of the Year

The online entry forms are easy to complete and entry is FREE. The deadline for submissions is 15 July 2016. The winners will be announced at a gala lunch at The HAC, the London home of the Honourable Artillery Company, on 6 October.

The judges will then select the winner of the Grand Prix from the winners of each category. For more on what it takes to win, and how to enter, turn to page 22 or visit: **www.beeas.co.uk**

TECH BRIEF

ELECTRICITY FROM RAIN DROPS



Chinese scientists have developed a prototype solar cell that not only doesn't need optimal weather conditions to produce power, it claims it can also create electricity from rain drops.

The 'solar panels' use a thin layer of graphene coating on solar cells, developed by scientists from Yingkou OPV Tech New Energy. Graphene is known for its conductivity, and the one-atom thick graphene layer can allow electrons to move across the surface of the cell. In situations where water is present, graphene binds its electrons with positively charged ions. A process called the Lewis acid-base interaction.

The water adheres to the graphene, forming a dual layer, or pseudocapacitor, with the graphene electrons. The energy difference between these layers is so strong that it generates electricity.

Products

Visit the Eureka website and in the search engine enter any of the numbers below.

SMAC moving coil actuators
117,953

Thermal imaging for materials testing
117,945

High torque coreless brush DC motor
117,828

Simple, robust, cost-effective control for smaller plants
117,785

Cost efficient, compact, precision hydraulic control
117,751

Durable rotary position sensing
117,748

Simple one touch fastening
117,079

BelGAS pressure reducing regulators
117,197

Hexapod gives accurate positioning
117,200

UL certified anti-vandal switch
117,094

1945 – 2015
70 Years

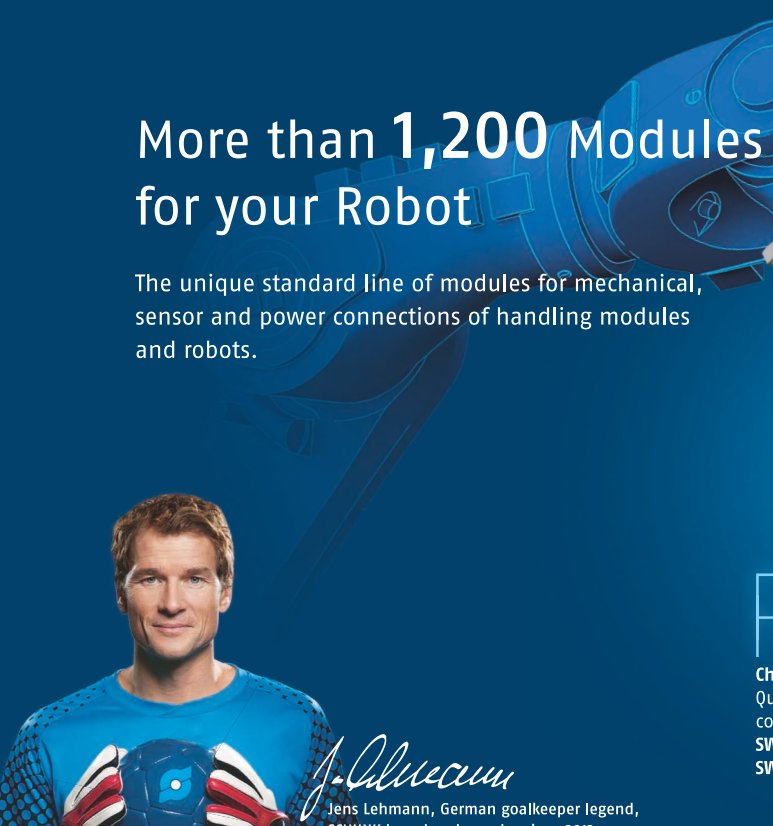
www.gb.schunk.com/robotaccessories

Superior Clamping and Gripping

SCHUNK®

More than 1,200 Modules for your Robot

The unique standard line of modules for mechanical, sensor and power connections of handling modules and robots.



Jens Lehmann, German goalkeeper legend,
SCHUNK brand ambassador since 2012
for precise gripping and safe holding.
www.gb.schunk.com/Lehmann

NEWS

Online motorsport engineering degree

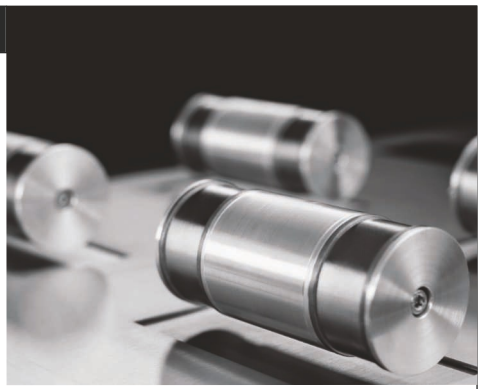
The National Motorsport Academy has launched the world's first online motorsports engineering degree. Open to young and mature students it claims to be a fast-track to an exciting new career in motorsport.

College and school leavers can gain practical motorsport experience through taking the 'earn while you learn' approach. Meanwhile, because the course is part-time and entirely online, mature students without qualifications can balance studying with their work and personal commitments.

The course will equip students for a range of motorsport careers, including race engineer, data acquisition technician, aerodynamicist, propulsion engineer, chassis design engineer, drive train engineer or member of a manufacturer design team.

TECH BRIEF

Automated by superconductors



Festo has unveiled its SupraCarrier - an application concept for superconductor technology that is claimed to open up new and previously unthinkable applications in automation technology.

Below a certain temperature superconductors can 'freeze' the field of a permanent magnet at a predefined distance and can thus hold it in suspension. The resulting air gap remains stable in any spatial position. By this means, objects can be stored contact-free without any control technology and be moved with minimal expenditure of energy. Its dust- and abrasion-free operation makes it suitable for the transport of items in cleanroom environments.

Georg Berner, head of Strategic Corporate Development, Group Holding Festo, said: "There are already various solutions for storing and moving objects without contact. But only with superconductivity is it possible at the same time to execute a rotation through 360° in any spatial direction."

TECH BRIEF

ThingWorx in clouds

PTC has extended its ThingWorx Internet of Things (IoT) open platform strategy. In addition to offering its own device cloud service, the ThingWorx platform now integrates with Amazon Web Services IoT, and will fully support Microsoft Azure IoT Hub in July. PTC is pursuing additional device cloud integrations for ThingWorx, which will allow customers to realise the collective range of services provided by these companies, including the availability of connected device data.

Solution to last month's Coffee Time Challenge

SPONSORED BY
MICRO EPSILON

The solution to last month's Coffee Time Challenge, how to monitor the lifestyle of your pet, comes partly from Kickstarter company AniFit, which has essentially designed a wearable fitness monitor for dogs.

The device is worn on the collar to track movements and activity. In addition, this syncs with a smartphone and corresponding app to allow owners to enter information such as weight, breed and age, as well as scan the QR code of petfood and enter the amount being fed.

The nutritional information and exercise log are then used to tailor a guide about how much to feed your pet, as well as the amount of corresponding exercise. The algorithm also learns from the data collected with advice on pets' wellbeing increasing over time.

The one area we felt the AniFit fell down was in the omission of a GPS to track location, from which other pieces of information can be determined. Here, Pawtrack has brought to market a collar with a GPS to see where your cat is. You simply open an app and your cats location is overlaid on Google maps. You can even set a virtual fence to give you notification when your cat goes beyond them.

Perhaps a combination of the two, for both the felines and canines, would offer the best of both worlds and solve this challenge. What do you think?

ogle

MODELS + PROTOTYPES

Ogle Models & Prototypes provide a single comprehensive source for all your model making and prototyping needs.

- Bench Model Making
- CNC Machining
- Industrial 3D Printing
- Rapid Prototyping
- SLA, SLS & FDM
- Vacuum Casting

+44 (0) 1462 682 661 info@oglemodels.com www.oglemodels.com
Ogle Models & Prototypes Ltd, Birds Hill, Letchworth, Hertfordshire, SG6 1JA, UK

Meet the INTRODUCING

In an effort to stay competitive, engineering firms are looking at ways of automating areas previously off limits. This is leading to a rise in the use of collaborative robots. Justin Cunningham meets, what might become, your future co-workers.

Fifty years ago when mobile technology was barely conceived, it was predicted that machines would become so ubiquitous that households wouldn't be without a mechanical servant to help with daily chores. Sadly, while the tools of the trade have improved, they still need people to operate them. The industrial landscape though has become more mechanised, a trend set only to increase.

Manufacturing is also beginning to look as if it could again become more local. Driven by rising labour costs abroad, coupled with a desire for faster delivery, increased quality and more flexible production, means that reshoring is happening, albeit at a slower rate than many would like.

It is, however, not a straight win for old school industrialists. To remain competitive automation technologies are likely to be applied much more widely. The UK's manufacturing sector could grow significantly in coming years, but jobs are unlikely to keep pace at the same rate.

The road to automation

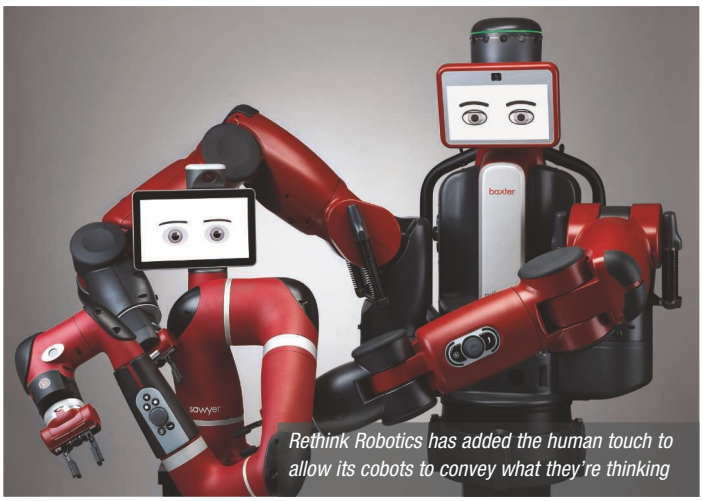
There are all sorts of social, economic and operational incentives and disincentives about whether or not to invest in automation. The common belief is that automating leads to job losses and upfront investment is steep. Indeed, installation is a formidable undertaking. Large cells with safety cages are needed, with set up requiring expertise and time. It means traditional robotics are seen as an 'us or them' technology. All in all, UK manufacturers have, on the whole, rejected the concept as a consequence. The landscape is changing though.

The rise of the internet and connectivity has fundamentally changed the consumer. It is no longer a case of one size fits all so high volume manufacture rules the way. Designers and engineers are being increasingly asked to produce more customisable products, and that needs manufacturing flexibility.

Those involved in automation and robotic design are having to rethink how machines are used. Many have started to offer something that is more easily customisable, can be intelligent and flexible, and have coupled it with a financial package that's more accessible to the masses.

Enter the cobot, or collaborative robot. These multi-tasking robots are designed to support workers, rather than completely replace them. No doubt, inspiration has been taken from the consumer world, where technology is viewed as beneficial and accompanying, and not overly intrusive or in danger of making users obsolete.

One of the forerunners is from Rethink Robotics. The US based company is now moving in on the UK and sees potential targets in areas that have not yet automated. Rodney Brooks, chief technology officer at Rethink Robotics, said: "Imagine if you had to take a six month course to use a smartphone, I don't think they'd be so popular. One of the reasons robots aren't popular in factories is that ordinary people are not able to



Rethink Robotics has added the human touch to allow its cobots to convey what they're thinking

new guys: *the* COBOTS

Fanuc's CR-35iA has a 35kg payload and can work side-by-side with humans to lift heavy objects and do the hard work

> "WE OFFER HOPE TO MANUFACTURERS LOOKING FOR INNOVATIVE WAYS TO COMPETE IN OUR GLOBAL ECONOMY."
> **RODNEY BROOKS, RETHINK ROBOTICS**

use them. What we see in factories is workers asking if they can get the robot to do a particular task that they might hate because it's boring, or if there is a lot of dust, or maybe a bad smell."

'It' has a name

Brooks founded the company in 2008 and introduced his first robot in 2012, which he calls Baxter. He wanted to design and engineer automation technology that is inherently accessible and safe for workers to be around, making it possible to deploy in environments that have historically been off-limits for automation.

"Roboticists have been successful in designing robots capable of super-human speed and precision," said Brooks. "What's proven more difficult is inventing robots that can act as we do, that are able to inherently understand and adapt to their environments. We believed that if we can cross that chasm within the manufacturing environment, we could offer hope to manufacturers looking for innovative ways to compete in our global economy."

Baxter and its more recently released partner, Sawyer, have both been given a humanoid touch by the inclusion of a screen that shows eyes and expressions. While this might seem a little excessive and even superfluous – and let's face it, they are – the screens are not without function. They act as a touch screen to control all kinds of parameters and settings, but also the eyes convey messages to surrounding workers about the machines behaviour and almost, what it is thinking... almost.

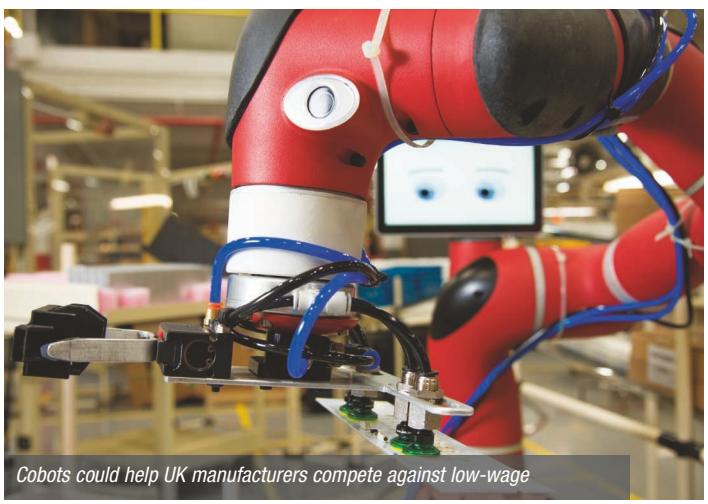
"The interesting thing is, Baxter has some basic common sense," claimed Brooks. "The eyes on the screen look ahead to where it is going to move so a person interacting with it understands where it is going to reach and isn't surprised by its motions."

The eyes can also signal that it is aware that a person is approaching or that, for example, it has understood a task that has been manually programmed by moving the arm through the required movements. It also signals if it is surprised, confused, or even sad – equating to various levels of operational abnormality. Baxter is targeted at pick and place type applications, and any repetitive or monotonous job. An example might be in distribution where there is a great deal of variability between the many products needing to be packaged for delivery.

Sawyer, on the other hand, is designed for more precise tasks and has pick and place repeatability of 0.1mm. Examples of its use include circuit board testing, with multiple different boards coming down the line.

Safety concerns

The biggest concern within robotics, whether you believe the movies or not, is being injured or killed by one. Safety, therefore, makes up a key



Cobots could help UK manufacturers compete against low-wage

part of Baxter's industrial design. It's safety systems include a 360° sonar used to sense and map surroundings, making it aware of workers in the vicinity so it can track their movements and ensure they remain out of harms way. If, however, the robots do hit something, they are able to sense the collision in millisecond, enough time for them to reduce the force behind the impact.

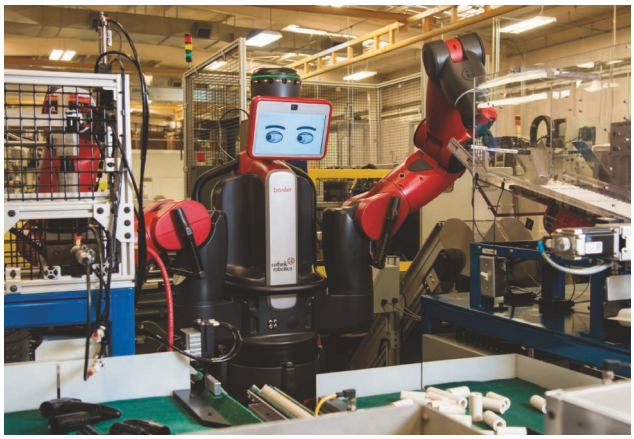
To aid this dampening effect, internal motors are driven by a spring, and that spring drives the robots arm instead of a direct motor. These are known as series elastic actuators, and provide instant 'give' upon impact. In addition, all joints are back-drivable, meaning they can easily rotated by hand regardless of whether the robot's powered on or off.

It is not just the new kids on the block that are looking at developing cobots, however. Automation giant Fanuc has also brought to market cobots that are to work side-by-side with humans, do away with safety cages and assist in strenuous or repetitive work.

Its CR-35iA and smaller CR-7iA, as the names suggest, make less of an effort to give off humanoid overtones. They look, essentially, like a standard robot – though differentiate themselves by the bright lime green colour, as opposed to the normal yellow used by the company.

"Wherever we go at the moment, the collaborative robot is what everybody wants to talk about," said Tom Bouchier, managing director of Fanuc UK. "We are getting enquiries from industries I hadn't even considered."

The larger CR-35iA targets a slightly different application to Rethink's offering. The payload is the largest of any cobot on the market at 35kg. For cobots this is huge, and by comparison, Baxter is rated at 2.2kg and Sawyer 4kg. Such a large payload seems to indicate this is to rival standard robotic units as much as anything else.



This is a heavy unit, weighing in at 990kg, meaning that it is less likely to offer quite the same shop floor manoeuverability . However, its higher payload is matched by its 1813mm reach, and repeatability of ±0.08mm. Like other cobots this opens up areas not previously automatable, but in this case also within industries that already automate such as automotive or aerospace.

"Up until now, some companies have been limited in how much they automate as they've needed the space," added Bouchier. "Everything with a normal robot needs to be kept behind a cage and that takes up room.

"And, normally you can't automate some operations as you need a human hand to do some indicate work or to get access to a certain part. But now you can. These can work in areas where you will always need people, but they can help lift heavy objects or do repetitive tasks."

It is a lot more of an assistive robot, to take some of the repetitive and heavy lifting work from workers, and ultimately improve efficiency and output. Workers and machines can be tightly integrated into production lines, where it can help lift heavy objects into position for a worker and assist in the production process. In short, cobots are set to become one of the team.

> "WHEREVER WE GO AT THE MOMENT, THE COLLABORATIVE ROBOT IS WHAT EVERYBODY WANTS TO TALK ABOUT."
> TOM BOUCHIER

Like many other cobots, safety featured highly during the design process, with the CR-35iA carefully engineered to make sure it keeps humans safe. It uses a soft rubber skin over the entire body of the robot to reduce the force of a potential impact.

Other safety features include when a worker approaches or gets within a given perimeter, the speed of the robot slows down. The CR-35iA typically moves at 250mm/s when it is working as a collaborative robot, but has the potential to reach 750mm/s when working alone. The robot uses force sensing to decide when it should stop moving and uses force feedback sensors embedded in each joint.

The cost

The upfront cost of a cobot purchase and installation is much lower than traditional robotics, with Rethink Robotics retailing Baxter and Sawyer for £19,000 and £20,000 respectively. The cost of the Fanuc CR-35iA is also expected to be considerably lower than a standard robot installation of the same payload, reach and repeatability.

"A lot of industries will see cobots as the way to go as the return on investment is faster," said Bouchier. "You don't need guarding, PLCs – system to system there is quite a lot of saving."

These are, however, a different offering than standard robotics which no doubt offer greater productivity gains. But, standard robots cannot do everything, are incredibly expensive and sometimes you just need people in the loop. Cobots, on the other hand, are seen as a halfway house, and this has seen a number of manufacturers including Kuka, Universal Robot and ABB developing more integratable robotics. And this in turn is driving component manufacturers to develop new products.

An example comes from Harmonic Drive that has developed a very large hollow shaft gear, to allow cobots to have all the cables internally fed though, an increasing demand from engineers developing cobots as it leaves nothing to accidently catch nearby workers.

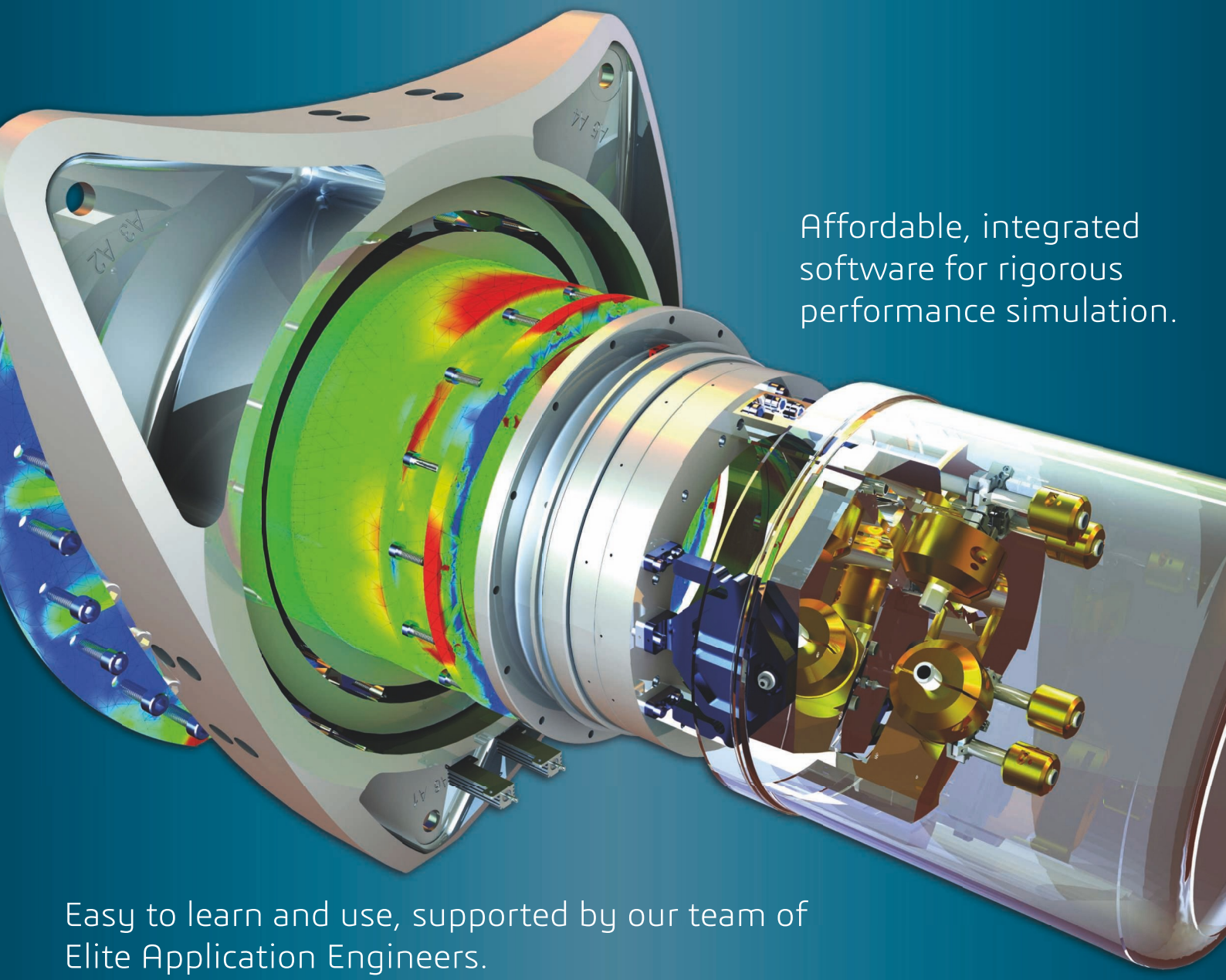
The cobot market is expected to take off over the next decade, and along with additive manufacture, the Internet of things/connectivity, and artificial intelligence – the technology is predicted to be fundamental in the way future products are designed and made, and how future engineering and manufacturing sites operate. However, it is unlikely to stop there. Will you, for example, be getting your Starbucks or McDonald's from a cobot sometime soon? Almost certainly.

www.rethinkrobotics.com
www.fanuc.eu

SOLIDSOLUTIONS
SUPPORTING EXCELLENCE

SOLIDWORKS

TEST IN **SOLIDWORKS.**
GET TO MARKET FASTER.
SPEND LESS ON DEVELOPMENT.



Affordable, integrated software for rigorous performance simulation.

Easy to learn and use, supported by our team of Elite Application Engineers.

Find out more on 01926 333 777

www.solidsolutions.co.uk/simulation SOLIDWORKS reseller of the year 2002-2015

"A year ago people said, 'it's not important what OnShape are doing'... they now seem to think what we're doing is important."
Jon Hirschtick, OnShape

Jon Hirschtick

Hirschtick holds a Bachelors and Masters Degree from the Massachusetts Institute of Technology (MIT), and has worked in CAD for over 30 years. He was a founder and CEO of SolidWorks, a group executive at Dassault Systemes, director of engineering at Computervision, manager at the MIT CADLab, a player and instructor on the MIT Blackjack team, and a professional magician. He serves on the Engineering Advisory Board at Boston University and as an advisor to Magic Leap and MarkForged. His hobbies include golf, 3D printing, tennis, yoga, and magic.

Ahead in the cloud

Using the cloud has emerged as a standard IT option, but true cloud-based CAD has been sniffed at in the past by the design community. Its time has come, or so believes Jon Hirschtick, founder and chairman of OnShape, as he explained to Tim Fryer.

The capacity and accessibility potential of using cloud-based IT functions has been first recognised and then realised. Not so, however, with CAD. Perhaps driven by the notion that precious IP could not ever be released to the ether, engineers have at best used the cloud to share models rather than it being the place in which they actually do design.

Jon Hirschtick made his name as founder of Solidworks and is therefore no stranger to introducing disruptive technology. It was his idea to have a true cloud-based CAD system – not just a resource that people download to their individual workstations or servers, with files being zapped back and forth as different engineers work on them. The OnShape solution sits in the cloud and the model that is being worked on remains there. No software needs to be downloaded to the designers desktop. Could this be a turning point in how CAD is purchased and used?

There are, according to Hirschtick, three reasons why the time is right for CAD to exist in the cloud, and for the industry to move to offering Software as a Service (SAAS). The first of these is economics. "Who wants to spend $5,000 for software?" Hirschtick declared. "It's only in CAD that we talk about that."

However, the upfront costs compared to the SAAS fee is just one of the economic considerations. "It's how much you save on not having to buy special hardware, not having to pay staff to configure and install it or look after it," said Hirschtick. "It's like electricity, you can run a generator or you can buy it from the electric company, and we think most people are better off buying it. Same with computing, cloud and software as a service, compared to the economics of the total picture of licence costs, labour and hardware. Those economics favour the cloud. But saving money is the least important of the three benefits."

The second big benefit, claimed Hirschtick, is that productivity is much better when both the CAD software and the model being worked on is in the cloud. It means that everyone in the design team is working on the same version of the software and the same iteration of the design. There is no need to copy and send files, install updates and manage revisions.

"And the third reason is teams work together incredibly well," said Hirschtick. "If two people work alone we can make a good design story, but if you work as a team, it's an amazing story. [Engineers] produce better results in teams. Not only do they save time, but more importantly they're more innovative when they're working together."

So what about the security fears of working on the cloud – are you one hack away from losing your design?

"There's the perception and then there's the reality," claimed Hirschtick. "The reality is that anyone who uses email is willing to put their private messages in the cloud. Most people who object to the cloud actually will see their security improve on it."

The logic is that company servers are potentially compromised as soon as anyone connects to the internet or transfers any external or executable files. Equally, anything that leaves a building on a laptop is a potential risk.

Hirschtick continued: "There are three types of people regarding security. Many people are not concerned. Some people are so concerned they won't talk to us. And in the middle are people who talk to us, and many of them, once they think about it, they take our view that they're way more secure than before."

Another consideration is the uptime of the system. OnShape claims to have uptime of 99.9%, but that is only relevant if the user is online.

Hirschtick admitted: "If you have an unreliable Internet connection, we are not your choice. But to me it's more reliable than electric power. My electricity is off more minutes in a year than my Internet, living where I do in the Boston area. The interesting thing about reliability is that we don't crash the way installed CAD does. If the Internet drops out, you're down. But traditional CAD drops out too, and drops out way more often than the Internet."

OnShape is only three years old, releasing its full version early in 2016 and there will be more developments.

Hirschtick said: "We have more to come in areas like controlling who can do what, auditing what has been done, and managing those workflows more precisely."

But is OnShape an anomaly or will other CAD vendors follow suit with cloud-based offerings?

"Well, clearly they're trying to," said Hirschtick. "People are talking about new things they've installed and adding a browser, but those aren't solutions. If you use those tools, you install software. It's like using CAD and DropBox.

"I'm flattered that a year ago people said, 'it's not important what OnShape are doing, don't worry about it,' and now they're saying, 'oh, we do it too - it'll be here in a couple of years'. Obviously they now seem to think what we're doing is important."

EXHIBITION

The only event in the region featuring a stellar line-up of world-class suppliers entirely dedicated to the needs of design engineering and manufacturing professionals

Headline sponsor

FANUC

www.

6-7 JULY 2016

METRO RADIO ARENA **NEWCASTLE**

Created specifically for the needs of production, maintenance, design and management professionals from all markets

CONFERENCE

Hear inspirational case studies, global success stories, manufacturing innovations and how the North East impacts the wider UK economy. Industry leading experts offer insight on the issues affecting your business

WORKSHOPS

A full programme of FREE practical workshops from first-class suppliers provide best practice learning and insight into the latest engineering and manufacturing techniques

book your free ticket now at:

menortheast.co.uk

The winning formula

With the British Engineering Excellence Awards fast approaching, we look at last year's Materials Application of the Year to see what it takes to be a winner. Justin Cunningham reports.

It was a category packed with impressive material innovations. Surrey NanoSystems brought along the world's blackest material. Diamond Hard Surfaces an amorphous diamond coating. But, for the second year running, Nylacast was able to narrowly beat the competition with an impressive application of its staple material and process, cast nylon.

For the Leicester based firm punching above its weight has become a way of life, as it regularly competes against the likes of DuPont, Solvay and Covestro (formerly Bayer) for business. It's secret, it says, lies in its ability to form close working relationships with customers where it acts as a consultant. It's led to the company gaining a reputation for innovative material application, as much as it has material supplier.

"We want to be a solutions provider," said Junaid Makda, marketing manager at the firm. "We don't want to just sell plastic materials or have to sell a certain tonnage a month. We want to offer that engineering expertise, which provides our customers with genuinely better solutions."

An example is its 2014 British Engineering Excellence Awards entry, the worm-wheel gear used in automotive power steering assemblies. The part uses a co-polymer attached to an inner steel hub. The worm-wheel offers weight reduction, reduces NVH, and resists corrosion.

It's made from a combination of polymer and steel. The steel inner hub provides dimensional stability and strength, while the outer ring is made from a custom formulated Nylon 6.12 developed by Nylacast. Like many of its parts, surface friction can be engineered depending on need, in this case the worm-wheel is self-lubricating. In short, it's a better solution, backed up by the fact it's sold more than 11 million of the parts worldwide, on 45 vehicle models. The team even trawl junkyards to see how the gears fare after a lifetime of use. Some look almost as good as the day they left the factory.

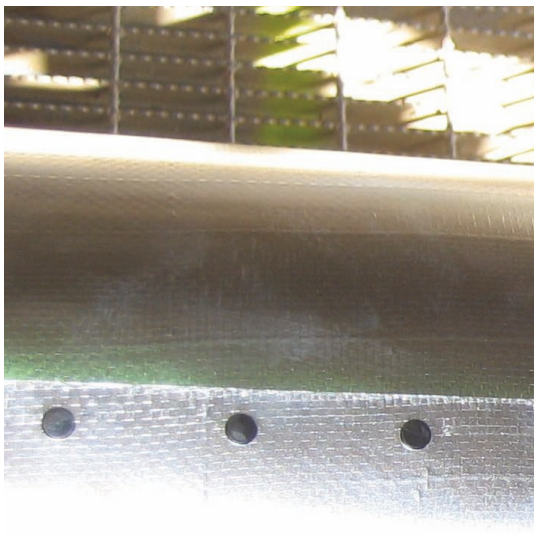
Why cast nylon?

The company casts nylon for a number of reasons. Other manufacturing methods such as injection moulding or extrusion can result in brittle or weak materials. So, after casting, the nylon undergoes an annealing process to relieve any internal stresses, making it much stronger as a result and also improving dimensional stability. This is particularly useful during machining operations, post processing and throughout the life of a part as the material exhibits little creep even under load. It's meant that Nylacast's materials have been particularly successful at replacing metals in parts normally made of bronze, steel and iron.

Pipe-in-pipe spacers

The ability to engineer the plastic for a given application and work towards a better solution has seen Nylacast work on a number of offshore components for the oil and gas industry. Polymers are being increasingly sourced by the sector as mechanical properties have been improved and costs reduced.

Polymers can offer low wear, high strength, corrosion and chemical resistance as well as being lightweight; typically one seventh the weight of a like-for-like steel component. Polymer components can also be self-lubricating, eliminating the need for routine and costly maintenance and machine downtime, a massive advantage for those operating on a rig.



Mussa Mahomed (left in picture below), Group MD of Nylacast receiving the 2016 BEEAs for the Pipe-In-Pipe spacer (above)

One of the big wins for the company was to engineer a pipe-in-pipe spacer (PIPS), traditionally made from metal. The pipe-in-pipe spacer is a component that sits in-between oil transporting pipes. These use a smaller diameter inner pipe sleeved within a larger outer pipe. This configuration is commonplace in the oil and gas industry as it keeps water out, enabling the contents to be maintained at a temperature that allows it to easily flow, as well as acting as an environmental shield. The outer pipe also withstands environmental challenges such as corrosion and hydrostatic pressure.

To properly seal and centralise the pipes and ensure there is no movement requires a precise

Do you have what it takes to win?

If you think you have what it takes, then why not enter? The British Engineering Excellence Awards (BEEAs) remains true to its original remit: to recognise and award the achievements of British engineers and companies.

Now in its eighth year, the Awards celebrate those that have demonstrated the skills, invention and dedication to compete on an international stage.

Event organiser, Ed Tranter, said: "Every year the judges are blown away by the innovation, technical ability and imagination presented to them, and now is the time when you can impress them with your designs. Ask yourself whether your company has a success story to tell. And if you do, then enter this year's BEEAs."

Entries close on 15 July 2016.
www.beeas.co.uk

fit. And getting the spacers in place required Nylacast to engineer some very different surface properties within the single component.

"We've been able to utilise a combination of materials derived from our in-depth understanding and knowledge of material science," said Makda.

The company created a custom formulated grade of cast Nylon 6 on its PIPS, which is first attached to the inner pipe. The inner surface of the PIPS uses a patented ferrous metal coating to provide high friction to allow the product to exert an immense grip on the inner pipe.

Once attached, the inner pipe (with PIPS) needs to be slid inside the larger outer pipe. To help with this process, the PIPS has a low friction, self lubricated, top surface to allow the outer pipe to easily slide over the inner pipe.

"The high friction under layer allows the spacer to exert an immensely strong grip on the inner pipe," said Makda. "It can withstand significant shear forces during installation and operation to avoid the spacers moving and possibly bundling up at one end, which can unbalance the inner pipeline and potentially result in damage.

"The combination of ferrous and non-ferrous materials eliminates the disadvantages of each, with the polymer excelling where the metal would not be suitable, and vice versa. It's led to faster installations, better performance and improved costs within the industry."

Nylacast PIPS are utilised on projects with service lives ranging from five to more than 25 years. To date, hundreds of thousands of spacers have been deployed within thousands of miles of pipeline around the world, with no reported failures, defects or other issues.

It was this clever application of material innovation, providing two very different frictional properties on the same part, which secured the company its second BEEAs, and back-to-back awards. On announcing Nylacast as the award winner, the judges commented: "Nylacast's Pipe-in-Pipe Spacer clearly met and solved real world application demands. It is used extensively in the oil and gas sector, the system uses the company's custom polymers, with low friction on one surface and a patented ferrous metal underside where high grip was required. This clever application demonstrated a real understanding of an industry's needs."

The design and manufacture of Nylacast Pipe-in-Pipe spacers takes place at Nylacast's headquarters and main manufacturing facility in Leicester, alongside its Houston sales office, with deployment to key locations worldwide including Angola, the Gulf of Mexico, the Norwegian Continental Shelf and the UK North Sea.

www.nylacast.com

PI announced as Manufacturer of the Year 2016

During an evening of industry networking, a few sensible drinks and a fabulous meal, Birmingham's National Motorcycle Museum on April 12th was transformed into the Motion and Control Industries' first annual awards ceremony. Its theme was Celebrating, Recognising and Rewarding the achievements of both individuals and companies operating within this important sector.

Hosted by the brilliantly funny Simon Evans, PI (Physik Instrumente UK Ltd) were extremely proud to be presented with the Manufacturer of the Year award.

This year's ceremony ran alongside the 2016 Drives and Controls exhibition at which PI were exhibiting and were able to speak to many incredible people.

Upon collecting the award, PI Ltd's managing director Kevin Grimley said "I am proud that we have received the award as it properly recognises our commitment to customer service, quality and product reliability. Our employees both here in the UK and throughout the world deserve this formal recognition as it reflects all the hard work and professionalism put in by them on a daily basis."

From left to right: Simon Evans, Steven Locket (PI Manager), Kevin Grimley (PI's MD) and Ryan Fuller from award sponsor Hydraulics and Pneumatics magazine

Richard Moss, PI's Marketing Manager added, "Being in the company of the best in Motion and Control and shortlisted for the prestigious award of Manufacturer of the Year 2016 alongside other incredible organisations, in itself was very rewarding. To be selected as the overall winner, is a reward for everyone at PI who has contributed towards achieving this".

The MCI Awards are run by Touchwave Media. Andrew Castle, Touchwave's Managing Director said in response to PI picking up this award, "Many congratulations to PI on winning the first ever MCIA 'Manufacturer of the Year Award'. It was a closely contested category and I feel sure that this important accolade will serve them well in their ongoing endeavors".

The PI team can be contacted at:
uk@pi.ws
01234 756360
www.physikinstrumente.co.uk

Car design in the bright lights

Everyday engineering design solutions are emerging from the sci-fi environment of the synchrotron – a facility that takes x-ray based measurements to a new, brighter level. Tim Fryer went to visit.

Safety, performance, appearance... everything in automotive design is being squeezed, redeveloped and optimised. But such changes of course are no longer a mere flourish of the designers pen, or click of the mouse. And while complex simulations and wind tunnels provide invaluable information that can be used to iterate designs, such testing techniques will only go so far.

The next leaps in car design require engineers to delve deeper, understanding the behaviour of the materials themselves and the way they change in manufacture and in service. To do this requires some ground-breaking test and measurement equipment - and some very bright lights.

Welcome to the synchrotron

Situated on the technology park at Harwell in Oxfordshire, this synchrotron is the UK's largest and latest. It was designed, built and is operated by Diamond Light Source, a company owned by the Government (86%) and the Welcome Trust (14%). It is a place where science and engineering collide to provide designers with new building blocks for their products. There are many sectors that benefit from the facility including the physical and life sciences which feed medical and environmental developments. Another area, and the focus of the iCAR conference that the facility hosts, is automotive.

Above: A view along the storage ring. The electron beam travels through these tunnels, before being siphoned off into the beamlines as x-rays
Below: An aerial view of Diamond Light Source

The science behind the synchrotron is incredibly complex, but the basic principle was outlined by Prof Andrew Harrison, CEO, Diamond Light Source, speaking at the last iCAR event.

"Diamond Light Source produces brilliant light primarily in the form of x-rays," he explained. "What we have is a storage ring, which circulates electrons close to the speed of light. As these go around the ring the current builds and gives out a brilliant flash of light in the x-ray part of the spectrum. We use that light to feed instruments that we think of as very high powered microscopes."

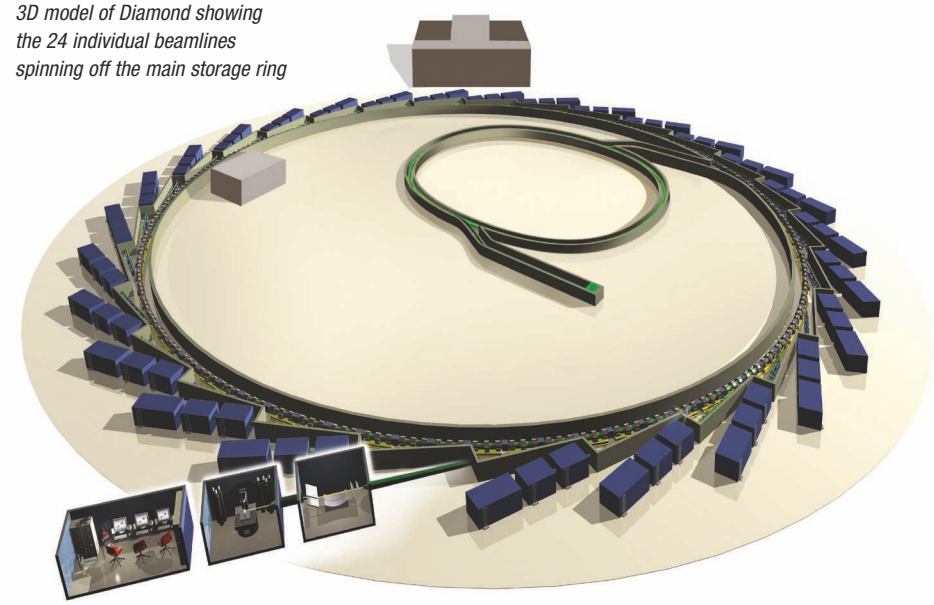
Diamond's accelerator system starts out with a 100MeV (Mega electron volt] linear accelerator. The electrons are then accelerated up to 3GeV in a synchrotron with a circumference of 158m before they are injected at full energy into the main storage ring which has 24

All images in this article Courtesy of Diamond Light Source

sectors in a 561.6m circumference. Each sector is part of a double bend achromat lattice, each with two bending magnets, 10 quadrupole magnets and 7 sextupole magnets. This provides 24 straight sections of which 22 are for experimental stations.

"This allows you to look at the structure of materials on the atomic scale," continued Prof Harrison. "The work done on DNA 60 years ago would have used x-rays, but x-rays in a laboratory are far, far less intense. Compared to the x-rays Crick and Watson used to determine the structure of DNA, Diamond is 10 billion times brighter."

The consequence is that it's possible to quickly look at the structure of very complicated materials. And, most excitingly, it can investigate structures as they are being transformed during processes.



3D model of Diamond showing the 24 individual beamlines spinning off the main storage ring

Prof Harrison said: "Traditional structures were seen as static – you see something in the beam and say that is the structure of that material. Increasingly what we are using x-rays to do is to look at how things change during a process – so it could be during a chemical reaction, it could be during an engineering process."

One of the users is Prof Richard Dashwood, a Professor of Engineering Materials (Metals), describes the work of the WMG as unusual in that it sees a key part of its role as sitting at the 'elbow' of industry. He commented: "In terms of research it is taking all the rigour and impact that you would expect from a university and applying that at scale but also across all the technology readiness levels – not just the fundamental research that you expect universities to do, but a lot of the applied research that needs to be done to gain the confidence of the industry to take it from research into action."

A particular focus area for WMG is the automotive sector with its three main challenges of lightweighting, autonomous cars and advanced propulsion systems. Reaching EU CO_2 targets for 2020 would involve cutting the weight of an average car by 170kg, he claimed, and to meet the 2030 target would require doing the same again. "So it's all about making lighter, stronger materials that are greener, manufacturable in high volume and instead of thinking about a car as a steel can, we need to think about putting the right materials in the right part of the car," he said. "All this requires some incredible research challenges going forward."

So where does Diamond Light Source come in? Firstly they can provide some very detailed information about stress and what materials are present in the components.

Prof Dashwood continued: "We are getting to the point when we can do all of those things simultaneously and you can do that in real time. So we can work out what is happening to the materials while we are processing them, while we are shaping and joining them to make a car, and also what is happening in service."

It is therefore also possible to work out what happens to a car in high strain rate events – e.g. during manufacture or in a crash – as that plays an important part in designing cars that are safe.

"It's all about validating the models as well because you can't design anything these days without having a mathematical model," added Prof Dashwood. "And there are a lot of things we assume when we create these models that we can't validate without these techniques."

An example of the research concerns joining high strength steels. Over the past two decades the quest for lightweighting has resulted in steels becoming ten times stronger, but in doing so they have lost some of their ductility. They also have a problem when used with the traditional joining method - resistance spot welding. Using this process without any changes will result in a hard bit in the middle of the weld surrounded by a soft area - a doughnut area that will fail if any load is placed on it.

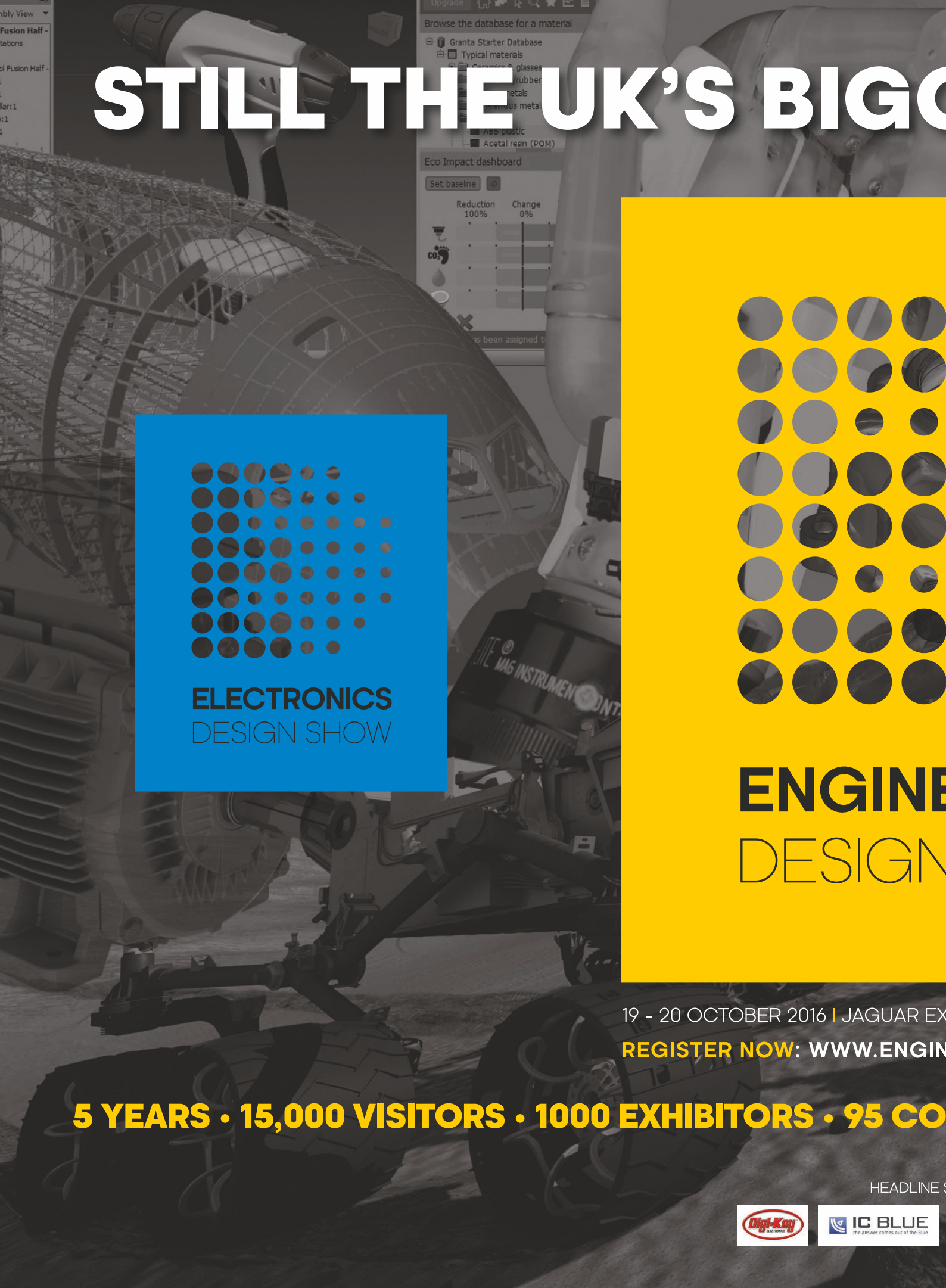
Prof Dashwood commented: "What we were charged with doing for a project with Tata Steel, was to develop a model so that we could predict what the properties of a weld would be and then, by understanding the stresses that were developed inside that weld, what would happen if we applied a load. We used these facilities to validate that model."

In another case, this time working with JLR, a problem needed resolving concerning cosmetic problems that were arising when the company was migrating from steel to aluminium. The phenomena of the 'bruise' (a black mark) appearing when metal was being formed round a tight radius was defying conventional modelling.

"Again by looking at residual stresses inside," said Prof Dashwood, "we realised that there was a lot of out of plane stresses, which are very rare in metal forming – most stresses are in plane, and all the modelling techniques that are used assume there are no out of plane stresses. So we had to go back and remodel that and came up with a solution. We wouldn't have been able to achieve this without access to these facilities."

Visiting Diamond Light Source does underline the impression that this is big science, but it is being used to solve genuine, real-life engineering problems. Prof Harrison concluded: "It is a two-way process and that is what we are trying to achieve here [with iCAR] - trying to get a greater understanding of what the industry needs."

www.diamond.ac.uk
www2.warwick.ac.uk/fac/sci/wmg/


STILL THE UK'S BIGG
Browse the database for a material
Granta Starter Database
Typical materials
Eco Impact dashboard
Set baseline
Reduction 100%
Change 0%
ELECTRONICS
DESIGN SHOW
ENGINE
DESIGN
19 - 20 OCTOBER 2016 | JAGUAR EX
REGISTER NOW: WWW.ENGIN
5 YEARS • 15,000 VISITORS • 1000 EXHIBITORS • 95 CO
HEADLINE
Digi-Key
IC BLUE

GEST DESIGN EVENT

EERING
N SHOW

EMBEDDED
DESIGN SHOW

XHIBITION HALL | COVENTRY ARENA
IEERINGDESIGNSHOW.CO.UK

NFERENCE SPEAKERS • 200 PRACTICAL WORKSHOPS

SPONSORS

Autodesk Manufacturing User Conference 2016

Powered by cadline

WHY ATTEND?

- Change the way you design your products with the Future of Making Things
- See the latest manufacturing workflows using Autodesk 2017 tools
- Receive half a day of free product training with 3 x Technical Masterclasses
- Full supporting Technical documentation provided
- Autodesk product tips and tricks
- Great networking opportunities
- Hands on Solutions Technology center

DATES & VENUES:

Mercedes Benz World, Weybridge – 21st June 2016
Radisson Blu, Manchester – 5th July 2016
Crowne Plaza, Aberdeen – 7th July 2016

FIND OUT MORE & REGISTER NOW: **www.cadline.co.uk/UserConference2016**

Making it 'unique'

As consumers ask for increasing personalisation in products, design engineers from high volume industries are turning to 3D printing to offer some solutions. Justin Cunningham finds out how.

Honda is using 3D printing to develop accessories and speed up the process of customising cars for different regions

The world is changing. The trend of product personalisation – driven largely through software, but also accessories – has empowered consumers and left them wanting more. It has become all about them. Standard is no longer desirable, it has to be 'unique'. The fallout has left many in design and product development scratching their heads as they figure out how to mass produce personalised products. Global firms that produce products in their millions are having to find ways to engineer products to feel more... local.

"People are getting more demanding, and in many markets are beginning to want things that are personalised for them, rather than a standard off the shelf type item," said Amos Breyfogle, a senior application engineer at 3D print firm Stratasys. "For the automotive industry, generally, they are looking to make their vehicles more adaptable, and focused on specific regions and individuals."

The automotive market is at the coalface of this changing demand. As an industry, automotive is the epitome of high volume mass-market production.

The automotive market is at the coalface of this changing demand. As an industry, automotive is the epitome of high volume mass-market production. But, while the use of common platforms among different models really took off in the 90s, this was more about the manufacturers consolidating costs and tapping into different market segments, than offering consumers anything unique.

Nevertheless, this is changing. Accessories and options for new cars run in to the hundreds. This level of customisation has seen automotive giant, the Honda Group, actually set up its own subsidiary company to specifically take care of its accessory design and development work.

Honda Access assist the Tokyo based firm to make its cars, motorcycles and other vehicles appeal to local buyers all over the world. Overall, a typical Honda car can have anywhere from two to three hundred accessories that are tweaked and customised.

The accessories used to customise vehicles allow Honda's global products to be tailored to the needs of local markets and consumer tastes. A simple example is the adjustment of cup size holders for the North American market where imperial, rather than metric sizes, are used.

"We have to take into account a range of considerations such as regional driver preferences, climate considerations and the road surfaces when designing the accessories," said Hiroshi Takemori, a senior researcher from the product planning department at Honda. "We offer distinct specifications according to a country's needs and demands.

"Take the CR-V, for example. In the United States, the vehicle is marketed to parents who use it to pick up and drop off their children. But, in China, it is positioned as the ultimate SUV and a status symbol. Since the vehicle body is built to the same standards worldwide, we use accessories to give the car a little regional flavour."

Click and print

Sindoh is a Korean company that makes many of the leading 2D printers on the market. It has now developed a 3D printer, the 3DWOX, that it is selling under its own label. Available through Amazon (although it is not yet on the UK site), the $1300 unit has a number of nice features including cartridge loading of the filament – a nice draw-through from its 2D printing roots. Rather than having to load spools, then cutting and threading the filament, it is simply a case of slotting a cartridge in and everything else is taken care of automatically.

There is a software plug-in that allows direct printing from Solidworks, although not any other CAD packages at the moment. An exporting or reprocessing of files is therefore unnecessary – printing parameters can be set up in the design window and then it is a matter of click and print.

3dprinter.sindoh.com/Product3Dwox

From CNC to 3D Printers

Given the vast amount of customisation that is required, Honda recently undertook a project to make the process of design and production more efficient. The company was using CNC machines for product development of parts that could be trialled and tested, but that process entailed excessive effort and cost.

While 3D printers have been used for 10 years by the Honda Group, the adoption of the process has been limited. Designers have always been excited by the possibilities it offers, but the technology and access to machines has been limited. This, however, has begun to change with the benefits incrementally explored for both the design and implementation of parts.

"There was a lot of buzz about the possibilities of 3D printers," said Takemori, "We realised that 3D printing would be extremely advantageous for product development... by enabling the realisation of ideas in a very short time."

Prototyping realism

The recent launch of the Stratasys J750 is offering designers and engineers a step change improvement when it comes to prototyping. The machine moves well beyond being able to replicate the form and fit of a product, and uses a combination of six foundation materials to offer numerous permutations. These 'recipes' can be used to achieve a wide range of mechanical, tactile and surface finishing properties as well as virtually any colour imaginable.

"In the prototyping realm, to get the feel of something like leather for example, you normally need leather," added Breyfogle. "But with the J750 you can print something very similar in the feel, texture and even looks of it. And, you can do that overnight without waiting for tooling or material samples.

"You can be prototyping cup holders and dashboards with the leather look. So, it really opens doors in terms of versatility. You can see, from a prototyping point of view how this can start to replace many more traditional machines."

Cost-effective customisation

For Honda Access, it has continued to explore the advantages of 3D printers with its customisation development. It has found the

laser prototypes europe ltd

Additive Manufacturing Services

LPE offer a range of services including **STEREOLITHOGRAPHY (SLA)**

SELECTIVE LASER SINTERING (SLS), 5 AXIS CNC, METAL SINTERING

and **VACUUM CASTING**

CELEBRATING 25 YEARS 1991 - 2016 LASER PROTOTYPES EUROPE LTD

Celebrating 25 years in the Additive Manufacturing Industry

nqa. ISO 13485 Registered

Call: 028 9070 6940 Web: www.laserproto.com

Email: sales@laserproto.com

nqa. ISO 13485 Registered

New dimension in electronics

Nano Dimension has developed a new system that adds a further twist to the story of 3D printers. Its DragonFly 2020 due for release later this year is aimed at companies who do a lot of prototyping of products that have electronic components. The system is an inkjet and curing deposition system that is said will print professional quality PCBs.

It will build 20 layer boards, and possibly up to 30 layers, depending on the design. It can also print flexible or rigid boards or even a combination of the two. So rather than designing a product around a set rectangular PCBs, it can now be designed to fit into the design space available. The company has developed highly conductive nano-particle silver inks that are an enabling technology within its process.

The big advantage is time saving. Rather than taking days or even weeks to turn round an outsourced PCB, this can now be achieved in a matter of hours on the DrangonFly 2020, allowing more opportunities to iterate and innovate.

www.nano-di.com

overall design process has improved dramatically. Previously, it would use CNC machines to prototype parts in-house, as well as outsource part of the development operation.

"3D printers allow us to synchronise the development schedule with the vehicle itself and create the accessory parts simultaneously," said Takemori. "This improves both the quality and speed of the prototyping process. The technology has become indispensable for our business."

Honda said that the CNC machines it did use required full-time operators, while its experience with outsourcing often resulted in delays due to slower communications with service bureaus. These issues have been eliminated since adopting 3D printing with the quality of the design improving too.

It uses the rigid opaque Vero family of materials and paints the printed part with a clear coat in post-processing, resulting in a texture that closely resembles the final product. Designers are now able to examine physical and realistic 3D products during the design process such as headlight enclosures, and quickly modify them. The Objet Eden500V 3D Printer Honda uses also has a large build size, which allows designers to create large parts, such as 14-inch wheels.

Injection moulding parts

For Honda, and others like them, their high volume production rates mean that 3D printed parts are never likely to be used on a car. However, the technology could well move beyond the prototyping stage and help offer more unique production parts.

"When a company decides on a certain cup holder, for example, they then would probably produce upwards of 100,000 of this item," said Breyfogle. "The reason is because the tooling is very expensive."

However, as materials improve, the idea of printing injection moulding tools begins to make sense, and further leverages the philosophy of mass-customisation. At present, mould tools can be 3D printed but these are generally used for one-off tests or for short runs, as they soon become warped, worn and unusable.

If a 3D printed mould could be used to produce 5,000 to 10,000 parts, and the mould is a fraction of the cost, then producing even more customisable parts becomes economically viable.

"In some cases people would pay a premium, maybe not for a cup holder but specialised badges or something like that on the vehicle," added Breyfogle. "This idea of using 3D printing for production tooling really starts to challenge the way that manufacturers produce products, and it also offers them some answers about how to create more customisable products, economically.

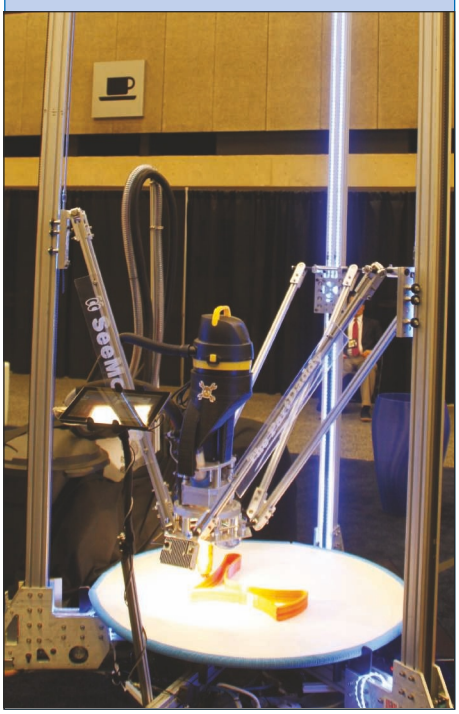
"It begins to make sense to pay a little bit more per unit cost, but not have to pay for tooling. And it's more flexible. You can make adjustments and tweak a mould design every 5,000 units, and not worry about the cost of the tooling."

www.stratasys.com
www.honda-access.com/uk/

Building bigger models

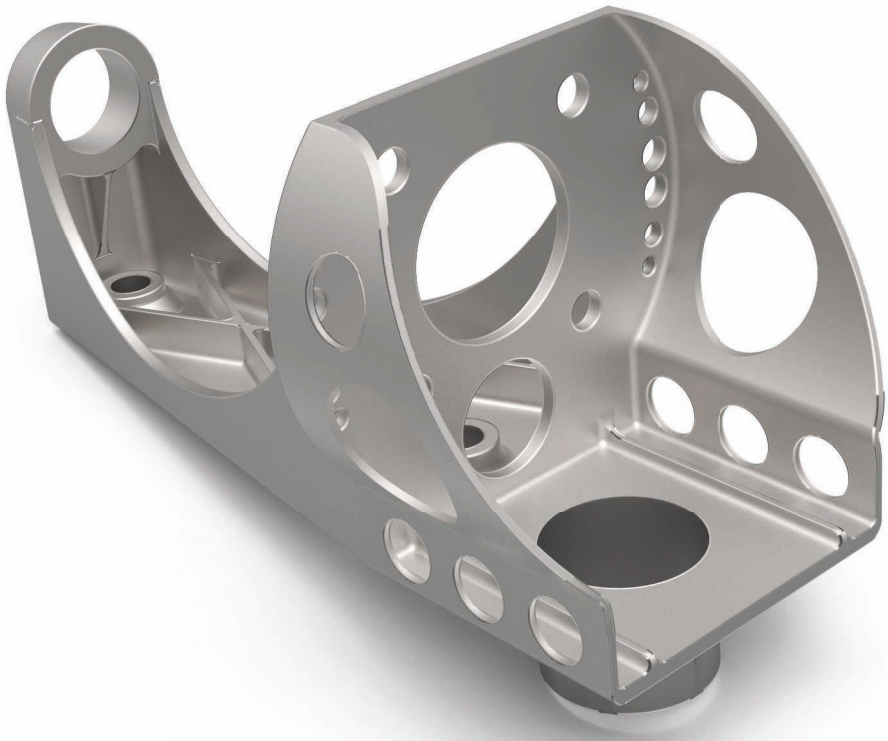
Something of a curiosity to demonstrate a point, the PartDaddy can build models up to 3m high. It was produced by SeeMeCNC to show that its delta format 3D printing platform is scalable. The company's core products are 3D printer kits, the Rostock Max V2 and the Orion, plus a factory assembled version of the former which can build models of up to 40cm. PartDaddy shows the basic technology is stable enough to get bigger – much bigger.

www.seemecnc.com



Fast. Reliable. Precise.

3D printing with 3 advanced processes: stereolithography, selective laser sintering and direct metal laser sintering.



3D printing technologies creates extremely accurate prototypes, from small parts with complex geometries to large, precise patterns – we can make 1 to 50 parts+ in 7 days or less.

3D PRINTING | CNC MACHINING | INJECTION MOULDING

proto labs®

Real Parts. Really Fast.™

Order online anytime | Free design analysis

Emma Spilsbury
Account Manager

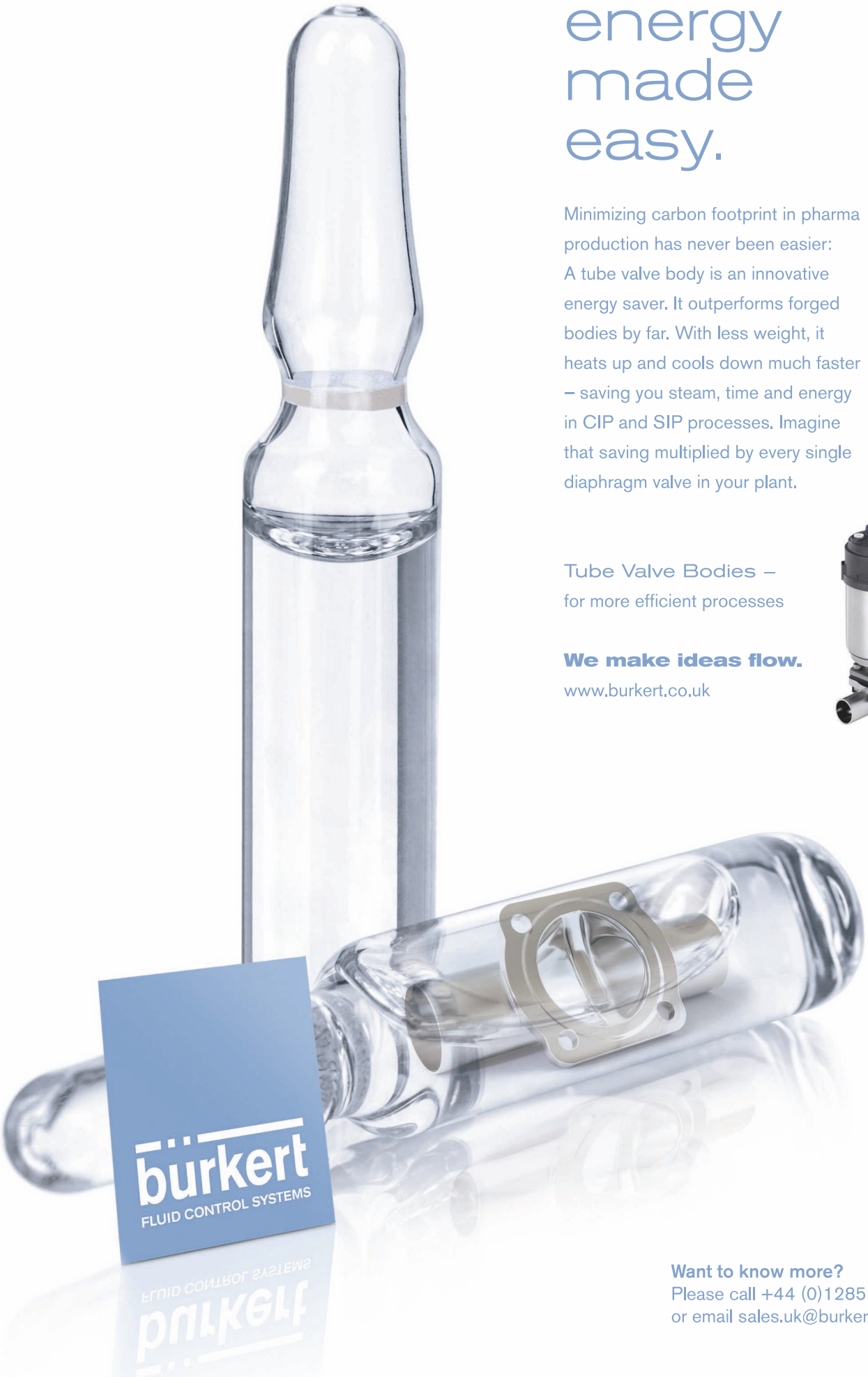
protolabs.co.uk
+44 (0) 1952 683047
customerservice@protolabs.co.uk

Saving energy made easy.

Minimizing carbon footprint in pharma production has never been easier: A tube valve body is an innovative energy saver. It outperforms forged bodies by far. With less weight, it heats up and cools down much faster – saving you steam, time and energy in CIP and SIP processes. Imagine that saving multiplied by every single diaphragm valve in your plant.

Tube Valve Bodies –
for more efficient processes

We make ideas flow.
www.burkert.co.uk



Want to know more?
Please call +44 (0)1285 648720
or email sales.uk@burkert.com

Fighting *the* fakers

Once seen as a problem in low-tech, low-value consumer products, counterfeiting has grown to encompass industrial products, and is spreading across global supply chains. Tom Austin-Morgan looks at the strategies used by the counterfeiters, the implications for users and the best lines of defence.

Hungarian State Railways (HSR), whose trains are used by 140million passengers per year, has been forced to implement stricter stock control and purchasing routines after an audit at its premises uncovered a significant number of counterfeit bearings.

A request for verification was sent from HSR to the presumed manufacturer, SKF, along with the suspect products' designations, quantities, supplier's name and other relevant details. A thorough verification of all the products was made, concluding that many of the bearings in question were indeed counterfeits, marked and packaged like genuine SKF bearings, but manufactured using inferior materials and tolerances.

Peter Horvath, technical director at HSR Machinery, was both shocked and impressed at the outcome of the verification procedure: "SKF's quick and professional reaction and the astonishing result of verification proved to us that HSR Machinery is not an exception as a target by companies selling fakes. New processes are being implemented to prevent this from happening again and from now on quality documents must accompany all bearings we purchase."

Phil Burge, country communication manager at SKF, said: "This kind of event is becoming an increasingly common one for many major manufacturers of high quality industrial products. Problems are occurring right around the world and the items affected aren't just simpler, lower cost items.

"Counterfeits were once most likely to be smaller bearings and parts consumed in high volumes, like those used in consumer products and by the automotive industry. Today, counterfeiters are also targeting large specialised products," Burge added.

Counterfeiters use a number of strategies to get their products into the hands of unwitting customers. They may purchase low quality products direct from factories, and etch them with the brand markings of high quality manufacturers. Alternatively, they may obtain genuine bearings from the remanufacturing supply chain and pass them off as new products. In some cases the 'remanufacturing' process involved can be limited to cleaning and polishing a worn out bearing before putting it into new packaging.

Problems are occurring right around the world and the items affected aren't just simpler, lower cost items.

Technological advances have made life easier for counterfeiters. The sophisticated equipment used in printing and packaging manufacturing means it is relatively straightforward for an unscrupulous company to create convincing copies of genuine packaging. Often it takes inspection by highly trained and knowledgeable personnel to tell the difference.

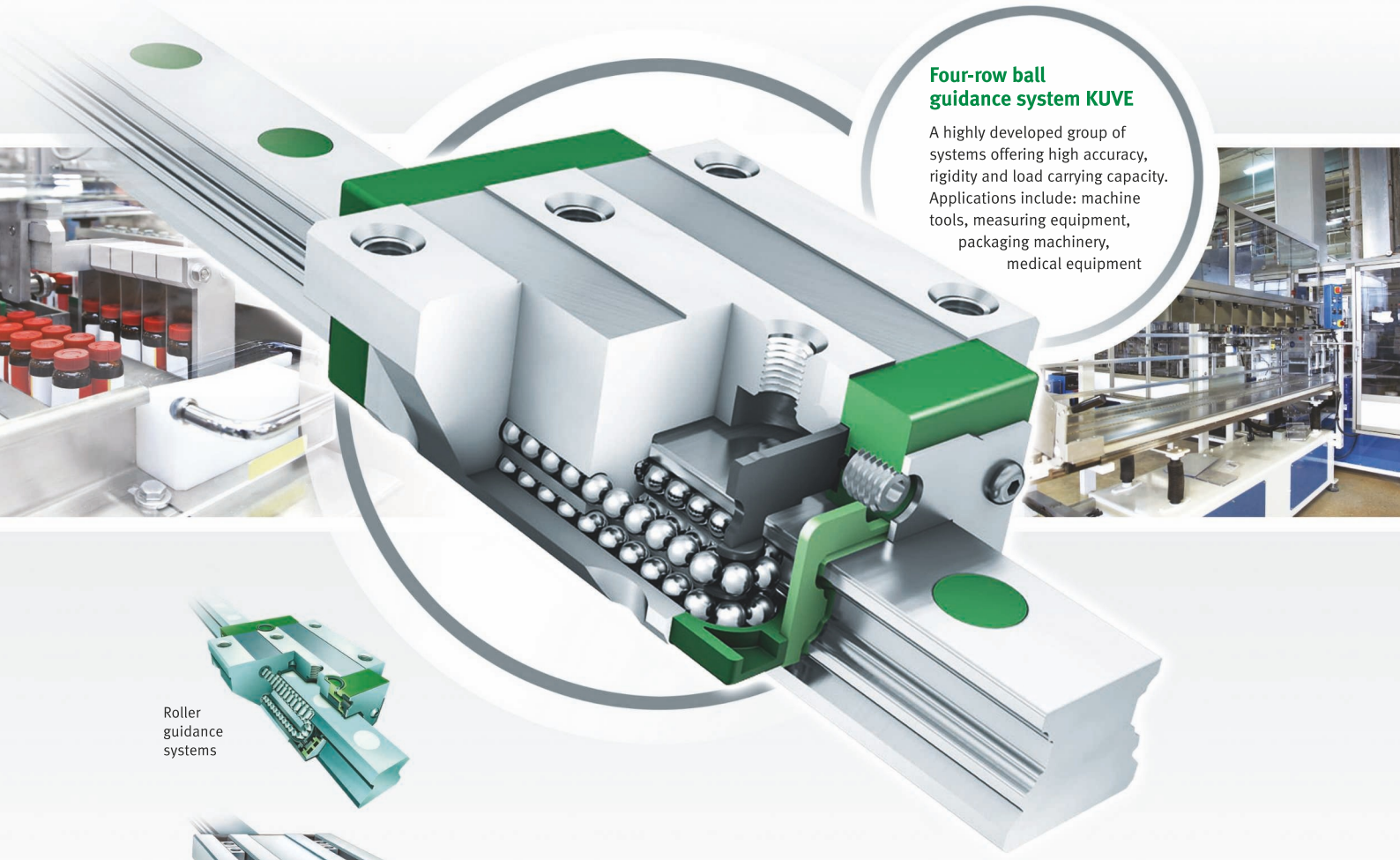
Ian Blackman, technical manager at the International Institute of Obsolescence Management (IIOM) said: "Criminals are increasingly turning towards counterfeiting from other crimes because the profits are better and the jail terms are shorter. However, the US legal system is looking to enforce harsher sentences to set a precedent and to make a stand against these criminals going forward."

Once they have a product that looks right, counterfeiters need a route to customers. Here again they can take advantage of technology and complex global supply chains to find their opportunity. With purchasing departments under ever greater pressure to find best-cost sources for products, the internet and e-commerce play an increasingly important role in many sourcing activities. Counterfeiters take

SCHAEFFLER

First in Line

The world's largest range of linear systems from a single source



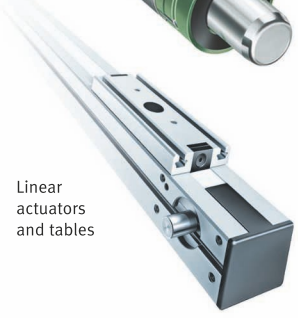
Four-row ball guidance system KUVE

A highly developed group of systems offering high accuracy, rigidity and load carrying capacity. Applications include: machine tools, measuring equipment, packaging machinery, medical equipment

Roller guidance systems

Track roller guidance systems

Shaft guidance systems



Linear actuators and tables

INA linear bearings and guidance systems from Schaeffler offer first quality products to meet linear guidance requirements across a comprehensive range of applications.

From simple guidance mechanisms for low to moderate accuracy to heavy duty systems offering high rigidity and load carrying capacity, the INA range is deservedly first in line.

Taking the quality envelope even further are X-life premium products that feature enhanced characteristics including increased load carrying capacity, higher rigidity, lower operating temperatures and reduced noise levels.

So, whether you are designing a new machine tool, packaging machine, medical device, door closing mechanism or anything else that involves linear motion, the INA linear product range can provide the perfect solution.

Schaeffler (UK) Ltd E-mail: info.uk@schaeffler.com Web: www.schaeffler.co.uk

LUK INA FAG

advantage of this trend using the same techniques they exploit in the consumer space: emailing potential customers with tempting offers, and creating sophisticated websites that give the appearance of a genuine distributor's.

Some organisations claim to be able to supply a range of industrial products from multiple brands from a large and well-stocked warehouse. In fact, the warehouse shown in the company's marketing materials often does not exist at all, and products may be faked to-order, applying appropriate markings and packaging to generic low quality items as required. Counterfeiters have also become adept at fooling customers' purchasing due diligence processes, providing convincing-looking documentation and 'certificates of authenticity'.

"Best practice must come from procurement," Blackman advised. "But the collaboration between procurement and the engineering department must be strong too. The teams need to stay on top of documentation, which is where good obsolescence management comes in."

According to a report published by information analyst, IHS, 60% of counterfeit devices were obsolete or end-of-life parts that have been repackaged and presented as new. Blackman says that manufacturers will usually give an 'end-of-life' notice to alert their customers to a line of products becoming obsolete. The reaction of customers here is important.

"Manufacturers are trying to help by posting end-of-life notices," Blackman explained. "The best thing to do when presented with one of these notices is either to buy large stocks of that part or take note of the recommendation given by the manufacturer with regard to replacement parts."

Counterfeit products present real financial and even safety risks to end customers, and a significant risk to the reputations of genuine suppliers. That's why major manufacturers take counterfeiting extremely seriously. SKF, for example, has a no-tolerance approach to counterfeiting and its brand protection team actively assists law enforcement authorities in taking action when shipments of counterfeit products are identified, however large or small.

Recent investigations have resulted in the seizure and destruction of products from small airfreight packages to two full shipping containers, identified by French customs last year and found to contain more than 60 different types of counterfeit bearings, housings or other products. Leading suppliers are taking steps to make counterfeiting more difficult too by introducing anti-counterfeit marking, for example, making it simpler for trained personnel to tell whether a product is genuine.

For CADENAS, a supplier of 3D CAD models of various components, counterfeiting is one of the first areas that is brought up by manufacturers who have objections about sharing their designs.

"Our 3D models and PDFs don't include any information that isn't already provided by the manufactures on their websites," explained Colin Johnson, managing director of CADNEAS UK. "We don't share any important IP information in the model. Before any content is put on our site it is approved and certified by the manufacturer."

CADENAS' system creates a unique identifying number for each part and, from the customer's details collected through its registration process, can see in real time which customer is downloading what part, and even what country they are in. Through this monitoring CADENAS can restrict access to users who are downloading entire catalogues from a specific manufacturer or other such suspicious activity. It can also block certain email addresses, only allowing customers with credible domain names to access and download from the catalogue.

Johnson said that some UK manufacturers have been slow to incorporate 3D content for fear of counterfeiting. When asked if a counterfeiter could manufacture a fake part from one of the 3D models on CADENAS' site, he replied: "In my opinion, no. It's only really a tool for engineers to see where the product would fit in their designs. If someone is determined to copy a product they'll buy the physical product, take it apart or scan it and reverse engineer it."

Customers choose brand name products because they want brand name technology, quality, service and support. And what customers want - and pay for - they should get. The fact that counterfeiting of industrial products is becoming more widespread is encouraging manufacturers and bodies like the IIOM and the World Bearing Association to take steps to confirm the certification and traceability of products.

The most straightforward action design engineers can take is to work closely with their procurement team and suppliers to ensure that the selected components have been approved by the original manufacturer. Such information should be available from the manufacturers' websites or their local representatives and can be easily queried via email or similar contact channels.

www.skf.com/uk
www.cadenas.co.uk
theiiom.org

MENE *powers on*

There are many reasons to spend a day, or even two, at the Manufacturing & Engineering North East event. While some may be hunting out new suppliers in the exhibitor hall, there are high level conference and workshop programmes that promise to be informative, inspirational and possibly even entertaining, with James Wharton MP, Secretary of State for the Northern Powerhouse topping off the programme on day two.

The conference keynotes provide high level engineering and manufacturing speakers from market leading companies. They cover a wide range of topics including manufacturing and engineering strategies, best practice and innovation.

CONFERENCE PROGRAMME - DAY 1 (6TH JULY)

9.15 Hitachi Rail: bringing an £82m super factory to the North East

Hitachi Rail

Hitachi will explain how it has developed a four year blueprint for building a fully operational 43,000sqm site in Newton Aycliffe. Delegates will discover how it has overcome skills challenges to fill 730 new roles. It will also detail its efforts to establish new supply chain partnerships with firms in the North East and beyond.

10.15 Making a difference

Philippa Oldham, Institution of Mechanical Engineers

The North East has experienced a real revival in manufacturing. The first half of the presentation looks at the impact this region has had not only on the UK but further afield. The second half will look how the region can continue to lead the UK's continued manufacturing revival – this will include a discussion into future technological developments.

11.15 Embracing the smart factory

Ben Morgan, Head of the Integrated Manufacturing Group, AMRC

As we move into the 4th industrial revolution, the question on manufacturers' lips is "What can it do for us?" This presentation will try to de-mystify some of the complications of this subject and show what we are doing in the UK to achieve greater efficiency, flexibility, shorter lead times and zero-defect products.

CONFERENCE PROGRAMME - DAY 2 (7TH JULY)

9.15 Nissan

Kevin Fitzpatrick, vice president, Manufacturing, Nissan UK

Nissan will host the opening keynote on the second day of the MENE conference.

10.15 Increase productivity through proactive maintenance

Dr David Baglee & Roger O'Brien, AMAP

David will present how a small project team developed a new approach to maintenance strategy development for a medium sized drinks company which included a mix of simple standard operating procedures, training programmes and condition monitoring techniques.

11.15 Successful diversification

Geoff Ford, Chairman, Ford Aerospace

The Ford Engineering Group occupies three sites in the North East, each of which serves different markets, using different processes and equipment, producing different components and working closely with different supply chains. Geoff Ford will describe how this diversity came about, and the challenges and opportunities faced by the Group.

WORKSHOPS

There are two workshop theatres situated in the exhibition area and these provide best practice learning and insight into the latest engineering and manufacturing techniques.
The full agenda will be released in next month's issue of Eureka, but here are a few of the highlights:

Flexible manufacturing automation – can you afford not to?

Nick Statham, Fastems

Specifically aimed at Flexible Manufacturing, we will explore how automation gives significant increases in spindle up time, reduced component cost, improved quality, reduced WIP and stock, overtime on demand, reduced dependency on skilled personnel, faster order response and improved cash flow.

Data breaches are inevitable …but you have a plan?

Dr Christopher Laing, Sciendum

Granted, while protecting data is an important aspect of business life, too much time is spent on defending information infrastructures, and very little on managing a security breach, otherwise known as incident response. But businesses need a plan, and this presentation will outline a simple and cost effective way of building an incident response plan.

Unique properties drive the polyketone revival

Manfred Bär, AKRO-Plastic GmbH

Aliphatic polyketone compounds boast outstanding mechanical properties.

To register and for the full conference and workshop

The triple award winning Manufacturing & Engineering North East conference and exhibition will again bring together world class speakers and exhibitors in the Radio Metro Arena, Newcastle, 6-7th July.

With over 10,000 design engineering and manufacturing sites within a 100 mile radius of Newcastle, Manufacturing & Engineering North East is ideally located to support the region's industry. The event offers a prime opportunity for those organisations to source new suppliers, test equipment, acquire expert knowledge and forge new supply chain relationships without travelling much further afield.

Pre-registering is quick and easy and will guarantee entry to this free event. Once registered, visitors can select the workshop and conference sessions they would like to attend.

12.15 Addressing the skills gap

SORA Group

Despite the renewed enthusiasm with and for the manufacturing and engineering industries, many companies within it are struggling to find engineers of the right calibre. As a nation we are simply not producing enough graduates and apprentices with the right skills – so what are we going to do about it?

13.15 Driving success in the North East automotive supply chain

North East Automotive Alliance

The automotive industry has been one of the leading lights in the regeneration of the Northern Powerhouse, but what are the opportunities for companies wanting to get involved in the automotive supply chain

15.15 Opportunities & support for SMEs in the North East

David Land, North East LEP

A panel discussion covering the opportunities and support available for SMEs in the North East.

12.15 Designing for additive manufacturing: the opportunities, challenges and the way forward

Andrew Triantaphyllou, Senior Research Engineer, Manufacturing Technology Centre

Additive manufacturing has been a disruptive technology, but if it is to be used to its best and full effect then engineers need to know the possibilities and limitations of the technology and how to design with additive manufacturing in mind.

13.15 Exporting is great

Simon Crosby, Senior International Trade Adviser, UK Trade & Investment

Exporting is a sure-fire way to grow your business and reduce your exposure to the domestic market. If you can sell you products or services in the UK, there's a good chance that you could do the same in overseas markets. Join us to find out about the benefits of exporting, the opportunities that exist and the support available from UKTI to help you.

14.15 James Wharton MP

James Wharton MP, Secretary of State for the Northern Powerhouse

The closing presentation will address the political commitment to, and the economic benefits of, the Northern Powerhouse.

These properties are well suited to mechanical applications such as gears, and when extruded they are of great interest to cable and pipe producers who require chemical resistance.

Product evolution

Damian Hennessey, Proto Labs

Digital manufacturing is changing fast, and the options that are available to enable your product to get to market quicker are evolving. This workshop will discuss what those options are, and how those choices will help at every level of product evolution.

Integrating systems

Cathie Hall, K3 Syspro

Manufacturers all have a range of systems. This workshop uncovers how to leverage value by integrating those systems, saving hours of rekeying information, having one version of the truth, having real time, reliable information all along the supply chain.

Protecting investment and avoiding costly down time

Sean Murphy, FANUC UK

A well maintained machine or robot will give years of trouble free production as long as a few simple steps are followed.

Reduce your manufacturing costs with CIM and MIM

Walter Kuhn and Paul Williams, maxon motor

Ceramic and Metal Injection Moulding are two processes that produce components that are wear resistant and give long life. This workshop gives information on everything from the manufacturing process to price examples.

programme visit: www.menortheast.co.uk

ATTRACTION *of* MAGNETIC GEAR

High efficiency. Low wear. Little maintenance. Three reasons to be attracted by the possibilities of magnetic gears. Tim Fryer reports.

Zilift's artificial lift pump assembly (the silver cylinder suspended on a cable) at the well head being fed into the well

Investment in the oil and gas sector is now more 'considered' than it has been for decades. Clearly productivity is paramount, but at the same time profit margins are being squeezed by the low oil prices. Investment too has obviously suffered, making it a difficult environment for new technology to make its mark.

Such technology therefore needs to demonstrate improvement and one example is the first implementation of magnetic gear technology from a Magnomatics. This Sheffield University spin off has developed technology that it believes will find favour in the aerospace, automotive, rail, renewable and marine sectors, but the most advanced application is in oil production, having licensed its technology to Zilift, a start-up that provides downhole pump equipment.

Magnetic gear concepts started emerging in the 1960s but failed to provide any benefits over traditional planetary gears. There are two principal reasons for this according Magnomatics' CEO, David Latimer: "One reason was they didn't have strong magnets, but then the other reason is it's quite complicated. We're moving magnets around in quite a complicated irregular space and creating lots of harmonics – we're chopping magnetic flux into different fields."

A simplistic description of the Magnomatics model is a ring of magnetic pole pairs. The rotating field of magnetism this produces is disrupted by steel pole pieces, which act as a flux path while the air acts as a flux barrier – the arrangement effectively reducing the number of poles.

For example, Fig 1 has an outer ring of 46

magnets (in red and blue) creating a 23 pole pair permanent magnetic field. Inside that are 27 steel pole pieces (in grey) and because of the way they are arranged they create four pole pairs (called the dominant harmonic) on the inside. (in pale pink and blue).

The maths is simple: 27 (steel poles) – 23 (permanent pole pairs) = 4 (pole pair dominant harmonic). The gear ratio in this case is 23/4 = 5.75/1.

Latimer said: "Because we're creating harmonics, it's quite difficult to actually predict how that works, and that's where some of our intellectual property is. So we know that certain numbers of pole ratios work well and some don't."

The result is a gear that has a number of advantages over its mechanical equivalents. They are very efficient, reliable, and have no touching parts and so wear is limited, maintenance reduced and lubrication unnecessary.

There are also disadvantages. A magnet will demagnetise if it is subjected to excessive heat, so there are limits to the working environment, albeit quite extreme limits – depending on the type of magnet, they will recover their magnetism as they cool after reaching temperatures of up to about 200°C. However, if heated beyond that they will permanently be affected. High speeds are also a potential problem.

Latimer explained: "You've got some quite chunky magnets and they want to fly off. So you start putting composite tubes around the magnets just to hold them on. And as you put the composite in place that increases the air gap which means you need bigger magnets to create the flux, which means you need more carbon fibre wrap and the technology runs away from you."

The other main issue is that if the rotor is overloaded it will simply slip, so the magnets need to be strong enough to cope with maximum torque. If peak operation is much greater than the ordinary operating modes, then excessively large magnets need to be used to avoid slipping. This slipping can be an advantage however, as it effectively acts as overload protection.

One such example of this is with Zilift's 'artificial lift' products. When an oil reservoir starts becoming depleted, it loses the pressure that initially squeezes it through the well and up to the surface. When it reaches this stage then productivity can be enhanced by an artificial lift – a pump.

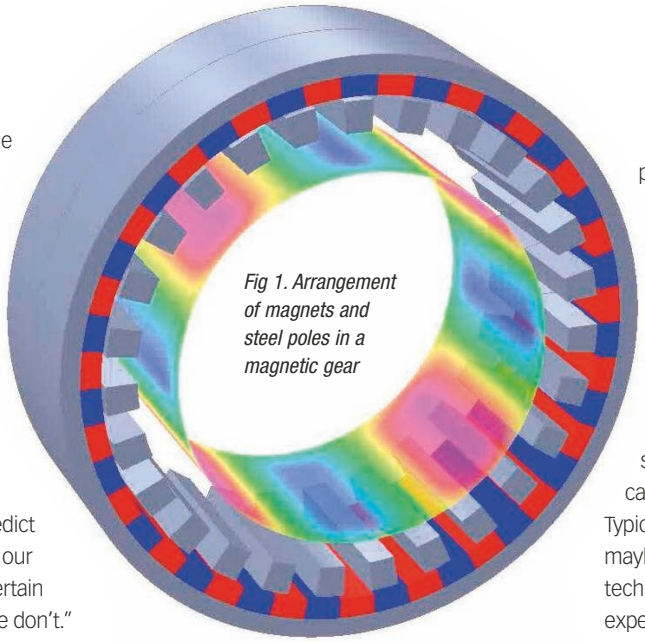


Fig 1. Arrangement of magnets and steel poles in a magnetic gear

Traditionally such pumping used a 'nodding donkey' at the wellhead to drive a reciprocating pump at the bottom of the well. This was fine in the days when wells were, relatively speaking, short and straight. Nowadays wells can be several kilometres in depth and change direction – there is far more likelihood of wear from the push rod between the nodding donkey and the pump.

Zilift puts the whole pump assembly on a cable so it can sit at the foot of the well (or any other optimal point) and be driven electrically. "They are now using the three main benefits of the magnetic gear," claimed Latimer. "The first thing is it's more efficient. The second thing is, it doesn't wear out. So because there's nothing to wear, you can keep it down there for a lot longer, because there's no maintenance required.

"The final thing is what you're actually pumping down there is not just oil. It's oil, water, sand, all sorts of stuff. So, what typically happens when a chunk of sand hits the pump is the pump will tend to seize up. In a normal system with a mechanical gear that will then probably strip the gear teeth so you're going to have to take the thing out, repair it, and put it back in. What happens with our magnetic gear is it just slips. They then detect that it's slipped, and can stop it, reverse it and clear the blockage. Typically we're seeing down well times that are maybe six times the life of an equivalent technology, and taking it out of the well is both expensive and also of course you lose production time."

Zilift claims optimal pump placement in horizontal heavy oil will result in an average 60% increase in production.

The key enabling technology has been the emergence of rare earth magnets that combine magnetic strength in a small package. But, another factor that has allowed a small company like Magnomatics to develop is the use of the simulation software – in this case the Opera FEA simulation software.

"We can use our parametric design programs and design a hundred gears and then in a virtual world we can evaluate whether they are any good or not - we don't have to make them. And you couldn't do that 20 years ago."

www.magnomatics.com
www.zilift.com

Magnetic motoring

Magnomatics has taken its technology in two directions. One is the pseudo direct drive, described in the main article, which will find its applications across many sectors. The other technology goes by the name of MAGSPLIT and it is specifically aimed at hybrid vehicles.

The MAGSPLIT transfers power from the engine to the wheels in a way that allows it freedom to operate at optimum engine speed and torque, but also employs high-efficiency mechanical power. The MAGSPLIT has two rotors known as the magnet rotor and the pole piece rotor, forming the basis of a magnetic gear with a fixed ratio of torque. The outer part of the MAGSPLIT is a stator – the stationary part of a conventional electric machine. Electric current flowing through the windings of this stator drives a magnetic field.

The speed ratio of the pole piece and magnet rotors can be modified by rotating this magnetic field, which is achieved by controlling the current through each of the three phases. The mechanical power of the two rotors will then no longer be equal; the stator converts this difference to electrical power, which can flow into or out of the MAGSPLIT. When the stator holds the magnetic field stationary the two rotors behave like a conventional gear with the MAGSPLIT intrinsic ratio.

The consequence, claims Magnomatics, are improved drive cycle fuel economy and emissions that are 5% better than a mechanical power split; 17% better than parallel hybrid; and 32% better than a conventional gearbox.

Eureka Knowledge
is a free online resource for the discerning design engineer

Eureka's Knowledge provides useful content and tools to help make your designs more efficient, cost-effective and commercially successful.

In the first of a series of topics, Eureka has teamed up with simulation experts ANSYS and Comsol to explore simulation, which is of integral importance to a vast range of projects and industries.

Used at the right time and in the right way, simulation can reduce design time, help identify potential failures earlier in the product development cycle and enable simulated tests that might not otherwise be possible.

- *News*
- *Videos*
- *White papers*
- *Events*
- *Blogs*

EUREKA KNOWLEDGE

Increase your knowledge
www.eurekaknowledge.co.uk

Content partners

ANSYS COMSOL

Designed for a *quiet* life

Design engineers, quite rightly, care about the workstations that they work on. Apart from making sure that it is capable of running your software, there are other factors that can be looked at when drawing up your workstation spec. Tim Fryer reports.

New technology and its application are the bread and butter of *Eureka,* but design engineers are often called on to fulfil many other roles in their company. DESIGN PLUS is a new regular section to address such issues.

Workstations are still perceived in IT environments as being complex beasts. IT managers are unlikely to have much experience of high end CAD applications and, as it is the software that will dictate what hardware is required, workstation users frequently specify their own equipment in a way that users of ordinary office desktops might not be allowed to.

Dom Webb handles sales of professional workstations for Fujitsu and his focus is very much on the design and 3D CAD market. "The reason I am fascinated [by this market] is because there is resonance between what we do from a company viewpoint, and what most designers in engineering companies do. The reason we say that is because we are the only manufacturer who designs and builds [in Germany] for Europe. Everyone else designs in the US or in Asia and then builds in Asia."

This engineering led approach will appeal to companies who have engineering excellence at heart, claimed Webb, and these companies tend to be small – only a handful of engineers each. "To me, that is a really interesting market, and actually, that's what I think we have in the UK now."

The first consideration always has to be the software

Equipping education

The biggest recent contract for Fujitsu in the UK and Ireland was with the Irish Government to deliver 24 of its W series workstations to each of its 428 schools in Ireland.

Dom Webb, workstation sales at Fujitsu UK and Ireland said: "Each school has a CAD department, and each CAD department runs the latest version of SolidWorks. The students are trained and even take their exams on SolidWorks. And it's just brilliant, because they're training the engineers of the future. Often students come out of either secondary school or college and they can just use an education piece of software, where with this program they're coming out and they using one of the leading pieces of software available."

The whole project is costing the Irish Government around €6.5 million. Back in the UK, Webb is in discussion with Reading University Technical College (UTC). "They're an Autodesk user and they're looking to equip a classroom to train the students. But, it will also be used to train the wider community so one of the remits is to be involved in the wider community."

It's a good project but perhaps reflects a more piecemeal approach to engineering education in the UK compared to Ireland? "Yes, it's a problem," observed Webb. "It's just a bit of a different viewpoint on investing in engineers of the future."

environment and the leading software vendors certify hardware to ensure its suitability, although there will obviously still be differences between what runs adequately and what runs optimally.

But if we are to assume that software compatibility has been taken care of, there are other considerations. For example, how does it fit on your desk. "Within the last few months we launched a new workstation form factor for us, which is a small form factor, so it's like a small desktop. It can be orientated either on its side or on its bottom, so it even looks like a desktop. Because the typical workstation isn't very thick, you can only put a very limited set of graphic cards in it. Very cleverly, what the German engineering team did, was run the PCI slot in a new orientation in the lid, so you can put a full-size card in."

Another feature is that the new workstations are relatively quiet. Rather than pumping out heat and fan noise they are pitched at around ambient levels of room noise. Even if engineers are not constantly designing, they are likely to be using the same computer as their general PC, so they will be sharing desk space with the same bit of equipment all day. If that bit of equipment is non-invasive then so much the better.

"The reason we can do it is because we use our own piece of software to design the internal chassis - we use fluid dynamics analysis within the boxes. So we are already designing the box to be quiet whereas I think a lot of people design the box and then try and make it make it quiet."

The actual components are not necessarily that much different from other solutions, although it does feature solid state drives, but what is important is the way they are positioned and the way the air flows around them. "These are the subject points I want to talk to our customers about, because this is what customers are doing with workstations," continued Webb. "So they understand the message, that we're not just another workstation manufacturer who takes a PC and puts a big processor in it. We are actually engineers."

uk.fujitsu.com

Virtual move for workstations

HP is collaborating with NVIDIA to deliver workstations to create visually engaging and immersive virtual reality experiences.

New HP Z Workstation configurations are NVIDIA VR Ready systems, equipped with NVIDIA Quadro professional GPUs. The new configurations are claimed to provide the performance necessary for content creators to deliver a seamless and accurate VR experience. Each configuration is tested with optional HTC Vive head mounted displays. The 'ultimate' content creation configuration features dual NVIDIA Quadro M6000 24GB cards with availability planned this quarter.

"We are embarking on a new frontier that will change how content producers and artists develop the most immersive, visually stimulating content available," said Jeff Wood, vice president, Worldwide Product Management, Workstations and Thin Clients, HP Inc. "HP Z desktop workstations with NVIDIA graphics are the ideal combination for this new content creation era."

Bob Pette, vice president, Professional Visualization at NVIDIA, added: "VR is expanding beyond gaming to revolutionise fields across everyday life - like medicine, architecture, education, product design and retailing. Our VR Ready initiative makes it easy for professional users to adopt VR technology to make better, more informed decisions and perform their best work."

www.hp.com
www.nvidia.co.uk

Best of British?

Have you got what it takes to get your name on a highly-prized BEEAs trophy?

Now in their eighth year, the British Engineering Excellence Awards continue to champion innovation in engineering design and give it the recognition it deserves.

Our expert panel of judges will be scouring the entries to find the best people, the best products and the best companies in the UK.

Make sure you are among the best

ENTER NOW AT
www.beeas.co.uk

Headline sponsor

Cambridge Consultants

Gallery sponsor

RS

Category sponsors

maxon
maxon motor uk ltd

premier
eda solutions

Coatings

WS2 Stops galling of SS and Titanium

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

WS2 works well from -273° to 450° C and down to 10-14 Torr. WS2 has been applied to bearings and gears to extend life.

Design Out maintenance problems with WS2!

www.ws2.co.uk

@: sales@ws2.co.uk
✆: 01430 861222

ANSMANN's Li-Ion Range

Complete range of standard Lithium Ion batteries and chargers from stock

With more devices using Li-Ion battery technology, one of Germany's largest battery and charger manufacturers has introduced a range of standard battery packs and chargers.

> 'Turnkey' solution – battery and charger from one source

> ISO 9001 quality accredited factories in Germany and China

> Medically accredited EN ISO 13485 battery pack assembly line

> In-house design and modification to customer specification

> Transportation testing facility to UN 38.3

> UK Offices with professional quality, engineer and enquiries team

www.ansmann.co.uk

@: info@ansmann.co.uk
✆: +44 (0) 870 609 2233

Anti Vibration Products

FIBET GROUP

Manufacturer of High Quality Anti Vibration Products

From Conception through to Implementation

In addition to our extensive standard range of products, Fibet offer:-

- Bespoke Product Conceptualisation
- Design & Development using the latest CAE & FEA analysis techniques
- Inhouse Tooling Design & Manufacture
- Extensive Laboratory Facility with life cycle validation capabilities
- Optimised Manufacturing Facilities to suit your specific requirements

ISO9001:2008 ISO TS16949:2002

www.fibet.co.uk

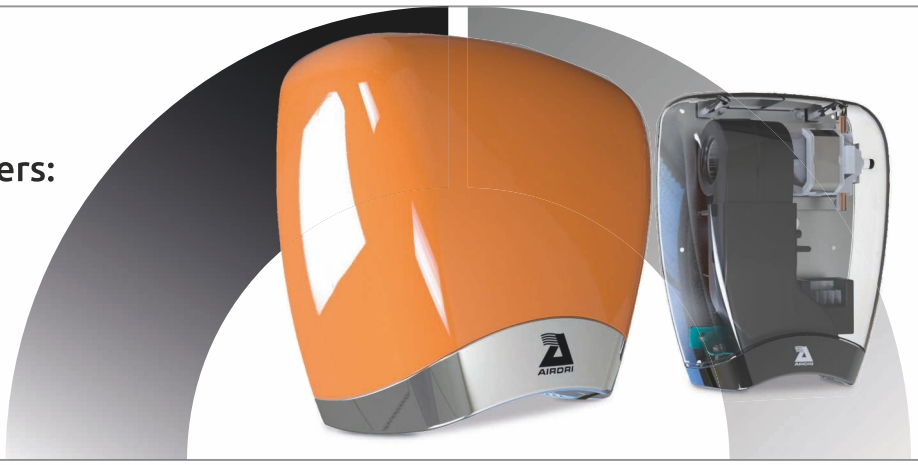
@: sales@fibet.co.uk
✆: 01282 878200

Crucible

Product design that **delivers:**

- **Creative innovation**
- **Technical solutions**
- **Profitable results**

www.crucibledesign.co.uk
+ 44(0)1235 833785

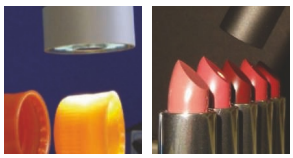


Sensor Centre

Sensors and more

Your Sensor & Barcode Specialist

Colour Sensors



Sensor Instruments — Let's make sensors more individual

Position Sensors

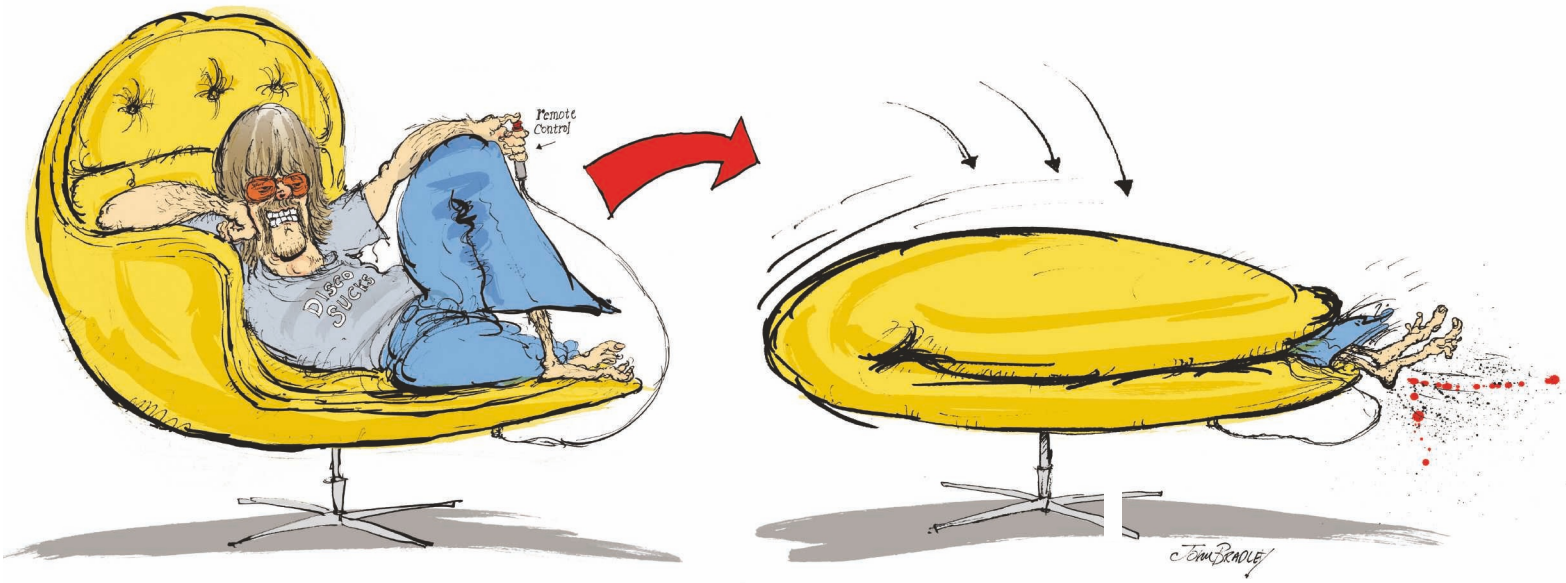
Micro Detectors
Italian Sensors Technology

Bar Code Readers

DATALOGIC
QUALITY PARTNER

Tel: 0844 3351232 Email: info@sensorcentre.com www.sensorcentre.com

Funky furniture



Predictably the 70s is making another comeback. How this has ever come about with flares and platform shoes the size of breeze blocks is beyond Eureka's editorial team.. but it happens. With the limitations that clothing imposes, fashions are bound to cycle, so it is no surprise when comebacks happen.

Some elements of 70s design seemed to define the era and, we thought, would remain unvisited except in 40 year old photographs. But all of a sudden avocado bathroom suites and cappuccino wall coverings are de rigueur once more. One such product of the era was modular furniture – various sized bits of sofa that could be reconfigured to fit a living room or be changed to create different seating patterns. Not a bad idea in its own right but it suffered from evolving into huge areas of leather that were less than comfortable.

Fast forward 40 years and we have the technology to create something better – and that is your challenge this month. We are looking for some fun furniture that still retains the malleable benefits but uses technology to make it more comfortable, more aesthetically appealing and more interesting.

It should, of course, look like it belongs in the 21st century rather than a homage to the 70s, but if you are inexplicably drawn to finishing your design with large floral pink and blue nylon coverings then who are we to judge.

As always we have a solution in mind that we will unveil next month, but in the meantime if you have any inspirational or entertaining ideas then please feel free to email the editor at tim.fryer@markallengroup.com or visit the Coffee Time Challenge section of the website and leave your idea as a comment.

Last month's Coffee Time Challenge was to design a pet lifestyle monitoring tool. You will find the solution on p12.

ENGINEERING DESIGN SHOW

19 - 20 OCTOBER 2016 | JAGUAR EXHIBITION HALL | COVENTRY ARENA

REGISTER NOW: WWW.ENGINEERINGDESIGNSHOW.CO.UK

HEADLINE SPONSORS

Digi-Key ELECTRONICS | IC BLUE the answer comes out of the Blue | Mentor Graphics pads personal automated design solutions | RS

Half the seal friction, twice the limiting speed

Small sealed SKF Explorer spherical roller bearings with improved performance

With up to 50% less seal friction, resulting in up to 20% less total bearing friction, the operating temperatures of small sealed SKF Explorer spherical roller bearings are as much as 20 °C lower. As a result, limiting speed ratings are now double those of previous sealed SKF spherical roller bearings.

This means that many more applications, from conveyors and cranes to elevators, fans and food and beverage equipment, can benefit from a long service life and reduced maintenance costs.

Customer benefits:

- Significantly increased uptime
- Substantially reduced need for maintenance
- Reduced grease consumption and disposal cost
- Improved worker safety

Call: 01582 496662 or visit:
skf.co.uk/sealedsrb

Follow us on:

SKF®