

DESIGN | INNOVATE | ENGINEER

# Eureka!

## F1 TO INDUSTRY

WHY MORE FIRMS ARE SEEKING TO PARTNER WITH THE RAPID WORLD OF F1

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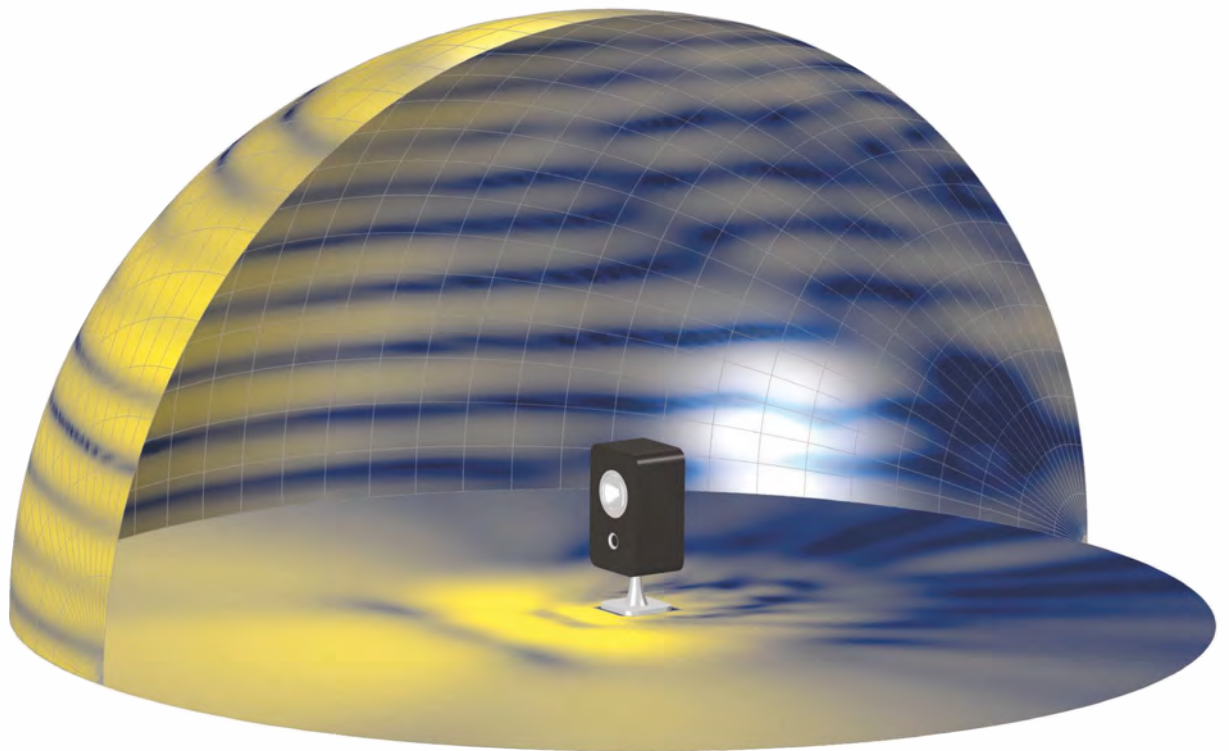
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## What's so special about this colour table?



*Visualisation of the sound pressure level produced by a loudspeaker driver mounted in a bass reflex enclosure.*

8% of men and 0.4% of women see the significance of the plot above. It uses a colour table created so that people with colour vision deficiency can accurately interpret simulation results. And that's a beautiful thing.

The Cividis colour table, courtesy of Pacific Northwest National Laboratory, is now available in the COMSOL Multiphysics® software for simulating designs, devices, and processes in all fields of engineering, manufacturing, and scientific research.

[comsol.com/release/5.3a](https://comsol.com/release/5.3a)



Picture Credit: Adobe Stock

# WE NEED TO STOP TALKING BREXIT



**EXPECT THE FLAVOUR** of 2018 to be vanilla. Why? With just about everyone worried about the fallout of BREXIT, our declining productivity as a nation and the continuation of an unpopular Government, no one anywhere wants to rock the boat. Slow and steady has become the name of the game.

From boardrooms to the cabinet to the water cooler, I get the sense a lot of people are pushing the mantra of, 'don't do anything stupid until this mess blows over'. It means being bold is not a position anyone particularly wants to entertain at the moment. That is except, of course, for every other nation around the globe. Believe it or not, the rest of the world doesn't really care about BREXIT and our insular problems and infighting.

The UK and Europe desperately need to move beyond this self absorption that has swept over us these last 18 months or so. We need to look outwards once again and get some sense of purpose of what it means to be British, and not European. Please, everyone, keep it amicable and let's move on. If we don't, this divorce is about to get a lot worse than the upfront bill.

While we have been inwardly fighting, other industrial nations have seen the disdain and a sense of entitlement from all sides. They see it for what it is; a trading landscape rife with opportunities. It's divide and conquer, except we are the ones doing the dividing.

China and India are two examples that are keen to progress quickly and find some quick wins as European business leaders sit on their hands in these uncertain times. The two countries have been investing heavily in Industry 4.0 technologies and automation, and are producing engineers like they are going out of fashion.

So, perhaps it is time to be bolder and see 2018 as the year that we all took the decision to move on from a messy divorce and see BREXIT as an opportunity to realign the economy, be bold with industrial strategy and actually start to invest and implement technology that will add-value and make us more competitive.

**Justin Cunningham,**  
Editor

## MISSION STATEMENT

DESIGN | INNOVATE | ENGINEER

*Eureka!* connects design engineers with the UK's industrial heartbeat by providing in-depth coverage on the very latest technology developments and industry trends; keeping you inspired, informed and innovative.

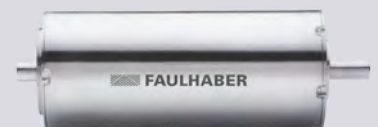


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# Eureka!

Editor **JUSTIN CUNNINGHAM**  
justin.cunningham@markallengroup.com

Assistant Editor **TOM AUSTIN-MORGAN**  
tom.austin-morgani@markallengroup.com

Consulting Editors **NEIL TYLER**

Art Editor **CHRIS CHARLES**  
chris.charles@markallengroup.com

**ADVERTISING SALES 01322 221144**

Sales Director **JEZ WALTERS**  
jez.walters@markallengroup.com

Sales Manager **JAMES CREBER**  
james.creber@markallengroup.com

Production **HEATHER WOODLEY**  
heather.woodley@markallengroup.com

Circulation Manager **CHRIS JONES**  
chris.jones@markallengroup.com

Publisher **LUKE WEBSTER**  
luke.webster@markallengroup.com

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#### MOVING ON?

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## FACEBOOK OPENS FIRST UK ENGINEERING HUB

**FACEBOOK HAS OPENED** its new office in London's Rathbone Place, creating 800 jobs in the capital over the next year. More than half of the employees there will focus on engineering, making it Facebook's biggest engineering hub outside the US.

Facebook opened its first office in London 10 years ago. Since then, the UK has played a major role in the development of some of Facebook's global products like Workplace which is used by 30,000 businesses globally.

The 247,000ft<sup>2</sup> office includes seven floors and features a new public square just off Oxford Street

called Rathbone Square. In a first for a Facebook office, the site will house a dedicated incubator space for UK-based start-ups, called LDN\_LAB.

Nicola Mendelsohn, vice president, Facebook EMEA said: "The UK's flourishing entrepreneurial ecosystem and international reputation for engineering excellence makes it one of the best places in the world to build a tech company. This country has been a huge part of Facebook's story over the past decade, and I look forward to continuing our work to achieve our mission of bringing the world closer together."

## Eastern expansion plans

**COVENTRY-BASED DESIGN**, engineering and niche manufacturing group, Envisage is working with Birmingham-based accountancy firm Moore Stephens to help it expand into China. This comes after Envisage opened offices in the US and India in the last 12 months.

"We have enjoyed a successful year with business growing in the automotive, rail and marine industries," said Bryan Campbell, chairman and founder of Envisage. "With China looking to cap its carbon emissions by 2030 and becoming the largest market for electric cars – with more than 335,000



Above: Paul Fenner (partner, Moore Stephens) and Paul Atkin (Envisage Group finance director)

registered last year – there is high demand for skills in design and engineering which we have in abundance."

In 2016, Envisage acquired CGI, which produces show cars for motor manufacturers all over the world, to enhance its client offering.

Paul Fenner, a partner at Moore Stephens, said: "Envisage is the perfect example of a company which has used its pedigree in engineering, combined with cutting edge technical ability to drive growth.

"The fact that we can use our network to help them make totally informed decisions around the expansion is also valuable as it just increases market intelligence."

# RESPONSES TO THE INDUSTRIAL STRATEGY

## BUSINESS SECRETARY

Greg Clark launched the Government's Industrial Strategy on 27 November 2017, setting out a long-term vision for how Britain can build on its economic strengths, address its productivity performance, embrace technological change and boost the earning power of people across the UK.

With the aim of making the UK the world's most innovative nation by 2030, the Government will invest £725m over the next three years in the Industrial Strategy Challenge Fund (ISCF) to respond to some of the greatest global challenges and opportunities faced by the UK.

Construction, life sciences, automotive and AI are earmarked to be the first to benefit from strategic and long-term partnerships with Government, backed by private sector co-investment.

Clark said: "The Industrial Strategy is an unashamedly ambitious vision for the future of our country, laying out how we tackle our productivity challenge, earn our way in the future, and improve living standards across the country."

The white paper focuses on five foundations of productivity—ideas, people, infrastructure, business environment and places. Each foundation is supported by policies designed to provide businesses with certainty and reassurance that the UK will continue to have a competitive edge, including: raising total R&D investment to 2.4% of GDP by 2027; increasing the rate of R&D tax credit to 12%; and the investment in the ISCF programmes to capture the value of innovation.

To ensure that the Government is held to account on its progress in delivering the strategy, an Independent Industrial Strategy Council will be launched in 2018.

Juergen Maier, CEO Siemens UK,



Picture Credit: Adobe Stock

said: "We are optimistic that through greater investment in R&D, especially through the application of advanced industrial digital technologies like AI and robotics, we can support many more new and existing manufacturing industries—raising productivity and creating thousands of highly skilled, well-paid jobs."

Mike Cherry, national chairman of Federation of Small Businesses, said: "The UK's 5.5 million small businesses have a huge role to play if we are to increase productivity across the economy. This is the only way to achieve sustained wage growth and higher living standards. We particularly welcome the focus on improving technical skills, new physical and digital infrastructure and increased R&D."

Sally Benton, director of policy & research at the Design Council said that while she welcomed the recognition of the importance of design for the future of the UK's economy, it is still absent from practical policy discussions.

"Whilst the strategy opens the door to design it does not incorporate design across R&D infrastructure, open tax incentives for business to use design, or address the urgent need for design skills across our economy by incorporating design into new T-Levels or wider STEM subjects," she said.

Carolyn Fairbairn, director general of the CBI, welcomed the message behind the strategy but added that it is only the start. She said: "The hard work starts now. [The Industrial Strategy] must be the beginning of a strategic race, not a tactical sprint. And it needs to last.

"This is a time for consistency and determination, not perpetual change with the political winds. The creation of an independent council with teeth to monitor progress will help this."

David Bailey, Professor of Industry at Aston University also described the strategy as "welcome news" but added to the voices questioning if the amounts mentioned were sufficient to make any real impact.

"Given the scale of the challenge, investment of £725m is unlikely to be enough and the competition for cash will be high across a broad range of sectors," he said.

These concerns were echoed by Mike Thornton, head of manufacturing at RSM, who questioned whether the promised money would ever materialise against what he called the, "backdrop of a weaker growth forecast for the UK and uncertainty around Brexit". He added: "It will be interesting to see whether the Government has the financial clout to deliver this strategy against a backdrop of continued austerity."



## BUSINESS NEWS

### ADDNODE GROUP ACQUIRES MCAD

Symetri, an Addnode Group company and provider of software and services for design, data management and workflows, has acquired MCAD Sverige. MCAD will become part of Symetri's design management business area.

### ANSYS BUYS 3DSIM

ANSYS has acquired 3DSIM, a developer of additive manufacturing simulation technology. ANSYS says this acquisition gives it the industry's only complete additive manufacturing simulation workflow.

### AIRBUS SIGNS \$17.2BN DEAL WITH WIZZ AIR

Airbus has signed a deal with European airline, Wizz Air Holdings, relating to the purchase of 146 Airbus A320neo aircraft. At current list prices, the aircraft are worth more than US\$17.2 billion.

### PTC PARTNERS' CONTINUING GROWTH

PTC says its partner programme is continuing to show momentum, with more than half of partners experiencing double-digit growth in the last year. Over the past three years, the number of PTC partners has grown by 45%, totalling approximately 1,150 companies worldwide.

# BREAKING GROUND ON THE 'FACTORY FOR TOMORROW'

## A GROUND-BREAKING

ceremony has taken place at the site of Schaeffler's first smart factory – the 'Factory for tomorrow' – in Xiangtan, China. The construction of the 315,000m<sup>2</sup> plant will begin in 2018 and it is expected to start operating in 2019.

The factory is modelled on the shape of a butterfly with four halls representing the wings, and the buildings in the centre representing the body where various production-supporting departments are accommodated. This arrangement is designed to improve internal communication. The production area has a modular design, which means that new production lines and product ranges can be easily added.

"We want to actively shape 'Mobility for tomorrow', which is why we are concentrating



on the key opportunities for future e-mobility, Industry 4.0, and digitalisation," said Oliver Jung, chief operating officer of the Schaeffler Group. "With our approach, we want to shape the 'Factory for tomorrow' so that we can make our production plants

fit for the future."

The Factory for tomorrow will manufacture components and systems for engines, transmissions and chassis systems for the automotive industry. These products aim to reduce emissions and increase driving comfort.



## Bionic limbs for babies and toddlers

**RS COMPONENTS IS** supporting an innovative start-up by providing 3D printing filaments for the prototype development of functional, body-powered hydraulic limbs for children around the world who need them, after the inventor began developing one for his son.

Ben Ryan set up Ambionics, which has so far been crowdfunded with RS supporting and sponsoring the beta trial with 20 families around the globe.

Alison Hutchings, assistant global category manager, 3D print at RS, said: "We were inspired by his mission and bold vision – especially from someone with no former design background whatsoever – and decided we wanted to support Ambionics.

"Providing the 3D printing filament means Ben can concentrate on the beta trial unrestricted by product costs. The project has received wide interest already, achieving £23,000 through crowdfunding of the £150,000 total needed. It's a very worthy project and one we're proud to be a supporter of," she added.

Ryan said: "My aim through Ambionics is to help children everywhere adopt and continue to use prosthetics into adulthood. Offering safe function with no small parts or batteries at the earliest possible age is key to achieving this."

## TECH BRIEF

# SMOOTH SCADA SOLUTION

**TERMINAL OPERATING SYSTEM** provider **DBIS** has created a solution for smoother integration of SCADA software for all models of programmable logic controllers (PLCs).

Most PLC manufacturers provide proprietary SCADA software, tailored specifically for use with respective machinery, making it difficult to find compatible PLCs for manufacturing environments.

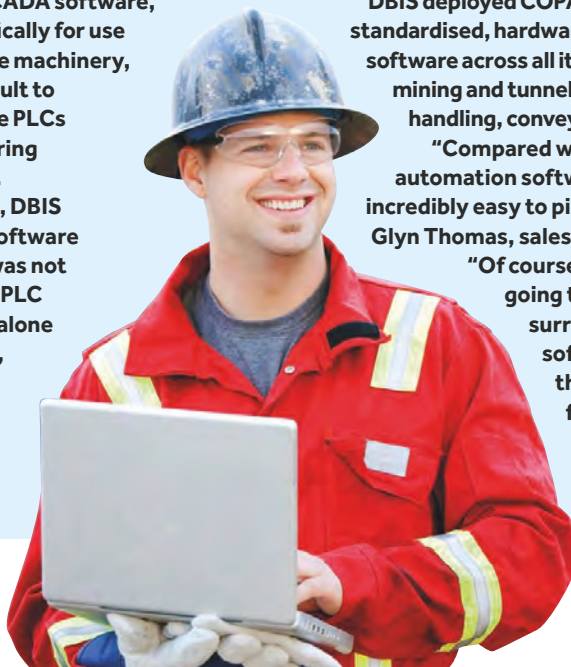
To solve this, **DBIS** researched a software solution that was not specific to one PLC manufacturer alone and, therefore, can work across a range of projects, regardless of the make

and model. Seeking software that could be standardised for all automation platforms, **DBIS** sought help from independent supplier of industrial automation software, **COPA-DATA UK**.

**DBIS** deployed **COPA-DATA UK's** zenon standardised, hardware independent software across all its projects from waste, mining and tunnelling to materials handling, conveyor and rail industries.

"Compared with some other automation software, zenon was incredibly easy to pick up," explained **Glyn Thomas**, sales consultant at **DBIS**.

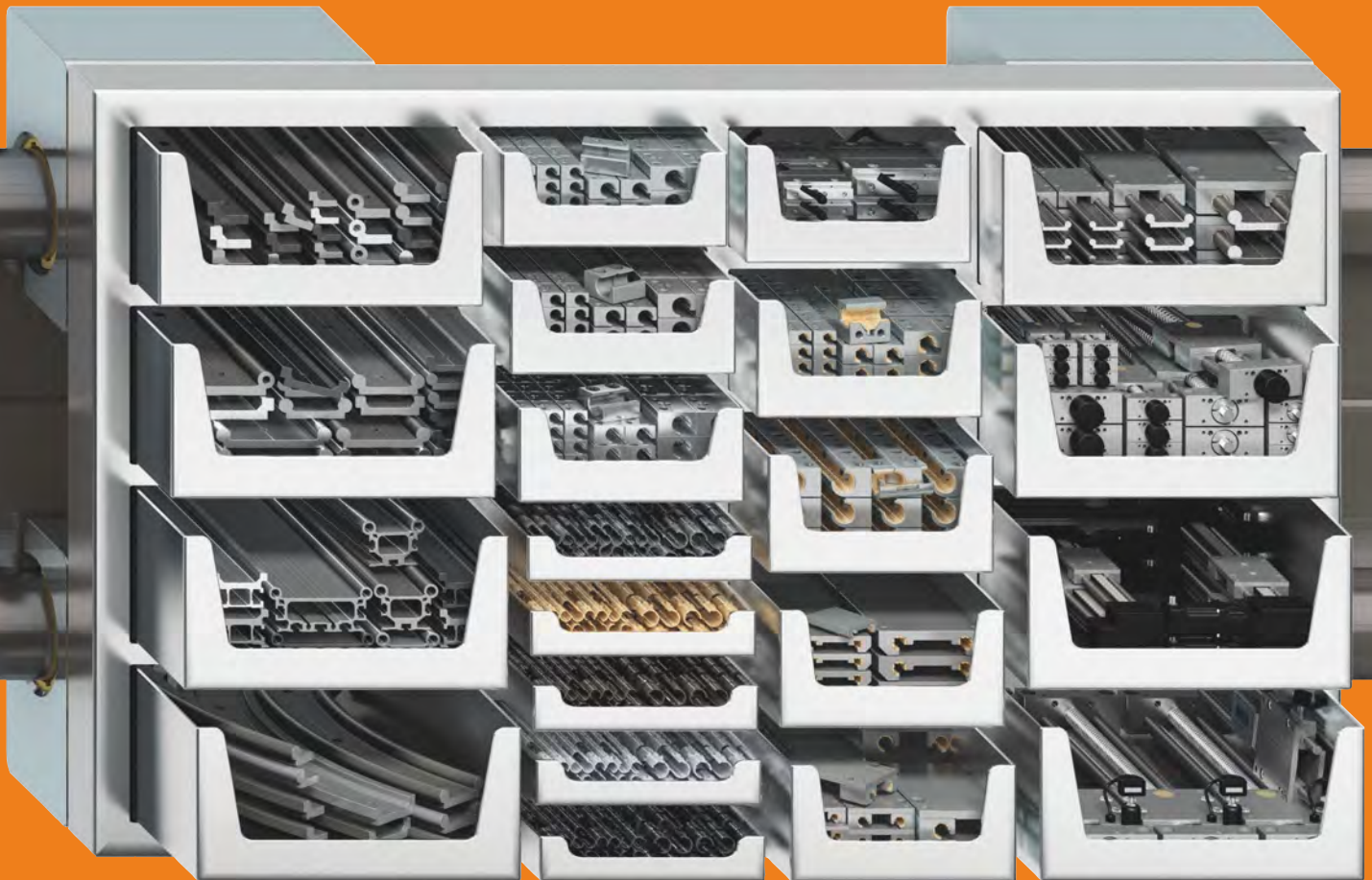
"Of course, there is always going to be some anxiety surrounding new software, but we find that the best way for our engineers to understand it better is to train them as early as possible."





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# MANAGEMENT BUY-OUT

## PRECISION SHEET METAL

manufacturer, Fife Fabrications, has secured a seven-figure funding deal from Royal Bank of Scotland to assist the company in undertaking a management buy-out.

The company will now be owned and operated by its four remaining directors John Penman, Craig McIntosh, Steven Smith and Roberto Morris, after they were supported by RBS to purchase the business from majority shareholder, Archie Smith, upon his retirement.

RBS has also assisted the company in creating and implementing a three-year business plan that focuses on employee development and an ongoing commitment to investing in cutting-edge technology.

John Penman, director of Fife Fabrications, said: "The support from Royal Bank of Scotland has been invaluable in advising on our management buy-out, progressing our business plan, and ensuring we continue to add value."

Ben Honeyman, relationship director at Royal Bank of Scotland, said: "It has been rewarding to work with a company so invested in its people and customers. An active member of 'Developing the Young Workforce', Fife Fabrications provides ongoing support for apprenticeships and skills development in the area.

"The business has an extremely positive impact on its local community and we wish the team ongoing success."



## MOVERS & SHAKERS

### NEW CHIEF EXECUTIVE FOR MERIDIAN

Dr Daniel Ruiz has been appointed to the role of chief executive of Meridian, the £100 million connected and autonomous vehicle acceleration programme, which was launched in September 2017. Dr Ruiz takes over leadership from launch director, Jim Campbell, who has successfully completed his assignment to establish the organisation.

### VERT ROTORS FOUNDER MAKES TOP 100 LIST

The founder and CEO of Edinburgh-based Vert Rotors, Oly Dmitriev, has been named in the Manufacturer Magazines' UK's Top 100 most inspiring individuals in the manufacturing sector. Dmitriev, who was also named 'Inventor of the Year' at the 2017 Made in Scotland Awards, invented the world's smallest low-vibration compressor for a range of applications including space and terrestrial applications.

### SUPPLY CHAIN PRESIDENT

Electrocomponents has appointed Debbie Lentz as president global supply chain. She will be responsible for leading the further development of the Group's supply chain capability. With her leadership team, Lentz is tasked with defining and implementing a strategy to create a flexible and responsive supply chain for customers and suppliers.



## SOLUTION TO LAST MONTH'S COFFEE TIME CHALLENGE

The solution to last month's challenge of how to stop someone with epic snoring skills comes in the form of a chin strap. While the device will make you laugh at the wearer, it has proven to help those with the impediment to keep the snorts and throat wheezes to a minimum.

The one-piece chinstrap is designed to hold the jaw in a stable position and prevent air flow through the mouth, meaning the deep inward breath necessary for an echoing snore, is stopped before it begins.

The EasySleep Pro's Anti-Snoring headband claims to have been clinically tested and proven to improve sleep quality by extending the REM phase, something difficult to achieve when the snore is turning it up to 11.

The headband is also made from a non-itchy, soft, flexible fabric that won't irritate the face, similar to sports supports. Reviews from sites such as Amazon give the EasySleep Pro Adjustable chin strap solutions 4.5 out of 5 stars as the average review.



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# ACCELERATING

From the 1950s to early 1960s F1 cars raced in national colours. British cars like Lotus ran in British racing green, Italian cars like Ferrari were painted Rosso Corsa and French cars were Bleu de France. The exception, of course, was Mercedes, which eschewed Germany's white paint scheme altogether and raced with bare metal to save weight.

By 1967, however, running an F1 team and developing a competitive car was becoming an unworkable expense. It marked a new era of sponsorship in the sport that began with the Lotus 49, the first Grand Prix car to not only feature logos, but also a title sponsor that dictated the colour of the car. Gold Leaf – a tobacco company – signed the lucrative deal, which stipulated the car adopt its colour scheme of red, cream and gold rather than British racing green.

Since then technology development and running costs have skyrocketed, and sponsorship has become a de facto part of modern F1. Top teams need a budget of around €450 million to be competitive, with up to 75% coming from sponsors. Less competitive teams operate with a much lower budget, around €150 million with 50% coming from third parties.

So, apart from the marketing collateral of sponsorship deals getting valuable air-time on TV screens around the world, what do sponsors get from the deal? The first thing to note is that most F1 teams have sponsors and also partners. For the most part, sponsorship gives access to drivers for adverts, branding on the car and drivers' overalls, and perhaps access to hospitality tents and the pits on race weekends. In short, it allows corporations to associate themselves with the F1 limelight.

For many smaller technology firms in UK industry, however, F1

**In the world of Formula One, what do the companies whose logos adorn the vehicles get out of the deal, and how does wider industry benefit from this symbiotic relationship? Tom Austin-Morgan reports.**

*Red Bull Racing has early visibility of beta-code, allowing engineers to report back any bugs before general release*

partnerships offer a much lower cost to entry and companies can get their technology pushed to the limit by some of the world's fastest moving and most capable engineers, mechanics, designers and drivers. It's far from one way traffic though, as teams rely on their partners' technologies to give them the tools that will make a car more competitive. Teams are constantly on the lookout for small innovations that could have an impact and can regularly be seen around the floors of UK engineering shows.

Stratasys is in the first of a four-year technical partnership with McLaren Honda after the team bought its first

Stratasys machine in September 2016. McLaren now has nine machines installed from the Fortus 900, Stratasys' largest FDM machine, to the more portable Fortus 450 that the team takes to each race in case it needs parts printed straight away.

The benefit for Stratasys is that McLaren needs very specific properties from the materials that it uses to make the components on its cars. High stiffness to weight ratios are required for structural components, for example, and suspension materials must be fine-tuned to find a balance of flexibility and toughness. To this end, McLaren constantly 'beta-tests' a range of materials that can

**Traditional industries are working within F1 to develop rapid design and change management capabilities to shorten product development cycles**



# INDUSTRY

have uses far from the pit lanes of the world's racetracks.

Amos Breyfogle, lead technical consultant at Stratasys, says: "Having people like McLaren explain to us what they need, and solving that problem, means they're really driving our technology roadmap.

"They use carbon fibre filled nylon for a hydraulic bracket. That is an incredibly stiff material for the weight, and it's something we can reliably produce for other industries as well, like orthopaedic inserts, prosthetics or end of arm grippers for manufacturing equipment. The data we get from the F1 side feeds into countless other industries. So, for us, the partnership is much bigger than just F1."

## RAPID DEVELOPMENT

The Red Bull Racing Formula One Team uses software from ANSYS and Siemens for simulation, design and communications. Siemens'

Teamcenter and NX PLM software are used to design everything from the individual components that make up the chassis of the cars right down to the crates used to transport tools, parts and sub-assemblies from track to track around the world.

"Red Bull has an extremely fast paced design cycle between races and seasons, with a very large number of design iterations," explains Jan Larsson, senior marketing director EMEA at Siemens PLM Software. "As such, they can influence what our final products are going to look like because we're always working to optimise the way in which engineers interact with our software from a workflow point of view to cut down on unnecessary work."

Larsson says Red Bull has early visibility of Siemens' beta-code, typically about 10 months before a product is released. »



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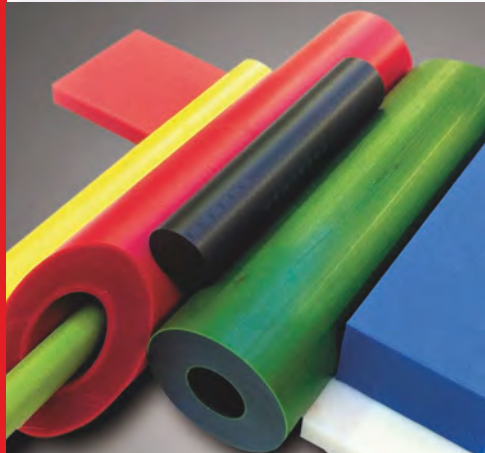
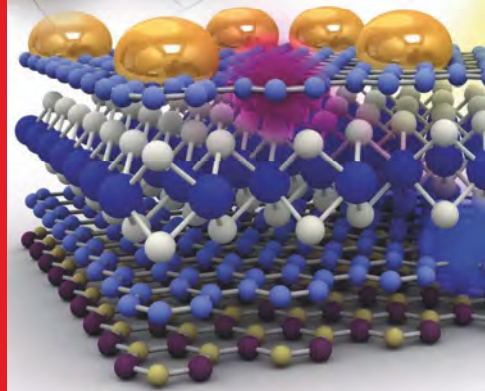
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» As such, Red Bull engineers and designers flag up any bugs that surface in the code so they can be fixed before the software makes it to general release.

He adds that Formula One isn't the only industry that requires up to the second data analysis. Increasingly, traditional industries are demanding rapid design and change management capabilities as companies shorten product development cycles and look to offer more product variants.

ANSYS also provides Red Bull Racing with beta-versions of its Fluent CFD software to help with the aerodynamic design of its cars but also to push the software to the limits of its capabilities and often beyond.

"Working with a Formula One team comes with big challenges," says Andy Wade, lead application engineer at ANSYS. "It's tricky because their use case is massive."

Part of the problem for ANSYS and Red Bull Racing is that the simulations are so large and complex they can't be run on a single computer. It means a cluster of computers needs to

be used, which essentially means multiple computers connected and working together to solve the problem. The sheer size, computation and datasets needed for these advanced simulations often push both the software and hardware to the limit.

"A lot of their design challenges don't tend to scale down to workstation sized cases," says Wade. "It means you really need to be on a cluster to overcome the issues they're facing.

"I've been working with F1 teams for more than 10 years and they're always well ahead of us in terms of hardware and capability. Sometimes they can send you cases and you just think 'Oh my god, what are we going to do with this?'"

Additionally, due to restrictions by the FIA on how much data a team is allowed to crunch through during a season, as well as the fact that current designs are highly sensitive, Red Bull

Racing can't send ANSYS current design problems. Generally, the use case geometries they can share are around 30 months old – which, »



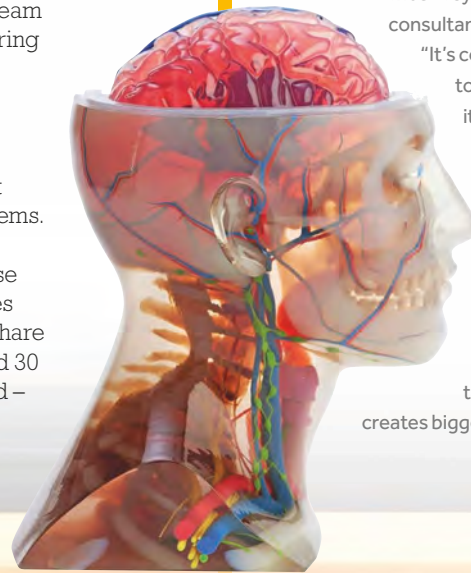
## F1 MATERIALS USED IN THE MEDICAL INDUSTRY

Stratasys' Agilus30 is a flexible, rubber-like material that McLaren has validated for use in parts around the suspension of its Formula One cars. However, the very same material has also been put to profound use in the healthcare industry.

Patients suffering from brain tumours can have their head scanned to produce a multi-material, 3D printed model, complete with hard bone, soft skin and blood vessels. This model can then be used by surgeons to practice the removal procedure so they can assess any difficulties they may face before performing surgery on the patient.

Amos Breyfogle, lead technical consultant at Stratasys, says:

"It's completely different to what McLaren use it for, but they've helped us test and validate it, allowing us to bring it to a wider audience. And if this works for the surgeons around the world that are using it, it creates bigger value for us."





» in F1 terms, is ancient history – upon which ANSYS would reproduce the issues and combat them.

Again, the relationship between ANSYS and Red Bull Racing is a partnership, meaning that Red Bull Racing engineers are meticulous in reporting bugs in the code of the software before it reaches wider industry.

Developers from both companies share information and best practice, meaning some of Red Bull Racing's IP finds its way into the alpha code of Fluent.

### BESPOKE DESIGN

SKF has been involved with F1 for 70 years and supports most, if not all, of the teams on the grid with a multitude of bearings and condition monitoring equipment.

One of the biggest challenges for SKF's dedicated Racing Unit is the speed at which the teams want to design, develop and test its products.



*3D printing steering wheels allows the complicated layout of buttons to be optimised for drivers*

Almost every bearing the company supplies into Formula One is 100% bespoke for the team and the application. The standard lead time for a fully-bespoke bearing is a couple of months, however if a bearing needs to be replaced after it has failed at a race weekend, SKF normally has a maximum of two weeks to create a replacement.

"It's quite different to any other industry in that respect," says Guy

Miller, a key account manager at SKF's Racing Unit. "In Formula One we're generally asked for things that we might think from the outset are impossible to achieve, particularly with things like short lead times.

"But, when factories have done it once for F1, they realise that they really can make something that quickly. So, when another customer outside of racing asks to do the same thing we already know it's possible. Without that experience with Formula One we'd have written it off from the outset and said, 'it can't be done'."

The most recent area in which racing technology has trickled out into other industries is ceramic

rolling elements. Racing was the first industry to develop ceramics with SKF around 10 years ago but now ceramic bearings are used in buses, trains and trams with significant interest being shown by the aerospace industry.

"Our ceramic rolling element production is going from 300,000 to 3 million," says Miller. "If you look a couple of years in the future that technology will be out and in use by all kinds of industrial applications."

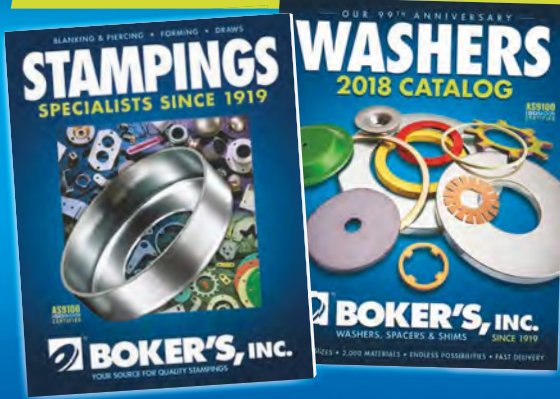
### HIGH SPEED WORK ETHIC

The pace at which Formula One engineers work, develop and apply technology reflects the breakneck 'right on the limit' performance that drivers exhibit during a race. It is by far the most aggressive in the automotive sector and just about anywhere in industry. This, it seems, is the biggest challenge and reward for the various partnering technology companies involved.

The partner names and logos emblazoned on the chassis of F1 cars are a badge of honour for engineers, proving they met the stringent time demands placed upon them. In such a high-profile sport, this is a massive validation of technical ability. It means that all-important television airtime provides not just brand awareness to keep the marketing department happy, but also acts as a ringing endorsement for the engineers involved on a huge platform from which to shout about it. **!**



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# ENGINEERING A BETTER WORLD

**Around the world, millions of newborns are at risk of lifelong disability and even death from easily treatable conditions. Solving these kinds of problems is what motivates Design that Matters (DtM). Justin Cunningham finds out more.**

**F**ounded in 2003, DtM is a non-profit organisation committed to innovative design that helps improve healthcare in underprivileged communities. The organisation began focusing on medical devices in 2010 – collaborating with leading social entrepreneurs and hundreds of volunteers to solve problems in global health.

DtM is recognised as an international leader in human-centred design, rapid prototyping and low-volume manufacturing, which allows the team to deliver breakthrough global health technologies to niche markets at a fraction of the traditional R&D investment.

For DtM, rapid prototyping is crucial. The process gives the company the freedom to experiment with numerous iterations of the overall medical device form factor, user interface and key components. And, with the right hardware, this process reduces product development time.

DtM recently started using the Lenovo ThinkStation P900 series, which allows them to generate three or four renderings in the time it used to take to do one. This turnaround is mission-critical to ensure the team can more quickly conduct user-testing in the field with doctors and patients to ensure they're delivering what they really need.

One example of this collaboration is DtM's work with medical device company Medical Technology Transfer and Services (MTTS). Since 2009, MTTS has used its local connections to direct DtM to hospitals in need for testing new medical devices. Now, DtM comes back to

*A newborn phototherapy device helping treat jaundice in low-resource hospitals.*



**“There are disconnects between the organisations or individuals that fund healthcare, those that select the medical equipment and those that use it.”**

those hospitals to test new device prototypes knowing doctors and patients will provide honest feedback that results in speedy adoption.

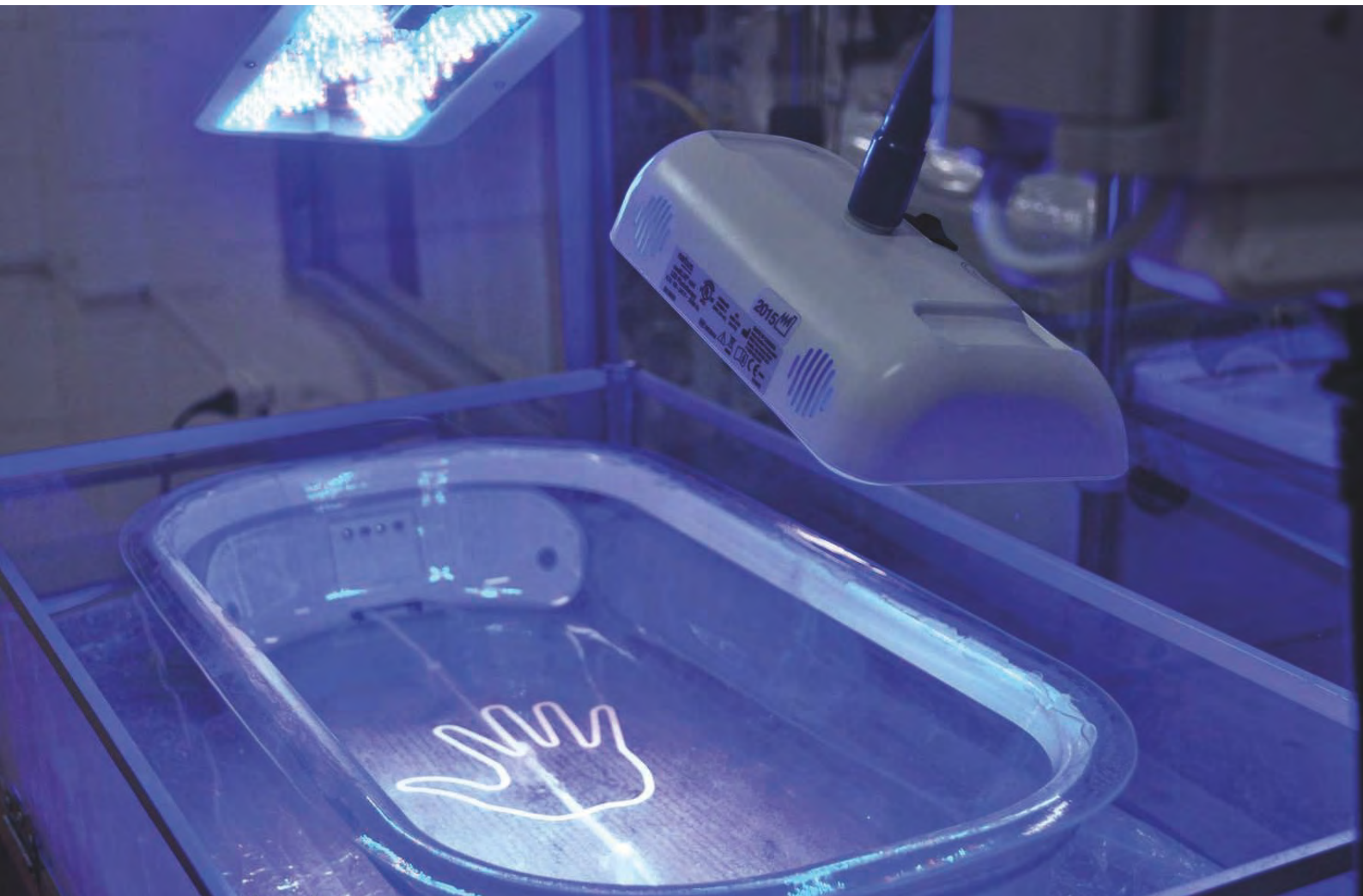
Over the years DtM has developed several notable devices including; Pelican, a portable pulse oximeter that allows low-skilled community health workers to quickly diagnose newborn pneumonia; Otter, a simple and easily cleaned newborn conductive warmer helping prevent hypothermia; and Firefly, a newborn phototherapy device for low-resource hospitals helping treat jaundice, which has been used by over 35,000 newborns in more than 20 countries to date.

Based on experience, DtM has learned that people aren't going to use a device unless it works within their context. Medical device standards are often written for US, European and Japanese use but when devices are placed in a rural hospital

in Africa there are often challenges to local adoption. For instance, large pieces of equipment with tiny casters assumes smooth floors and working elevators, which are often uncommon in underprivileged countries. To ensure products meet the needs of communities, DtM takes three steps: identify the opportunity, conduct design research and build partnerships.

First, the team looks at how the design of a device contributes to healing sick patients. Then the team researches everything including how to solicit feedback from countries that do not speak their language. To get the answers they need, the DtM team must know how to work with translators, frame questions and understand techniques for illuminating gaps between what people say and what they really do.

“One of the biggest challenges we see is that needs don't always



equal markets." says Timothy Prestero, CEO of Design that Matters. "There are disconnects between the organisations or individuals that fund healthcare, those that select the medical equipment and those that use it.

"On top of this, hospitals routinely receive donations of equipment they cannot use. In fact, the World Health Organization estimates that up to 80% of donated medical equipment is never used."

To combat this issue, Prestero and his team work closely with people in the communities they serve to ensure that every stakeholder is involved from the very beginning to avoid any miscommunication between the creators and the users. With this in mind, the team is able to consistently provide devices that meet the needs of those they serve.

To design these life-saving devices, DtM requires technology

*DtM is a small organisation making a huge impact with the help of the right technology and hardware.*

and hardware that is reliable anywhere – from its headquarters to rural clinics across the world. Along with its ThinkStation P900 series, Lenovo's mobile workstations offer DtM flexibility to do work in the field, allowing its members to share design updates on the fly.

"We're not sitting in an office developing product, we're out in the field understanding the environment it will be used in," says Prestero.


"Because of this, our hardware must be indestructible, with tremendous power so we can prototype quickly – and ultimately get the devices to them to start saving lives."

DtM is a small organisation making a huge impact with the help of the right technology and hardware. The non-profit also recruits numerous volunteers and students – exposing them to problems faced by poor communities and empowering them to realign their life trajectories to focus

on careers in the social sector.

"DtM is committed to increasing our results and impact by building the next generation of social impact designers," says Prestero. "We have a growing network of over 1,200 staff and volunteer alumni who have embraced the organisation's mission, and we will continue to recruit and train these future social sector leaders through our open, collaborative design process."

So, what's next? DtM may be developing ground-breaking devices now, but its overall vision is that each product developed will become the standard of care in low-resource settings. Once this happens, the non-profit will have the ability to focus resources on even more high-burden global health needs.

Prestero concludes: "We want to design for outcomes. Our mission isn't to make beautiful stuff – it's to make the world a better place." 

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# IMPROVING EXPERIENCE

**The use of metal-based additive manufacturing machines in hospitals is allowing medical professionals to pioneer the use of custom made implants for use within the NHS. Eureka! reports.**

**A**dditive manufacturing is a burgeoning technology in hospital environments. In the last few years, there has been a significant shift towards patient specific implants (PSIs), which previously would have only been used for very complex cases. Today, they are beginning to slowly be used in everyday practise.

PSIs can be produced by additive manufacturing (AM) in several different materials for medical applications, and it should be remembered that AM is still a relatively new technology for the medical sector.

AM offers several benefits over traditionally made implants, including fewer geometric limitations on implant design. Implants created using AM technology are built in layers from powdered metal resulting in fewer restrictions on what can be manufactured. What were extremely complex structures are

straightforward to manufacture using AM.

## ADOPTING AM IMPLANTS

AM implants are now commonly used in Southmead Hospital, Bristol, for craniomaxillofacial (CMF) procedures.

Prior to adopting the AM implant technology, the prosthetics team would produce a 3D model of the patient's skull from a mould made of dental plaster and stone. This would be used to press a sheet of titanium to form the implant.

Additive manufacturing eliminates the need to make a mould as the implant is produced on an AM machine using digital data, speeding up both the design and manufacture processes.

Models required for surgical planning can also be

printed from a patient's CT data and can be integrated with surgical planning software to produce a digital 3D visualisation.

From my experience, I have found it very straightforward to adapt to the new technology. However, it is important that work continues to develop on more advanced software packages, as current options require highly trained and experienced members of staff to do the design. In Southmead Hospital, we use a platform called Geomagic Freeform Plus to design the implants.

In future, software packages such as ADEPT, available from Renishaw, will make the design process even more straightforward. ADEPT is computer-aided design software that has been specifically

created for the rapid design of craniomaxillofacial, PSIs by metal 3D printing.

Once an implant has been designed, the hospital can send the design to a third-party company, such as Renishaw, for manufacture. Additive manufacturing produces precise guides, models and implants to the surgeon's »

**Once an implant has been designed, the hospital can send the design to a third-party company, such as Renishaw, for manufacture**

» specification, which can improve the outcome for the patient as it allows for a quicker procedure, less surgery time and an accurate fit with good aesthetics.

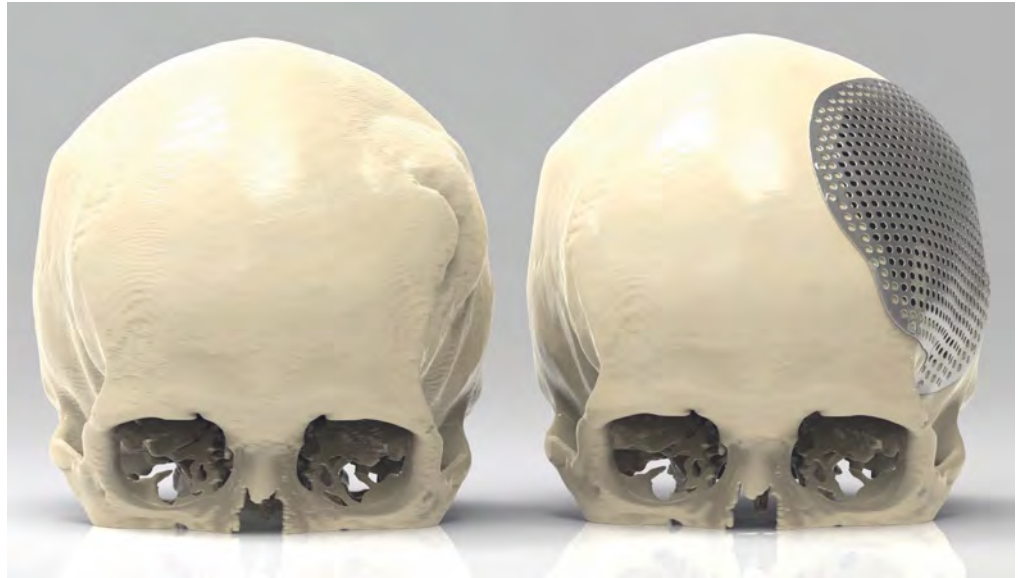
**OPENING DOORS**

Additively manufactured implants are helping to improve treatment processes and decrease procedure revision numbers and times, which can also reduce costs for the NHS and provide better patient outcomes.

There can be greater benefits in more complex cases, however AM technology can still help to streamline surgery for less complex procedures. Surgeons are able to carry out careful pre-planning, which means they have reduced spans of problem solving during surgery.

The implants offer improved treatment processes for patients. One major advantage is the reduction in the number of procedures a patient may need. Traditionally, if a patient had a particular cranium tumour, a surgeon would first have to remove the tumour and close the wound. The patient would then require further CT scans to determine the size of the cranial plate needed. The surgeon would then perform a second procedure to insert the implant.

By using surgical planning software and AM technology,



**ABOUT THE AUTHOR**

*Amy Davey is a reconstructive scientist at North Bristol NHS Trust.*

the surgeon can pre-plan before surgery. Custom AM surgical guides and implants are also created before surgery. The guides allow the surgeon to remove the tumour and place the cranial plate, in one surgical procedure, with precision.

Improved surgical planning streamlines the surgery process leading to a reduction in theatre time, which in turn can reduce NHS costs.

In order for the technology to reach its potential, industry and healthcare need to work

together to progress it further by developing a body of evidence demonstrating the efficacy and benefits both to the hospital and patients.

It is also important that early adopters of the technology, such as the team in Southmead Hospital, apply their knowledge to drive the technology forward to also reinforce that the additive manufacturing of implants could improve not just patient care but could also be of

financial benefit to health services. **!**

**CT SCAN DATA DRIVES IMPLANT DESIGN**

Replacement jaw implants have been made to treat temporomandibular joint endoprotheses, which severely reduces many facial senses.

Typically, implants are made from medical Grade-5 titanium alloy Ti6Al4V by direct laser metal sintering. For its surgical guides and implant models, a biocompatible polymer PA 2200 (also known as Nylon-12) is selective laser sintered.

Medical CT scans are the basis for preparing the CAD model, while inspection of AM parts is carried out with a Nikon Metrology industrial, high

voltage, micro-CT scanner.

Milda Jokymaitytė, clinical engineer at Ortho Baltic explains: "To create anatomical models, 3D reconstruction engineers use the patient's radiological data to perform a 3D reconstruction."

A Nikon Metrology XT H 225 micro-CT scanner is used to monitor the quality of the final part and inspect the external geometry and internal structure. The inspection uses a 225kV micro-focus source that non-destructively reveals any voids, cracks and other defects of the complex internal features

of the AM components.

Domantas Ozerenskis, product quality manager at Ortho Baltic, adds: "Micro-CT scanning is the only way to non-destructively check for voids and cracks inside a part.

"We considered a coordinate measuring machine, but it is inconvenient for taking non-parametric measurements and there is no possibility for inner structure investigation.

"The internal quality of implants is very important, as it



determines the part's mechanical strength."

After 3D metal printing, post-processes such as sandblasting and polishing can remove thick surface layers up to 200µm – even more in the case of other manual processes. It means micro-CT data can also help adjust CAD models to reflect a part's final geometry.

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# CRITICAL TIMING

**Despite the internal combustion engine (ICE) coming under fire in recent months, it hasn't stopped ongoing work to make all ICEs cleaner and more efficient. Justin Cunningham finds out how.**

It might well be the beginning of the end for ICEs, but make no mistake, it will not be a quick death. Expect petrol, and possibly diesel, engines to continue to play a decisive role within the automotive industry for at least the next 10 years.

Iterative improvements within ICEs have predominantly come from smaller component part improvements, such as bearings, but also in the precise and adjustable control of components like valves.

The aim of many engine makers today is to take out the variability that a driver can have on emissions and efficiency, without taking over or limiting the amount of acceleration available.

Precision engineering manufacturer, Schaeffler, has been a long-term supplier of engine components and over the years it has increasingly taken on more of the development work for engine builders. The firm has been working on different types of variable valve trains and has long

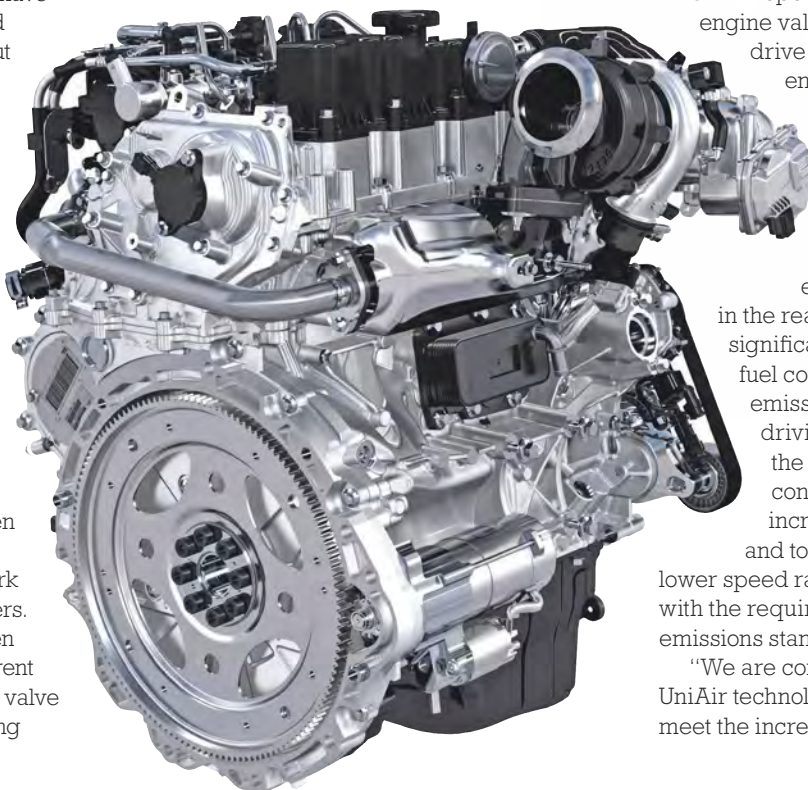
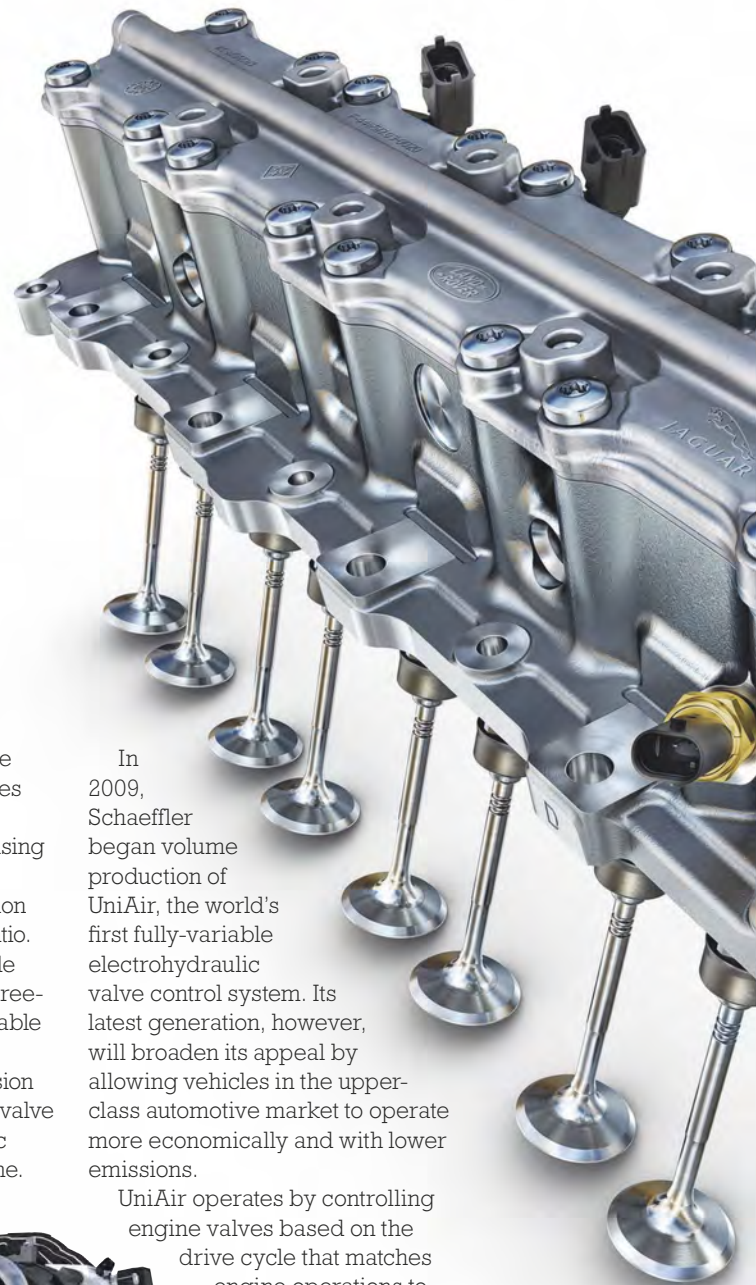
made a distinction between valve train systems with variable phases and those with variable lift.

It says, variable camshaft phasing units that adjust the phases can influence exhaust gas recirculation and the effective compression ratio. Meanwhile, systems with variable lift can have a discrete two- or three-step lift actuation or be fully-variable depending on the throttle input during acceleration. The conclusion is that fully-variable mechanical valve trains such as BMW's Valvetronic can't meet future challenges alone.

In 2009, Schaeffler began volume production of UniAir, the world's first fully-variable electrohydraulic valve control system. Its latest generation, however, will broaden its appeal by allowing vehicles in the upper-class automotive market to operate more economically and with lower emissions.

UniAir operates by controlling engine valves based on the drive cycle that matches engine operations to specific situations and requirements. In essence, the technology makes it possible to achieve laboratory efficiency figures in the real world, meaning significant reductions in fuel consumption and emissions, regardless of driving style. It's claimed the system reduces fuel consumption by 10%, increases power by 10% and torque by 15% in the lower speed range while complying with the requirements of the Euro 6 emissions standards.

"We are continuously developing UniAir technology in order to meet the increasing demands of







**Fast and precise control of the valves allows an increase in torque without impairing efficiency due to the significant retardation of the ignition timing**

its optimised mass design means that the engine can operate in an even broader spectrum of the engine data map with optimum efficiency.

Another advantage of the technology is the fast and precise control of the valves to match the relevant cycle, which allows an instant increase in torque without impairing the efficiency of the engine due to the significant retardation of the ignition timing.

Ron Lee, powertrain director within the development department of Jaguar, explains: "The new generation of Ingenium diesel engines are wholly designed and manufactured in-house. No opportunity has been missed in ensuring their design is right on the cutting edge of technical advancement."

With the new Ingenium diesel engines driving the rear wheels, the aluminium-intensive XE is the most fuel-efficient Jaguar yet, with CO<sub>2</sub> emissions from just 99g/km. The new XE will feature two versions of the 2.0-litre Ingenium diesel. The first, rated at 163PS/380Nm, delivers benchmark efficiency figures of 75mpg and 99g/km CO<sub>2</sub> without any compromise to launch performance or mid-range acceleration. The 180PS/430Nm variant has one of the highest torque outputs in the class.

Variable exhaust valve timing also shortens the catalyst light-off phase and improves diesel particulate filter (DPF) regeneration. The cooled low-pressure exhaust gas recirculation (EGR) system reduces combustion chamber temperatures, inhibiting NOx formation. Selective catalytic reduction (SCR) technology cuts NOx emissions to very low levels and the new XE has been engineered to meet the most stringent global regulations.

The Ingenium range is produced at JLR's £500 million, 100,000m<sup>2</sup> Engine Manufacturing Centre in the West Midlands. **1**

our customers to produce engines that reduce fuel consumption and emissions," says Professor Peter Pleus, the chief executive of Automotive at Schaeffler. "Since its development, market interest in the system has steadily increased. The fact that other automotive manufacturers are using this innovative technology provides us with a source of recognition and of motivation to continue along this path."

By using UniAir, controlling the modern combustion processes, such as Miller and Atkinson cycles, can also be realised in accordance with manufacturers' requirements. The modified Atkinson cycle uses late intake valve closing (LIVC) and the Miller cycle extreme early intake valve closing (EIVC) to increase fuel economy.

The latest generation of UniAir technology combines for the first time two hydraulic camshaft phasing units. This additional degree of freedom offered by the system with

## CONSTANT AND IMPACT-FREE TORQUE

Mayr Power Transmission has developed a product tailored to the requirements of PET filling plants to apply plastic screw caps with pre-formed threads onto the plastic bottles so that they close tightly, but can be easily opened later on.

Rustproof hysteresis ROBA-capping head devices generate a constant and impact-free torque due to its magnetic clutch that works according to the hysteresis principle. In normal operation, it transmits the set torque synchronously from an input onto an output element. The torque is generated through magnetic forces, which are produced by permanent magnets and which magnetise hysteresis materials. Here, the torque transmission takes place contactlessly.

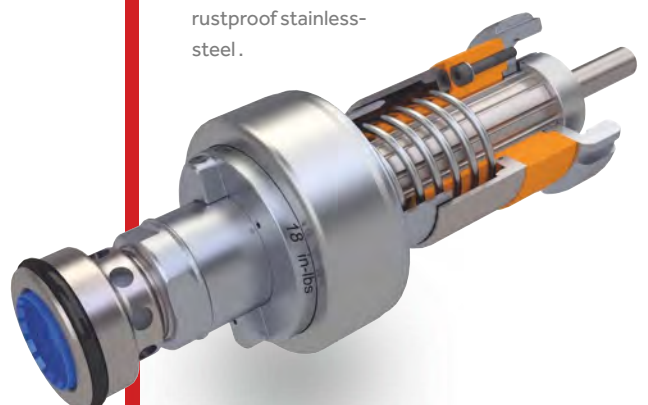
The magnetic clutch features synchronous running, meaning that it does not slip. Only at the end of the capping process, when the cap has been screwed on does the clutch slip at the predetermined torque.

Here, the hysteresis technology ensures contactless and therefore wear-free torque transmission, meaning no contamination is generated through friction, which is ideal for use in the food industry.

"The ROBA-capping-head achieves a high torque consistency and repetitive accuracy through a special contactless seal labyrinth," says Oskar Fleischmann, a research and development engineer from Mayr Power Transmission. "These sealing systems influence the capping torque both through speed and temperature fluctuations and through friction value changes in case of aging and wear on the sealing elements.

"Our capping clutches also feature a substantially softer torque build-up than conventional commercial products, which ensures a better capping result and also reduces the vibrations along the entire driveline."

The clutch is available in a rustproof stainless-steel.



# MAKING A MEASURED CHOICE

The trade-offs between pneumatic, hydraulic and electromechanical linear actuators are seldom understood. Here, Eureka! gives a rundown of key criteria when making the selection for your next project.

Linear actuators are used in many applications around industry. Pneumatic, hydraulic and electromechanical technologies are the primary options for providing linear actuation but the selection and use of these technologies depends greatly on technical knowledge, budgets, available energy sources, and careful consideration of the performance trade-offs of different approaches.

For example, pneumatic actuators don't deliver high force output, but are practical when a cost-effective, easy start-up is required. Conversely, hydraulic linear actuators are suited to high force applications but generate a lot of noise. And, while electromechanical actuators are quieter, they are much more difficult to install and maintain.

So, what are the considerations and trade-offs when selecting linear actuators for a linear motion application?

## PNEUMATICS

There have been several recent improvements in pneumatic design, including positional feedback capabilities from proximity and linear position sensors. Better sealing has also allowed pneumatic linear actuators to be used more often in

challenging environments or applications requiring wash down.

However, pressure losses and the compressibility of air can make pneumatics less efficient than other linear technologies. While the speed ranges from a couple of centimetres per second to 150cm/s, force output is dependent on the maximum pressure rating and related bore size. Typically, however, pneumatic actuators have a maximum pressure rating of 10bar with bore sizes ranging from 12 to 320mm for approximately 80N to 80kN.

## HYDRAULICS

Hydraulic systems therefore have a much higher possible force output, with typical pressure ratings up to 210bar with bore sizes ranging from approximately 12 to 355mm translating to about 220 to 171,000N of force. Hydraulic actuation also generates a significant amount

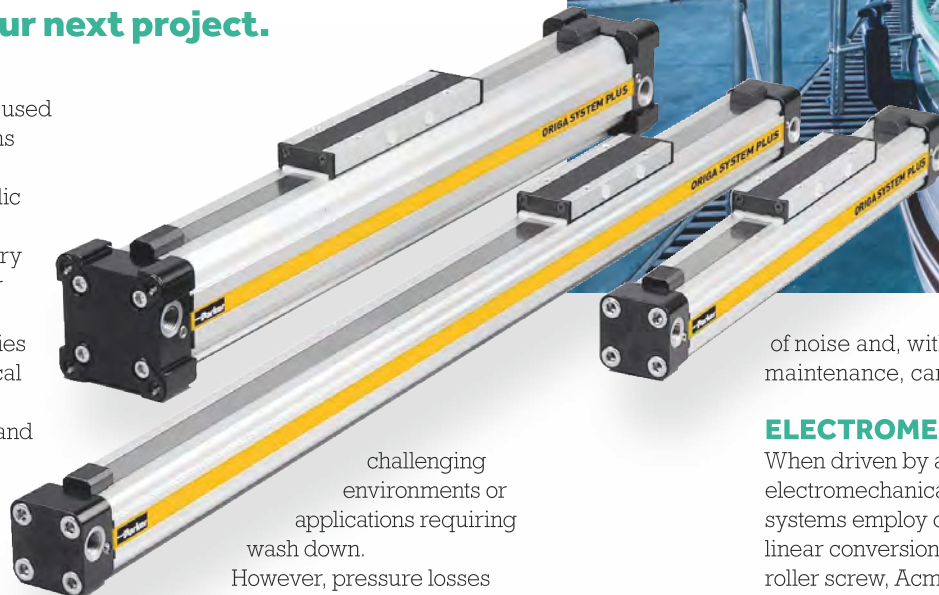
of noise and, without proper maintenance, can leak.

## ELECTROMECHANICAL

When driven by a rotary motor, electromechanical linear actuators employ one of four rotary-to-linear conversion systems: ballscrew, roller screw, Acme (lead) screw, or belt drive. In addition, a linear motor can be used to provide motion.

A linear motor is similar to a rotary motor, but the motor coils make up the forcer. Depending on the design, one or two rows of magnets comprise the magnet track. In a rotary motor, the rotor spins while the stator is fixed, but in a linear motor, either the forcer or the magnet track can be the moving component, which is then integrated with an appropriate linear bearing. By sending electrical current to the forcer, the resulting magnetic field interacts with the magnet track and drives the linear motor carriage back and forth.

Linear motors have high dynamic performance, with acceleration of greater than 20G at velocities of 10m/s or higher. Due to the direct drive nature of linear motors, there are no



## ABOUT THE AUTHOR

Rebecca Hammes is business unit manager for actuators at Parker Hannifin.



Picture Credit: i06photo/Getty Images

**Selecting linear actuators for an application greatly depends on technical knowledge, budgets, available energy sources, and performance**

mechanical components to add backlash, torsional wind-up, or other positioning errors. Sub-micron resolution and repeatability are achievable and as the motor is directly coupled to the load, there are fewer components to fail, which adds long-term reliability.

### BALLSCREWS

Most linear motion applications, including positioning tables, convert motor torque to linear thrust using ballscrews. They are characterised by high thrust (up to 9000N) and they generate high speeds at shorter stroke lengths – up to 1.8m/s. Ballscrews can be precise from 10 to 50mm and some manufacturers rate them for 100 to 2,500km of total lifetime travel.

Sometimes, their bearings ride on the flights or leads of the screw for 95% efficiency or better.

Rolled ballscrews are lower cost, whereas ground ballscrews deliver higher critical speeds. In some models, re-engineered recirculating ball tubes are designed especially for

screws, including lubrication seals on the ball nut end, which reduces noise as much as 7dB.

### ROLLER SCREWS

This is the most recent evolution of the ballscrew. The latest roller screws incorporate multiple roller bearings in the nut, which operate like planetary gears around the screw itself. Roller screws provide high efficiency, duty cycles exceeding 50%, and acceleration from 1 to 2G. Typical stroke lengths range from 5mm to 2m; speeds can reach 1.8m/s. In short, roller screws have the speeds of ballscrews, but possess much higher thrust capacity and force density.

Roller screws are used in many small machine presses and injection moulding machines. The downside of roller screw technology is its low availability because the technology is relatively new, so lead-time and prices are generally significantly higher than ballscrews.

### ACME SCREWS

Acme screws, also known as lead screws, are one of the simplest and lowest cost mechanisms for converting rotary power to linear. However, because there are no rolling ball bearings, they transfer only 30 to 50% of the motor's energy to driving the load. The remaining energy is lost to friction and generated heat. Heat limits the duty cycle of Acme screws to less than 50%. Despite this, Acme screws are useful for applications with low speeds and duty cycles below 50%,

and those that must hold position while the motor power is off — such as while holding a vertical load.

### BELT DRIVES

Belt drives offer many of the benefits of ballscrews, but have fewer moving parts and no critical speed limitations, making it suitable for higher travel speeds with minimal component wear. Belt drive designs, however, have lower repeatability and accuracy.

Some product designs allow tensioning at the carriage. Others allow tensioning at the idler end cap of the actuator, because it eliminates the need to remove any load while tensioning the belt.

### MAKING A MEASURED CHOICE

Designers can take four main categories of requirements into consideration when choosing a linear actuator: Precision, Expected life, Throughput and Special considerations (PETS). For example, if precision is considered to be the most important factor, a linear drive or a precision ball screw will be more suitable for the job, but is likely to be more expensive. Where precision is not a high priority, a belt drive may prove to do the job more economically.

Placing a priority on one type of application parameter could mean that performance in another area might be sacrificed, but nevertheless all the decision making categories should be carefully weighed up before making the final choice of actuator equipment. 📌



# EASY IoT

**Condition monitoring and predictive maintenance are certainly not new, but as the cost of entry drops, we ask if IoT is really about making the technology accessible to the masses? Justin Cunningham reports.**

**W**e all get the concept of Industry 4.0 and the Internet of Things. But, while we are told that the next components we buy are 'IoT-ready' or 'Industry 4.0 compatible', what does it actually mean? It seems collecting data is one thing, but making sense of it and unlocking hidden insight is quite another.

ABB's Motors and Generators is on a mission to make its motors past and present not just IoT capable, but IoT operational by offering an easy to install retrofittable sensor known as the Ability Smart Sensor. But, how exactly is this different from the idea of condition monitoring and predictive maintenance?

Jonas Spoorendonk, global product manager of the ABB Ability Smart Sensor, explains: "This is not doing anything that couldn't be done before. It's just doing it cheaper, better and making it simpler to install.

"This sensor works with any motor old and new, large or small, variable or constant. It is an industrial Fitbit that you put on an electric motor to take measurements with cheap and simple equipment to calculate what that means for the health of the motor."

Broadly speaking, The Ability Smart Sensor is about optimising the operation of motors, monitoring efficiencies and minimising the risk of unplanned and unexpected downtime.

The wireless sensor is fitted using an adhesive putty that is stuffed between two heat vanes on a pump's housing, upon which a wedged shaped bracket is inserted and held in place. The sensor simply attaches to the bracket and can be turned on.

It can be installed and running within 10 minutes.

Once attached, the sensor measures vibration, temperature and the motor's magnetic field, making measurements once an hour for its design life of five years. Though more or less frequent measurements are possible, this correspondingly affects battery life.

That data is sent via Bluetooth to a smartphone based app, which is able to calculate the speed and energy consumption and log this data over the long term for easy graphical comparison.

Only raw data is stored in the sensor itself, meaning that the app is needed to analyse the data in the cloud to calculate the various performance attributes and provide analytic insight such as a gradual decline in efficiency that points to the need for a service or a vibration that

*The low-cost Ability Smart Sensor is easy to install and provides powerful analytics and insight.*

indicates a looming failure.

"If you have an engineer walking around a factory and doing weekly condition monitoring checks, for example, in between his checks he doesn't know what happens," says Spoorendonk. "But now you can have a measurement every hour and a trend curve showing historic data that you can access via the app. And you can see how a trend is developing and if anything odd is happening.

"This is not replacing the maintenance professional, but it is doing things to make them more efficient, gain better insight and allow





**“It is an industrial Fitbit that you put on an electric motor. This sensor works with any motor old or new, large or small, variable or constant.”**

early warnings of future problems.”

Engineers simply need to get within a few metres and connect via a smartphone or tablet to the sensor to pick up the data. Many people are using the sensor as an early warning system with safety, downtime reductions and energy saving noted as the typical benefits.

“If you shift from reactive to proactive maintenance,” says Spoorendonk, “you can reduce maintenance by as much as 70%, extend motor lifetime by as much as 30% and cut energy consumption by up to 10%.”

The sensors work under a ‘traffic light system’, so green is operating normally, amber indicates there could be a problem, and red means there is a problem.

“Early warning systems help you to mitigate risk,” says Spoorendonk. “Imagine having a flight recorder on equipment.

“We put this on motors and we can also put it on the pump. We can even monitor the transportation during delivery. If you have a warranty case, it is there as a flight recorder. You go there and pull out the data.”

ABB is selling the Ability Smart Sensor as a retrofit kit for around £300, although the price is unconfirmed, and that buys a sensor, the pieces needed to mount it on your existing motor and then a two-

year subscription to ABB’s web portal and smartphone app that provides the analytics and insight. After two years, users have the option to extend the subscription to the app and web portal.

However, one question this does throw up is the common worry of who owns the data? It’s an IoT minefield but ABB want to keep its solution as simple as possible.


“You buy the sensor and receive it,” says Spoorendonk. “When you receive equipment, it is shipped in flight mode. You activate it and commission it on the motor if it’s a retrofit, for example. In that moment, the data is only sharing data with you. You have the control. You then decide who to share it with.

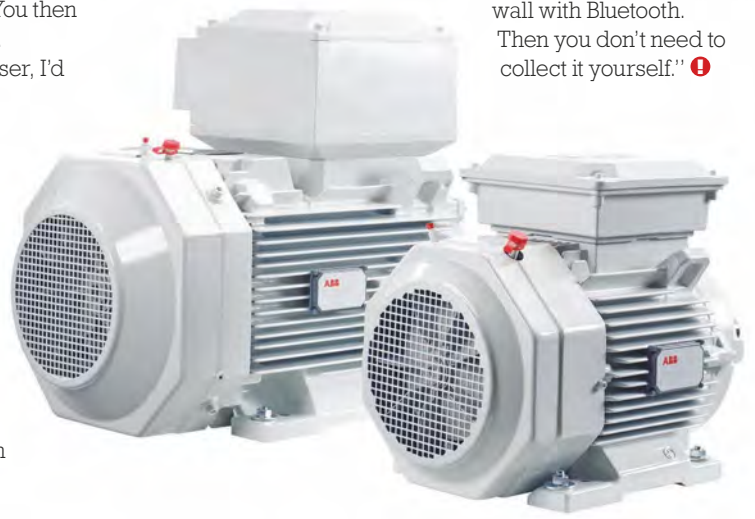
“If you are not the end user, I’d imagine the end user will have an opinion on that as well. And they might want visibility of that data too. Maybe they want to share the data with us so we can help, but it is up to them what they share.”

### **SECURITY AND STORAGE**

The data is stored on the ABB Ability Cloud, which in turn is based on Microsoft

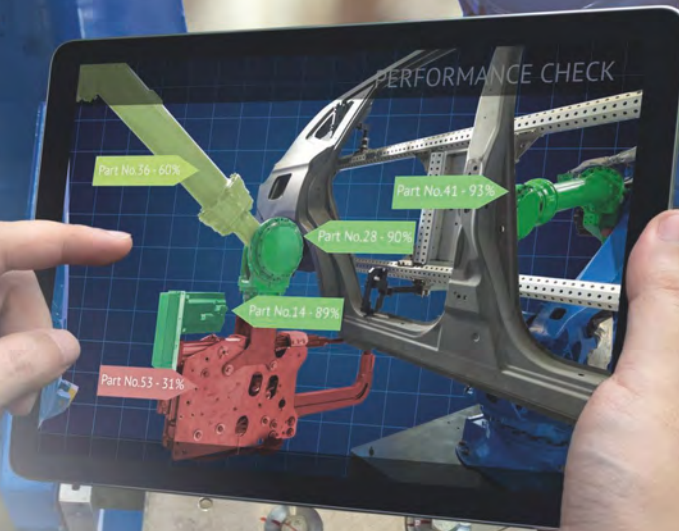
Azure. Then, the communication between the sensor and the phone is encrypted and the communication between the phone and the cloud is the same. The cyber security, according to ABB, is as good as it gets.

“The scalability is nice here,” says Spoorendonk. “You don’t need to tear down a factory and rebuild it. You can get IoT and start with just one motor. And if you like it add five more. Then add 50 more, or 500, but at some point it becomes cumbersome to go around with a mobile phone and collect data from each individual sensor so you then get a gateway or router hanging on the wall with Bluetooth. Then you don’t need to collect it yourself.” 



# AUGMENTING THE WORKFORCE

If VR is about improving visualisation in the digital world and IoT about connectivity, AR is about blending digital capabilities with the physical world



**W**hen it's reported Apple is assembling a large team of specialists in virtual and augmented reality (VR/AR) to build headsets to rival Oculus Rift and Microsoft's HoloLens, it suggests there is a shift towards real commercial deployment.

AR and VR have different use cases, technologies and market opportunities. While VR is completely immersive, with the user entering a virtual world via a headset which cannot be seen through, AR overlays digital imagery onto the real world.

AR, when combined with wearable technology, can offer a hands-free computing environment that gives users a greater level of interaction between digital information and the real world. And AR is not just for gamers or consumers, it is aimed squarely at technical and skilled workers from engineers to architects.

## IMPLEMENTATION

AR is forecast to go well beyond 'Google Glass' by enabling increased collaboration between AR/VR and IoT developers. If VR is about visualisation and IoT about connectivity, AR is about blending our digital capabilities with the physical world.

Industry is already one of the strongest adopters of AR, leading to some reconsidering product plans. In fact, many businesses are expected to soon place smart glasses at the core of their IoT systems, as they look to make workers more productive and to streamline their backend operations.

Valerie Riffaud-Cangelosi, new markets development manager at Epson, says: "Deploying AR will enable more efficient processes by enhancing the reality of the user, so they'll be able, for example, to maintain an engine or a complex electrical board in an intuitive and easy way. They'll be able to see inside the device and act on the information there and then.

"Epson unveiled its first AR product – the Moverio BT-100 – six years ago. Today, our BT-300 smart glasses offer video and access to new AR experiences for a variety of commercial and vertical market applications."

The Moverio BT-300, unveiled at Mobile World Congress in Barcelona, 2016, employs a variety of

## As the technology around augmented reality improves, companies are increasingly keen to implement the technology among the workforce. Neil Tyler reports.

technologies and can project in-line digital content into the wearer's field of view.

According to Riffaud-Cangelosi, the most significant advance with the BT-300 is a proprietary micro display projection system called Si-OLED (silicon organic light emitting diode), which can produce deeper and truer black tones. That's important because a true black projected onto lenses of smart glasses equates to the sense of colour. Therefore total transparency means the latest Si-OLED displays are able to blend projected digital content more realistically.

The glasses weigh just 60g and the use of Android 5.1 has expanded the complexity of the apps that can be written for the glasses.

## FUTURE DEVELOPMENTS

AR headsets are expected to evolve from the current type of eyewear to much sleeker devices like contact lenses and, in the distant future, it could be possible to make AR implantable with apps having direct access to the nervous system.

One key technological challenge, especially for mobile AR, is packaging the components into a compact, sleek and lightweight format that people can wear comfortably all day. Additionally, AR headsets must remain cool, which brings additional power and thermal constraints.

"For a true mobile AR system, there is still not enough computing power to create stereo 3D augmented reality graphics," argues Radhika Arora, ON Semiconductor's IoT product line manager. "Laptops are just about starting to be equipped with the necessary graphics processing units and both sensors and haptics will play

a critical role in future adoption.

"For image sensors, getting the form factor more compact will be key as well as improving their performance in varying light conditions."

But while the future may witness fashionable eyewear, AR developers need to focus on a common interface that integrates with wearables in use today, whether that's a pair of glasses or even a smartphone.

"AR is still very new, with limited market penetration," says Adam Kerin, Qualcomm's senior manager of marketing. "But as the technology advances and the form factor decreases, we can expect to see it evolving into a seamless experience that users will interact with daily.

"We're continually adding more functionality to better support AR use cases. It is very challenging to implement because of the processing complexity and latency issues, along with requirements for improved sensors and new display technologies.

"A lot of the technologies that are relevant for smartphones are applicable for AR, whether it is computer vision, graphics, image processing, audio processing, latency optimisation or low power processing."

As AR expands from mobile phones and tablets into wearables, it's crucial that advanced and compute capable feature sets are retained whilst silicon area and development costs are reduced.

"Imagination's technologies are already deployed in a range of glasses with some AR features and new technologies like our PowerVR GPUs enabling more usable and efficient future generations of wearable AR devices," says David Harold, senior director of marketing communications with Imagination Technologies.

"Beyond multimedia, another important consideration is connectivity. A lot of AR devices will incorporate wifi and companies can reduce BoM costs and power consumption by integrating this functionality onto a SoC, rather than a chipset."

Sensors and processors will also need to be able to effectively process complex AR functions such as predictive head motion tracking and reduce 'motion to photon' latency. **!**



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# MAXIMISING THE BENEFITS

**The UK's engineering and manufacturing sectors are world famous for their expertise and ingenuity, yet infamous for being behind other sectors when it comes to claiming R&D tax credits. Here, Eureka! puts forward why you should claim.**

**T**he latest Government statistics show that, to date, over £14 billion in R&D tax credits has been claimed across all sectors but only a tiny proportion of this has been claimed by the engineering and manufacturing sectors.

So, what are R&D tax credits? Put simply, they're a Government initiative to encourage companies to invest in developing innovative processes and technologies. And, for qualifying expenditure, the benefit in claiming can equate to up to 33p for every £1 of costs incurred.

They can be claimed by any UK trading company and the claim is made annually together with the company tax return. If you have missed a claim it is possible to go back up to two years to make one.

There are some telltale clues that identify what counts as R&D in the eyes of the Government. For a start, are there specialists working on a project? If so, are they having to spend time trying to solve technical difficulties or uncertainties? Do the contracts contain extensive retention and indemnity clauses? Any one, or all, of the above point towards the potential for R&D qualifying activity and could be claimed for.

Some text book examples of R&D work in engineering or manufacturing include developing new processes to meet the latest Government legislation, work that



involves prototyping, working on the interaction of two or more new technologies or materials, development of new

equipment to fulfil a project or other commercial use, developing materials that are cheaper or greener, developing new packaging bespoke to a particular product or purpose such as maintaining a specific temperature or a lower weight to what is currently available. Finally, is there a ready-made solution or alternative to what you are doing on the market? If not, this is an indicator of R&D qualifying activity.

Many costs are claimable including employee costs of those

*Identifying what qualifies for tax credits is not as difficult as you might initially think.*

## ABOUT THE AUTHOR

*Richard Marsh is tax partner and head of tax at RPG Crouch Chapman*

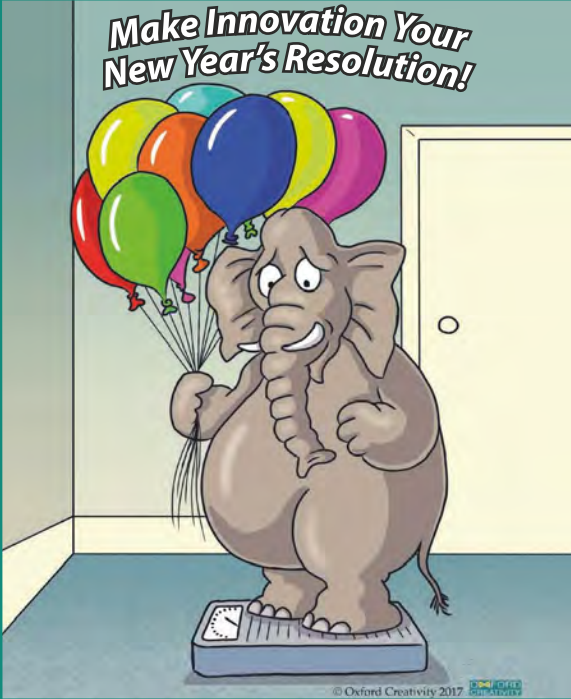


carrying out R&D activities, including salaries, employers NIC and pension contributions; directors costs if they are involved in the project; support staff if they are engaged wholly or partly in supporting the R&D; agency staff; materials used in carrying out the R&D, such as those for prototyping or testing; materials that are consumed or transformed as part of the R&D; costs of electricity, gas, water and other fuel directly relating to the R&D can be claimed; software to enable the R&D; and even some subcontractor costs.

If you think you are eligible to claim R&D tax credits or are already claiming them, speak to your accountant to ensure they are experienced in preparing R&D claims for your sector as, if they are not, you are likely to miss out on valuable parts of your claim. **!**

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**3D Electromagnetic Field Solver**

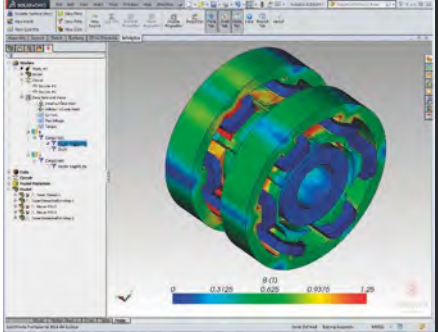
**Infolytica - MagNet for SOLIDWORKS**

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.

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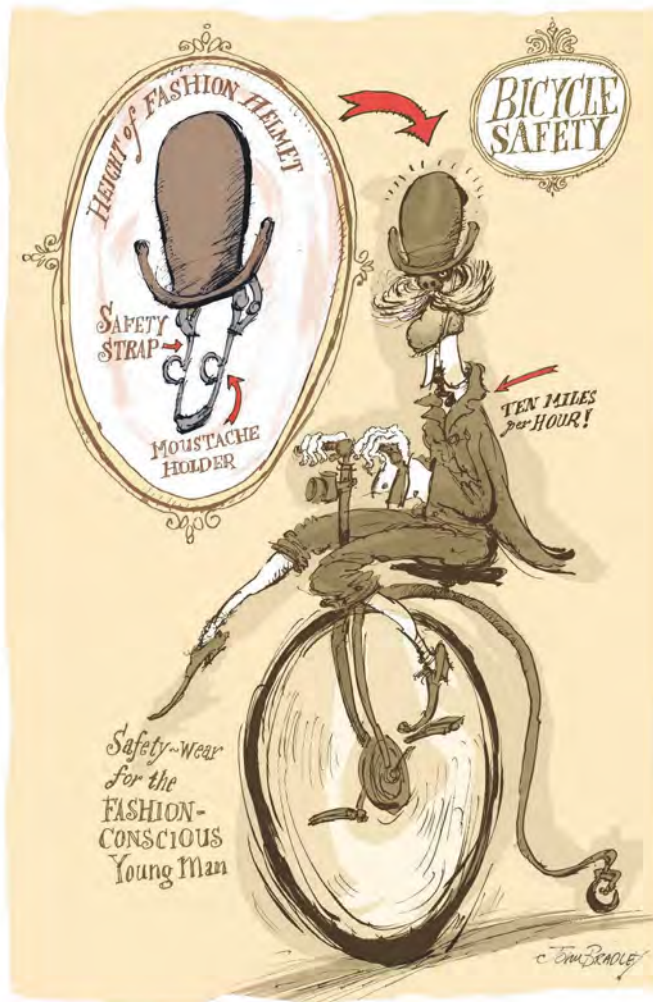
# THE INVISIBLE HELMET



**T**he humble bicycle helmet continues to save countless lives and for most that commute on a bicycle, helmets are a core part of their apparel. However, for so many young people, wearing a helmet still has a stigma attached to it. Wearing one is seen as uncool, particularly for image conscious teens trying to impress just about everyone but their parents.

The trouble is, for the most part helmets are an uncomfortable necessity that is there in case you need it, though you hope you never will. There is also an argument that helmets don't adequately protect the head for more serious incidents, such as in the event of a collision with a car.

The other lacking capability of many bike helmets is that it does not support the neck. As many accidents will result in the cyclist falling from the bike, protecting the neck is vital. The reality, however, is that most choose not to bother protecting the neck, as it makes a helmet even more uncomfortable and obtrusive to wear.



## THE CHALLENGE

The challenge this month is to therefore come up with a better way of protecting the head and neck of cyclists that isn't a traditional helmet. The aim is to make any such device so discreet, even the most image conscious teenager would be able to wear one without sulking.

The key for this challenge is to implement new ideas that are available in other industries, but not to cyclists: think car safety! The device could be installed on the bike itself or worn by the cyclist, though if it is to be worn, it should be unnoticeable until needed. Perhaps some kind of rapid unfurling padded device is the way to go. The question is, how? **!**

The idea we have in mind will be revealed in the **February issue** of Eureka! Until then see what you can come up with. Submit ideas by leaving a comment on the **Coffee Time Challenge** section of the **Eureka!** website.

## Sensors tailored for your application



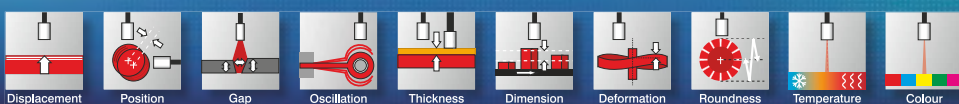
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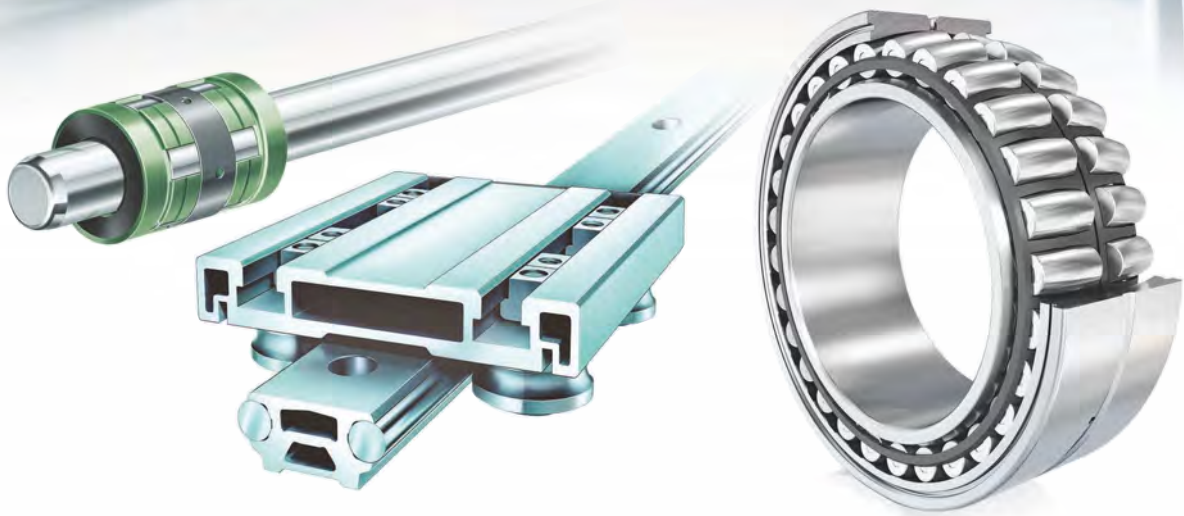


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