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In this issue: Composite fastening • Wearable technology • North East event • 3D printer selection

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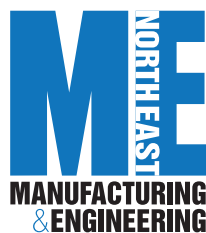
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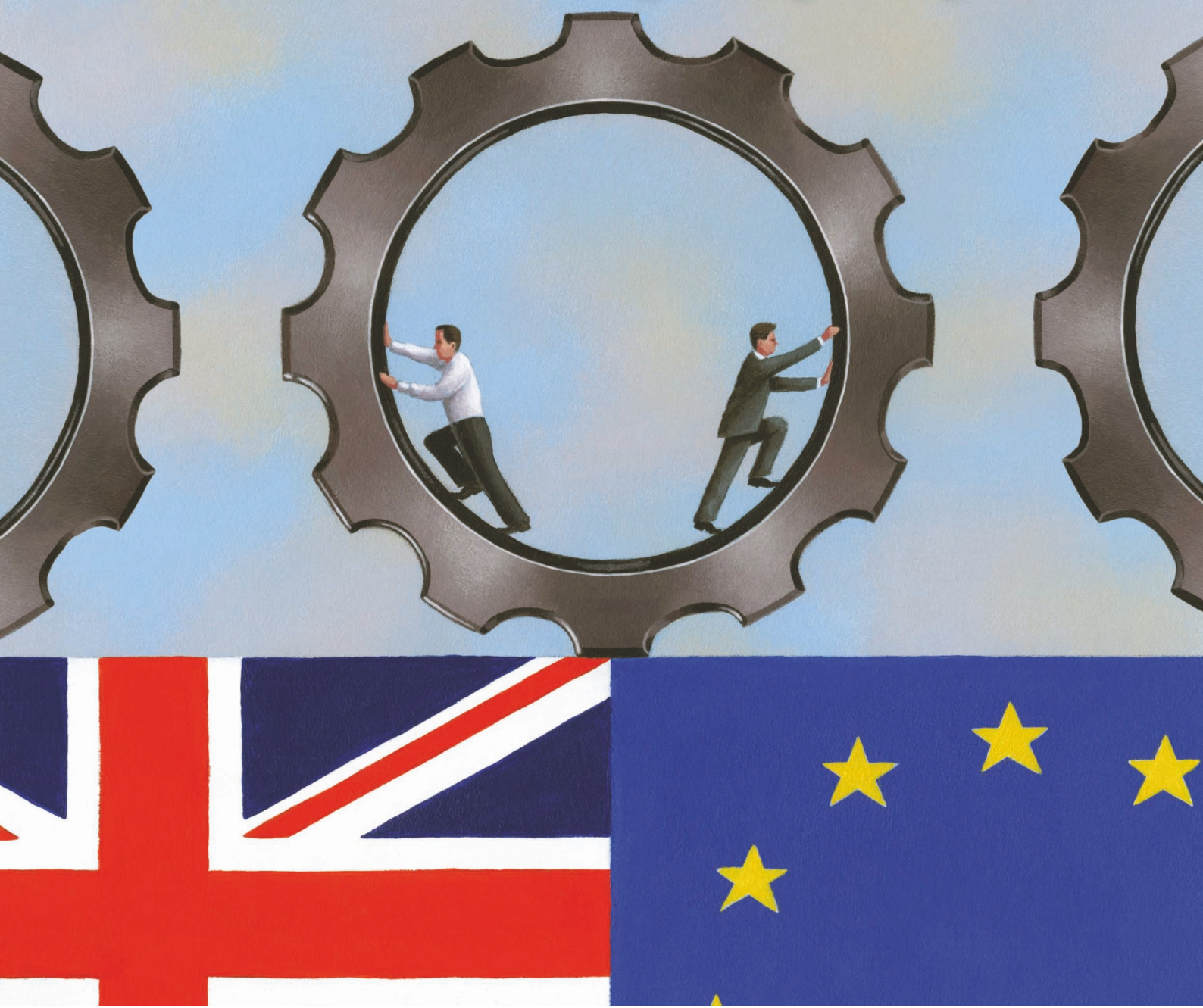
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THE MAGAZINE FOR ENGINEERING DESIGN

In this issue: Composite fastening • Wearable technology • North East event • 3D printer selection

Engineering a European exit?

The practical issues affecting the engineering sector



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Cover illustration: James Fryer

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Personal and emotional issues will play a major part in determining who wins the EU referendum, but there are practical consequences for the engineering sector in aspects such as trade, standards, IP protection and innovation investment.

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Young Design Engineer of the Year Dan Stamp makes a fine role model for future generations of engineers. But what is his perspective on the current state of the engineering sector in the UK and its future prospects?

23 **Twist on composite connections**

Back in 2012 *Eureka* covered an interesting development in fastening technology called Rotite. Getting new technology adopted, particularly when it is primarily aimed at the aerospace and automotive industries, is not easy though, but now the company could be at an inflexion point.

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From athletes to couch potatoes, wearables are becoming an increasing part of modern day life. However, this has left many designers demanding more from current sensing technologies.

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For an aerospace company, the complexities of propulsion systems had previously meant trial and error was the only way of producing reliable rockets. It is now partnering with a software company to develop a CFD solution.

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Preview of the event taking place in Newcastle on July 6 - 7.

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Bluster and bile sums up the European debate - wouldn't an engineering approach of problem solving be better?

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Public lack confidence in driverless cars

Innovate UK honours women in engineering

Mars robot improves crop yields

Electric propulsion saves fuel on ships

Changes in solar cell technology

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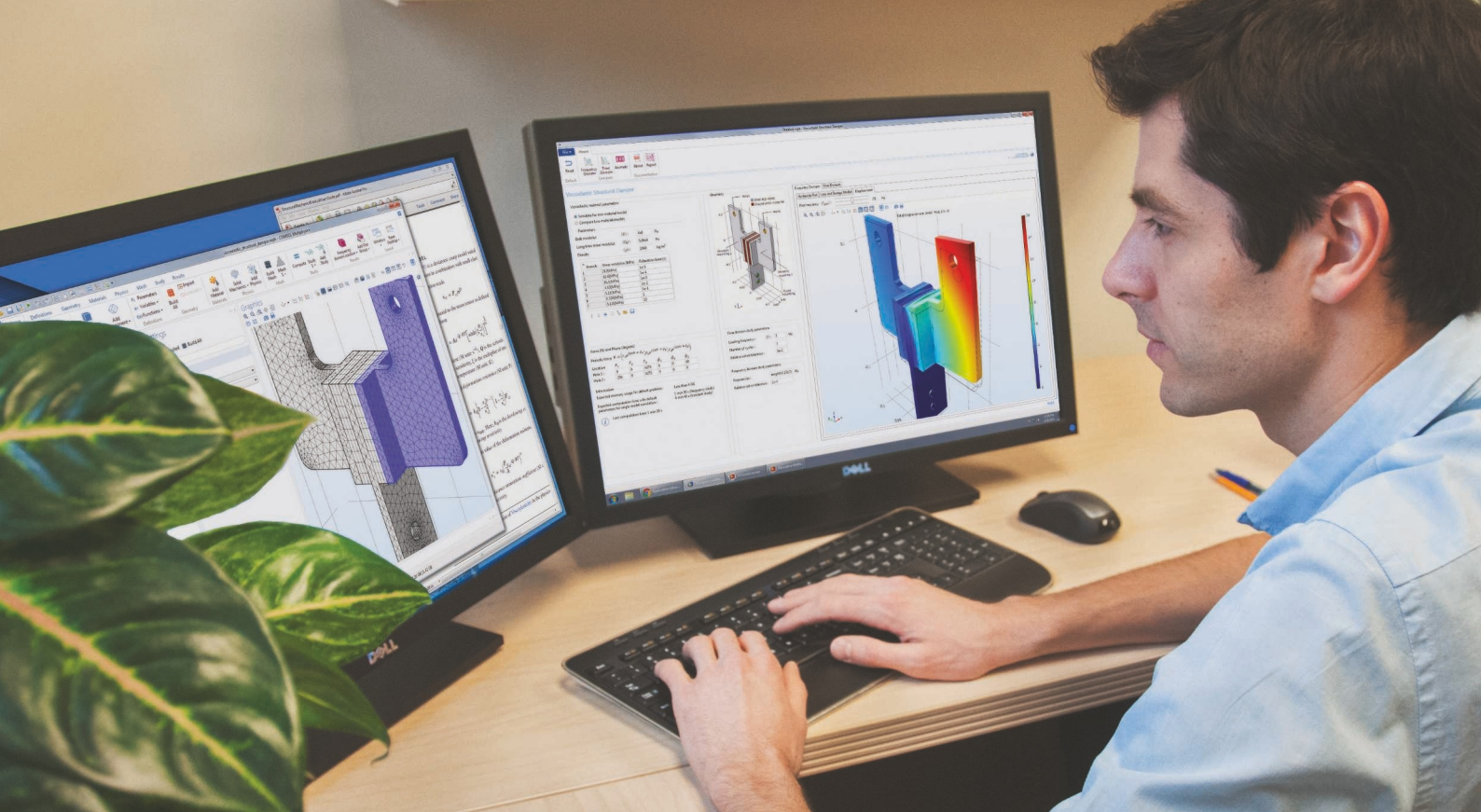
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Flying rubber on the open road! Not much is more dangerous than a lorry having a tyre blow-out at speed on the motorway. So what can be done to minimise the dangers?

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MULTIPHYSICS FOR EVERYONE

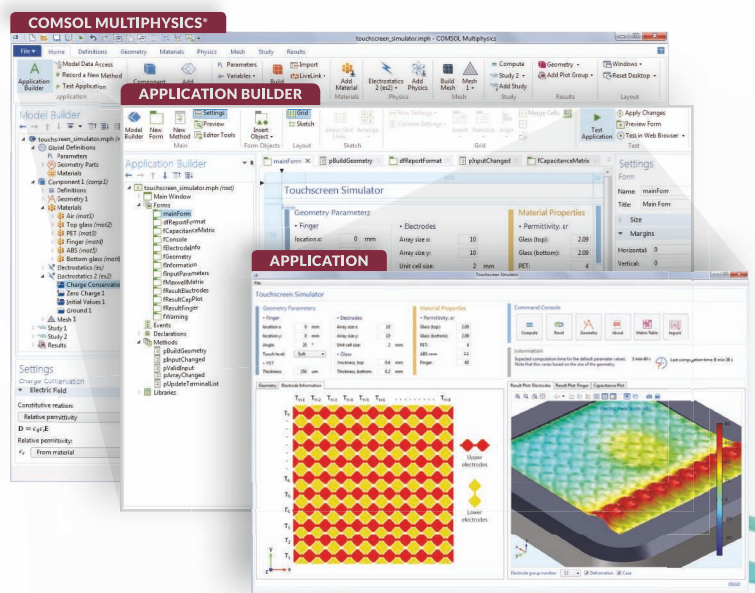
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Eton mess

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

While there are other things going on in the world of engineering, it is difficult to avoid the Brexit issue at the moment. Such is the nature of the debate that there is no debate at all, just politicians making ever wilder predictions about the end of civilised society should they not get their way. Whatever the outcome, it is going to be in everyone's interests to make it work – whatever side of the English Channel they are viewing the problem from.

Engineers by their nature take problems and find solutions. Wouldn't it be nice if those carving up Europe had the same philosophy. When researching the cover article for this issue Gary Livingstone, from British company (LG Motion), told me he believed the problem wasn't Europe at all, but more the sharks already circling that are ready to profit from it. He said: "In my mind, too many lawyers and accountants have made money setting up Europe. And they'll make even more if we go back out again. That's not progress."

Cynical, perhaps, but it seems to sum up the problem with the European Union, there are too many people involved whose interests are about personal gain and power, rather than those of their nation or the Union as a whole.

Hopefully our lead article takes a look at some of the practical realities around EU membership for the engineering industry, rather than bombarding you with claims and counterclaims of apocalypse depending on whether you vote for a posh bloke from Eton, or a posh bloke from Eton.

However, if Europe is not on your mind but the realities of national and regional engineering are, then those in the North East have the return of the MENE exhibition to look forward to. All the details are on page 37 onwards. Perhaps, the ideal opportunity to escape all that European bluster and concentrate on technical engineering design issues.

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Abssac has well over 30 years of experience in supplying precision ball screws. Typically, we supply ball screws with outside diameters in the range from 1.8mm to 25mm for the precision ranges and up to 80mm on the transport ranges, each with a range of leads per diameter can be supplied.

Whether your requirement is for a precision rolled or precision ground ball screw, Abssac can assist you in specifying the right part for the application and welcome the opportunity to develop linear solutions within tight cost budgets.

With a rapid turnaround many ball screw customers often request that the journal ends of the screws are supplied pre-machined, so that the parts are ready to fit. This eliminates potential scrap rates for the customer, but also ensures that the assemblies are supplied and certified to the accuracy tolerances required.

Precision Rolled

Put simply, the rolling process forms a thread for less cost than a ground one. Ball screws that have been cold rolled formed are ideal for applications that do not require the finite accuracy of the ground ball screw equivalents, but are still required to reliably transmit an axial load with a high degree of accuracy. Using

the traditional recirculation of the balls within the nut housing, a typical ball screw may be 90 percent efficient, versus 50 percent efficiency of a lead screw of equal size. Precision rolled ball screws achieve accuracies of C7-20 (that's 50 microns per 300mm of cumulative lead accuracy - 20 microns of axial backlash).

Precision Ground

Ball screws that have been formed by a grinding process are used where acute linear accuracy is paramount within the application. We offer a quality program of diameter and lead combinations with a variety of ball nut styles. Precision ground ball screws achieve accuracies of C0-0 (that's 0 microns per 300mm of cumulative lead accuracy - 0 microns of axial backlash).

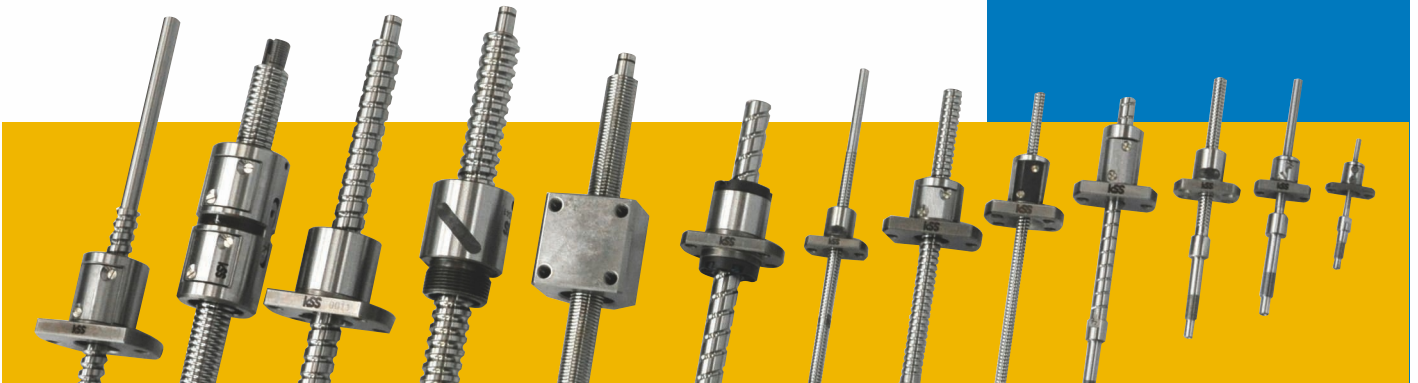
So if you are a user of ball screws give us a call to see how we can make your requirements heard.

NEW



Abssac is now supplying what is believed to be the world's smallest precision ball screw and nut assembly. With an amazing screw diameter of only 1.8mm and lead of 0.5mm, the new miniature ball screw range is ideally suited to the ever-smaller requirements of medical, optical and military application requirements. Using a ground screw format, the hardened steel ball screw can be supplied complete with machined journal ends.

A standard 6mm diameter nut body is used to house the 0.4mm diameter ball bearings, which are captivated in a recirculating ball nut design. Remarkably, the new product range offers a C3-05 accuracy grade (i.e. 0.005mm axial play). Fixing the nut to the application is made simply by a range of pre-drilled nut flange sizes.



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NEWS

55% reluctant about driverless cars



A poll carried out by ICM Unlimited on behalf of the Institution of Mechanical Engineers (IMechE) saw 55% of the 2002 people surveyed say they were unlikely to want to be a passenger of a driverless car, with 40% saying they were very unlikely to want to be a passenger. Just 21% of the people surveyed said they would be happy to ride in a driverless vehicle.

Philippa Oldham, head of transport and manufacturing at the IMechE, said: "The benefits of driverless vehicle technology are huge, with estimates that it could be worth as much as £51 billion a year to the UK due to fewer accidents, improved productivity and increased trade."

Members of the public can, however, register to take part in the UK's first public driverless vehicle trials, due to take place later this year. The trials are part of the GATEway (Greenwich Automated Transport Environment) project, an £8 million research project to investigate the use, perception and acceptance of autonomous vehicles in the UK.

Professor Nick Reed, technical lead of the GATEway project said: "Testing these vehicles in a living environment gives the public a chance to experience what it's like to ride in an automated vehicle and to make their own mind up as to how much they like it, trust it and could accept it as a service in the city."

Support for women innovators

Innovate UK has up to £200,000 and a package of tailored support to award to businesswomen who have exciting ideas, the potential to become leaders in innovation and deliver significant economic growth.

According to Innovate UK, under-representation of women in industry means that, as a nation, the UK is failing to harness, capitalise on and celebrate the entrepreneurial talent of female innovators to the detriment of its economy. Innovate UK claims that boosting female entrepreneurship could deliver approximately £60bn extra to the UK economy.

To address this, the In Focus Awards have been launched to celebrate and reward women working across four key sectors: Materials & Manufacturing, Health & Life Sciences, Infrastructure Systems, and Emerging & Enabling Technologies.

Events

14 - 15 June
PDM Plastics Event 2016

Telford

15 - 16 June
NAFEMS UK Conference 2016

Telford

25 June 2016 - 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

Full rundown on page 37

Metro Radio Arena, Newcastle

30 August
National Instruments Hands-on Taster

NI HQ, Newbury

07 & 14 September
Build your 'hands-on' expertise in the Testing of Materials

University of Sheffield

14 - 15 September
Low Carbon Vehicle Event

Millbrook, near Bedford

21 - 23 September
Experience Composites – powered by JEC 2016

Augsburg, Germany

06 October
BEEAs - Awards luncheon

London

19 - 20 October
Engineering Design Show

Ricoh Arena, Coventry



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In the fight for high performance with minimum weight, FAULHABER with the development of its series 3274 BP4 has put a new champion in the ring. The brushless DC servomotor, measuring 32 mm in diameter and 74 mm in length, has a huge continuous torque of 165 mNm. Furthermore, it weighs in at just under 320 g, which is half that of conventional motors with comparable power.



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WE CREATE MOTION

NEWS

Mars robot to improve crop yields



A system originally developed to explore Mars has been transformed into an agricultural monitoring device for testing the quality of soil. The STFC (Science and Technology Facilities Council) says its AgriRover has the potential to reduce the environmental impact of farming.

The device consists of a mobile rover platform with a robotic arm which carries a soil sensing instrument. It is based on technology developed by STFC's RAL Space and will be used in a project being run by a team at the University of Strathclyde.

STFC's RAL Space team also built a 'Laser Induced Breakdown Spectroscopy' instrument for soil quality characterisation. "With this novel instrument design we are tackling multiple challenges at once," said Aron Kisdi, space systems engineer for RAL Space. "First we have to miniaturise an instrument that is normally the size of a large wardrobe to fit on a small mobile robot so the measurements can be completed on-the-go. Second we are looking for nitrogen based fertiliser that can take multiple forms and is hard to measure accurately."

TECH BRIEF

SUPPORT FREE 3D PRINTED METAL

Researchers at Harvard's Wyss Institute for Biologically Inspired Engineering and the John A. Paulson School of Engineering and Applied Sciences have created a way of printing complex metallic architectures in mid-air.

The team's laser-assisted direct ink writing method allows microscopic metallic, free-standing 3D structures to be printed in one step without auxiliary support material.

In the team's method an ink composed of silver nanoparticles is sent through a printing nozzle and annealed using a precisely programmed laser that applies just the right amount of energy to drive the ink's solidification. The printing nozzle moves along x, y, and z axes and is combined with a rotary print stage to enable freeform curvature. The resulting printed wires are said to exhibit excellent electrical conductivity, almost matching that of bulk silver.

High speed 3D printer

HP has unveiled two industrial 3D printers that claim to produce high quality parts up to 10 times faster, and at half the cost, of current systems.

The Jet Fusion 3D 3200 is suitable for prototyping, and will cost \$130,000 (£89,750) when it is released in 2017. The higher-end Jet Fusion 3D 4200, whose price has not yet been announced, is designed for prototyping and meeting same-day demands for short-run manufacturing and will be available from the end of 2016.

Stephen Nigro, president of HP's 3D printing business, said: "The new HP



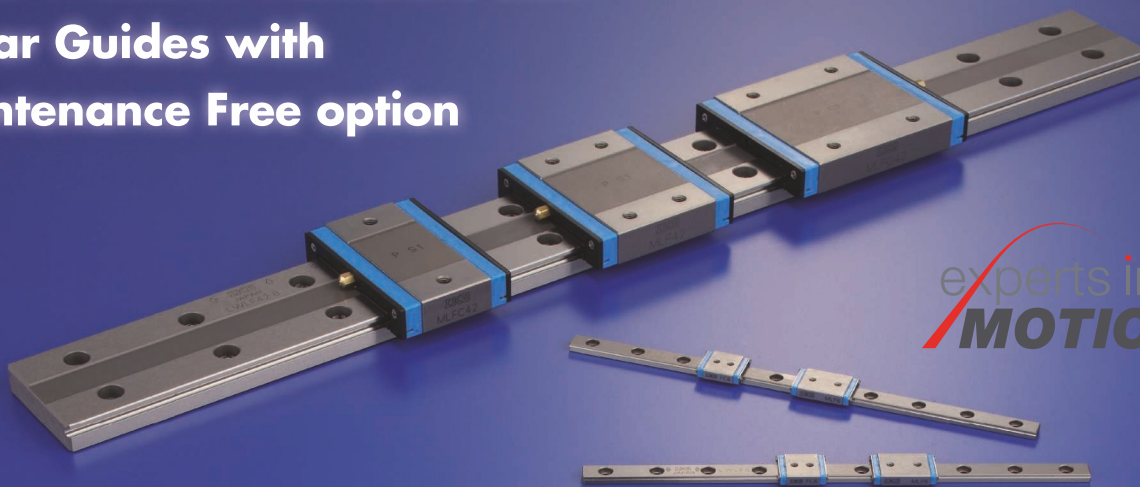
Jet Fusion 3D Printing Solution delivers a combination of speed, quality, and cost never seen in the industry."

Instead of using lasers, the HP printers use 'multi jet fusion' technology - similar to inkjet printing technology. The company says it can precisely apply materials at up to 340million voxels per second; further claiming that it can create 12,600 copies of a typical plastic gear in the time it would take a

competitor to make 1000.

As yet, the printers can only print in monochrome thermoplastic, however HP has promised additional materials, including metals, as well as full colour printing in the future.

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NEWS

Electric propulsion saving fuel on ships

A gearless, steerable propulsion system that reduces fuel consumption by up to 20% has been installed on a range of vessels including the world's largest cruise ship, an advanced icebreaker and one of the largest crane vessels in Asia.



The Azipod electrical propulsion system by ABB features an electric motor with a propeller mounted inside a streamlined pod beneath the ship to drive and steer the ship at the same time. The company claims the total fuel savings for vessels using its Azipod system, since being launched, is estimated to be more than 700,000 tonnes.

According to shipbroker and research firm, Clarkson's Research, the number of vessels with electric propulsion is growing at a pace of 12% per year, three times faster than the world's fleet.

The entire installed Azipod propulsion unit base has accumulated 12 million operating hours in merchant, offshore and special vessel segments.

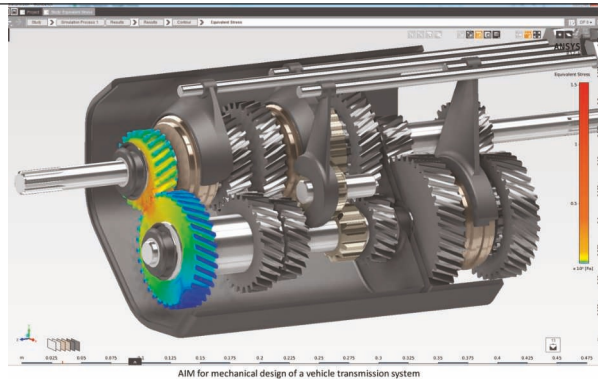
"Much has changed in the shipping sector since we introduced the first Azipod but the desire for efficiency, manoeuvrability and reliability remains the same," said Juha Koskela, managing director of ABB's Marine and Ports business.

TECH BRIEF

Elastic computing, big data and machine learning boost simulation

ANSYS has released SeaScape that it claims allows organisations to innovate faster by bringing together the advanced computer science of elastic computing, big data and machine learning with engineering simulation. The first product on the SeaScape infrastructure, SeaHawk, dramatically transforms electronic product design through improvements in simulation coverage, turnaround times and analysis flexibility.

The combination of big data techniques and ANSYS' proven simulation capabilities is said to arm SeaHawk users with the capabilities to reduce size of the chip and its power consumption without sacrificing performance or schedule constraints. Early users claim to have realised an average of 5% reduction in die size, which could result in millions of dollars of savings during production.



"Die size and development time reduction are targets that electronic design engineers have pursued with marginal success given the limitations of today's in-design solutions," said John Lee, general manager, ANSYS. "ANSYS SeaHawk bridges the in-design and sign-off needs by bringing unprecedented simulation performance and design insights without sacrificing sign-off accuracy and coverage."

3D prints as easy as printing document

Stratasys has unveiled a feature it hopes will make printing a physical 3D CAD model as easy as printing a normal document. The approach is powered by an open architecture 'design-to-3D print' workflow application called GrabCAD Print, which resides on the GrabCAD SaaS platform.

GrabCAD Print is designed to make 3D printing fast, intuitive and easy-to-use, and promises to reduce errors by eliminating the requirements to translate and repair CAD files. Product designers, engineers, and 3D printer operators will be able to send native CAD files to a Stratasys 3D Printer or service

bureau directly from their chosen CAD environments.

GrabCAD Print works with a variety of Stratasys FDM and PolyJet 3D Printers and can natively read popular CAD formats from PTC Creo, Dassault Systèmes' Solidworks, Siemens PLM Software's NX software, CATIA and also Autodesk Inventor. The application also facilitates data sharing related to job scheduling, print queue status, material usage and historical usage. All information is readily available via standard Web browsers, mobile applications or locally installed clients while securely managed through the GrabCAD Platform.

Products

High-dynamic linear piezo nanopositioning stages
141487

Rugged thermal imaging camera
141183

Problem solving by design
141133

Low cost pneumatic process actuator
141132

Safe, speedy non-contact troubleshooting
140130

Affordable thermal multimeter and ScopeMeters
140124

Simplifying motion integration with motorised lead screws
140065

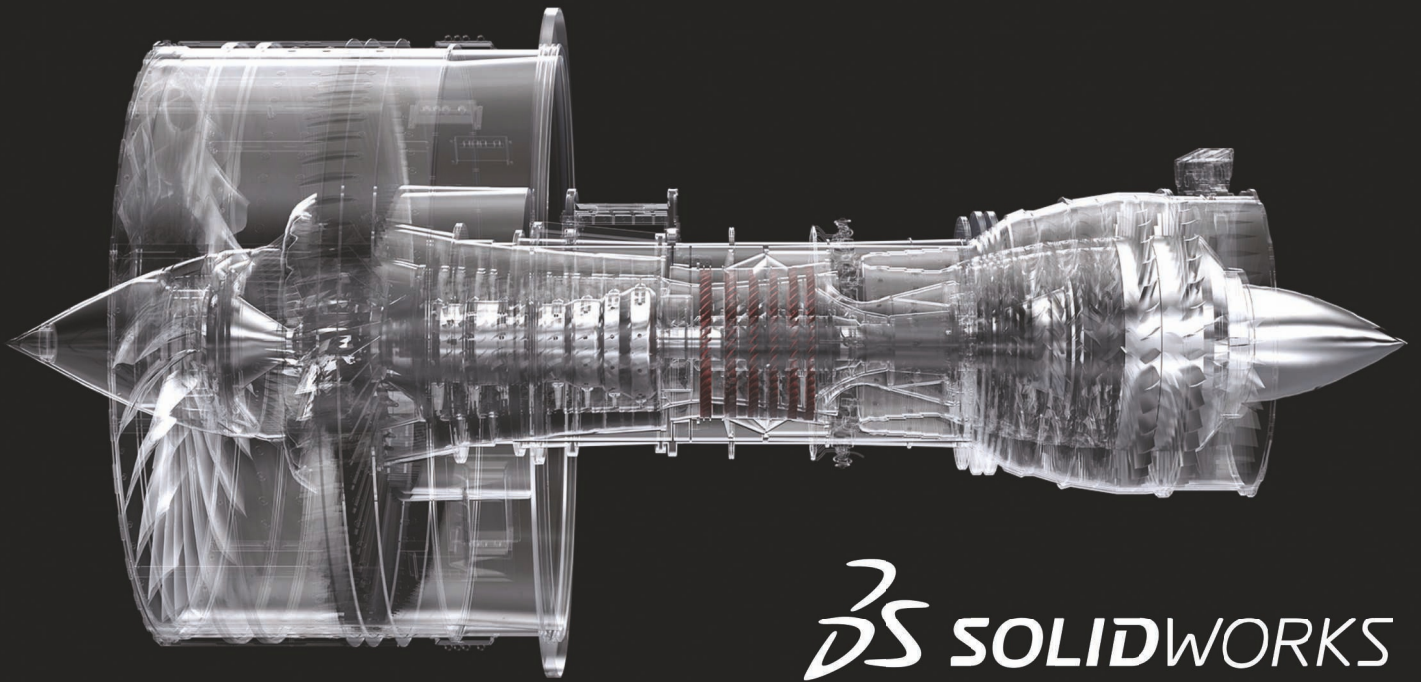
Compact contactor brings ease-of-installation to the next level
140064

Microstep drive for OEM applications
119203

Heavy duty encoders for extreme environments
119201

PTC introduces latest version of its ThingWorx IoT platform
119136

Miniature linear guideway with position feedback
119098



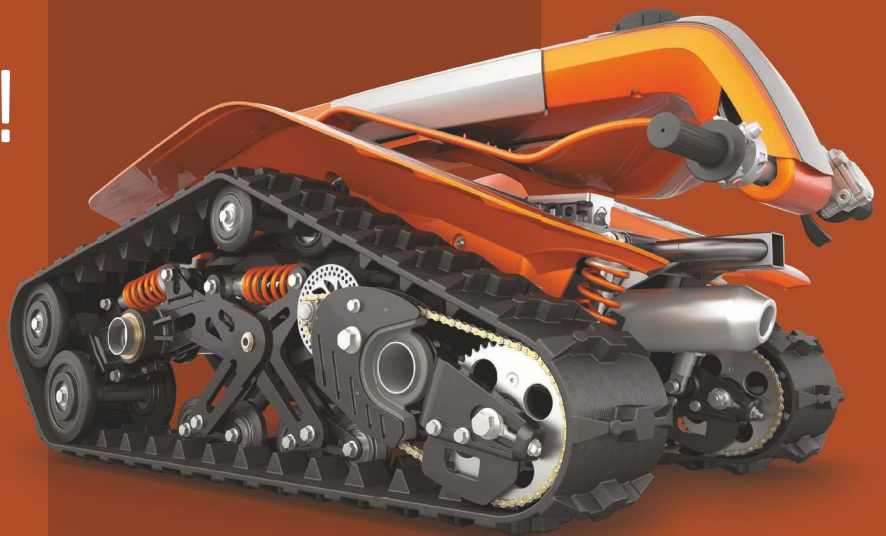
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NEWS

Solar cell manufacture finds boost

A laser-based manufacturing process from Fraunhofer in Freiburg, Germany is shaking up the photovoltaics market. For the first time point-contacted solar cells can be manufactured in series.

The total amount of electric energy from photovoltaic sources is more than 250 terawatt hours, approximately equivalent to the amount produced by 30 nuclear power plants, and this is set to rise.



Today most solar cells are equipped with a wide-surface metallic contact, covering the entire backside of the silicon wafer and allowing electricity to flow from the cell to the electrode. This configuration however limits efficiency. A higher performance alternative, discovered in 1989, is the Passivated

Emitter and Rear Cell technology (PERC). In contrast to conventional cells, this technology includes an additional reflective layer on the backside of the cell and thousands of electric contact points. The LFC process developed by the Fraunhofer researchers has enabled the first industrial mass production of PERC solar cells.

A very thin non-conductive layer is deposited on the underside of a PERC solar cell between the contact layer and the wafer. Acting as a mirror, this layer reflects the share of sunlight not absorbed when penetrating the wafer back into the silicon wafer. Since the front side also reflects this light back into the wafer, it is also captured in the silicon wafer and the efficiency level of the solar cell increases. Drawing the electricity from the wafer requires many small apertures in the non-conductive layer in order to establish contact between the electrode metal and the silicon wafer.

The LFC procedure creates each of these approximately 100,000 contacts per wafer with a single laser pulse. The challenge was to coordinate the pulses in such a way that contact is completely established, while damage to the silicon is kept to minimal levels. Here it's crucial that the laser light effect is limited to between 50 and 2000 nanoseconds.

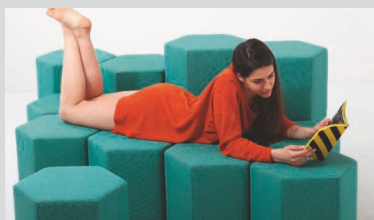
Solution to last month's Coffee Time Challenge

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Last month we asked you to come up with a new form of reconfigurable furniture – an update on modular seating that became popular in the 1970s. Our solution, Lift-Bit, claims to be the world's first Internet-of-Things sofa. The concept comes from the product design and innovation firm Carlo Ratti Associati, with the support of Swiss furniture manufacturer Vitra.

Lift-Bit is a modular, digitally-reconfigurable furniture system that allows a sofa to seamlessly turn into a chair, a chaise longue, a bed, a lounge



room, and myriad of other configurations. The system is composed of a series of individual, upholstered stools. Each element is motorised using a linear actuator, enabling it to be raised or lowered. Height can double (or halve) in just a few seconds.

Lift-Bit can be controlled in person, via a simple gesture (just hovering your hand in the air over the seat), or from a distance, through the use of a mobile app. The app includes both a series of predetermined three-dimensional shapes and a tool to create new, dynamic combinations. Paying homage to radical British architect Cedric Price's 1970s "Generator Project", the Lift-Bit system can even become 'bored': when not used for a long time, it will start shape-shifting on its own to engage users.

www.carloratti.com



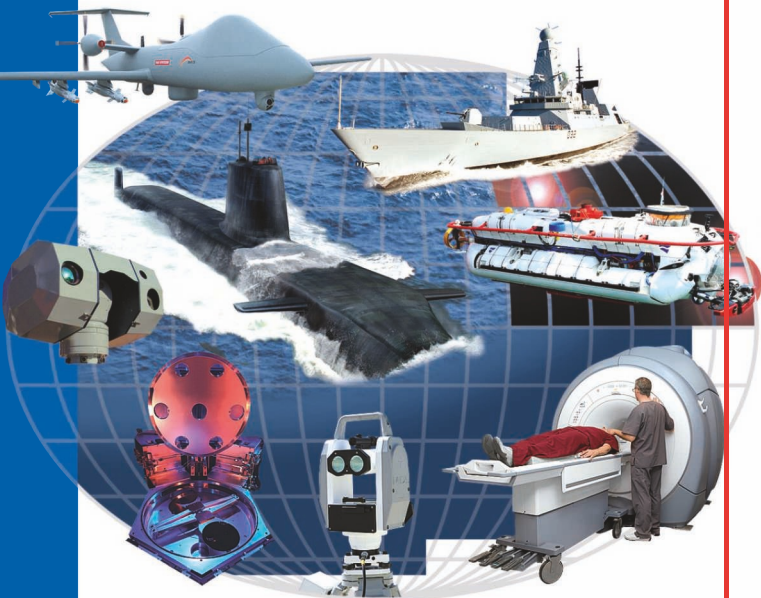
Gasoline Technology improves fuel efficiency by 25%

Precision bearing and automotive systems supplier Schaeffler and project partner Continental, in close collaboration with Ford, have unveiled its second-generation Gasoline Technology Car (GTC II).

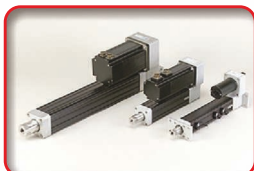
The GTC II showcases the potential of intelligent 48-volt hybridisation and features a highly efficient integration of the electric motor between the internal combustion engine and the transmission.

The electric motor on the GTC II is integrated in the drive train by means of a belt that runs between the internal combustion engine (ICE) and the transmission. Two clutches, one upstream and one downstream of the belt, allow the internal combustion engine to be completely decoupled when required. The electric motor can then be used independently of the ICE. As a result, the GTC II supports both constant-speed electric coasting at low load, as well as electric launch, for example in stop-start driving.

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This article will not tell you that scavenging migrants will continue stealing our jobs (and benefits) if we stay in the EU, nor that the economy will collapse following a Brexit. But, it will discuss some of the real issues that are of direct relevance to engineers, with opinion from engineers and those in industry. Tim Fryer endeavours to consolidate some of the arguments.

You will likely be reading this a few weeks before giving your personal endorsement to either our continued involvement in the EU or to our withdrawal from it. It should perhaps be a straightforward engineering-style analysis of the facts that would lead us to a decision? Yet, what appears to be missing most are those facts.

The 'facts' that have been presented to us, particularly by politicians, are cherry picked to make the appropriate case. More importantly they are often unsubstantiated. Only hindsight will determine whether or not they turn out to be true, but until then they're guesses or educated opinions at best.

It appears that many are struggling with a heart vs head quandary. It makes business sense to stay in the EU but emotionally it would be rather nice to be on our own again. Unless either IN or OUT campaigns deliver a knock-out blow, we can assume that this is the argument that will drive indecision right up to referendum day.

Thinking clearly

While the 'heart' side of the debate is crucial to its outcome, the issues that are most likely to have an impact on engineering companies are aspects such as trade and supply chain management, movement of and access to personnel, IP, standards and EU investment.

Most engineering firms import or export, and many source components overseas. As all trade tariffs are negotiated by the EU, this clearly affects not just the EU, but every other country that features either up or down the supply chain. As Barack waded in by saying he thinks that an EU exit will push us to the back of the tariff setting queue, Boris responds claiming there is no reason we shouldn't have a tariff-free future as we do now. It highlights why politicians are perhaps not the best people to listen to in this debate.

So what are the opinions of engineers and engineering companies, which are interested in realities rather than agenda? Gary Livingstone is managing director of Basingstoke based motion technology specialists, LG



"If it is possible to step away from the European Union and set up new stronger trade agreements with key markets including potential developing markets, this could provide further opportunities for exporters such as us."

Giles Forster, Chairman, HepcoMotion



Engineered

Motion – a company that has considerable experience of dealing with Europe during good times and bad.

"We exported more to the EU when the pound was stronger against the euro," he said. "When it got weaker, we got fewer orders from overseas because they went all protectionist and nationalist and didn't order from the UK. At least that was our own unique experience. Our exports went from 20% down to about 8% when the pound and the euro were almost at parity."

Another company that relies on the European market is HepcoMotion, with around three quarters of its total sales being made up as exports. Chairman, Giles Forster, commented: "If it is possible to step away from the European Union and set up new stronger trade agreements with key markets including potential developing markets, this could provide further opportunities for exporters such as us. However, a reduction in potential



for Europe

markets would of course be a significant problem. As a business working globally, we appreciate that successfully negotiating trade agreements within the available two-year time frame will be challenging.”

This is a response typical of many. Cautious, uncertain, and exit or not, this decision is a gamble with potential big wins and losses as to what the future may hold.

Standards – changing the rulebook

Another aspect core to the debate is that of rules and regulations. Overly zealous red tape has given ammunition to Leavers, but IN campaigners claim most are a necessary evil. After all, anyone selling to Europe, whether we vote IN or OUT will need to follow Europe’s standardisation system anyway.

The British Standards Institution (BSI) looked at the possible outcomes

MOST ENGINEERING FIRMS IMPORT OR EXPORT, AND MANY SOURCE COMPONENTS OVERSEAS. AS ALL TRADE TARIFFS ARE NEGOTIATED BY THE EU, THIS CLEARLY AFFECTS NOT JUST THE EU, BUT EVERY OTHER COUNTRY THAT FEATURES EITHER UP OR DOWN THE SUPPLY CHAIN

of a Brexit. It analysed what would happen if the UK applies to join the European Free Trade Area (EFTA) and sign the European Economic Area (EEA) agreement. Norway and Iceland are both in this position. Switzerland has joined EFTA but not signed the EEA, leaving it to negotiate its own trade agreements with the EU.

The consequence of either course of action is that BSI would still retain its position with the European standards organisations CEN and CENELEC. However, BSI says that an OUT vote may affect its relationships with partner countries and the ability of the BSI to influence regulatory policy at a European level. Were the UK not to be accepted into EFTA, or apply to join it, then it would require CEN and CENELEC to change its statutes, if the UK was to be part of them. And that may be challenged on grounds of ‘lack of commitment to reciprocity of market access’.

As an independent and politically neutral organisation, BSI doesn’t offer an opinion one way or the other regarding the referendum, but it is clear from its analysis (a full version of which is on its website) that it feels trade and international relations would suffer from an exit. However, doubters retort that as a standards organisation use to playing at the top table it is in BSI’s interests to maintain its role in standards setting. They say, were we to leave, particularly when it comes to domestic trade, the standards framework could be less complicated and less expensive for British traders to adhere to.

The intellectual property position

The nature of Intellectual Property is even more global and, as with standards, staying in the EU will have no impact on IP laws for the UK. However, the Chartered Institute of Patent Attorneys (CIPA) believe that some changes could follow an EU exit, though they are likely to be limited.

It said: “Leaving the EU would mean that the UK would no longer be bound by legislation and would be able to change its IP laws. However, the UK would still be bound by international treaties and because a substantial part of IP law is internationally harmonised, it is improbable that there would be any change in national IP legislation.”



“We have polled the membership and 66% believe that the UK should stay in the EU for the benefit of engineering and design. The general feeling is that any change would be disruptive with changes to trade agreements and associated financial implications.”
Libby Meyrick, Chief Executive, IED



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Moreover, the European Patent Office is not an EU body and so UK membership would continue. There may be some differences though if we do choose to leave. Registered Community Designs (RCDs) that register the appearance of a product will no longer be recognised in the UK. Also the Unitary Patent, which effectively allows protection throughout the EU rather than on a country by country basis, would also fall by the wayside.

Investing in the community

EU investment is one of the most interesting and potentially most significant issues. For those involved in science, engineering and technology, investment comes in different forms than that of, for example, farming, which is a fairly direct path from EU to farmer. Following Brexit this path could be direct from the UK Government. Equally the amount of direct funding for developing innovative technology could be expanded, as this network already exists through various Innovate UK programmes.



"The UK is a very attractive place for scientists and engineers to work and this greater pool of talent drives competitiveness, growth and creates more of the high value jobs we want."
Dr Rod Wilson, Engineering Director, Trolex

"There's a lot of good brains coming in and out of Europe to do science projects such as Rutherford, Diamond and BSA," added LG's Livingstone. "Does that all stop when we're out of the EU? So I'm more concerned for long-term science funding as I don't think the UK will necessarily do it all on their own. Transfer of skills sets and knowledge would be a concern, as well."

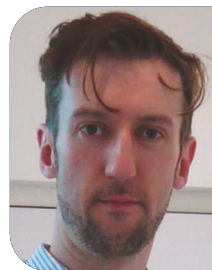
Europe's most glamorous laboratory, CERN, incidentally, is funded by its 21 member states with about half that funding coming from Germany, the UK and France. It, and our involvement in it, would therefore remain unaffected by Brexit. Perhaps, it could be argued, CERN could be a model for further British involvement in European research? But when research programmes originate from the EU, a Brexit is not going to exactly help encourage our involvement.

According to figures from the Royal Society, UK expenditure on research in the period 2007 to 2013 (the period of the EU's Framework Programme 7) was €226bn but only 3% of this came from the EU. This compares with 11% from our own Government.

What is interesting is that the vast majority - €4.9bn out of €6.9bn - of the EU money goes to universities. A related fact may be that UK



"Many advocates for a Brexit don't realise that highly-skilled workers aren't taking jobs from local talent, they are occupying roles we can't otherwise fill and, in doing so, are creating additional jobs for local workers through wider economic benefit."
Geoff Holden, Engineering Sector Expert, Prime Advantage

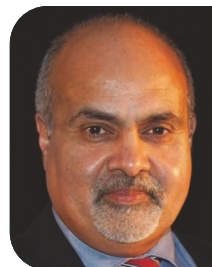


"When UK suppliers can't be found, EU suppliers can provide fast, hassle free supply with no customs delay, administration or cost."
Stephen Knowles, Managing Director, IDC

universities occupy 12 of the top 25 places in European university rankings. Our research institutes may not have developed to the same extent as Germany's Fraunhofer, for example, but the universities remain world class and play an important role in the collaborative science effort across the continent.

A prime example is the National Graphene Institute set up at the University of Manchester and at the heart of the EU's €1bn Graphene Flagship project. Writing in the Guardian, Dr Sylvia McLain of Oxford University took this as an example.

She said: "The Graphene Flagship project is exactly the kind of investment that will be jeopardised if the UK withdraws from the EU. The UK benefits enormously from EU science funding largely because Britain is at the vanguard of shaping policy and direction, and it is not some peripheral partner hoping for a knock-on benefit. If a comparison is needed for what it could be like, just look at Switzerland. The European Commission responded to their referendum on immigration by freezing them out of several important Horizon 2020 funding streams; the UK could well suffer the same fate. It is a pretty simple equation really: if you have no seat at the table, you have no influence over policy."



"As a British manufacturer exporting to over 47 countries there are already challenges in the global market, a Brexit will create further complexity, boundaries and barriers to export. There is certainly greater value in remaining than going through the elongated process of a Brexit."
Mussa Mahomed, CEO, Nylacast

Space race

A specific application area is the space industry – a sector the Government recently claimed would be 10% British, in terms of the global industry, by 2030. It is an industry the Government funds partly through the UK Space Agency and partly through the European Space Agency (ESA).

Paul Febvre, chief technology officer at the Satellite Applications Catapult, describes the positive position that the UK space sector finds itself in: "We are witnessing unprecedented recent inward-investment into the UK by both European primes and by other multi-national space sector organisations, largely thanks to the recent focus and growth as well as innovation and clusters such as Harwell across the UK."

As it stands only 20% of the ESA budget originates directly from the EU, but the two organisations are, according to ESA, 'increasingly working more closely together towards common objectives'.



Moving forward there is a real opportunity for the UK in developing the market for microsatellites as well as creative, commercial use of the data beamed down from near space. However, bigger satellites and space projects are beyond the budget of the UK on its own and will require ESA's financial and technical muscle. EU membership is not a requirement of being in ESA – Canada is a member – but, as Febvre observes: "I imagine there would need to be significant work to facilitate a change."

Conclusion

Sadly, the EU referendum will probably be decided by unsupportable 'facts' that are thrown around regarding immigration and the economy. However, there are some real issues for engineering that need to be considered, issues that may have implications for both the short and long-term future of the sector. While this article might not have provided the answers, it hopefully has highlighted some of the considerations.

READERS' VIEWS FROM EUREKAMAGAZINE.CO.UK

IN

The EU is a £12 trillion economy with 500 million people. We have free trade and easy access to this market. Anyone exporting knows the importance of this. If you supply to customers who export you should also think carefully. Being out could not possibly be better for export trade, maybe in the longer term we could negotiate similar terms but that is far from certain. I'm with the vast majority of business people, being in is best for business and being in equals influence. *Dave Hall*

I run an SME electronic business. It is so easy trading with the EU Common rules and regulations (EMC, Wireless standards etc) goods can be sent back and forth eg for repair with no customs paperwork. Try and do the same with Switzerland or Norway. As for Democracy, ours is bust when less than 30% of the electorate elect a government. *Lucian Hatfield*

I voted to be in the EEC in the 70s and supported the transformation into the EU. I see no good reason to be leaving and find that the best arguments from the exit campaigns seem to focus on migration, a situation that will get worse with Brexit. We get a great deal of economic benefit from being members of the EU, from trade and research funding, and even though its rules are not perfect (what is) we will be better able to change those rules from within. *Paul E. Bennett*

Everyone talks about money going to the EU. No-one has produced figures for what we get back? How many people with British passports work in the EU, probably in better paid jobs than the EU migrants who do the low paid jobs in UK. Yes reform the bureaucracy and have more efficiency in Brussels, but that's not a reason to give up the free trade and grants we benefit from. The world is becoming global and it's not a good time to cut ourselves off in isolation. *Ged O'Shea*

The SNP has already indicated that there would be another Scottish independence referendum if we leave, so we would probably lose Scotland. We will probably have to accept most of the controls the EU already imposes in order to trade with the EU, just have no say in them if we leave - look at Norway. There would be around five years of uncertainty in trade and investment with the UK already teetering on the brink of recession. In short plenty to lose, very little to gain, why take the risk? Pretty much anyone outside the UK with any sense is saying "don't do it". *Andrew Hunt*

OUT

The people of the UK never voted for political union with the mainland European Countries. If we stay in now then all hope is lost, political and financial union will happen. Nobody asked us what we wanted when the Maastricht Treaty was signed in 1992 and if we stay in nobody is going to ask us if we want full Political and Financial Union... it will just happen! *John Donovan*

The EU is a joke, and an expensive one. I run a small company involved in electronic development and small-scale manufacture. I made the error of getting involved in an EU-subsidised project involving partners in Germany, Italy, Greece and Ireland. Although ultimately successful from a technical point of view, financially it was a disaster, and it was mostly due to the endless hoops specified by the EU. *Paul Archer*

We originally signed up for the EEC (European Economic Community), that is what we all voted for, not to be run by them but to have open trade borders. That can still exist, but without the control from Brussels. This is a once in a lifetime opportunity to take back control of our own future, let's not waste it! *Paul Gray*

I want to be governed by British laws and if they are no use we get the chance to dump the law makers every five years. We are as a manufacturing country capable of holding our own and we have some of the best engineers in the world. So let's leave the EU and show there is a GREAT Britain. *Ernest Blakeman*

From a local perspective, yes Europe is ploughing money into UK business, but despite being a small, machinery manufacturer exporting worldwide (which surely goes well with rebalancing our industry) we don't seem to be ticking any of their boxes. If we get out there's a (small) chance our government would spend this money supporting what UK (rather than EU) industry needs. *Timothy Jackson*

The EU should simply be a collective of friendly trading nations, with cultural, business and sporting exchange. Not the undemocratic, over complicated, failing superstate that it is. Britain is VERY GOOD at what it does, with a worldwide reputation for excellence in many sectors, including engineering. We are not looking to fall out with our European friends, just change the platform from which we trade. *Steve Hammond*

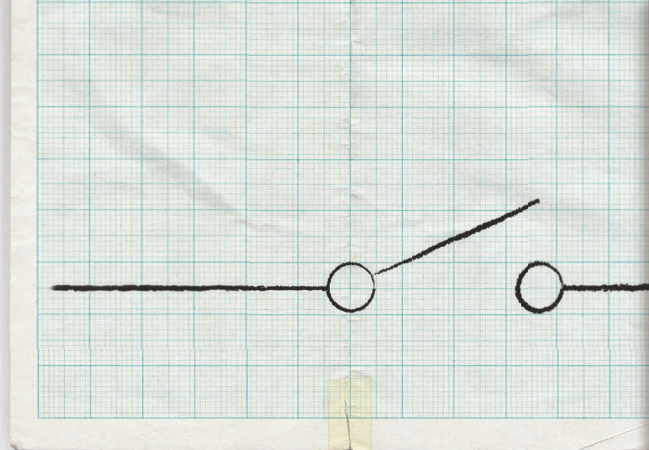
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Building the perfect package

Young Design Engineer of the Year Dan Stamp makes a fine role model for future generations of engineers. But what is his perspective on the current state of the engineering sector in the UK and its future prospects? He shared his thoughts with Tim Fryer.



“W

hen you're designing something, I find it quite personal,” said Stamp. “It's something that you've thought of and what's produced is something that you've imagined.”

What Stamp designs is machines. The sort of machines that package up tins of baked beans in their thousands. And as a design

engineer at Kliklok that personal touch is important. Two engineers working on the same application won't come up with the same solution.

Stamp commented: “They'll look completely different. They might operate in the same way or have elements that are similar, but that comes from having proven technology for 50 years in packaging machinery. But I can guarantee that it would look completely different.”

It highlights the sometimes forgotten link between engineering and design. “In primary school I used to love technical drawings, architects' drawings, schematics and stuff,” he said. “It was all quite appealing to me at that time. In secondary school, art definitely helped with the technology classes. Art is a creative subject but engineering is very creative - you're imagining something that has never existed before.”

It was this creativity along with the challenges of problem solving that enticed Stamp to proceed with an engineering degree. But while others in his peer group may have had similar interests at school Stamp said, “that kind of filtered out to the point where no one was left. Very disappointing. No one from my secondary school, that I knew of, went into engineering.”

So, as a person that's relatively recently been involved in making those formative career choices, what does Stamp think should be done?

“Engineering courses are a value added discipline for the country - so why should you be charged for your tuition fees if you're providing a service to help the country be better? What the country needs is more engineers to come up with transport systems, more fuel efficient cars, better renewable energy sources, and stuff like that.

“I think that for Great Britain to flourish again, it needs to come out of the Dark Ages, and become more modern. The only way to do that is to invest in our engineers and bring the UK up to a higher standard.”

A further problem, Stamp believes, is the perception of the engineer. "There's a blurred line between technician and engineer. Also, we see from working with Bosch, over in Germany and Switzerland the general perception of an engineer is at a far higher level than it is in the UK. I would say it's at the same level as a doctor."

The reference to Bosch is because Kliklok became part of the huge international group last November. So rather than being one of 70 employees, Stamp is now one of 350,000 in the €70bn organisation. While changes to working practices are inevitable, and so far very positive, a further benefit could be in addressing some of the issues Stamp raises with regard to encouraging future engineers.

"Bosch has a really good stance on helping young people, young engineers, get into the industry," said Stamp.

Although it has had successful outcomes from apprentices in the past, being a small company has prevented Kliklok from investing in a regular apprenticeship programme.

"The company would benefit by taking on more apprentices, training

up a workforce rather than advertise for a role that they may never fill because no one meets the perfect criteria," he explains. "No one really has a background of 'x' years designing packaging machinery – which can be anything from hydraulics, pneumatics to servo drives, belt drives, gears and everything else like this. It's such a massive role to fill. But, with an apprentice you could envisage within a few years you've got someone that is tailored to the position in such a way that they're indispensable."

So, for an engineer with many decades of work in front of him, is the future of British engineering rosy?

"A British engineer is always challenging the norm and always very intuitive," he replied. "We're all very passionate about what we do, and I certainly feel that the engineering industry will always be there for the duration of my career. I think there is a drive towards young engineers, scientists and technologists - everyone has a common goal. However, British engineering could be a lot better and a lot stronger than it is in Europe, which seems to be moving more towards Germany and France at the moment."



Young Design Engineer of the Year

Dan Stamp is the reigning Young Design Engineer of the Year from the 2015 British Engineering Excellence Awards. The competition in this category was tough as there were a number of outstanding candidates. "I was probably the most shocked I've ever been," admitted Stamp. "I thought the people I was up against were absolutely fantastic, and I really thought there were at least two of them that should have won instead of me. To me it's not just an accolade, it's a recognition from the judging panel that what I have done is worthwhile. It was just a real, big privilege to actually have won it."

The search is on for the stars of 2016, but you only have until 15th July 2015. More information about how to enter is on the website – www.beeas.co.uk

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Back in 2012, *Eureka* covered an interesting fastening technology development called Rotite. But, getting the technology adopted, particularly when it is primarily aimed at aerospace and automotive industries, is not easy. However, the company could be at an inflexion point. Tim Fryer reports.



Latest *twist* on COMPOSITE connections

The SMMT [Society of Motor Manufacturers and Traders] have determined that you can't make cars light enough using traditional means if you're going to meet all of the emissions targets that have been set. So now there's a countrywide determination that we have to make vehicles lighter," stated Stuart Burns, managing director of Rotite Technologies and inventor of the system that bears the company's name.

Burns describes the principle behind the Rotite system as connecting two items together with a geometric configuration based around helical interacting items. He explained: "It was originally based around a dovetail cross-section, and it's often been described as a helicoidal dovetail. Dovetail is just one of the interlocking profiles it can use. Some people have called it the flat screw. It is thread technology but applied in a different plane, and with a limited rotational extent."

But among the problems of having developed a fairly fundamental technology, are firstly gaining acceptance in ultra-conservative, safety critical industries, and secondly providing comparative data that is meaningful to engineers more accustomed to using more traditional fixing methods, like nuts and bolts. On top of this, Rotite

is a technology rather than a specific product, and it can be adopted in an endless range of shapes and sizes.

These problems have shaped progress over the intervening years since *Eureka's* first report. Burns said: "One of the things that we've been doing recently is refining the technology. Because when we talk to engineering companies, and there are potentially limitless derivatives, it can be a little confusing as to what the core system is. So part and parcel of an aerospace technology programme we are on, is we're working on standardising those geometries."

Refining technology

The logic is that if an engineer was using traditional fastening methods, say an M10 or M12 nut and bolt, there is standard specification about size, loads, manufacturing tolerances and so on. Rotite is now going through the process of creating the necessary core geometries to make the system equally 'specifiable'.

More so it needs to be comparable. "If you're going to teach people the language of Rotite, then you have to have parity with something else, like nuts and bolts," stated Burns. "The idea of

communicating the tensile qualities, shape qualities of an interface - this is exactly what we've done on the previous Innovate UK funded programme, under which they perform a standard range of tests such as those that you would use in any other fastening system. What we've had to do is basically refine down the technological prospect and then give it the validity. I would get an invitation to spaceship companies and Formula One teams and while everybody wanted to use Rotite, there was the need for the science behind it, the technological validity."

The Innovate UK funding Burns mentions was part of the 'snowball' that has led to collaborations with some leading aerospace companies. Innovate UK funding attracted investment, which allowed Rotite to get into the NATEP programme (National Aerospace Technology Exploitation Programme) allowing it to rub shoulders and have meaningful conversations with the likes of Airbus.

Beyond aligning the technology for the market, product development has also not stood still. Burns said: "What we are doing is forming consortia to provide novel, lightweight fastening systems for contemporary materials."

The materials in question are the composites that are the focus of many automotive and aerospace developments. Drilling holes in composites can seriously affect their integrity, so traditional fastening techniques, apart from adding weight, can also introduce engineering problems. The advantage of Rotite in such an environment is that the fastener can be moulded into the part, therefore requiring no further fastening components.

It is not work that a fledgling company of Rotite's size could embark on on its own, as Burns explained: "The Northwest Composite Centre at



Mechanical locking (inset) is just one of the many options using Rotite technology

Manchester University has two sections. It is at the basic NCC where we are working under the NATEP programme – they are the facilitators of our composite development programme. But there is also the NCCEF, which is the National Composite Certification and Evaluation Facility, and that is our test house, basically. I have some large, metallic objects that strain Rotites there, it does the assessment and validation of our various Rotite forms.”

Being a newcomer to the fastening world has made such alliances essential. In fact although essentially an IP company (although off the self products will be introduced within a year) one of the more productive routes to market is through the company’s technical consultancies, who explore with potential customers how the technology could be applied.

“One of the things that we often find in our

technical consultancies, is Rotite can actually do things that people don’t expect, which sounds a little far-fetched,” commented Burns. “It can do a number of different things at the same time as fastening two items together. For instance, electronics in composites - making conductive connection systems.”

This example is being pursued with Graphene Enabled Systems, the commercialisation arm of the National Graphene Institute. It is exploring the options of having multi point connections depending on the degree of rotation as well as making the whole joint out of homogeneously conductive materials.

The work with graphene is one of the areas in which Burns sees huge potential: “As an additive to polymers, Graphene can make things stronger, conductive, more wear resistant, and there’s the prospect of lightweighting items. In terms of

aerospace and automotive fastening technologies, it’s a very, very viable prospect.”

Other sectors are starting to recognise some of the other benefits of the system. For example, the design team is growing to deliver a range of products for the sports and leisure technology market. To this aim Rotite has recently embarked on a supply chain partnership with Albis UK – a polymer supplier. Products will be on the shelves very soon.

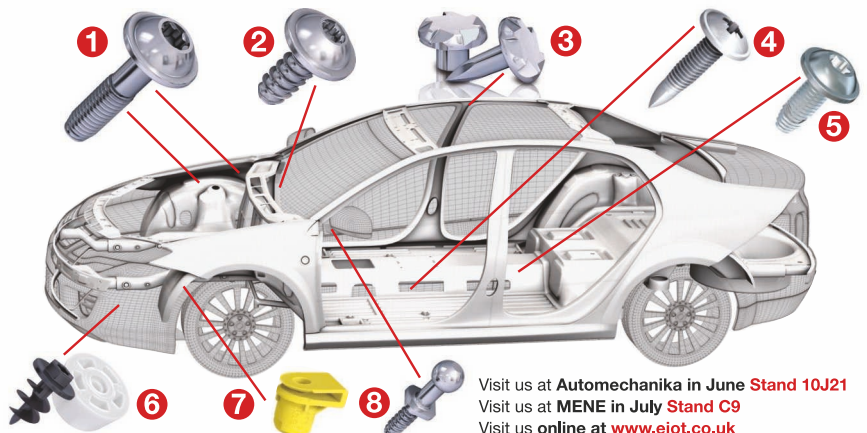
Another prime example is with manufacturing machinery. One of the tools in a Lean Manufacturing strategy is SMED – single minute exchange of die. The basic premise is that if tools can be swapped over quickly, then less production time is lost.

“It’s the idea that if you can design and make things quicker because you’ve got assembly aids and quick fastening systems and solutions, then it makes you more productive which makes you more profit,” said Burns. “So an awful lot of the interest in Rotite is now about jiggging systems, positioning systems and tooling change-over. We’ve had a number of companies who are developing applications for Rotite, who want it for things like positioning systems and clamping systems and assembly aids. It’s that repeatability, the high precision repositioning of things.”

However it is in the high tech arenas of aerospace and automotive that Burns sees his technology really making its mark. “As we move into an era of advanced materials manufacturing, some of the traditional fastening technologies are just not viable,” he concludes. “So we haven’t had to convince people particularly of the potential of developing composite fasteners based upon Rotite.”

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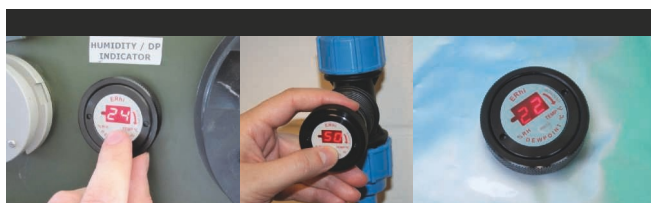


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From athletes to couch potatoes, wearables are becoming an increasing part of modern day life. However, this has left many designers demanding more from current sensor technologies. Justin Cunningham reports.



Surfers *under* pressure

The burgeoning wearable technology market is fast becoming inundated with fitness bands, smart watches, and intelligent headphones. These devices can collect all kinds of information about you from your step count to heart rate to the amount of sleep you're getting.

For wearables in prolonged contact with the body, the amount of pressure applied at specific points is a primary consideration. Too much and the device is uncomfortable, but too little and readings can become inaccurate. Gauging pressure, however, can be difficult as most people tend to be more sensitive to changes in pressure as opposed to constant loads. As designs get more advanced, so too must the sensor technology they employ.

Professional sports

It's not surprising wearable devices are becoming popular with athletes and sports scientists, as they try and gain a performance advantage. Brandon Larson, a technologist with the Red Bull High Performance Group has experience working within this field and has led a project to collect data and provide insight to several elite surfers.

The initial research focused on determining how the pressure of a surfer's feet transfers to

the surfboard to control it. To accomplish this, high resolution pressure mapping was used in conjunction with sensors within the insoles of 'booties'. Capturing the subtle changes in pressure across the entire sole of the foot proved a challenging task due to the constant pounding of waves in conjunction with the wide range of forces applied by the surfer's feet.

Adding to the demand was that the pressure mapping sensor system and the corresponding electronics would need to withstand water, corrosion, high humidity and a range of temperatures. When considering the options

Larson opted for capacitive sensing technology that has had a number of reported advantages recently over resistive sensors. These include greater stability, repeatability and

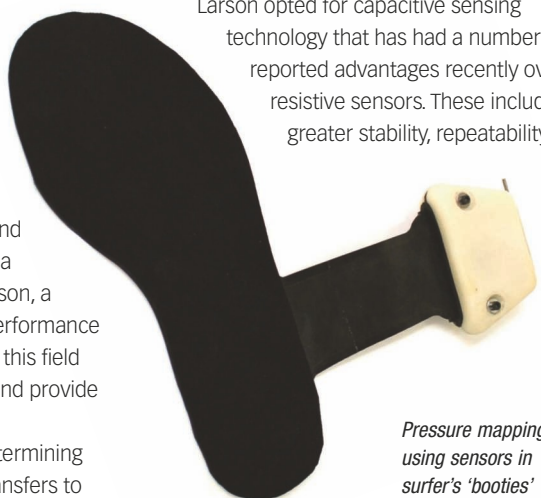
durability as well as the ability to measure extremely low levels of pressure with accuracy. In addition, the sensors are not influenced by humidity.

Larson eventually opted for a capacitive tactile sensing system by Pressure Profile Systems (PPS). Capacitive tactile sensors use two electrodes separated by a compressible dielectric structure. When pressure is applied, the gap decreases and capacitance rises. Unlike resistive technology, the two electrodes never touch. As a consequence, capacitive sensors are less susceptible to wear or failure even if subjected to multiple, repeat loads.

Using capacitive sensors, pressure can be measured using sophisticated arrays that measure thousands of points of force, which is then used to create a high resolution 'force map'. Then, in conjunction with this, miniature force sensors measure pressure at discreet points to both aid and correlate pressure data.

PPS sensors do not require a finger or stylus to interact with electrodes. Instead, two electrodes, separated by a proprietary compressible dielectric matrix, act like a spring.

To build its tactile array sensors, PPS arranges the electrodes as orthogonal, overlapping strips. A distinct capacitor is formed at each point where the electrodes overlap. By selectively



Pressure mapping using sensors in surfer's 'booties'



scanning a single row and column, the capacitance at that location, and thus the local pressure, is measured.

Surfs up!

During the design, it was decided onboard wireless data acquisition was going to be too difficult due to the interference of the signal caused by the water. The system deployed, known as the TactArray sensors, features up to 8192 integrated sensing elements and is able to measure pressures from 0.01psi to 700psi.

However, they are not waterproof, so the company provided sheaths to protect the tactile array. Here, engineers on both sides also collaborated to create a small, 3D printed waterproof housing for the data acquisition computer. To facilitate the placement of the housing, the team created a custom pocket just below the flexing point of the ankle so it wouldn't interfere with the surfer's technique.

The PPS sensor system was put to the test by Red Bull sponsored surfers at their Surf Science technology camp in Mexico. The system successfully captured and stored hours of surfing data that provided a unique view into how world class elite surfers use their feet to control the board.

Larson envisions the next step is to embed tactile array sensors into the deck of a surfboard to collect pressure distribution of the feet and also position. To date, surfer foot placement is only visually evaluated by video.

Other applications the Red Bull High Performance team has considered for the

technology include incorporating it into wingsuits to better understand airflow and air pressure distribution across the aerodynamic skin; mountain bike racer gloves or handgrips to determine grip and braking timing and firmness; and in the decks of skateboards to determine the pressure profile of skaters as they perform specific tricks and manoeuvres.

"Being able to see the pressure signature in some of these applications is a game-changing tool," said Larson.

Not for everyone

However, there are downsides to capacitive tactile sensors. Like resistive sensors, there can be long term loading issues associated with

them. As they are typically engineered using a silicone elastic-type material, it can creep. This can cause sensor output to change very slightly over a period of time. In applications that require stability of a load cell metal flexors can be used to improve long term stability.

They are also not the fastest owing to their complex array construction. The delay is unlikely to have an impact on most applications, especially wearables, though you might not want to use it to trigger an airbag, for example. And while the cost of capacitive tactile sensors has dropped over the past few years, resistive sensors remain significantly cheaper.

www.redbull.com

www.pressureprofile.com

Too much tech – too much distraction?

With technology becoming an increasing part of everyday life, complaints of tech and digital fatigue are on the rise. One of the biggest complaints from both individuals and companies is how distracting it has all become. There is multi-tasking, but then there is modern life. The hundreds of apps, notifications, emails, updates, social media, wearables, and advertisements: it's everywhere and begging for our attention. Distraction has not just become a problem, for many it is a way of life. So, for readers considering a solution, we've plucked two options.

The first is, of course, the techy answer. An Anti-Distraction band called RE-vibe has been created by FokusLabs. The wearable is designed for all ages including those with autism and ADHD. It uses a proprietary algorithm to remind users to stay on task, or to get back to it, by using different levels of vibrations on the wrist. The algorithm is designed to make sure that the wearer doesn't get accustomed to the reminders and begins to ignore them.

Not convinced? Well perhaps the second wearable is more appropriate, an idea originally conceived in 1925 by inventor Hugo Gernsback. He proposed the Isolator helmet to help increase focus and concentration. The helmet would render the wearer deaf, pipe them full of oxygen, and also limit their vision to tiny horizontal slits that allows just one line of text to be read at a time.

So why not take a minute, get distracted and let us know what you think. Tweet us @eurekamagazine with the hashtag #bringbacktheisolator OR #vibrofocusplease OR #imnotdistracted





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A composite image showing BLOCAN profile systems. On the left, several extruded aluminum profiles are shown in cross-section. On the right, a long assembly line with a conveyor belt and safety railings is shown in a factory setting. A yellow crate is on the conveyor.

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It IS rocket science!

For one aerospace company, the complexities of propulsion systems had meant trial and error was the only way of producing reliable rockets. However, this all changed once it partnered with a software company to simulate the solution. Eureka finds out how.



More often than not, the things in life we describe as ‘rocket science’ are nothing of the sort. But when it comes to developing propulsion systems for the next generation of reusable spacecraft, the term is entirely appropriate. As befits the cliché, it’s a complex topic and one that has seen some of the smartest brains in the industry turning to the world of computational fluid dynamics (CFD).

Although CFD is by no means a new thing for the propulsion industry, it’s often been regarded as more of a curiosity than an everyday tool. Detailed combustion chamber data is tricky to obtain on account of the harsh environment, and without validation data, engineers are loathed to trust the predictions. That looks set to change, however, with more sophisticated software, increasingly affordable computing power and escalating testing costs. It’s a perfect storm that’s prompting rocket scientists and engineers to push the boundaries of numerical simulation.

ORBITEC, an American company that specialises in controlled environments for space and propulsion systems, has enlisted the expertise of CFD code developers Convergent Science to kickstart a new era of rocket engine development. ORBITEC has demonstrated and flown its Vortex rocket engines and is poised to insert variants of these engines into flight systems. The shift from purely R&D to mature product development presents many challenges, namely scaling the engine design to larger sizes

and producing entire propulsion systems.

According to ORBITEC, the primary challenge is optimising the fuel injector design to yield high performance at a larger scale. It hopes that addressing this with Converge CFD will illuminate the physical phenomena and facilitate further engine development.

“In the past we’ve not really been able to use CFD in a predictive way,” said ORBITEC’s senior propulsion engineer Dr Millicent Coil. “Most of us are from experimental backgrounds, so we tended to model the rocket alongside our real world testing, examine the results afterward, and then get no momentum from the data.”

Dr Marty Chiaverini, manager of Orbitec’s propulsion division is also keen to investigate how CFD might be harnessed more effectively. The ultimate goal is a fully predictive CFD simulation, which would be able to calculate the thrust capability of a new rocket design.

“We’d like to use the numerical tools to design a new engine instead of merely to fill in missing information from existing test results,” he said.

Money saving technology

The cost of physical testing during the development cycle has motivated ORBITEC to embrace CFD. At the very small, conceptual scale, experimental costs are reasonable, and all permutations are investigated on the thrust stand. With ORBITEC’s more ambitious projects, the material, propellant, and fixture expenses

preclude trial and error type designs.

“When we were first developing our vortex engine, most of the engines we were testing could be held in one hand – 50lbf or 100lbf thrust [0.22 – 0.44kN],” said Dr Chiaverini. “We could do a lot of the prototyping inhouse or outsource it at relatively low cost, so it wasn’t really an issue if we needed to run hundreds of tests. Now the engines are much bigger – up to around 30,000lbf of thrust [133kN] – so everything becomes more expensive.”

In contrast, CFD is becoming cheaper all the time. Inserting CFD at a key point in their design process, ORBITEC hopes to substantially cut prototype testing costs.

ORBITEC strives to use predictions from Converge CFD to accelerate its rocket engine development. Particularly the propellant injection hardware must be carefully designed to achieve peak performance, and these iterations can be lengthy. After sketching initial concepts, the current design process incorporates a number of tangential analyses to evaluate the performance of individual components in the propulsion system. Feedback from these analyses enables refining the design. Inserting CFD analysis of the rocket engine designs at this juncture will help downselect configuration options and refine the design before producing any hardware. This step will reduce the number of experiments needed and better target the experiments conducted, resulting in faster convergence on an optimal

design. The predictive capability is key, because it enables using analysis before the product is developed instead of after.

Partnership of innovators

ORBITEC's partnership with Convergent Science has catalysed its new design approach. Engineers from the two companies collaborate on topics in turbulence and kinetics to find the best approach for the models. The software company's Converge CFD code, originally developed for and proven on internal combustion engines, has some unique properties that enables ORBITEC to make a step change. Instead of using a static, manually generated grid for the duration of the simulation, Converge automates and fully couples the mesh generation at each time step. Uniquely, this process is coupled to both the flow and chemistry solvers. Known as Adaptive Mesh Refinement (AMR), this allows the simulation to automatically refine the mesh density around areas of specific interest, such as turbulent zones or large temperature gradients. These schemes drastically reduce preparation and computation time.

For ORBITEC, the cut-cell and automatic meshing approaches applied in Converge means starting iterations in a day rather than a week. "From an engineering point of view, not having to mesh manually is huge," said Dr Coil. "It's not that you don't have to think about the mesh – it still succeeds or fails on your choices – but you don't have to spend hours perfecting the mesh to avoid skewness like we did with the package we used



previously." Quick setup enables changing geometry very easily and thus simulating more variations of components more readily. With Converge, the experimental engineer can model complex phenomena with a shortened learning curve. The meshing strategies also enable accomplishing more simulation on a smaller number of cores.

The engineers at ORBITEC have been experimenting with Converge for around 12 months. They have seen good results from the package on a number of smaller projects such as external flows over rockets, wind tunnels, and preburners. Bolstered by this success, they are now plan modelling a new 30,000lbf [133kN] thrust rocket engine. The hope is to integrate CFD into the design processes for all of their new engines for various applications.

There remains some technical challenges

before ORBITEC is able to implement numerical modelling with the fidelity and the quick turnover rate required to effectively implement it into the design process. Like most combusting systems, rocket engines present some challenges in simulation. Faithfully modelling of cryogenic and supercritical propellants, phase changes, combustion of kerosene-based fuels, and the patented vortex swirling flow can prove difficult. With sound approaches to these challenges, ORBITEC and Convergent Science are aiming to break new ground in the propulsion industry. With a predictive CFD approach, they hope to slash the number of design iterations tested as physical prototypes and, perhaps more importantly, allow the engineers working on the project to explore new ideas. And that truly is rocket science!

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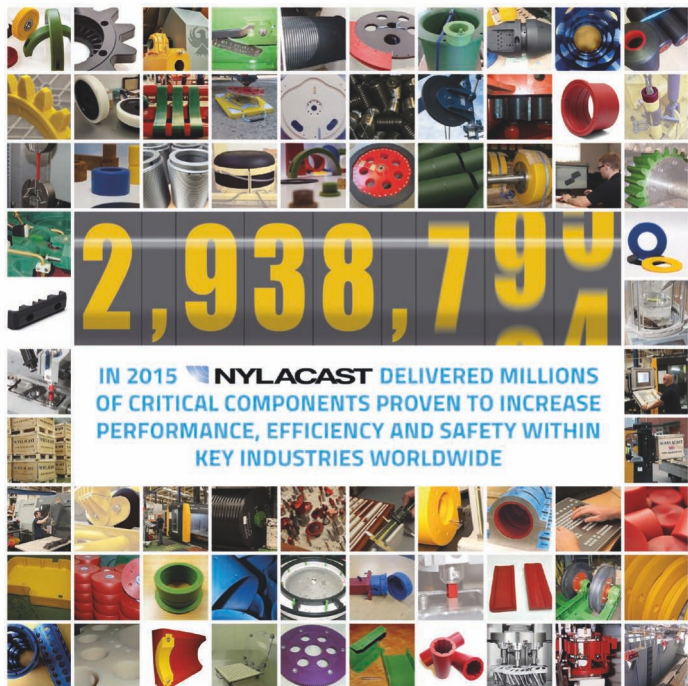
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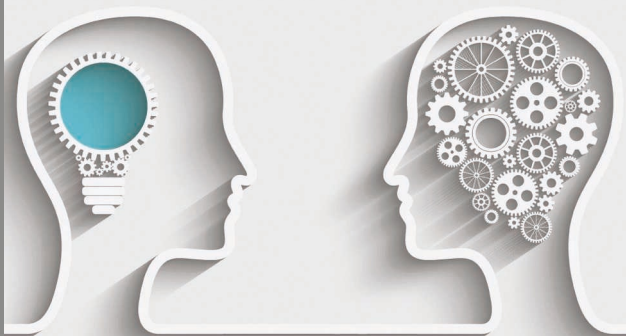
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Regardless of the type of transport – whether a car, train, aircraft or bicycle – the volume of traffic in city and urban centres continues to increase at a rapid pace and is changing the ways in which people move around. At the same time, the desire for emission-free, clean mobility is leading to a political rethink, which is giving rise to new, individual mobility solutions in urban centres. On this basis, Schaeffler has analysed areas of application and the future requirements for individual forms of mobility according to its holistic strategy, ‘mobility for tomorrow’. The result is the Bio-Hybrid concept vehicle.

“All-electric mobility will not be sufficient to guarantee sustainable, energy-efficient mobility for tomorrow in the passenger car sector,” said Prof. Peter Gutzmer, deputy CEO and chief technology officer at Schaeffler AG. “The Bio-Hybrid shows how Schaeffler envisages a solution for urban mobility.”

It is similar to a bicycle, but without the disadvantages in terms of weather protection and storage space. Thanks to the pedelec drive system with a restriction of 25 km/h, the Bio-Hybrid can be operated without a drivers license and can also be used on cycle tracks.

The Bio-Hybrid in detail

The Schaeffler Bio-Hybrid combines the advantages of stability and weather protection with the energy consumption and space utilisation of a pedelec (pedal electric cycle or e-bike). Due to an electrically-assisted drive system (up to 25km/h)* with a minimum range of 50km**, the driver can travel in a sporty but comfortable manner. The Bio-Hybrid has two front and two rear wheels, providing increased safety and driving stability. The vehicle can also be driven on cycle tracks due its compact dimensions (2.1m long, 1.5m high, 85cm wide).

The electric reverse gear system also enables manoeuvring without any problems. In combination with its portable battery system, variable luggage compartment and automatic gearshift system, this two-seater can be integrated into existing infrastructure and day-to-day life.

The extravagant design underlines the lifestyle character and matches the innovative roof construction, which can be easily stored under the seat using an intelligent swing



There are many technology driven consortia and organisations that are looking for solutions to the problems caused by increased traffic congestion in urban centres. Schaeffler has joined the party by unveiling its solution: the Bio-Hybrid concept vehicle.

mechanism. With the weather protection roof retracted, the Bio-Hybrid is transformed into a stylish cabriolet, allowing the driver to enjoy the fresh air. Thanks to an integrated smartphone connection, the driver is able to link to a large number of apps and can access information such as weather reports and traffic updates at any time.

Prof. Gutzmer added: “Important prerequisites with regard to infrastructure must be fulfilled before this type of individual vehicle can become established in the market. Metropolitan areas and major cities must continue to change – and they will. Cities such as London, Paris and Singapore are already

investing hundreds of millions in the development of cycle tracks. High-speed cycle tracks that connect cities, for example, in the Ruhr area in Germany, will enable extension stages of the micro-mobile with higher speeds. There are already discussions in Germany about opening cycle tracks with a legal speed limit of 40km/h. All these developments mean that our concept has great potential to change urban mobility.”

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SHOW PREVIEW

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MENE PREVIEW

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Our conference programme for 2016 has been announced. 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. Book your conference and workshop sessions now on the website – places are free, but limited, so please register now to avoid disappointment.

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Conference Programme - Day 1, 6th July

09:15-10:00

Bringing an £82m super factory to the North East

Darren Cumner, *Manufacturing Plant Manager Hitachi Rail*

Last September, Hitachi Rail opened an £82m state-of-the-art 43,000m² rail vehicle manufacturing facility in Newton Aycliffe. The facility is building the next generation of rolling stock for the Intercity Express programme. Hear about the four year blueprint for building a fully operational site, overcoming skills challenges to fill 730 new roles and the efforts to establish a supply chain with local suppliers.

10:15-11:00

Manufacturing - making a difference

Philippa Oldham, *Head of Transport and Manufacturing, Institution of Mechanical Engineers*

The North East has experienced a revival in manufacturing. The first half of the presentation looks at the impact this region has had on the UK and further afield. The second half will look at how the region can continue to lead the UK's continued manufacturing revival – this will include a discussion into future technological developments as well as addressing the ever present challenge of finding people with the right skills.

11:15-12:00

Embracing the smart factory of the future

Ben Morgan, *Head of the Integrated Manufacturing Group, AMRC*

As we move into the 4th industrial revolution with the rise of High Powered Computing, greater networking and more connected devices, 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.

12:15-13:00

Addressing the skills gap

SORA Group

It's one of the most pressing issues for engineering and manufacturing firms – getting skilled individuals. Here, the discussion looks at the scale of the problem and some recent initiatives.

13:15-14:00

Driving success in the North East automotive supply chain

Paul Butler, *CEO, North East Automotive Alliance*

Following decades of decline, the UK Automotive sector is having a significant renaissance period. This presentation will highlight the NEAA's progress to date and its future plans to support the sustainable economic growth of the North East Automotive sector.

15:15-16:00

Opportunities & support for SMEs in the North East

David Land, *North East LEP*

A panel discussion to look at the opportunities and support available for companies in the North East. David will be joined by Hitachi and Nissan and field questions from the audience about how these two industry giants were able to build up a viable supply chain, and the opportunities for other firms to build in the regions success.

Conference Programme Day 2, 7th July

09:15-10:00

Investing in Sunderland for high quality automotive manufacturing

Kevin Fitzpatrick,

vice president, Manufacturing, Nissan UK

Learn about the manufacturing philosophy that has helped Nissan establish Britain's largest car production plant of all time in Sunderland. The site produces some 500,000 cars every year including the Nissan Qashqai, Note, Juke, Infiniti Q30 as well as the all-electric Nissan Leaf.

10:15-11:00

Increase productivity through proactive maintenance

Dr David Baglee & Mr Roger O'Brien, *Senior Lecturer, AMAP – The Institute for Automotive and Manufacturing Advanced Practice, University of Sunderland*

David will present how a small project team developed a new approach to maintenance strategy development for a drinks company. Roger will present AMAP, how it informs, inspires and innovates in Advanced Manufacturing, helping companies in their development.

11:15-12:00

Successful diversification

Geoff Ford, *Chairman, Ford Aerospace*

The Ford Engineering Group, which was established 106 years ago, is made up of a holding company with two operating subsidiary companies, Ford Aerospace Ltd (FAL), and Ford Component Manufacturing Ltd (FCM). The Group occupies 3 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, the challenges and opportunities faced by FAL and FCM, and what the future may hold for the Ford Engineering Group.

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12:15-13:00

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

Andrew Triantaphyllou, *Senior Research Engineer*, Manufacturing Technology Centre

The hype behind 3D printing is in danger of having many take up the technology, only to be disappointed later. This session is all about the reality of how to produce 3D parts and identifying where it is most useful for you. Whether that is to use it for development and validation, marketing and communications, or as an end-use parts -there are many opportunities as well as challenges along the way.

13:15-14:00

Exporting is great - how your business can get involved

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 your products or services in the UK, there's a good chance that you could do the same in overseas markets. Trading internationally can grow your profits, improve staff retention and help you stay in business longer. On top of that, it's fun! Join us to find out about the benefits of exporting, the opportunities that exist and the support available from UKTI to help you.

14:15-15:00

State of the region

James Wharton MP

Secretary of State for the Northern Powerhouse

The MP for the Northern Powerhouse is to give his view of the state of the region and why it is important for people in industry to not just get behind the movement, but to get involved within it. He will speak about the value that the Northern Powerhouse represents and his hopes for future growth.

Workshop agenda. Programme - Day 1, 6th July

Workshop Theatre 1

10:15-10:55

Unique properties drive the Polyketone revival

Günter Prautzsch, Business Development Manager, AKRO-Plastic GmbH

11:15-11:55

Product evolution

Damian Hennessey, Director, Proto Labs

12:15-12:55

Flexible manufacturing automation – can you afford not to?

Nick Statham, Sales Manager, Fastems

13:15-13:55

Selecting the right cable for dynamic applications

Liam Kinnally, Chainflex Product Manager, igus

14:15-14:55

Data breaches are inevitable...but do you have a plan?

Dr Christopher Laing, Director of Cyber Resilience, Sciendum

Workshop Theatre 2

10:15-11:00

Integrating manufacturing systems

Cathie Hall, Managing Director, K3 Syspro

11:15-11:55

Integrated management systems: coherent or complicated?

Mike Denison, HSS Area Lead, EEF

12:15-12:55

Protecting your investment and avoiding costly down time

Sean Murphy, Regional Sales Manager, FANUC

13:15-13:55

A guide to getting the most from your electric motors

Mark Convery, Electro Mechanical Services representative, Houghton International

14:15-14:55

New engineering design creativity techniques

Ross MacLachlan and Gillian Hatcher, Teaching Associate and Research Associate, Department of Design Manufacture and Engineering Management, University of Strathclyde

Workshop agenda. Programme - Day 2, 7th July

Workshop Theatre 1

10:15-10:55

Finding investment in the North East

Dr Stephen Price, Investment Manager, Northstar Ventures

11:15-11:55

Selecting the right cable for dynamic applications

Liam Kinnally, Chainflex Product Manager, igus

12:15-12:55

Reduce manufacturing costs with CIM & MIM

Walter Kuhn and Paul Williams, Product Manager and Sales Engineer, maxon motor

14:15-14:55

Getting the most from your electric motors

Mark Convery, Electro Mechanical Services representative, Houghton International

Workshop Theatre 2

10:15-10:55

Product evolution

Damian Hennessey, Director, Proto Labs

11:15-11:55

Protecting your investment and avoiding costly down time

Sean Murphy, Regional Sales Manager, FANUC UK

14:15-14:55

Advanced Manufacturing Forum

Advanced Manufacturing Forum (AMF) panel debate



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One of the founding principles of Manufacturing & Engineering North East was to provide the region with an event that reflected both the needs and interests of the region. While publishers and exhibition companies are well placed to do this, it takes additional expertise from within the industry to fine tune the content. Here, the five main industry partners of MENE explain why they are involved and the significance of having such an event in the region.

The **voice** from industry



As someone born and bred in the north east and from a family who were, and are involved in manufacturing via shipbuilding, electrical engineering, defence, offshore platforms and automotive I see manufacturing as part of the DNA of the region.

The MENE event gives manufacturers, including organisations like AMF, an opportunity to communicate with and support engineering while also promoting the strengthening of supply chains. The emphasis placed upon skills, innovation, technology and productivity are all themes that dovetail into the requirements of north east manufacturing companies. After the first event last year our members are already looking forward to July's exhibition with relish.

Jack Hanwell

Manufacturing Sector Development Manager
AMF Advanced Manufacturing Forum



The North East is a region famed for its manufacturing and engineering excellence, making the products and innovating technological advancements

that help drive economic growth. Automotive, subsea, healthcare and process industries are all areas of world-class strength, where the region's ethic of hard work marries successfully with the very latest in manufacturing and engineering processes.

Nissan, Hitachi Rail Europe, Caterpillar, Siemens – to name but a few – all choose to base themselves in the North East, drawing on the talents of a committed and skilled regional workforce.

Manufacturing & Engineering North East provides a valuable platform to showcase what we do best in the North East, a chance for the industry to come together, share success and generate new business.

Helen Golightly

Chief Operating Officer
North East Local Enterprise Partnership

Engineering goes hand in hand with the North East. Starting with the heavy industries of the past the engineering spirit still thrives through high tech engineering and the advanced manufacturing that is behind some of the UK's best engineering success stories.

The Institution of Engineering Designers is pleased to support MENE – an event that not only recognises what has been achieved in the region, it also provides a catalyst for that success to continue. The debut show exceeded expectations and we are thoroughly looking forward to working with the organisers to ensure that second year is even better.

Libby Meyrick

Chief Executive
Institution of Engineering Designers

We are delighted to support Manufacturing & Engineering North East, an event which provides a fantastic opportunity to showcase our competitive strengths in this sector and the businesses that thrive here.

Catherine Walker

Inward Investment Director
Newcastle Gateshead Initiative

Engineering and manufacturing in the UK have a rich heritage and a great future. Nowhere is this more apparent than in the North East of

England, which has undergone significant rejuvenation in recent years. We support the Manufacturing & Engineering North East show. Our sector is on the cusp of a new technology-driven industrial revolution - this show looks to help our region grow and develop its capabilities for world class technology in industries that include electric cars, future rail projects and wind power generation.

Liz Mayes

North East Region Director
EEF – The Manufacturers' Organisation



Tech on the ground

Alongside a packed conference agenda will be an exhibition hall full of suppliers and distributors keen to make visitors aware of the technology, products and services on offer. Here, we asked some of those that will be at the show this year to give a rundown of what they will be ready and eager to talk about.

Zygology

Zygology is the UK's largest authorised distributor for Southco quick access hardware, Pop-Avdel blind riveting systems, PEM self-clinch fasteners and Pemserter installation presses. It is also the sales and distribution centre for Masterfix blind riveting products, providing next day service to distributors around the UK and Ireland. Zygology also offers tool and spare part sales as well as a full repair service.



Electro Mechanical Systems

EMS will introduce three ground breaking products at this year's show. The 2668 - CR DC motor from FAULHABER is the most powerful copper-



graphite commutated DC-Micromotor in its size class. In the medium power range. Next, the compact 1727 - CXR DC-Micromotor results in high power density from a 17mm diameter with a continuous torque of 4.9mNm. Finally, the 20/1R planetary gearhead achieves a continuous torque of 800 to 1.1Nm from a 20mm diameter stainless steel construction for intermittent applications and is compatible with a range of FAULHABER motors available through EMS.

Spectrum Metrology

Spectrum Metrology will be exhibiting for the first time at the MENE with a range of measurement solutions on show, including Taylor Hobson workshop surface finish measurement instruments such as the Surtronic Duo roughness checker. It will also demonstrate the inspection time savings using the VideoCAD Rapid precision geometry measurement station with intuitive Saphir software, which is useful for engineers manufacturing large and varied batches of small parts.



Stanford Marsh Group

Whether your need is Maya led software for animation or a Solidworks solution for manufacturing, SMG3D can supply a 3D printer to meet your needs. If you don't already have 3D Design software SMG3D can consult with you and provide a solution which can also include software training at one of its accredited training centres. At MENE16, the company will be showcasing its uPrint FDM 3D Printer which is suitable for individual designers and smaller teams.



RP Technologies

RP Technologies will be showcasing its prototype tooling and injection moulding capabilities at MENE and invites visitors to view an aluminium prototype tool and discuss upcoming projects. RP Technologies offers fast turnaround of complex aluminium prototype tooling, injection moulded components and CNC machined parts from its West Midlands based manufacturing facilities. The company manufactures what has been designed, no changes just a simple solution.





elobau

elobau will be exhibiting and demonstrating a range of its machine safety products for industry applications. eloProtect machine safety sensors are available as the magnetically actuated eloProtectM or as the RFID actuated eloProtectE. Both are available in 153 or 165 formats, with IP6K9K housing, and have increased tamper protection and increased sensing distances, together with compact, robust housing. Experts from elobau will be available on the stand to discuss any other of elobau's machine safety and industry products.

PDJ Vibro

PDJ Vibro will present the two sides of its business at MENE 2016 - first, its new and used finishing machine sales activities and secondly, its contract finishing service. Both are designed to make life simpler for manufacturers that want to minimise manual work and move towards automating the finishing process for health and safety reasons and to improve consistency.



Schunk

Schunk will be showing new products alongside some of its established market favourites. Schunk will be drawing customer's attention to the Schunk RGG Cleaning Unit, ROTA-S chuck, TENDO E Compact hydraulic expansion toolholder and the MPG-plus parallel gripper. If you would like to view some of the new innovations from the market leading toolholding, workholding and gripping specialist, please visit Stand D13.



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Chess Plastics

Chess Plastics offers a complete package so its customers can benefit from a fully project managed tooling specification, selection and manufacture procedure through to a plastic injection moulding production solution for easy UK supply and delivery. The company also offers 24-hour production meaning it can manufacture and deliver quality components to automotive, leisure, beverage, construction, household and a variety of other markets.



Panasonic Electric Works UK

Panasonic Electric Works UK will be exhibiting a range of its Factory Automation products which includes the FP7 Series Programmable Logic Controller and Laser Marking systems as well as introducing new products from their range of sensing products. These products are suited to the Automotive and Industrial Automation markets offering state of the art technology with long term reliability.

Eastern Seals (UK)

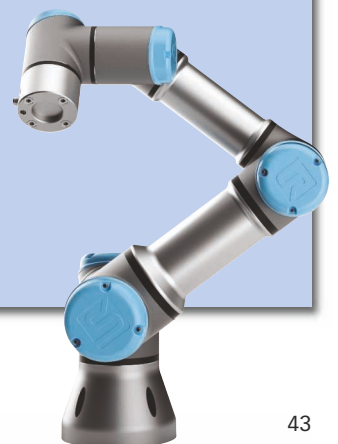
Eastern Seals' stand will focus on a range of products and services including FEP Encapsulated O-Rings, Spring O-Rings and O-Ring Cord. Other products include Back-up Rings, Bonded Seals, X-Rings, V-Rings, Oil Seals and Bespoke Rubber Mouldings. Eastern Seals supply NORSOK

M-710 approved materials and other approved/certified products, including compounds approved to the latest Aerospace/Military specifications, and materials for use with drinking water or food applications.



Olympus Technologies

Olympus Technologies will be launching its new welding application for the Universal Robot at MENE16. The Universal Robot supports a range of applications, including pick and place, assembly, machine tending, gluing, packing, and quality inspection across the automotive, food, furniture, machining, pharma and research industries. It is also introducing a lightweight welding cell incorporating the Universal Robot interfaced to a welding package, to provide a lower price point for 6-axis automated welding applications.



Zoller UK

Zoller will be showcasing its Venturion tool presetter and tool management software at MENE 2016. The Venturion is an advanced presetter with unique functionality and enhanced performance that can accommodate tooling weights up to 35kg, featuring an accuracy of up to 2µm. The intuitive tool management software compliments measurement machines with advanced CAM interfaces, vending solutions, ERP integration and more.

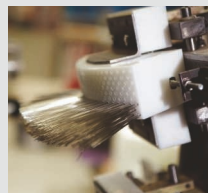


HEIDENHAIN

HEIDENHAIN will be exhibiting its latest TNC 620 and TNC 640 CNC software running on a TNC Programming Station simulator, together with its HIT suite of on-line training software. Another product on display will be a new version of MT length gauge which has virtually zero gauging force for measuring delicate surfaces. Samples from HEIDENHAIN's range of rotary and linear encoders will also be on show.

Cottam Brush

Cottam Brush will show its increased range of capabilities in sectors including water treatment, pharmaceutical processing and agriculture.



Whether you need a replacement brush or you're designing a brand new process, Cottam Brush's in-house design team can work from specification or idea to produce drawings or 3D prototypes of products during the design phase, enabling a smooth transition from concept to product.

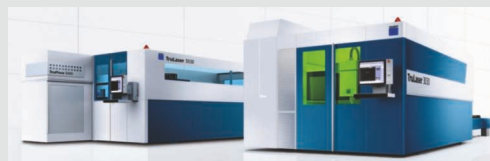
CGTech

CGTech will be showcasing the latest version of its VERICUT software at MENE 2016. VERICUT CNC machine simulation, verification and optimisation software eliminates the process of manually proving-out NC programs. It detects collisions and near-misses between all machine tool components and other user-defined objects. The latest releases of the software have focussed on full integration with the CAD/CAM and machine tool industry.



TRUMPF

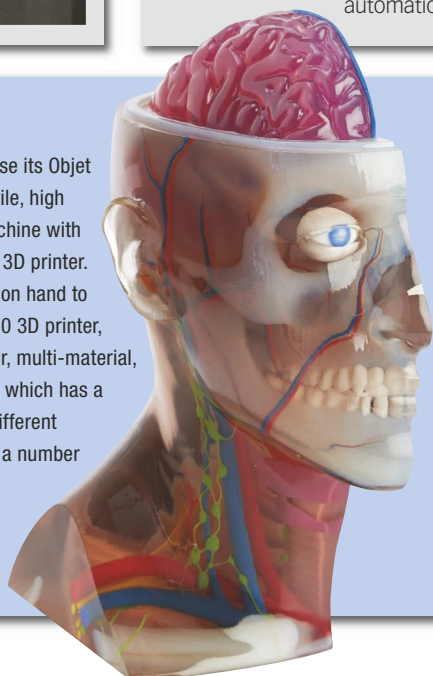
TRUMPF will focus on the scope of its products and services that support manufacturers through the life cycle of the machine investment and beyond. From systems for laser cutting, punching and bending to advanced laser processing technology, all machines are designed to accept flexible and expandable automation. The choice ranges



from simple productivity gains from features such as automatic laser nozzle exchange through to all the elements necessary for full, lights-out production.

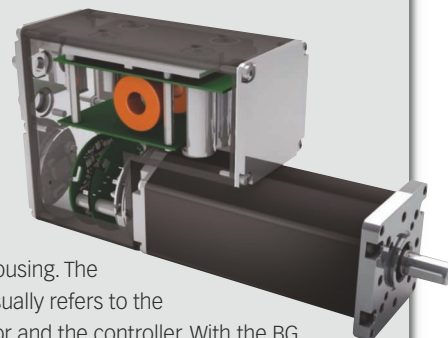
SYS Systems

SYS Systems will showcase its Objet 3D Pro, a compact, versatile, high end rapid prototyping machine with the footprint of a desktop 3D printer. SYS Systems will also be on hand to discuss the Stratasys J750 3D printer, the world's only full colour, multi-material, high resolution 3D printer which has a palette of over 360,000 different colour shades, as well as a number of material properties, including rigid, flexible, opaque, and transparent.



Dunkermotoren Linear Systems

Dunkermotoren will be promoting its 550W BG 75 brushless DC motor, among other products, at MENE 2016. The motor eliminates the need for an external power supply whilst also accommodating all the functionality into the motor housing. The term 'single-cable solution' usually refers to the connection between the motor and the controller. With the BG 75 DMC it includes the complete drive up to the 230Vac supply. This innovative, integral drive unit provides an ideal solution for motion control in modular or 'single motor' applications and machines.



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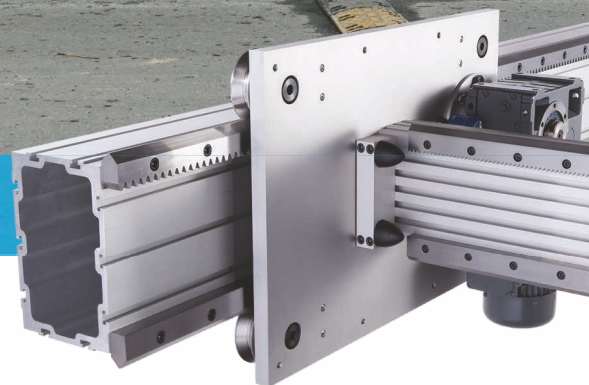
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Nusafe

Nusafe will be demonstrating its PPE vending system. The carousel machine reduces costs through in-depth reporting options that monitor product cost-in-use by user and by the company as a whole. The machine is simple to operate and takes minutes to learn. Only permitted users can remove contents and store data. Nusafe offers a matching locker machine for larger items to support asset management programs.



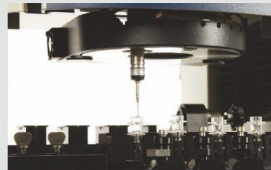
600 UK

600 UK will demonstrate its 'one stop shop' capability with Colchester and Harrison, which will be exhibiting its ranges of centre lathes. Pratt Burnerd International will be presenting its manual and power chucking solutions, and Clausing Precision Machine Tools will be showing equipment from its range of grinding, milling, sawing and drilling machines.



OGP UK

OGP will be displaying the Flash 200, offering multi sensor shop floor measurement with future proof capabilities. Components can be automatically measured to the highest levels of accuracy in the most hostile environments. Thanks to multi sensor deployment mechanisms, unmanned inspection is possible, as well as high component throughput that gives shop floor quality control that is accurate, fast, reliable and automatic.



Industrial Tooling Corporation

ITC will be promoting its BIG KAISER precision boring tools, air turbine spindles and tool holders, the range of Widia solid carbide and indexable insert products and ITC's UK manufactured Cyber range of high performance solid carbide milling tools. It will also introduce its latest promotion, the 'boring' challenge. The tooling specialist is confident that the cycle times with its BIG KAISER SW Twin-Cutter boring head cannot be beaten and, at MENE, ITC specialists will demonstrate why.

Meusburger

Meusburger offers a range of standard parts, combined with high-grade products in the field of workshop equipment, and makes dies, moulds, jigs and fixtures. The company will be demonstrating how it reduces plate warping during machining through high-quality steel heat-treated for stress relief, maintains consistent high quality based on strict quality guidelines, and offers short lead times through optimised processes and excellent logistic networks.



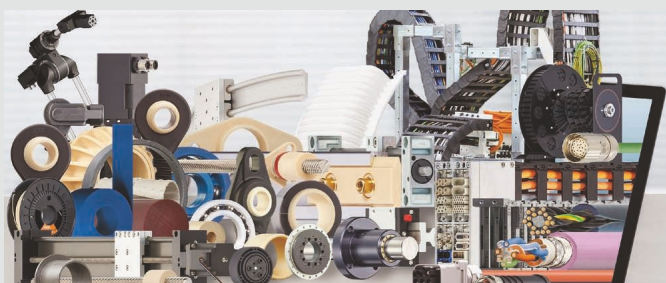
Amada

Machine tool manufacturer, Amada will be celebrating its 70th anniversary this year and has expanded its press brake range, providing a HFE MKII 5012 for live demonstrations at MENE 2016. Engineers will also be available to discuss all your current production needs, and advise you on all the latest solutions from Amada, including Fibre Laser, NCT Punching Cells and fully automated Bending Cells.



igus

igus, will be showcasing its high performance triboplastic bearings, cables and energy chains at MENE 2016. Visitors will be able to see a range of new and innovative products, to include triplex r, the third generation 3-axis energy chain for robotic and non robotic applications, and the innovative tribo tape material, made from tribologically optimised, food-grade iglidur A160 material, which is coloured blue for easy identification.



Turbex

Turbex, supplier of aqueous industrial cleaning machines and lines, is promoting its ability to provide a range of solutions for batch or in-line finishing applications ranging from shop floor to clean room in almost any manufacturing sector. There are over 100 standard models in the range including top- and front-loading spray washers, bench top and floor standing ultrasonic machines, precision cleaning machines with basket rotation and flood wash, and tunnel cleaning lines.





simulation

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.

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Tools of the trade:

Choosing a 3D printer

With so many 3D printers on the market, just what are the considerations when looking to purchase one? And what value is it going to add to your business? Justin Cunningham finds out.

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.

For some, the use of an office 3D printer has become an essential tool in developing and validating design concepts, for others no bid is complete without a 3D printed prototype to accompany CAD models. But, whether you are a one-man band, or a multi-national engineering firm, chances are if you are involved in design and development you are thinking about investing in a 3D printer.

So, whether you feel a genuine need, or you've just got caught up in the hype, if you are thinking about a 3D printer for the office then there are a few things to consider. The first thing to set out is, clearly identify what you want to use it for. While this sounds obvious, many have brought one, only to produce Yoda heads or Eiffel Tower paper weights. After a few months when the novelty has worn off, they realise that the machine is not set up for their needs.

Like many things in engineering, the 3D print market

is full of acronyms including FFF, FDM, SLM, SLA, SLS... it's enough to confuse anyone. The other problem is the cost of printers can be anything from just a few hundred up to nearly half a million pounds. So how can you decide which one is right for you?

"The first thing to consider is to decide what you want to get from the printer," said Mark Tyrntania, sales director at Laser Lines, a large Stratasys 3D printer UK reseller. "Do you want to use it for design verification? Or, do you want to use it as a communication and marketing tool? Are you buying it to win more work? There are all sorts of things they can do, but try to hone in on the two or three things that matter most to you, and then buy the machine that best fits your core needs."

Rarely does a printer do everything but there are some broad brush comparisons that can be made. For example, fused deposition modelling (FDM) printers tend to be mechanically stronger with better physical properties. These

types of machines are proving popular for use as jigs and fixtures, or where a part might actually be made for service. On the other hand, PolyJet printers have a much better surface finish and fine feature definition. These are popular with users

that want to use additive manufacturing for product realisation, as they are a better representation of the finished article. Then there is selective laser melting (SLM) of metal powder, which can produce parts for in-service flight



Multiple colours can now be printed in the same operation

qualified parts such brackets made for the Airbus A350 XWB.

There are, of course, many different types of 3D printers and substrates available, and all have different properties both from a mechanical and finish point of view, but also in terms of cost to operate. So if you think that a £5000 entry level printer will be able to build you a flight ready part, it can't.

"There is a lot of hype behind 3D printers and people think when they get one they can make anything they want," said Tyrntania. "You can't, like any manufacturing process there are limitations, and those will depend upon what machine you have. What we try and do is manage the expectations that people have, with the money they want to spend."

Buying cheap?

Many engineers might be tempted to try the technology out by purchasing a low-cost printer. It's a logical train of thought as it allows you to become familiar with the process of 3D printing, identify its value and figure out how it best works for you.

However, the 'sweet spot' for Laser Lines is actually around £25,000, and realistically if you want to get any serious use from a 3D printer then this is the kind of budget you can expect to be dealing with. Of course, lower cost options are available, but the adage that you get what you pay for certainly applies to the 3D print market, as much as it does anywhere else.

"I've seen time and again people go for an entry level machine, only to upgrade it in a relatively short space of time," said Tyrntania. "They trade in, upgrade or add to it as they see



the value of it, and this gets them thinking about the possibilities and opportunities inside their business. They identify exactly where it will be useful, where it will add value, and then they want to keep investing.

"There is a lot of noise at the lower end of the market with a lot of machines retailing for between £1,000 and £5,000. The Makerbot is a good example. And while I see lots of people joining that market, I also see a lot of people leaving it."

There tends to be a mental mind set that dictates certain price points in the marketplace. The most popular is around £25,000, and then again up to about £50,000. This goes up again to the Stratasys multi-material J750 at around £200,000 and then up to the very large Stratasys Fortus machines - capable of production volumes -

that can retail at as much as £450,000.

For some industries 3D printers have become essential for competitiveness. If a competing agency is putting in a multi-material prototype that shows off the full range of colours, material properties and functionality, it is of course going to trump a single colour, scaled down, plastic representation. 3D printers are fast becoming must-have tools, moving away from that reputation of being a bit of a fun toy to tinker with.

Bureau vs ownership?

Another common and sensible approach to purchasing a 3D printer is to try it before you buy it. The many 3D printing bureaus that are operating are able to show you the sorts of quality and types of parts that you are likely to receive back from machines at certain price points.

Many bureaus are only too pleased to talk you through the specifics of a particular machine that they use, and you can see first-hand the outputs you will get from them. It means before you or your company invest, you can prove it can work. This allows you to learn and understand the technology, and find the value in it.

Laser Lines also runs its own bureau service, that actually helps it turn many sceptics into buyers. Tyrntania explained: "You might think its counterintuitive to be a reseller of machines and operate a bureau. But what we find is, actually, they are intrinsically linked. Nobody invests in a 3D printer without doing research whether its £5k or £100k that you're spending.

"We have found that people might start and use us for bureau parts and then buy a machine once they see the value in the technology and see what it can do. It helps them to justify the investment and they then really know what it is they are getting."

A bureau is a great way to help identify some specifics, namely what you might use a 3D printer for. Identifying that core need is essential in getting value from them. Remember, no one machine will do everything, so you may find you'll still need to use a bureau even after you've purchased one.

The Stratasys Mojo is one of the entry level machines that allows engineers to experiment with 3D printing technology

3D printed parts can now cover many colours, materials and resolutions



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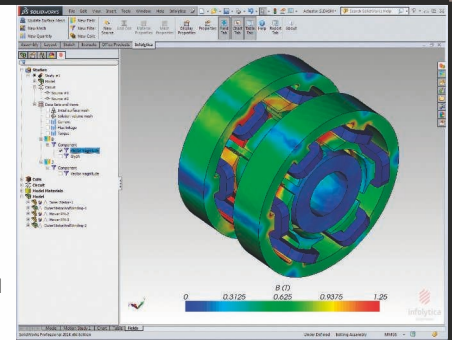
MagNet for SOLIDWORKS is the foremost 3D electromagnetic field simulator embedded in the industry leading CAD software. A combination beyond compare: just one design environment for drawing the model and analyzing the performance of any EM device such as power transformers, sensors, MRI, actuators, solenoids and much more. This is not a live link or connection of two standalone software tools, but rather a fully integrated add-in to SOLIDWORKS which runs seamlessly inside the CAD environment.

Perform electromagnetic field simulations and quickly make geometric modifications to examine their impact on the design without worrying about exporting model data and dealing with compatibility issues. The property management pages and study setup use the same look and feel of SOLIDWORKS interface, making it intuitive to existing users.

MagNet for SOLIDWORKS' solution approach is based on the highly accurate finite element method for simulating static, frequency dependent or time varying electromagnetic fields. Read more about the complete feature set.

Useful features include:

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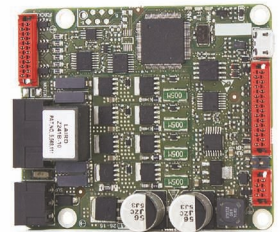
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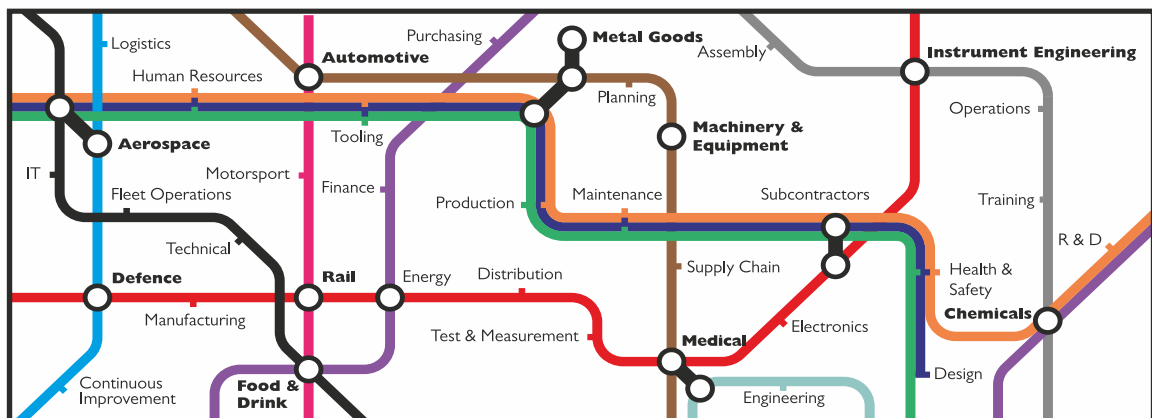
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Terror of tyre blow-outs!



One of the most dangerous failures on British roads is the lorry tyre. These catastrophic events tend to occur on motorways or A-roads, at speed, and without warning.

As tyres fail, large chunks of delaminated rubber is thrown in the path of oncoming motorists, meaning they are left to try and dodge the debris. Tyre debris can tear off bumpers, damage radiators, and even bounce up and smash windscreens. Either way, if you hit one, it doesn't usually end well. Lorry drivers are often just as surprised, and are as much as a spectator as anyone else in guessing where the rubber caucous might end up.

The challenge

The challenge this month is therefore to come up

with a method of predicting catastrophic failure in lorry tyres to reduce it from happening, or even stop it all together.

You might choose to make the tyres entirely from rubber, or find an innovative way of ensuring the rubber stays attached to the rim during failure, so it will not fall away into the road.

Another tack might be to look at monitoring the tyres to see if there are any warning signs. Poor tyre care can be a major cause of failure, including over or under inflating the tyre and also excess wear. Other factors can include excessive speed, impacts, tyre age, or overloading. So, although failure might seem sudden, there are warning signs.

Any solution like this must be cheap to install, have enough power to make it viable for several months or more before recharge. But critically, it

should give warning of any signs that there is a problem. This might include a loss of tyre pressure, excessive heat, or possibly that an impact has occurred over a certain 'g' rating.

And, finally, regardless of your proposed method, catastrophic failure will still be a distinct possibility. In such an event, the driver should be given an alarm that rapid deflation has occurred so that they can pull over as quickly and as safely as possible, before the tyre comes off the rim and falls in to harm's way.

Last month's Coffee Time Challenge was to put a modern take on 70s modular furniture. You will find our solution on p12.

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