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THE MAGAZINE FOR ENGINEERING DESIGN

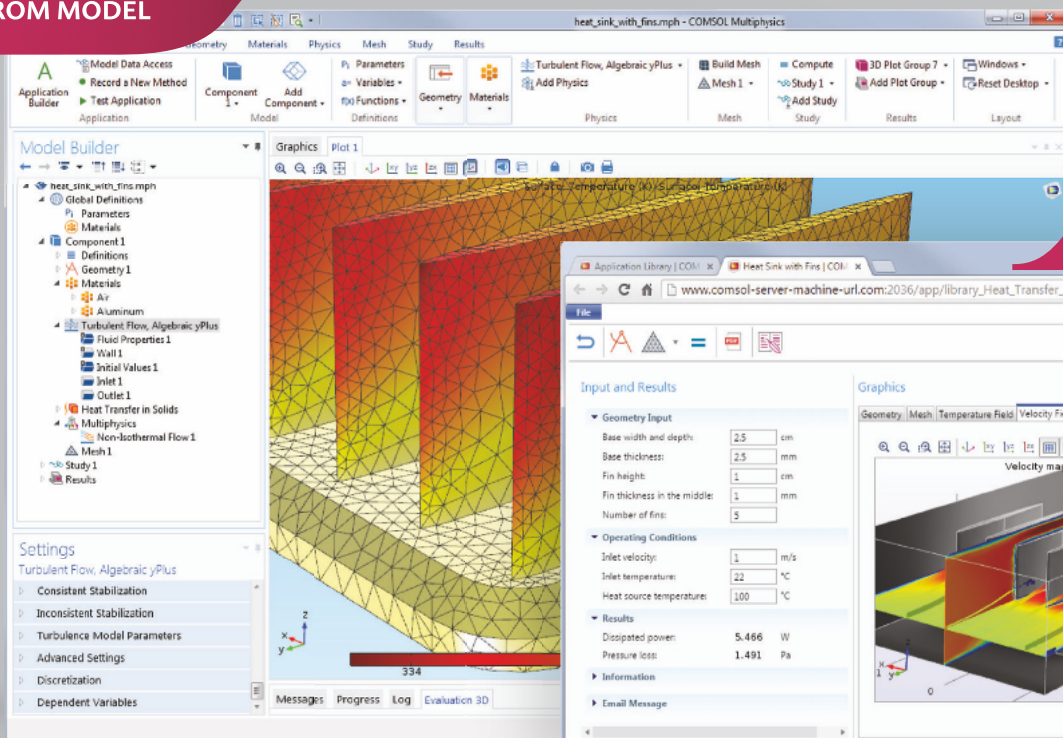
In this issue: Automotive composites • Sensing human motion • Rapid prototyping • Solar Impulse



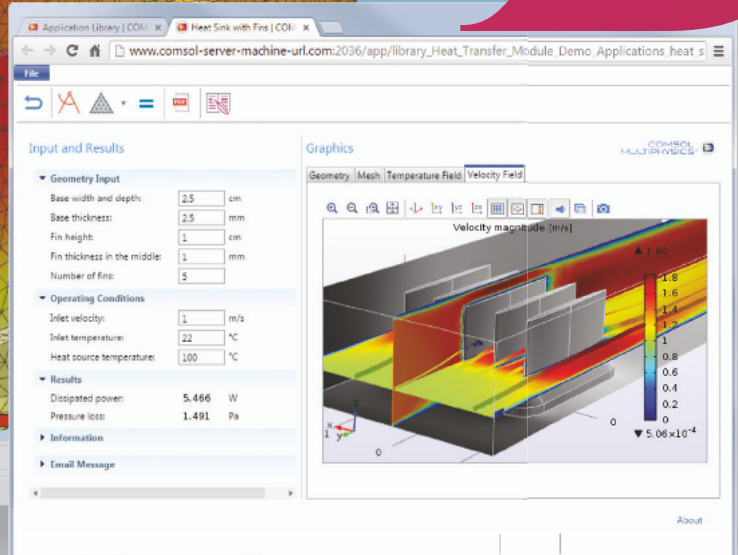
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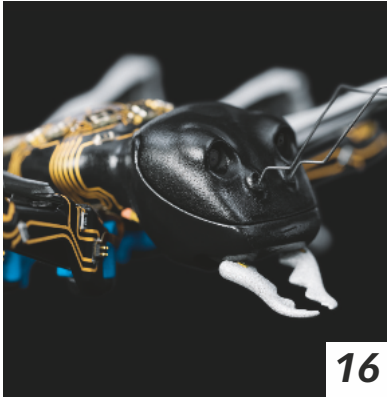
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Festo's 'Inspired by Nature' concept products, which range from kangaroos to jellyfish, have now been supplemented with its version of nature's ultimate collective – BionicANTS.

20 Interview: Andy Poon

Andy Poon is leading Romax Technology to greater success in designing and simulating rotating machinery, and has picked up two BEEAs trophies along the way.

23 Can you do it better?

It is time for those who are doing it better to stand up and be counted. The British Engineering Excellence Awards (BEEAs) are up and running for 2015 – let the games begin!

25 CFRP becoming an automotive choice

This year's flagship composite event showed that progress has been made by the automotive sector in implementing lightweight materials. But it's neither cheap nor easy.

29 Rapid route to the race track

3D printing is not just for prototyping. Lamborghini is also using it to rapidly create track-ready parts.

32 Suits design in motion

Clever sensor technology has seen the development of a tool with interesting possibilities for engineers, particularly for those whose designs cater for human movement.

35 On the right track

The V-system of linear guides, although it has been around for a while, often gets overlooked when selecting a linear systems.

39 Trenching on the level

For a 42 tonne subsea beast, the Hi-Traq is fairly benign – providing, as it does, cost-effective trenching services for the offshore renewable industry. This impressive piece of design won Product of the Year at the 2014 BEEAs.

43 Strange phenomenon of solar flight

The idea of flying around the world in a solar aircraft might seem like an exercise in technical bravado, but its success could have real potential.

5 Comment

And our survey shows... if you are reading this you are probably male and middle-aged. So where is the diversity?

7 News

An insect-inspired directional microphone could improve the quality of hearing aids.

3D printing has reduced component count in a rocket to be launched next year.

The motorsport industry is calling for a strategy for future business growth.

Dassault Systemes has added model-based engineering company Modelon to its portfolio.

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Airline flu - catch a flight and you catch a cold! But is there an innovative way round this problem?

www.eurekamagazine.co.uk – TAKE A TRIP ROUND THE NEW SITE

Actual parts

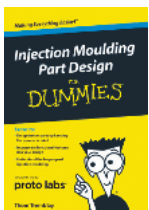
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It's an (old) man's world



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

Diverse as peas in a pod. That is unfortunately my conclusion following our recent Eureka readership survey. Firstly, the well-publicised lack of gender diversity in the engineering sector is backed up by our results, as only 2.5% of our respondents were female.

A further finding is that nearly 80% of respondents are older than 45 years old. It is another side of the same problem. A generation of engineers appears to be maturing without the next generation, or either gender, coming through. Incidentally, having taken several healthy steps myself into the plus 45 age bracket I do not regard that as 'old'!

Initiatives, such as that being run by the Engineering Development Trust (see page 13 of this issue), or the Primary Engineer scheme which we will look at in June, are both great conduits through which the engineering industry can help itself by building the next generation of engineers. If we fail to do so in the UK it will be to the detriment of the UK economy, as other countries will endeavour to have a younger, bigger engineering sector.

As a point of interest a survey of this healthy size statistically allows us to be 95% certain that any answer is within +5% or -5% of being correct.

More positively, when asked what the most exciting technologies are that will push industry forward 3D printing was the clear winner, but there was a host of others including new control functions, clever electronics and particularly new engineering materials. Interestingly only one person named the much lauded Internet of Things in this category, the same number of people who chose, for example, UAVs. Does that mean that the IoT is so vague in its definition and such a composite of enabling technologies that people don't recognise it as an entity in its own right? Or does it mean that the IoT is essentially marketing bluff and bluster? I will leave you to decide but maybe it is a bit of both.

Many thanks to all of our readers who did take part in our survey.

Editor
Tim Fryer
tfryer@findlay.co.uk

Technical Editor
Justin Cunningham
jcunningham@findlay.co.uk

Web Editor
Tom Austin-Morgan
taustin-morgan@findlay.co.uk

Group Editor
Graham Pitcher
gpitcher@findlay.co.uk

Art Editor
Martin Cherry

Technical Illustrator
Phil Holmes

Advertising Sales
01322 221144

Sales Director
Luke Webster
lwebster@findlay.co.uk

Sales Manager
Keith Murray
kmurray@findlay.co.uk

Deputy Sales Manager
Simon Bonell
sbonell@findlay.co.uk

Sales Executive
Paul Thompson
pthompson@findlay.co.uk

Production Manager
Heather Upton
hupton@findlay.co.uk

Circulation Manager
Chris Jones
cjones@findlay.co.uk

Publisher
Ed Tranter
etranter@findlay.co.uk

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New kid on the block The New Spinplus

If you use servomotors, there's a new shaft coupling that addresses the known limitations of other beam, bellows, pin or laminate disc style shaft couplings.

The new **Spinplus** is slight in dimension and vast in performance and is the ideal precision shaft coupling for highly dynamic applications. Whether it is to be precisely positioned, assembled or measured the new **Spinplus** is latest flexible shaft coupling innovation. When developing the **Spinplus**, the main focus was to achieve the lowest possible moment of inertia for the coupling, which is especially advantageous for quick bidirectional torque transmission. The unique function of the internal flexible element manufactured through a modern MIM (Metal Injection Moulding) process, allows for the shaft displacement compensation. As a result, an immediate technical advantage is achieved which allows for a very compact design

capable of transmitting high torque, with maximum torsional rigidity and a minimised moment of inertia.

Precise, torsionally stiff and backlash-free

Combine the mechanical advantage with a newly developed and innovative hub design highlights further optimisation for the lowest moment of inertia concept. The clamp hubs reduce the mass moment of inertia significantly compared to conventional hubs on the market. To adapt to the respective application requirements, two hub versions are available.



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Should the application be performance-orientated, the Semiflex® is designed specifically for reliability in the more arduous application. The Semiflex® precision shaft coupling is both torsionally stiff but has incredibly small radial restoring forces. In applications where shaft alignment cannot be guaranteed due to various scenarios such as manufacturing tolerances, assembly procedures, wear, or operational specifics, Semiflex® offers high radial shaft misalignment compensation in a compact design.

What makes the shaft coupling unique is the transmission of the rotary motion and torque takes place within the coupling through two pairs of parallel links arranged at 90° to each other. The lateral displacement compensation takes place through a swivelling movement of the needle bearing parallel link rods on the connecting bolts that are located within the internal discs. Innovatively, synchronisation between driver and driven ends is therefore guaranteed despite abnormal parallel shaft displacement. Semiflex® is a symbiosis of performance, compact design and generous misalignment capacity available in a choice of materials including Stainless Steel. Torque capacity dependant on model is 44 Nm to 14,500 Nm. Bore diameter up to 120 mm can be accommodated.



Affordable shaft connection - Controlflex®

The Controlflex® shaft coupling has been designed and developed specifically with shaft encoders in mind. The unique and integral functional element accommodates all kinds of shaft misalignment but also exhibits very low parallel, angular and skewed restoring forces, making it ideal for both encoder and tachometer use. The compact design consists of two anodised aluminium hubs and a unique middle element that transmits rotation with constant velocity. Controlflex® is easy to install, and can act as an electrically insulator between shafts if required. As standard the shaft couplings are balanced for high rpm applications up to 25,000 rpm. This includes the quick and easy clamp style hub versions. There are four series of these encoder suited couplings for different application requirements. The Standard series is the choice for all standard encoders and tachometers, offering outer diameters ranging from 19 mm to 37 mm. The series accommodates a maximum radial misalignment capacity depending on size up to 1 mm and a maximum angular misalignment capacity up to 1.5 Degrees. Standard bore combinations range from 3 mm up to 20 mm and are from stock at Abssac.



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Insect ear inspires hearing aids

A microphone that can locate sounds and eliminate background noise has been inspired by the ear of an insect, and could be used to reduce unwanted noise in hearing aids.

Research by the University of Strathclyde, and the Medical Research Council / Chief Scientist Office (MRC/CSO) Institute for Hearing Research (IHR) - Scottish Section at the Glasgow Royal Infirmary, will test a design using a miniature directional microphone.

Current directional microphone technology adds cost, weight and power requirements to hearing aids compromising their design. The collaborative research aims to create a hearing aid system that can reduce or control unwanted noises, focusing the hearing aid on only the sound arriving from in front of the user.

Dr James Windmill, of the Centre for Ultrasonic Engineering at Strathclyde, said: "Currently, users can tell whether a sound source is in front or behind, but struggle to detect sounds from below or above, such as echoes in a large room. We aim to solve the problem using a new type of miniature directional microphone, inspired by how some insects hear sounds.

"We will be able to evaluate the problems caused by the distance from which a sound emanates, for example how to separate a sound from a loud source far away, like a train or plane, from a quiet sound from nearby, like a human voice."

The project will also investigate 3D printing techniques to optimise hearing aid design to work in conjunction with the new microphone.

For more on how nature is inspiring engineering see p16.

Report on aerospace adhesives

A report from Research and Markets covers the global aerospace adhesives market and further segments the market on the basis of resin type, user type, end-user industry, and region.

It covers the aerospace adhesives and sealants market by resin type (epoxy and others), by end-user industry (commercial, military and general aviation), by user type (OEM and maintenance, repair and overhaul), with a global forecast to 2019.

Events

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

20 - 21 May Product Design + Innovation Conference

London
Conference for industrial designers

18 June Leading Business by Design Summit 2015

Birmingham
Design Council conference

08 - 09 July Manufacturing & Engineering North East

Newcastle

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targeted at the North East

09 September FAST

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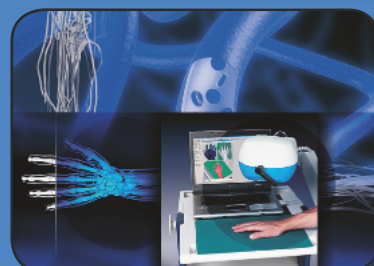
21 - 22 October Engineering Design Show 2015

Coventry
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conference for design
engineers

09 - 10 November Innovate UK

London
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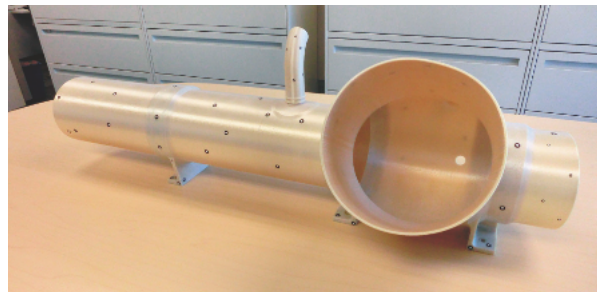
3D printing produces rocket components

3D printing has reduced the component count in the environmental control system duct system of the Atlas V rocket systems, set to launch in 2016.

Rocket manufacturer United Launch Alliance (ULA) will launch the Atlas V rocket, with a reduced component parts count, using 3D printing. The company claims that 3D printing helped consolidate parts from 140 to 16 parts for one complex assembly, lowering – it says – costs and risk.

This not only reduces installation time but also results in a 57% part-cost reduction. ULA selected ULTEM 9085 FDM thermoplastic material to produce durable, high-performance end-use parts. "ULTEM 9085 has great strength properties over a wide temperature range," said Greg Arend, program manager for Additive Manufacturing at ULA. "We have done testing to show that it is very capable of withstanding temperatures from cryogenic all the way up to extreme heat. And it's tough enough to handle the vibration and stress of lift off and flight. We're very satisfied with its performance."

ULA has supported America's presence in space for more than 50 years. It progressed from 3D printing prototyping to tooling and now to flight hardware production.



Motorsport manifesto for growth

The Motorsport Industry Association (MIA) has called for strategic input from UK businesses and stated its intention to help the UK's motorsport industry create a strategy for future business growth.

The Motorsport 2020 project will bring together ideas from leaders of the UK's motorsport business arena about the approach they want the new government to take, over the next five years, to bring further growth to the successful British engineering sector.

Chris Aylett, CEO of the MIA, said: "The UK is the undisputed leader in global motorsport and must work hard to maintain that position over the next five years. We are fortunate to be home to most of the Formula One teams, as well as the entire Formula-E programme. The UK also hosts the leading international supply chain for most major racing and rally series around the world.

"Motorsport Valley companies have developed state-of-the-art technologies which are now being used in defence, healthcare, aerospace, automotive and marine applications," continued Aylett.

"Nine in 10 UK motorsport businesses export overseas and the industry employs 41,000 people across 4,300 organisations, generating more than £9bn in worldwide sales."

He urges an industry-led strategy be created for business growth, similar to the approaches taken by the Automotive Council, the Aerospace and Defence Growth Partnerships and the National Composites Strategy.

Aylett says: "We are asking our motorsport industry leaders to put forward their ideas which can help us set the strategic direction of motorsport for the next five years."

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Dassault makes model acquisition

Dassault Systèmes has acquired Modelon, experts in model based engineering. Model-based systems engineering is an important facet of defining, imaging and shaping virtual products and user experiences that mimic future ones in the real world.

Modelon proprietary, multi-physics modular and reusable content – based on the Modelica open standard modelling language – brings industries beyond digital mock up to transform the engineering. From electric power storage to electric power distribution, its portfolio delivers a unified picture of complex product subsystem interaction and performance, throughout the design process as well as during optimal system operations.

"Since 2009, our industry-proven content implements the latest advances in Modelica tools and standards and, as a result, has enabled major industry milestones," said Johannes Gerl, CEO, Modelon. "As part of Dassault Systèmes, we can expand the reach and impact of our assets to inspire product development that will be emblematic of the bright future of experience-based systems engineering."

NEWS

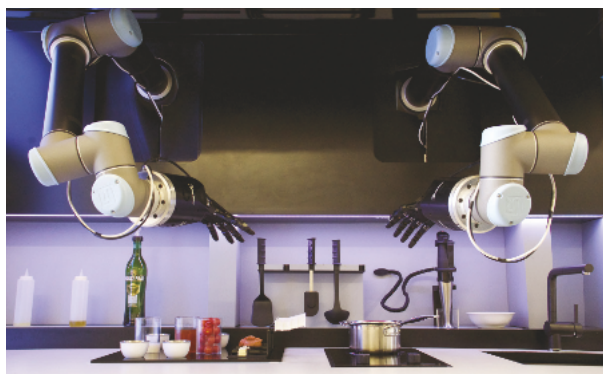
Robotic kitchen causes a stir

The world's first automated kitchen, created by Moley Robotics, was unveiled at this year's Hanover Fair. The company aims to produce a consumer version within two years, supported by an iTunes' style library of recipes that can be downloaded and created by the kitchen.

The prototype at the show is the result of two years development and the collaboration of an international team including Sebastian Conran who designed the cooking utensils and Mauro Izzo, DYSEGNO and the Yachtline company, who created the kitchen furniture.

Two complex, fully articulated hands, made by the Shadow Robot Company, reproduces the movements of a human hand, part of the ethos that the robotics system does not cook like a machine – it captures human skills in motion.

The Shadow Robot hands use 20 motors 24 joints and 129 sensors to faithfully recreate the exact range of movements of a human hand.



Award for Schaeffler's Evans

Roger Evans MBE, managing director at Schaeffler (UK), has been chosen by his peers to receive the national Manufacturing Champion Award.

The award celebrates the achievements of individuals who have made a significant contribution to UK manufacturing. The judges awarded the title after agreeing that Evans shows leadership, encourages innovation, invests in research and development, builds partnerships with suppliers, trains employees to high standards and generates profits to guarantee security.

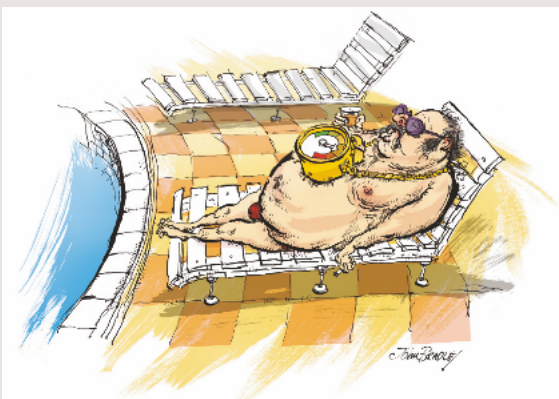


Cutting edge investment for composites

Increased demand has resulted in Morgan Advanced Materials investing in production equipment at its Composites & Defence Systems business in Coventry. A six-figure sum has been invested in a new high-specification water jet cutting machine which is further optimising cutting quality and consistency while also improving throughput. The Coventry facility is established as a global centre of excellence for composite materials and has specific expertise in the production of armour systems to protect both individuals and vehicles. Accurate cutting is crucial to finished product quality and performance and the water jet cutter accurately recreates CAD designs in a variety of materials from fibre glass and commercial composites to the high-protection materials used in the international defence sector.

Solution to last month's Coffee Time Challenge

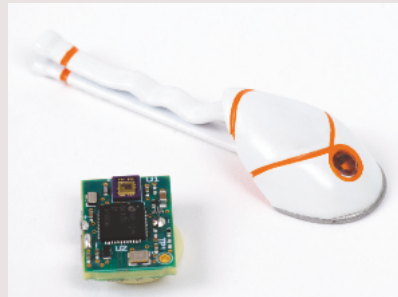
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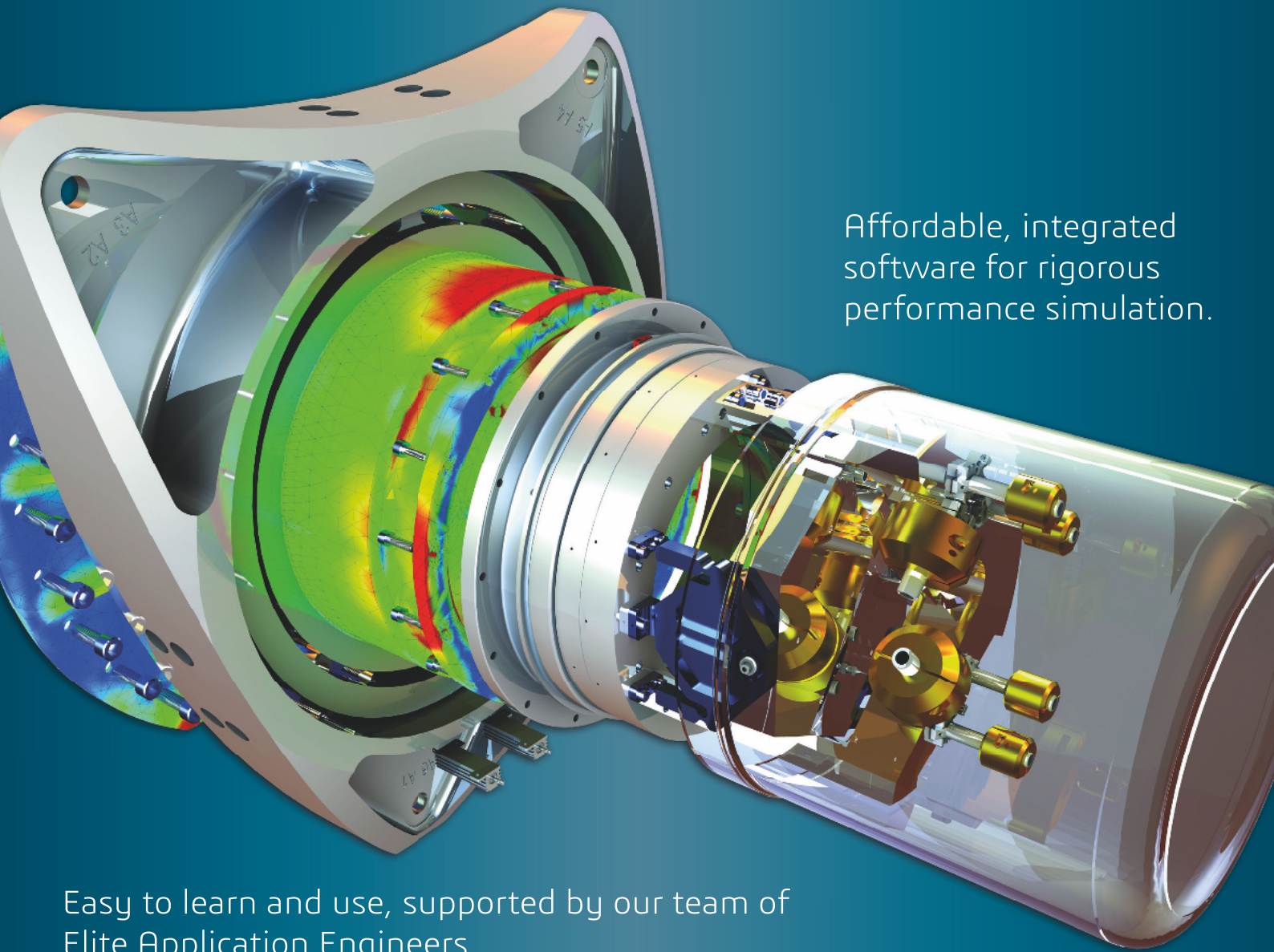
April's Coffee Time Challenge asked you to think up ideas about how to provide exactly the right amount of exposure to the sun. Enough to give the positive benefits of the Vitamin D, while not so much that the consequence is sunburn or damaged skin.

Our solution, Soltair, came from Cambridge Consultants. It monitors sun exposure and combines the information with skin type and the user's schedule for the day to give real-time recommendations about when it's time to cover up or move indoors. And all in a device that's smaller than the average car key and has a bill of materials cost of around \$5.

Soltair consists of a smartphone app linked to a small sensing device that could be clipped to a bag or worn as a brooch or hairclip. All the user has to do is take an image of their skin with their smartphone – to give a pre-suntan level of pigment. The Soltair app analyses the image and combines the information with the user's location, the weather forecast and their schedule for the day to give individual guidance on optimum times in the sun with and without sunscreen with different sun protection factors. The sensing device monitors actual sun exposure and gives real-time updates via the smartphone throughout the day – with alerts when the user is nearing the recommended maximum time.



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OPINION

No Skilled Girls?

Action now will avoid future regret says Estelle Rowe, director of diversity programmes for EDT (the Engineering Development Trust)

“National Women in Engineering Day (NWED) on the 23rd June is part of the wake-up call for UK engineering employers. It gives them an opportunity to start challenging the assumptions of girls and their families.”

We seem to have been talking about the low numbers of women in UK engineering for decades without having seen any significant changes in the numbers. The UK's single digit proportion of engineers (7% of engineering professionals and even worse for apprentices) ranks us as the worst in Europe where figures of 18% (Spain), 20% (Italy) and 26% (Sweden) put us to shame. Look further afield and you will see 19% in the US and a whopping 40% in China.

To be blunt, the time for talking is over because our failure to attract women into engineering is now significantly affecting the UK's ability to compete in our core industries. The lack of women in the engineering workforce is the single biggest reason why engineering companies in the UK can't find sufficient skilled people to fill vacancies to fuel growth and, once the ageing UK engineering workforce starts retiring in seriously large numbers, there is a severe danger that there will not even be sufficient engineers in the pipeline to keep existing jobs filled.

The best research into why girls don't see themselves in engineering careers suggests that it is cultural factors that apply. If the girls don't have an engineer in their family or among close family friends, then they and their family will have no clear idea what engineering involves or what a career in engineering can achieve. This ignorance and associated false stereotypes are self-reinforcing and girls assume a, 'that's not for me' attitude, without even knowing what it is they are rejecting. What we need is a change in culture and that can only be achieved by practically engaging girls, and ideally their families, with engineering achievement and challenges and exposing the incorrect, 'that's not for me' assumptions they are making.

National Women in Engineering Day (NWED) on the 23rd June is part of the wake-up call for UK engineering employers. It gives them an opportunity to start challenging the assumptions of girls and their families. Up and down the country engineering employers are holding events on NWED to challenge the stereotypes; visit the NWED website at www.nwed.org.uk to see what is going on and, if



you have time, to get involved. Organisations like my own, EDT, and Engineering UK's 'Tomorrow's Engineers' have programmes throughout the year which are proven to inspire young people, including girls, into considering engineering careers. Indeed many are specifically designed for girls. We facilitate these programmes up and down the country but I am sorry to report that we aren't able to run nearly as many as we would like, not because there is a lack of interest from schools, but because there is a lack of interest from engineering employers.

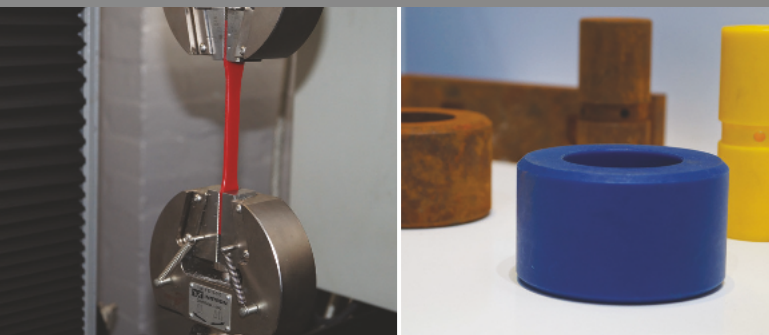
There is a tendency for engineering employers to see inspiring children into engineering as someone else's job. I believe they are wrong; years of experience suggests that the most effective way of changing the mindset of young people towards engineering is for them to meet engineers and see their working environment. The culture among companies that see engaging with schools as an optional 'CSR' activity needs to be seriously reviewed.

Overwhelmingly it is the medium and small engineering employers, which make up the majority of the industry, who need to reconsider their position. There are outstanding exceptions of course but in general it is these employers who are not undertaking work in schools, which is crucial for developing future talent streams. The message needs to get through that the only way to get girls, and indeed any young person, to start to think that engineering is 'for them' is to take them out to see real engineering and to meet real engineers. If it fails to happen, in ten years' time when small and medium sized engineering companies are losing business overseas because they can't find adequately skilled engineers in the UK, they may well regret having been inactive.

To take up the challenge visit the EDT website - www.etrust.org.uk



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The MENE Conference

Wednesday 8th July – Day 1

09.15 PepsiCo – From good to great!

A fascinating insight into why one of the world's most recognisable brands invested £10 million to gain an important strategic foothold in the North East of England and what attracted this global giant to Peterlee.



10.15 Advanced Manufacturing Research Centre (AMRC) – Engineering the next generation



Skills remains a pressing issue for technical industries, and with tuition fees skyrocketing, is the next generation in danger of being priced out? AMRC explores some of the alternative routes that are open to companies to ensure longevity in a quality work force.

11.15 EDITORS PICK: North East Automotive Alliance – The new capital of the UK's car industry

Find out what is making the region flourish and how you can get involved with its growing automotive business that continues to go from strength to strength. The North East is home to the UK's largest car plant, so what are the ongoing opportunities for tier I and II suppliers?

12.15 McDaniels Law – How to protect design and innovation

With a loss of manufacturing capacity to the East, this decade is seeing similar moves by the region to capitalise on design capability. Find out the best ways to protect your innovation and ensure high value design work is not copied or stolen by competitors at home or abroad.

14.15 EBAC – Making reshored manufacture competitive

EBAC has flourished in recent years since it decided to not only design products in Britain, but to bring back production from China. Gain an insight into the opportunities and challenges around reshoring manufacture and competing on the world stage against low labour cost countries.

15.15 EDITORS PICK: Innovate UK – Growth in high value engineering

UK engineers and manufacturers have seen resurgent growth, with many activities being reshored after decades of offshoring to lower cost economies. Innovate UK aims to identify global trends and how they can be exploited. Find out if you could capitalise on this wave of industrial demand.

16.15 Primary Engineer – Engineering in North East primary schools... Really!

Getting the message across to children that engineering is not about fixing washing machines, but solving problems and being creative. This is the perfect place to start addressing the skills issue.

Thursday 9th July - Day 2

09.15 Rail Alliance – Britain's second railway boom: reseeding our supply chain

Hitachi's new train manufacturing plant is due to begin production later this year and the opportunities to get involved in the rail sector have never been better. Find out how your expertise and capability could be of benefit, and how you can be part of this rejuvenated high value industry.



10.15 EDITORS PICK: IHC Engineering Business – Award winning design for subsea cable laying in the North Sea

Find out how the company's award winning design is helping it win new business and why it is able to punch well above its weight; winning big projects and holding off tough competitors. In this presentation hear how it designed and developed a mammoth four-tracked trenching and cable laying vehicle for operations in the offshore wind sector.

11.15 (Merck Sharp & Dohme) MSD – The North East vs the Far East

Just five years ago MSD Cramlington had an uncertain future. The site's survival depended on supplying products at a lower price than its Far East competitors. This session will reveal the lessons that were learnt. Find out how they can now be applied to other sites around the UK looking to beat global rivals.

Big Intentions

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12.15 The Offshore Renewable Energy Catapult – Engineering the UK's clean power

A look at the design,

development and commercialisation of wave, wind and tidal power technology in and around the UK. The aim is to exploit markets around the world. Find out how to become part of this potentially huge global market.

14.15 EEF – The post election fall out: what it means for UK engineers and manufacturers

With the election won and lost, who are the winners and losers in industry and what are the likely effects of the new Government on the UK's engineering and manufacturing strategy? Join this fascinating session that will give a timely indication of the face of things to come post May 7th 2015.

15.15 EDITORS PICK: Croft Additive Manufacture – 3D printing diversity

The use of metal additive manufacture has allowed Croft to enhance its capability as a filter designer and manufacturer, and also diversify in to other sectors. Find out more about how to leverage this exciting technology.

Places for conference and workshop sessions are **FREE** but limited, with the most popular already filling up. To reserve your place and avoid disappointment register now at www.menortheast.co.uk

*Registration takes less than 5 minutes.

MENE Workshop sessions

Wednesday, Day 1 – Workshop 1

10.15 Fanuc – Automate Now

Practical advice on why businesses automate, how to identify key areas and opportunities to upskill the workforce.

11.15 KD Feddersen – Lightweighting possibilities in automotive and beyond

Lightweighting is a high value topic within the automotive arena and is gaining importance in many other market sectors.

12.15 EEF – Bridging the skills gap and retaining skilled employees

A look at the different approaches to address the skills challenge, and how to keep those vital skilled employees.

14.15 Dunkermotoren – The changing face of linear motion: pneumatic to electric

The choices between linear motors and pneumatic actuation covering through life costs, cycle time, position errors and more.

Wednesday Day 1 – Workshop 2

10.15 Lombard and RBS – How to benefit from asset and invoice finance?

Funding has become more than

providing cash to invest in your business, today manufacturers have a choice of funding methods.

11.15 Materialise – Sweet spots for 3D Printing

Find out how to recognise and take 3D printing beyond prototypes into profitable and durable applications.

12.15 Schaeffler – Vibration monitoring to maximise asset reliability

Using a predictive maintenance strategy to avoid high repair and replacement costs.

14.15 NatWest – Manufacturing growth in the North East

This workshop is aimed at those looking overseas to find new markets for their products or for plant and machinery to import.

Thursday Day 2 – Workshop 1

10.15 Fanuc – Automate Now

Practical advice on why businesses automate, how to identify key areas and the opportunities to upskill the workforce.

11.15 CG Tech – Improve machining processes with CNC machine tool simulation

While CNC machine tools can produce parts in ever shorter

cycle times, the cost of getting it wrong has increased.

12.15 Materialise – Sweet spots for 3D Printing

Find out how to recognise and take 3D printing beyond prototypes into profitable and durable applications.

Thursday Day 2 – Workshop 2

10.15 NatWest Mentor – Social media in the workplace and EU Holiday Pay Ruling

The issues social media can cause for employers. Plus the EU's recent ruling on holiday pay calculations will also be addressed.

11.15 Schaeffler – Vibration monitoring to maximise asset reliability

Using a Predictive Maintenance strategy to avoid high repair and replacement costs.

12.15 K3 Syspro – ERP solutions

K3 develop and deliver excellent ERP solutions for small and medium-sized companies.

14.15 York EMC – The new EMC Directive, what it means for you?

In 2014, nine CE Marking directives were re-published that come into force during 2016. Find out how you will be affected.

Natural solutions

Around the turn of the millennium Festo started on a project to learn from nature with inspiration coming from one of the owners of the company, Dr Wilfred Store. "We obviously have a large research and development facility capability within the company anyway, which works on fairly traditional lines, but he very much wanted to tap into learning from mimicking nature," said product manager Steve Sands. "From the very early days we saw it, I guess from two different directions, one was either to see a challenge or a problem that we have got in industrial automation and then say can we see a phenomenon in nature that could give us some clues on how to solve it. Or the flip side would be, is there something in nature that inspires us and that we can then study and see if there is an application within industrial automation."

The resulting programme has gone under the name of the Bionic Learning Network since 2006 and has produced some eye-catching products over the years. This year's batch, revealed at the Hannover Fair in April, included BionicANTs, eMotionButterflies and the FlexShapeGripper, more of which later. Previous projects included birds, kangaroos, fish, penguins, jellyfish, arms and many more.

It is not intended initially as a product demonstrator for the company, although that does come further down the line. Initially it is a case of picking a phenomenon, like the movement of a fish tail or a bird's wing, and then try to understand it to the point where it can be modelled, simulated and then translated into the world of CAD.

"In parallel we are seeking to try and apply the technology," said Sands. "We are looking to see where the applications are in industrial automation but also along the line somewhere we will try and build a model, based wherever possible back on the original natural phenomena that we observed in the first instance, that tries to demonstrate some of the technology that we have been inspired by." This year's BionicANTs, for example, which are designed to demonstrate collective and flexible working, are still very clearly ants.

"The concepts that we build and normally release at Hanover Fair every year are really the demonstration of some of the technologies that we have been working on in the background, either directly ourselves or, it is important to say, through a network of universities and other like-minded companies that we are working with," added Sands.

Indeed, one of the reasons for the concepts is to create awareness of the technologies and therefore encourage more collaboration partners to engage in open research.

Annual releases

In general the plan is to work on a number of projects, with some running for several years, and be able to unveil new ones at the Hannover Fair every year, but many are long term and can re-visited if the original technology can be taken in different directions. For example, the



elephant's trunk was the inspiration behind the Bionic Handling-Assistant launched in 2010 - a lightweight, dexterous handling system. Two years later it was integrated with vision systems to get feedback through the system as well, and now it is being used as the basis for some voice control technology that the company is working on.

Voice control has consequently only recently become an area of expertise for Festo, but that, according to Sands, is one of the attractions of the programme: "Different methods of human machine interfacing very much are Festo's areas of expertise. We have done everything from thought control of machine interfaces to various haptic feedback devices and now to voice control as well. So, if you think about the big issues that we are looking at in terms of sensing controls, lightweight structures, safer environment, energy efficiency, these sorts of big major trends that we will be looking at, it is relatively easy to dive into nature and see examples of things that you would like to emulate in engineering terms. Some are more challenging than others obviously."

Concepts will not make their Hannover debut until the natural phenomenon is understood and the demonstrator is in good enough state to demonstrate that. Such products are produced by a team in Stuttgart which, apart from the expected engineering expertise, also includes a doctor from the biological side who looks at and co-ordinates research done elsewhere. This includes interaction – either 'importing or exporting' research challenges – with a number of universities including Stuttgart and Delft.

What external expertise is needed depends on the project. Festo's wide engineering capability covered such things as the 3D modelling and 3D printing on the elephant's trunk, but they were also working with the Fraunhofer on the modelling of the expansion joints. Sands said: "It is like

When nature and engineering collide, the results can be astounding. Tim Fryer found out more about Festo's 'Inspired by Nature' concept products.

a flexible bellow structure and some of their people were getting involved in developing the shapes of those bellows and the thicknesses of the materials to give us the flexibility that we wanted."

Blue sky to reality

One of the recent introductions, the FlexShapeGripper was another that needed development work on the materials. This concept, inspired by the fly-catching abilities of a Chameleon's tongue, actually came out of the previous fishtail as the same technique could be used to flexibly wrap round different shapes. In its initial form parts were 3D printed but when it became clear that this was a technology that had a definite application, the manufacturing method needed to be adapted.

The application was the food industry but this would only be possible if FDA (the US Food and Drug Administration) approved materials were used. Materials with the required approvals and properties were not available for 3D printing and so other manufacturing methods were required – a moulding process – that would not typically have been looked at until a concept was reaching the point of higher volume commercial adoption.

To date the Adapted Gripper is the only concept that has turned into a standard commercially available product. "A lot of the other things weren't really designed to be products in their own right, they are technologies," said Sands. "So things like the energy recovery in the bionic kangaroo, and the ability to store energy within a cycle of an industrial automated machine, that's very much something that we are interested in and will be incorporating into future products."

The Bionic Kangaroo came out of the blue sky side. The head of the bionics team was fascinated by some of the statistics he was seeing on kangaroos, that they are more energy efficient and they can travel further and faster than the pure calculations on the amount of energy it takes to do each jump. As a consequence Festo got involved in research that looked at how kangaroos have especially developed hamstrings that are a bit like rubber bands, so that when they land they store up the energy for the next spring going forwards.

Sands added: "His mind was going with the parallels in a lot of industrial automation movements, where we get involved in energy

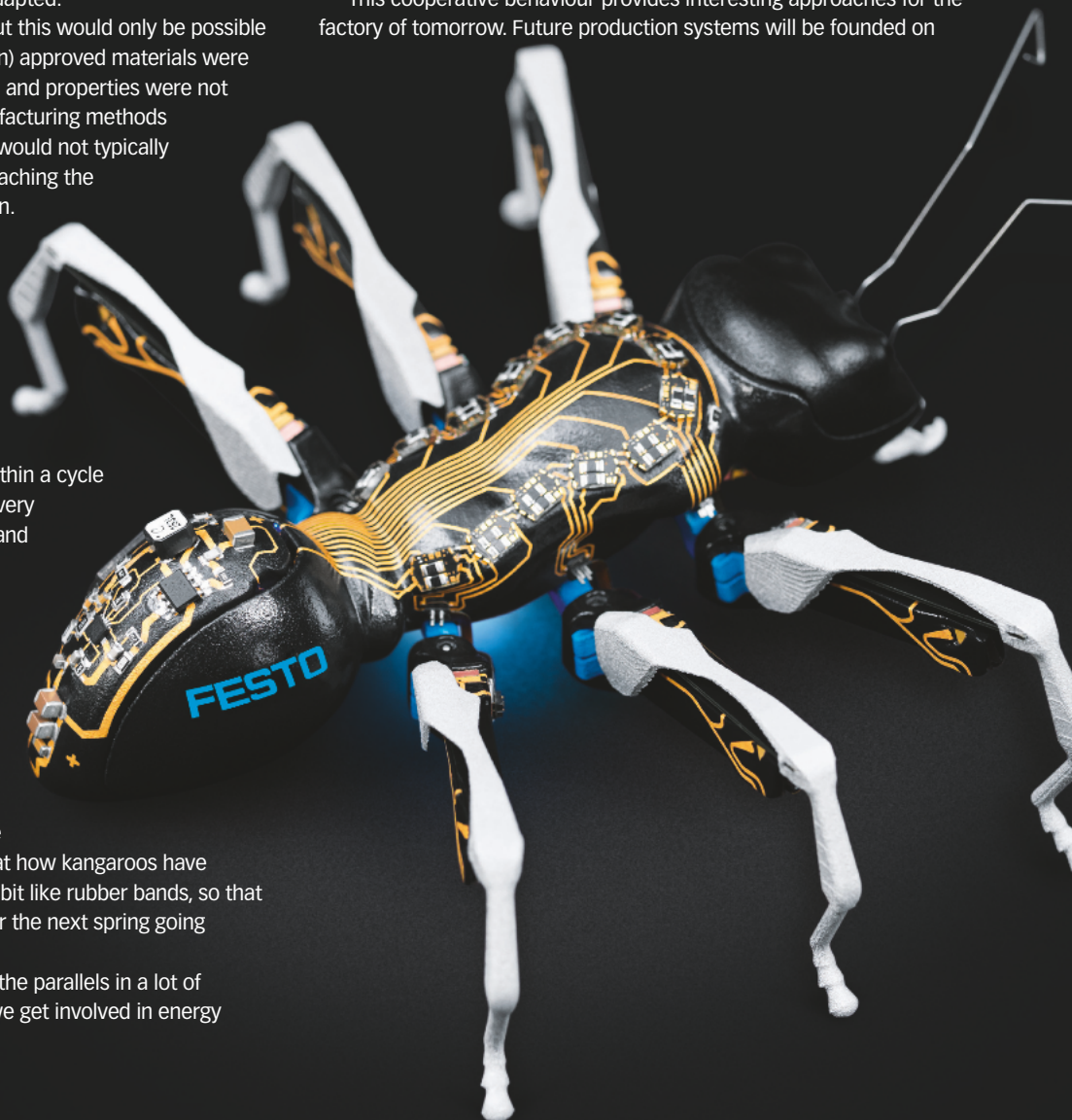
recovery and storage, and then re-use. So he set his team the challenge of trying to understand this in more detail and then the considerable challenge of trying to build a model to demonstrate it. I say it's tricky because when they were first developing it, it was the balance that they struggled with – in take-off and re-adjusting balance in mid air and landing correctly to be ready to store that energy, to then do the next spring coming off from it."

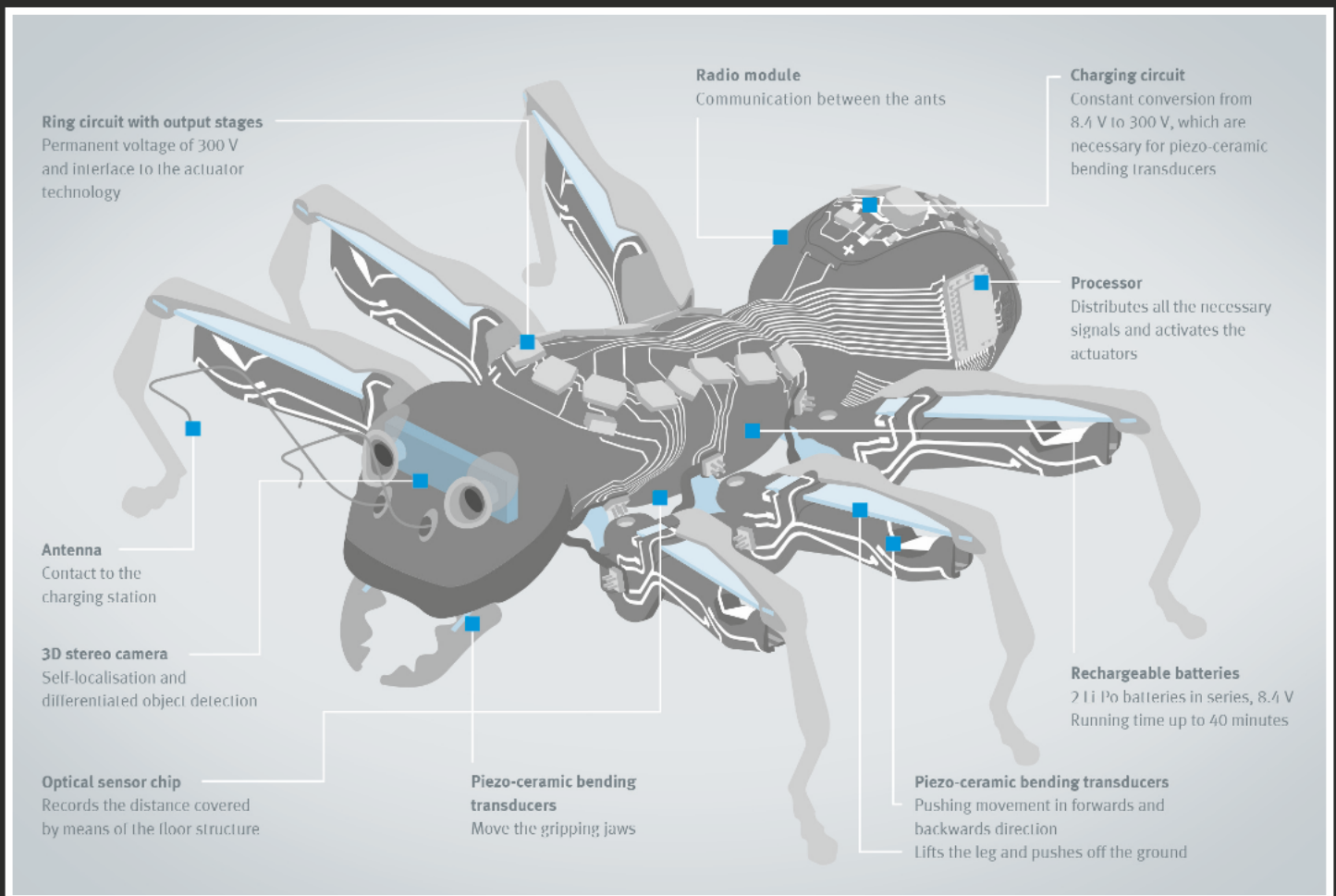
The Bionic Kangaroo was launched in 2014 and by the time it had made a guest appearance at the company's UK HQ had been fitted with gesture control as the form of human machine interface.

BionicANTS colonise 2015

Star of the show this year has been the BionicANTS, which has looked not just at the individual ant but also its role in cooperative working. Like their natural role models, the BionicANTS work together under clear rules. They communicate with each other and coordinate both their actions and movements. Each ant makes its decisions autonomously, but in doing so is always subordinate to the common objective and thereby plays its part towards solving the task in hand.

This cooperative behaviour provides interesting approaches for the factory of tomorrow. Future production systems will be founded on





intelligent components, which adjust themselves flexibly to different production scenarios and thus take on tasks from a higher control level. The BionicANTS demonstrate how individual units can react independently to different situations, coordinate with each other and act as an overall networked system. By pushing and pulling together, the artificial ants move an object across a defined area. Thanks to this intelligent division of work, they are able to efficiently transport loads that a single ant could not move.

Design of the ants is interesting. Laser-sintered components are subsequently embellished with visible conductor structures in the 3D MID (moulded interconnect device) process. The electrical circuits are attached on the surface of the components, which thereby take on both a design and an electrical function. In this way, all the technical components can be fitted into or on the ant's body and be exactly coordinated with each other. After being put into operation, an external control system is no longer required. It is possible, however, to monitor all the parameters wirelessly and to make a regulating intervention.

The BionicANTS also come very close to their natural role model in terms of design and constructional layout. Even the mouth used for gripping objects is replicated in accurate detail. The pincer movement is provided by two piezo-ceramic bending transducers, which are built into the jaw as actuators. If a voltage is applied to the tiny plates, they deflect and pass on the direction of movement mechanically to the gripping jaws.

With two rechargeable batteries on board, the ants can work for 40 minutes before they have to link up with a charging station via their feelers. All actions are based on a distributed set of rules, which have

been worked out in advance using mathematical modelling and simulations and are stored on every ant. The control strategy provides for a multi-agent system in which the participants are not hierarchically ordered. Instead, all the BionicANTS contribute to the process of finding a solution together by means of distributed intelligence. The information exchange between the ants required for this takes place via the radio module located in the torso.

The result could have an impact on production facilities in the future. If more products are customised then the automated production environment will need to be able to adjust accordingly – increased flexibility without increased manpower. BionicAnt technology could be a step towards such environments.

Natural technology

But is Festo doing anything new through its Bionic Learning Network, or is it pulling together other people's technology? Sands responded: "It is a really interesting question. A lot of people for many years, since Leonardo, have been trying to create a machine that flies and can do it in the same way that a bird does rather than just gliding or just through sheer power as in a jet aircraft, and we can show understanding and the ability of flight shown in the SmartBird and the BionicOptor, which is a flying dragonfly. What Festo could bring was the knowledge that we have got in-house of the way the air moves, flows and the effects of that, and then combining that with a close look at nature. I think that is how we have managed to solve that, where for many years people haven't been able to."

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A portrait of a middle-aged man with dark hair, smiling slightly, wearing a dark blue button-down shirt. He is positioned against a solid red background. His arms are crossed, and he is looking directly at the camera.

CV

Poon has played a key role in driving Romax's year-on-year growth, which led to the company receiving a Queen's Award for International Trade in both 2005 and 2009. CEO since 2013, previous roles included head of InSight, serving the wind energy sector, and software and engineering product manager roles dealing with gearbox noise, vibration and harshness issues for the automotive and wind sectors. Joining Romax in 1992 as a software engineer, he played a central role in developing the flagship RomaxDESIGNER software. A sub-committee member of the IEC 61400-22 Wind Turbine Certification Advisory Council, Poon studied Computer Sciences & Psychology at Manchester Metropolitan University.

Simulating success

While it was Peter Poon, founder and chairman, who physically picked up last year's BEEAs Consultancy of the Year and Grand Prix Awards, it is his son Andy Poon who, as CEO of Romax Technology, is driving the company forward. He spoke to Tim Fryer about its winning philosophy.



ight First Time is a bit like an ideal," said Andy Poon. "You will never actually get there, but it is definitely an overriding philosophy. You've got to look at how you can do things better all of the time and how you can bring information from downstream that would have been lost or not used and assimilated back at the start."

'Doing things better' was the mantra used by Poon's father when picking up the BEEAs Grand Prix Award last year, and Poon believes that combining design and simulation – two areas that Romax specialise in – can lead to the continuous improvement that 'doing things better' implies.

While the BEEAs recognition was for the design work, the company was built on its expertise in understanding and simulating the behaviour of rotating machinery, and currently its main 'product' is simulation software. Simulating performance at all stages of a product's lifecycle can provide invaluable information.

Poon commented: "You always want 20/20 hindsight but you can never get it, but you can get clues that are hidden everywhere. You try and have as much information as possible at the start, but you don't want that quandary when you have too much information, which then gives you no insight into what's going on. It is our job is to make sure that we can bring all the information in and create something that the designer can base decisions on – as soon as you do that you can empower the designer the freedom to do better and produce better designs."

There is an interesting dynamic at Romax itself because the disciplines of design and simulation could be perceived as competitive. Poon acknowledged: "There is a creative tension and also a business tension within Romax. The idea that you do consulting, and sell experience and knowledge – and maybe designs – while at the same time actually sell a piece of software that could potentially do yourself out of that business is an interesting dynamic. But, it is one that Romax has dealt with over the last 20-25 years."

Despite these tensions there is clearly also a synergy that makes it work. For example automotive gearboxes may be required to be strong and reliable, but they also need to be cheap and quiet. Doing a noise simulation can show the beneficial effects of super-precise manufacturing, and therefore highlight the trade-off between cost and performance.

"You need a very sophisticated designer to fully understand that

distribution of the manufacturing policies and then you want to piece those back together and put them into the design," said Poon. "Design Right First Time is all part of how you front load the simulation and design knowledge to really concentrate that during that initial phase. The alternative is using prior knowledge and experience, and rules of thumb, and you then bake in problems. You spend more and more money to develop the product, but you have to solve the same problems in the end. So we are trying to move this over-the-wall idea, where people leave problems to be dealt with by somebody else further

down the line, which is typically a way that a lot of design processes are set up."

"Knowing the full lifecycle and the failures is just as important to us as being able to simulate things from scratch"

That combination of design and making designs work, along with developing tools for simulation and lifecycle problem solving is what makes Romax different according to Poon: "It is that sort of ambiguity and almost that contradiction which sort of gives Romax that innovative edge. We don't want to define things quite so rigidly, we want to look at the problem and try and make sure that the problem has all the right

inputs into it to come up with the right solution. So yes, we are not a traditional consulting company nor are we just a traditional software only company."

Winning the two Awards at the BEEAs has been of obvious benefit for the company in terms of general publicity and when putting forward design consultancy proposals for new business. However, Poon has noticed that it has had a very positive impact internally as well.

"It is great recognition of the design work that we do because of the way the Judging process works, because it is peer reviewed – the award really means something. I think that was a really positive message inside the company.

"Recruitment as well. We are a technology company but we are also a people company. Our growth depends on both growing our people internally and also bringing new people in. So [the BEEAs successes] has been a very good way of being able to tell our story about design, design excellence and the sort of the opportunities that come along with joining Romax; being able to work with other companies in design and being able to contribute to British design excellence. I think that's really strong."



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These words from Poon sum up the spirit of the British Engineering Excellence Awards. So, as entries open for the 2015 Awards – ask yourself: ‘have you found a way to do it better?’ and ‘do you have what it takes to win?’

Romax came, “from a humble beginning, with an engineer who had a desire to improve things,” he said. “With everything around you, you can ask ‘can you do it better?’, and you will always find a way. That is deep in my psyche and in my blood, and I subscribe to it any success I have had.”

Romax’ success at the 2014 BEEAs was a recognition of the leading position it has established for itself in the design and optimisation of gearboxes. It now has more than 100 customers in multiple sectors and is involved with 14 of the top 15 automotive manufacturers.

In the opinion of the Judges for the 2014 competition, Romax’ approach is something all companies should embrace. It looks to engineer a better world for its clients and customers; it puts innovation at the heart of everything it does; it looks for continuous improvement; and believes it can deliver value and build loyalty through long term partnerships.

Onward to 2015

Now in their seventh year, the Awards are designed to celebrate those UK companies and individuals that have demonstrated the skills,

Can you do it better?

That was the question asked of the audience at the 2014 British Engineering Excellence Awards (BEEAs) by Peter Poon, cofounder of Romax Technology, as he accepted the Grand Prix trophy. Graham Pitcher looks forward to this year’s Awards programme.

invention and dedication to succeed and compete on an international stage.

Categories for the Awards run the gamut of engineering design and include:

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

The Judges will then select the winner of the British Engineering Excellence Grand Prix from the winners of each category. They also have the opportunity to select a winner of the Judges’ Special Award.

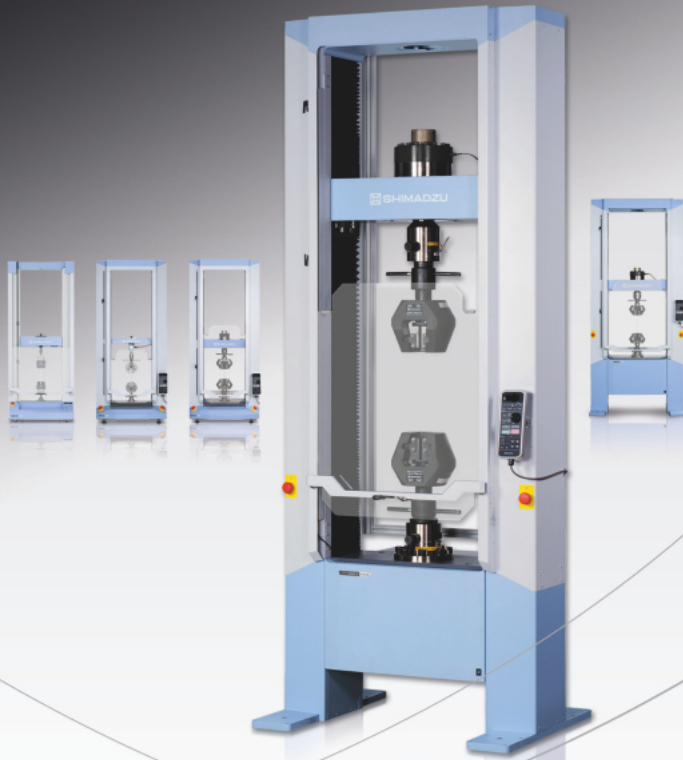
The Awards are not a rubber stamping exercise; entries are scrutinised by a high quality panel of independent judges.

In order to ensure that companies of all sizes can compete fairly, the Judges take into consideration such factors as team size, project budget, project design cycle time, the regulatory environment, the competitive nature of the target market, the materials and technology selected and attention to environmental issues.

If you believe you have what it takes to win in any of these categories – or know of a product, company or individual that does – entry forms, detailed entry criteria and additional information on the Awards categories can be found on the website.

Entries for the British Engineering Excellence Awards close on 31 July 2015. The Awards will be presented at a lunch event, being held at London’s Hurlingham Club on 29 October 2015.

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Fantastic five

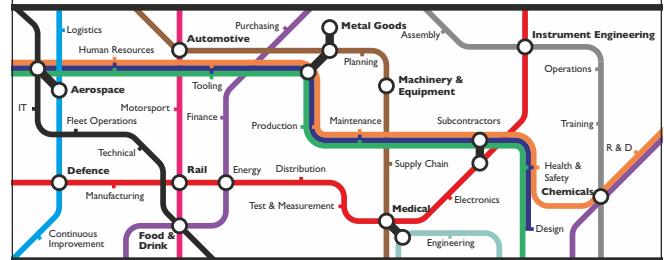
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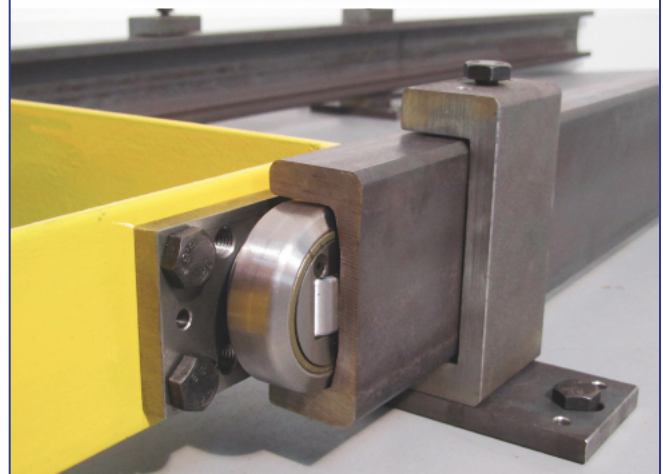
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The automotive industry is desperate to shed weight given impending regulations, yet implementation of lightweight materials is neither cheap nor easy. James Bakewell tracks progress from this year's flagship composites event.

Carmakers continue to troubleshoot CFRP

The mass-production of carbon fibre reinforced plastic (CFRP) could revolutionise the automotive industry. Strong, stiff and incredibly light, the material is set to be instrumental in enabling OEMs to reduce the weight of vehicles in the face of increasingly stringent regulations on fuel economy and carbon dioxide emissions.

At JEC Europe, the composite industry's flagship event, one of the most striking illustrations of this potential was the CFRP chassis of Hyundai's fuel cell powered Intrado crossover concept. Developed in partnership with carbon fibre manufacturer Hyosung, Lotte Chemical and Axon, the chassis is constructed using techniques that could change the way cars are made, according to Hyundai.

The chassis begins life as beams, which are fabricated by braiding carbon fibre over flexible

foam cores. Laying-up and bending these beams into shape is easy – no pre-forming steps are necessary – while the foam cores reduce the cost and mass of the frame. A vacuum-assisted resin-transfer moulding process is then used to infuse the carbon fibres within a plastic matrix.

The chassis is formed from continuous loops of this material. These serve as self-contained modular frames for the roof, bonnet and the apertures for the doors on either side of the structure. These loops are then bonded to one another along their lengths at ambient temperature. By bonding the loops along their lengths, rather than at their cross-sections, the chassis of the Intrado is strong and is highly resistant to torsional stress. And while the chassis weighs 50% less than it would if it was made of steel, for now the Intrado remains a concept.

According to market research company

Lucintel, CFRPs accounted for less than 1% of the materials used by the automotive industry in 2014. For the majority of carmakers, CFRPs remain too expensive and the processes employed to form them into parts are still too slow for the materials to be used for mass market vehicle production.

Speaking at the JEC Automotive Leadership Forum, the vice president of strategic automotive initiatives at Siemens PLM Software, Edward Bernardon, said: "You can Google it if you want to, but you won't find \$1/lbs carbon fibre. If you did, it would solve all of our problems. But the solution is bit more complicated."

Bernardon used to work at Vistagy, best known for its Fibersim composites design software, before Siemens acquired the company in 2011. Since then, he has been working with OEMs in Europe, North America and – most recently – in Asia on the problem of getting CFRP into high-volume automotive applications.

During this time, Bernardon has identified two relatively straightforward ways in which OEMs and their suppliers could alter their design philosophies that could help make this goal a reality. First, Bernardon says, these companies must eliminate 'black metal design', treating



Left: Dow Automotive have developed a resin transfer moulding (RTM) processes that could produce components in 60 seconds or less

Right: The mass production of carbon fibre parts is still problematic and expensive for the automotive, despite huge investment by the industry

Below: The 'one-step carbon fibre bobbin to preform concept' by Toho Tenax is producing a bonnet using its Part via Preform process



CFRPs as drop-in replacements for metals.

In black metal design, CFRP parts are made with quasi-isotropic properties and constant thickness sections, meaning that the designer is only taking advantage of the reduced weight of CFRP in comparison with metals, and negating any of the other advantageous properties inherent in the material itself.

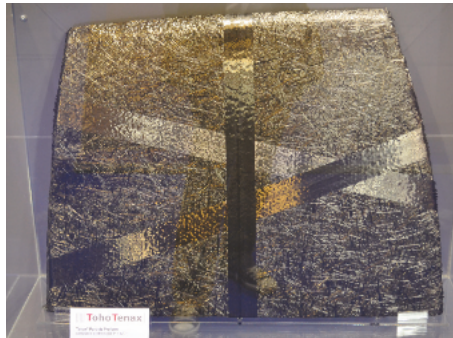
Perhaps more of an issue is the fact that black metal design can hinder the cost-effective manufacture of CFRP parts. Parts designed with tight corners, and steep and/or deep drafts are particularly problematic, causing buckling and in-plane fibre distortions in the carbon fibre fabric.

Bernardon added: "The result is that you can't make these parts in one piece, you can't stamp them out. So you splice them. You make them out of ten or twelve pieces and one of the main advantages of composites – part consolidation – is completely gone."

Designing parts with smoother and more rounded features could enable the use of more high-volume technologies for the manufacture of CFRP parts. For example, Dow Automotive revealed at JEC that the company's Voraforce 5300 epoxy – introduced in 2014 for use in resin transfer moulding (RTM) processes – has been assessed for use with wet compression processes and could be employed to produce components in cycle times of under 60 seconds.

Using the wet compression moulding process, a dry fibre reinforcement is placed in a mould and resin is applied on top of this reinforcement. The mould is then transferred to a compression machine, where the applied pressure infuses the fabric with the resin. The use of multiple moulds in coordination with one machine would allow resin to be dispensed onto one mould while another is in the compression machine, increasing throughput significantly.

However, this process is only suitable for producing relatively flat parts. More complex



components would need to be processed via the more long-winded RTM technique.

Second, optimising the use of the material could reduce the cost of CFRPs further.

Bernardon said. "If you think of a construction crane, it is full of holes, but by putting steel in the right places you can make a very stiff structure."

"Eliminate black metal design. Only use as much material as you need" **Edward Bernardon,** **Siemens PLM**

On the JEC showfloor, Toho Tenax exhibited a bonnet made using its Part via Preform (PvP) process that typified this approach. The process is based on what the company calls a 'one-step carbon fibre bobbin to preform concept', using Tenax Binder Yarn. This is a combination of carbon fibre and a binder resin.

The yarn can be processed to produce preforms with random fibre arrangements for isotropic behaviour, with aligned fibre placement in areas where higher mechanical performance is required, or with a combination of the two. By combining randomly orientated and unidirectional carbon fibres, preforms can be produced that strike a balance between mechanical properties and cost.

The company claims that the Tenax PvP process enables the automated manufacturing of preforms to any desired geometry, without the need for expensive intermediate processes. The technology helps to reduce both carbon fibre waste and manual labour compared with conventional preform production.

Bernardon continued: "In the case of the bonnet, Toho Tenax uses a spray-up process for the complex geometry and they put unidirectional carbon fibre just where they need it, so they can get the stiffness that they want."

Reducing the amount of expensive unidirectional carbon fibres required not only reduces the cost of the part, but also the area in which these are used is relatively small meaning they are laid over fewer complex features. The result is there is less chance of them wrinkling and affecting the quality of the part later on.

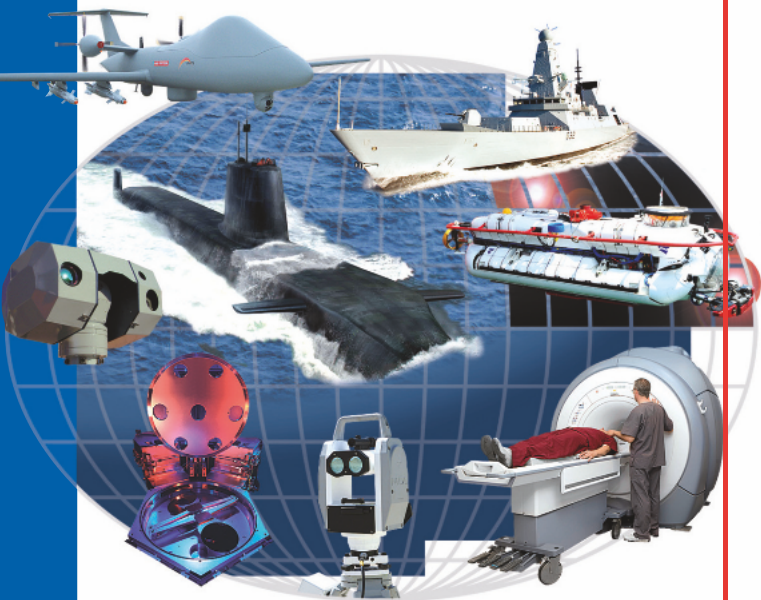
Bernardon concluded with some clear advice for the automotive industry, and those looking at using CFRP in the future.

"Eliminate black metal design. Only use as much material as you need. If you do these two things, it's going to be a lot easier to utilise the automated manufacturing technologies available today. If you don't do these things, these technologies just won't work."

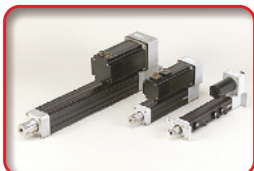
But there are numerous moves that signal the emergence of CFRP in the high volume automotive industry. Toho Tenax has already demonstrated the use of its PvP technology in high- and low-pressure RTM processes for both structural and non-structural automotive parts. It is currently working with OEMs worldwide to develop commercial applications for the technology.

As for the chassis of the Intrado, Hyundai has forged the key partnerships needed for it to put the vehicle into production. However, it remains to be seen whether the company is prepared to make the necessary financial investment.

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Lamborghini's fifty-year heritage has seen the brand become synonymous with extreme and uncompromising automotive design



Rapid route to the *race track*

3D printing is not just for prototyping. Lamborghini is also using it to rapidly create track-ready parts, as it revealed to *Eureka*.

As the home of Automobili Lamborghini S.p.a., Sant'Agata Bolognese, in Northeastern Italy, can genuinely lay claim to being a manufacturing epicentre for some of the world's most sought-after super cars. From its very first models released in the mid-1960s, Lamborghini prides itself on a 50 year heritage that has seen its brand become synonymous with extreme and uncompromising automotive design. The company has created a series of exclusive cars that include the 350 GT, Miura, Espada, Countach, Diablo, Murciélago, Gallardo and Aventador, as well as several limited series such as the Reventón, Sesto Elemento, Aventador J and Veneno.

Today Lamborghini is owned by Audi, part of the Volkswagen Group, which also boasts a prestigious stable comprising such brands as Porsche, Bugatti and Bentley. With its image and value proposition as important as ever, the company relies upon the most pioneering technologies to uphold its reputation for automotive excellence and exemplary design prowess.

Track-ready racing parts

Meeting this objective is aided by the company's continued use of Stratasys FDM-based 3D printing technology, which Lamborghini uses throughout the entire lifecycle of its parts, from rapid prototyping applications to direct digital manufacturing of end-use parts.

Indeed, Lamborghini's use of the technology to print track-ready parts is exemplified within the Lamborghini Blancpain Super Trofeo, a major international one-make racing series organised by the company.

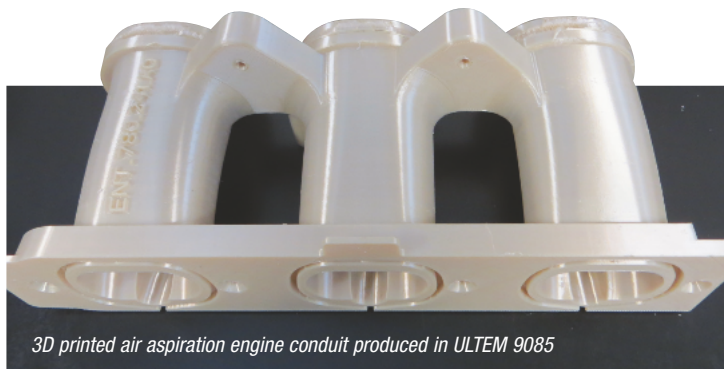
According to Fabio Serrazanetti of Lamborghini's car body technical department,

the requirement to produce high-strength end-use parts, tough enough to endure the rigours of high-speed racing, as well as the need to create complex geometries in a very tight timeframe, led the company's engineers to explore Stratasys' Fortus 3D production systems.

"We use Stratasys technology to produce FDM-printed end-use parts because, quite simply, it meets all the requirements demanded of it," he explained. "In the motor racing world, the capability to very quickly output highly durable parts and components within a seemingly unlimited design scope offers an unprecedented advantage. We use our Fortus 3D production systems to typically – but not exclusively – produce high-performance aesthetic parts, including profiles and air conducts."

In-house prototyping

Beyond the race-track, Stratasys has also accelerated Lamborghini's rapid prototyping applications by slashing costs and enhancing workflow efficiencies. Having previously outsourced its prototyping requirements,



3D printed air aspiration engine conduit produced in ULTEM 9085



Stratasys' Fortus 400mc 3D production system produces parts that include Nolders - an aerodynamic profile installed under vehicle bumpers

operations were brought in house in 2007 with the installation of a Stratasys Dimension 1200es 3D Printer. This was followed by a Fortus 360mc system three years later, before the most recent investment in 2013 – the Fortus 400mc with a large build envelope.

As Serrazanetti explained, the in-house FDM printing systems quickly delivered a raft of important and tangible benefits.

"Outsourcing our rapid prototyping operations proved both a lengthy and costly exercise," he said. "Today we have overall greater control of such projects and have

optimised lead times and reduced costs."

Serrazanetti and his team utilise Stratasys' technology predominantly to produce scale models and advanced functional prototype parts for design verification and fit and form suitability. These include an array of different exterior parts – from section bumpers, grills, aesthetic frames and those in the engine bay – to various interior parts that span door panels, seat covers, steering wheels along with aerodynamic components such as conveyors and air heaters. FDM eliminates tooling, which keeps costs down and allows rapid iteration on new designs without manufacturing constraints.

Material selection

Within these applications, the choice of material used will vary according to high temperature requirements and the level of stress subjected upon the model during assembly, dimensional and mechanical testing.

"We aim to use materials that mimic the material properties of the final product as far as possible," said Serrazanetti. "For example, we currently use Stratasys' ULTEM FDM thermoplastic with the Fortus 400mc to produce high-performance parts for the grill as they will be subjected to high temperatures from the engine compartment.

"We also use production-grade thermoplastic, ABS-M30, as well as PC-ABS," he added. "Indeed, this is perfectly suited to producing certain interior parts as it also offers excellent feature definition and surface finish,

making it better aesthetically."

In addition, Serrazanetti and his team use the ULTEM material to respond to the occasional urgent request from technicians at Lamborghini's Advanced Composite Research Centre.

"We're sometimes called upon to produce ULTEM models, on which very thin carbon fibre sheets are laid down and moulded around to produce carbon fibre parts," he commented. "Using ULTEM in this way reflects the key attributes of FDM technology in that it allows us to quickly and confidently produce extremely strong complex parts when the timeframe leaves the technicians with no other option."

Serrazanetti typically tests functional prototype parts on static scale model cars in a dedicated area of Lamborghini's quality control department, as well as mount 3D-printed parts onto working prototype versions of the company's next launches. These cars then undergo more intensive track or road testing in order to gauge a more realistic performance evaluation of specific parts during the development phase.

Given the ability to dramatically improve cost and production efficiencies within Lamborghini's rapid prototyping operations, Serrazanetti admitted that Stratasys 3D printing technology makes his and his team's life easier. "At the moment Stratasys' technology delivers the fastest and most economical means of constructing prototype parts for us," he concluded.

Poly Jet Technology

Tim Fryer on the latest innovation that allows multi-material printing.

One aspect that has limited the use of 3D printers, or at least made the time taken to print a single object more lengthy by having multiple passes, is that the majority can only use a single material. Stratasys has tackled this obstacle with its latest Connex machines.

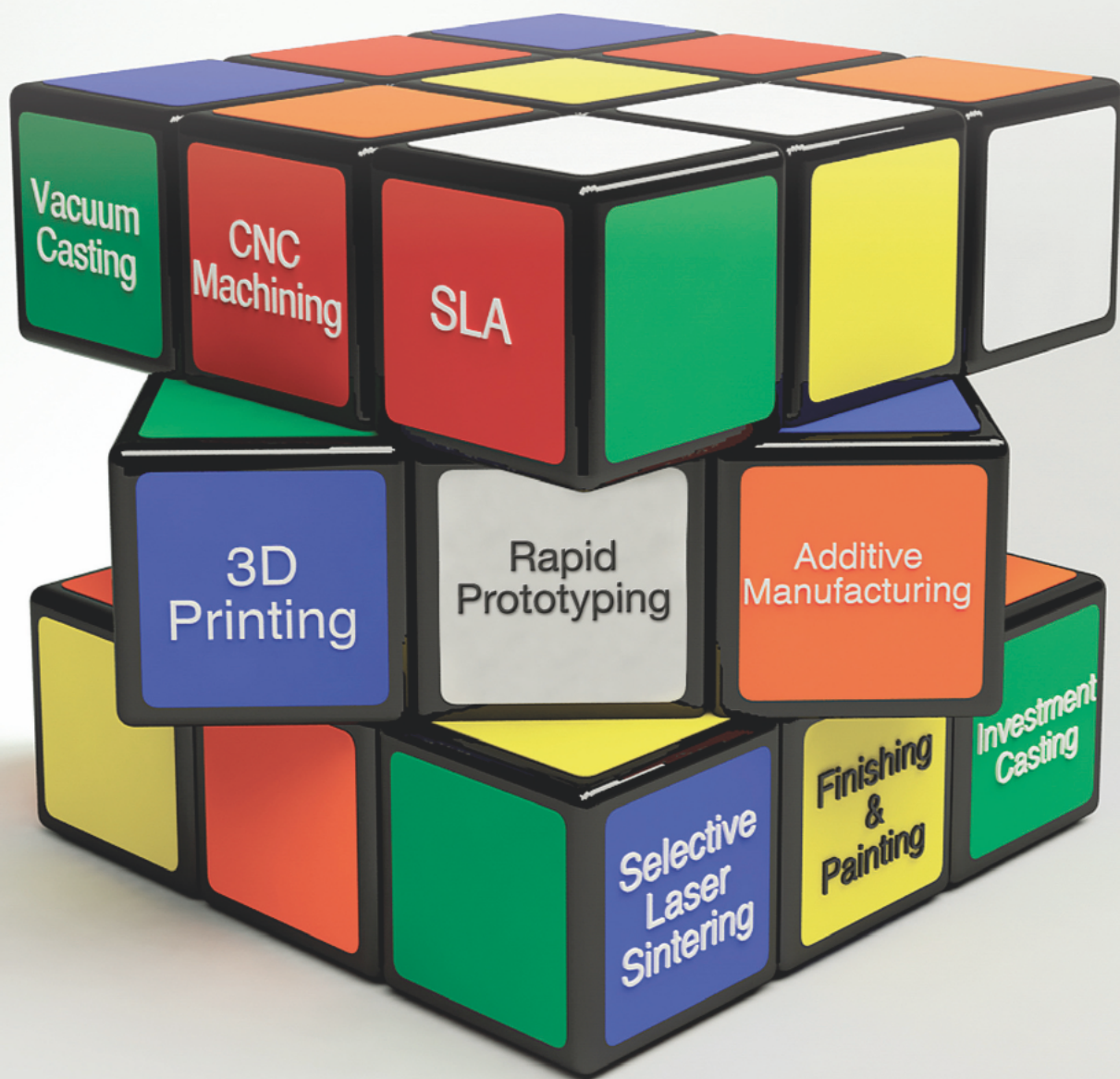
The Connex printers use PolyJet technology. Leslie Frost (right), marketing communications manager of Stratasys, commented: "They will take multiple materials and deposit digitally mixed droplets. Just like you would mix CMYK to create multiple different colours in a normal printer, this is mixing multiple materials and creating a whole range of material properties."

The materials in question are proprietary photo polymer resins, cured by UV light, that vary from very rigid to very flexible, and by combining them materials can produce and replicate many other substances. Frost concluded: "We have created a material that has the same characteristics as digital ABS does."





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Suits design in **motion**

Clever sensor technology has seen the development of a tool with interesting possibilities for engineers, particularly for those whose designs cater for human movement. Tim Fryer reports.

Wearable electronics can mean many different things. It can be a form of display perhaps, for those who want to constantly change the appearance of their garment. It can be a source of information – while some struggled with the appearance of the smart glasses, the latest tranche of smart watches are more stylish, safer and debatably more useful. However, where wearable technology has really taken off is in monitoring the body.

There is nothing new in having a heart monitor, and various health and fitness devices have successfully followed, quite often the make or break factor being in the smartphone app that supports them. When complex analytical software takes over from the app, and the sensor technology moves further forward, a new strain of wearable technology has design implications both when designing these systems in, and when using the system for design. Hopefully that sentence will make sense by the end of the article.

Sensing motion

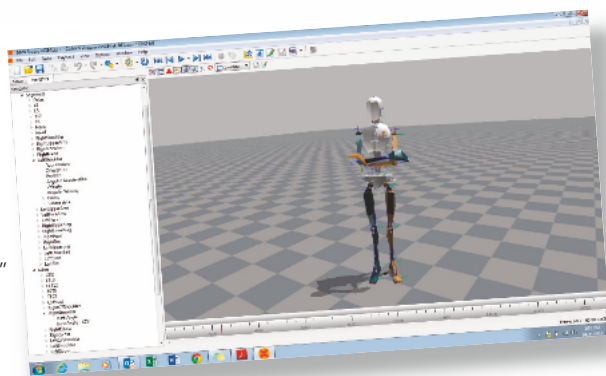
The MVN Biomech system from Dutch company Xsens is wearable technology providing 3D human motion tracking that can be used on production lines, sports fields, in vehicles and aircraft, in the home or any location where

human body movement needs to be analysed with high accuracy.

“Xsens’ systems are now considered the de-facto industry standard for human motion measurement. They are well established with trailblazers in entertainment, research and industry,” claimed Per Slycke, CTO and general manager at Xsens. “MVN Biomech is moving inertial motion tracking to the next level by taking it from research laboratories to where the action is. Combined with reduced pricing, this means that digitising 3D motion is now accessible to a much wider user base.”

MVN Biomech comes either as a full-body suit or a strap-based system. It is intuitive and can be set up for use anywhere, within minutes. Based on lightweight, wearable inertial sensors, MVN Biomech is portable, fitting into an average-sized backpack.

The core technology here, according to product manager Colleen Monaghan, is sensor fusion – the sensors being fused here are gyroscopes, accelerometers and magnetometers. “The gyro is the work horse, calculating the angular velocity,” explained Monaghan. “But to get orientation you need to integrate that signal and if you continuously



integrate a signal it will drift. So it then leans on the accelerometer to get the gravity signal – and therefore knows which way is down. Using mag data it knows which way is north, so it can constantly correct itself.”

This inertial sensor – the ‘fused’ gyro, accelerometer and magnetometer sensor – is physically a collection of MEMS sensors on a PCB in a small orange enclosure. In the full-body suit 17 of these motion tracking units are deployed.

“The inertial sensors send the fused data and display it on the computer through a software programme called MVN Studio Biomech,” commented Monaghan. “This contains things like the biomechanical models.”

Inside the biomechanical model the lengths of all the segments can be entered, like foot size and length from foot to knee and knee to hip.





Monaghan continued: "Using the sensor data and also knowing the length of the segments and the length of the body and feet, it can keep quite a tight control also on the position calculation. So when you stream all of this data through in MVN Studio, you basically see this lovely 3D character run around the screen and you can see it from all different camera angles or from one plane."

The overall technology has been gradually developed and improved over the 15 years the company has been in existence, and it has been used very successfully to bring animated characters to life in games and films. Some of its higher profile applications have been in Alice in Wonderland, Ted and for Gollum in Lord of the Rings. Most recently it was used in Walt Disney's UK-filmed Maleficent.

However, the detail that allows it to create such lifelike characters in film can also be utilised to study 3D human movement in other sectors.

Biomech in industrial design

Moving away from the big screen and games consoles, obvious users for this technology would be doctors, physiotherapists and sports coaches. Monaghan said: "People are actually doing research with skis and snowboarding kinematics – that's about the posture of the person, how does their knee move, what is and what is not a good ski pose – with the goal of how can we improve people's technique."

However there are other applications in the research and industrial sectors. "Automotive is a growing field," said Monaghan, "and also aeroplane and train manufacturers. But, then there are also people who want to design manufacturing plants using products like Siemens and Catia, and within that process

simulate humans. Then you can tell by having the actual person submerged in this environment if this layout of the plant makes sense. Sometimes things look great on paper, and even in simulations, but when you put the person in and finally build the manufacturing plant, then it's too late to realise that things aren't actually optimal."

For example the system could be used to see how certain tasks might be performed, using a real person in a virtual environment, to see if a repetitious movement might cause too much strain on the back or knees. Do work surfaces need to be moved closer together or be at different angles, or are the spaces between equipment sufficient for actual human movement?

"If you can evaluate this with a person in a simulated environment before you've built the whole thing, it saves so much money and so much time," observed Monaghan.

The suit is made of lycra and the trackers are attached to specific points on Velcro patches. Wires connect to the back pack that sends over data wirelessly. There is also a completely wireless version where the trackers are on straps. There is no back pack for this as each one sends its data to the 'window master' that ensures all data is completely synchronised before feeding through the MVN Studio software.

Apparently it's a very easy system to use and links seamlessly into Siemens and Dassault design environments amongst others. Car manufacturers for example have been early adopters. "They can see in the software, in real time, these characters move around on screen. And they use it to help speed up the whole process of their work," concluded Monaghan.

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Motion capture sensors are being increasingly used by engineers as a design tool, from the development of prosthetics to the optimisation of manufacturing plants



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On the **right track**

Tim Fryer looks at one system that, although it has been around for a while, often gets overlooked when selecting a linear systems.

Ball rails, or profile rails depending in your preference in terminology, are often the default choice when a linear system is required. Why not – after all they are reliable and proven. Other options, however, are available. And when performance issues are taken into consideration with cost benefits in terms of installation and maintenance, sometimes that alternative can turn out to be a better choice.

One such alternative is the V-guide. While not new, it is often overlooked largely due to this market inertia as well as preconceptions about the load bearing capabilities.

Chris Rees is sales director with HepcoMotion, the company that invented V-guide technology and which now deploys it in its flagship linear motion product, the GV3. A typical scenario is when a machine designer, needing a guidance system, automatically selects the THK type guide rail – the profile rail – as the default choice.

Rees commented: “What we say is ‘okay it’s a great product. It’s highly successful and does a good job, but have you considered V-guides in this particular application? Because it’ll give you low maintenance, it’ll be easy to install and it will work in your conditions very well, and it won’t

catastrophically fail.’ The worst thing that can happen is that they will have to change the bearings after so many thousand kilometres.”

The GV3 is essentially four rotational bearings with a ‘V’ in them. Two of these bearings are on concentric studs and two on eccentric, allowing easy adjustment onto the guide while removing any system play, resulting in a smooth running, low friction system. In fact HepcoMotion frequently provides the customer with the bearings already set in the carriage plate, meaning there is no adjustment and the system can be bolted directly onto the customer’s machine.

Each bearing has a ‘cap wiper’ which sits under the carriage plate to protect the bearing and provide lubrication to the slide.

“The key benefit of that is its low maintenance,” said Rees. “It doesn’t require a lot of lubrication to run. Basically, customers lubricate the product and they just forget about it. All we’re trying to do is to prevent two totally dry metals rubbing together, and providing you do that, the system will carry on working.”

Unlike profile guides the actual bearings are enclosed, which is a key advantage when it

comes to maintenance and one that is more pronounced in dirty conditions.

“The cap wiper won’t totally prevent dirt from getting into the system,” explained Rees. “But if it does happen then it’s just wiped clean, it doesn’t clog up and cause a potential failure. On the other hand if you get dirt into a ball re-circulating system then eventually it will just fail because the balls can’t re-circulate. That doesn’t happen with this system because the internal workings of the bearing are sealed. The important thing is the running of the bearing ‘V’ on the V-slide, but dirt can’t build up there because it basically wipes itself clean.”

However, there can be a build up of dirt in the cap wipers themselves. “If you get too much dirt in there you might find the friction gets a bit high,” added Rees. “Then, you’ve got to take the cap wiper off and get rid of some of the crud that’s in there. But that’s no big deal, it’s not a failure. In reality that rarely seems to happen because the cap wipers act as scrapers as well.”

It is possible to run the system completely dry of lubricant, but that will have an effect on the load capacity. Any system carrying over 20kg needs some level of lubrication.



The GV3 is challenging market preconceptions about its load bearing capability against the more established profile rail

The load capacity question

Load carrying capacity is an issue that is often looked at and Rees acknowledges that, taking a size for size comparison in terms of dynamic load carrying capacity, the V-guide will not compare to a profile rail.

"We accept that, but what we do is size the product to suit the application. In other words, in our discussions with a customer we'll determine what sort of life they want and if they want a life of five years, we select a guidance system which will give them at least five years' life. Whereas the re-circulating system might give them 50 years' life for the same application, but who's going to want a machine that's 50 years' old anyway? So you tend to find that any objections you get regarding load carrying capacity, and that's really the one objection we can get, you can get round by sizing the product to suit."

The nature of the product actually offers a degree of compliance that is not only acceptable but in some cases is desirable. It is not suitable for applications that need precision movement in microns, but instead is used, for example, in basic automation packaging machines, printing machines, scientific equipment, picking and placing, working with robots and applications where a little bit of compliance in the machine is actually quite useful as customers don't want to



Chris Rees from HepcoMotion is a champion of the V-guide system

get engaged in high precision just to get the machine to work. They want installation to be as straightforward as possible.

In its simplest form the GV3 is a guide, bearings and a carriage plate, but the system has evolved to offer many options. At the most basic level, if the designer doesn't want the carriage plate but wants it fitted straight onto the machine then it is simply a case of drilling four holes, fit the bearings into the holes and then adjust the eccentrics onto the slide.

At the other end of the scale there are a host of options from mounting beams, different sized carriage plates, to floating and blind hole fixing bearings to both make installation easier and to

increase design options. "That's part of the benefit - it's very flexible," said Rees.

One particular example of this is incorporating a drive system. Larger travel distances often lend themselves to the use of a rack and pinion drive. If this is not integral with the guidance system then precision parallel setting of a separate rack to the guide is required. In turn, this can mean another precision machined surface is needed just to mount the rack.

GV3 double and single edge rails can be supplied with the rack already in position. With the double edge roll this is a separate component fixed to the top of the slide at manufacture whereas with single edge rails the rack is machined into the free back edge of the rail parallel with the V-faces.

With the inclusion of a standard rack driven carriage for the double edge system and a pinion supplied to suit the single edge option, the whole aspect of driving the system becomes a simple process that is compact and does not require additional components and setting.

While the last major introduction for the system was the floating bearings, Rees alluded to development work which could see some interesting iterations for the next product generation.

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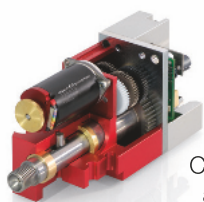
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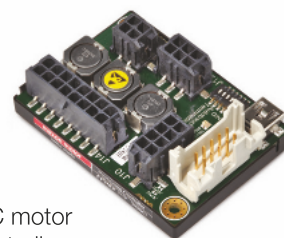
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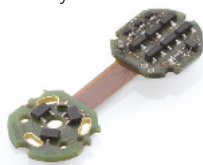


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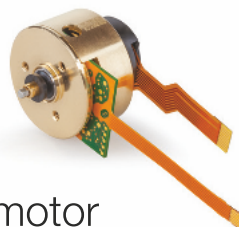


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- Total Error Band better than 1% (-10...80°C)
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Trenching *on the level*

For a 42 tonne subsea beast, the Hi-Traq is fairly benign – providing, as it does, cost-effective trenching services for the offshore renewable industry. This impressive piece of design won Product of the Year at the 2014 BEEAs, as Tim Fryer reports.

HC Engineering Business had been approached by various companies regarding trenching in the offshore renewables market. It decided to dedicate extensive research and development into investigating innovative methods that would challenge existing technologies and ultimately lower the 'levelised cost of energy' (LCOE) for offshore renewables. The product that emerged from the programme was Hi-Traq - an innovative fourtrack subsea crawler vehicle designed to be a tooling platform to facilitate a range of activities.

The design intent for the Hi-Traq was to mitigate the problems and operational downtime incurred using conventional oil and gas equipment during inter-array cable burial. This was achieved through the application of a crawler vehicle with four tracks and a self-levelling system. The Hi-Traq's four track system gives the necessary traction performance required for the sort of subsea terrain associated with shallow water. The harsh seabed environment found at the offshore renewable locations dictated the requirement for a highly manoeuvrable system which resulted in a chassis from which a variety of subsea tasks can be conducted.

William Stephenson, IHC's product manager for Subsea Vehicles, said that the aim had been to use proven, reliable engineering in a new configuration to facilitate more efficient operations in the challenging subsea conditions.

"The vehicle was designed from the ground up starting with a blank sheet of paper by looking at industry lessons learned, the causes for recent

project delays and by examining the issues faced by existing equipment operating in shallow water locations," he said. "Well established and best practice approaches were taken during the design phase but the vehicle format is completely new. We have used reliable and robust engineering techniques with standard cylinders and pins."

An analysis of current trenching technologies found that although there are a range of tools operating in the field, none have been designed specifically for offshore inter-array cable burial.

Current trenching equipment was designed for the installation of oil and gas lines (heavy subsea crawlers and large free swimming ROVs) or the burial of telecommunication cables across long distances (ploughs). However, offshore renewable locations are found in shallow waters that are subject to strong currents and wave action leading to significant seabed sand waves and mega ripples which make trenching using conventional assets problematic. Free swimming trenching alternatives can risk damage to the cable as they have difficulties staying on-station in



The Hi-Traq undergoing tests on a circuit specifically designed to replicate the subsea environment it will have to operate in.

these strong current conditions.

Another consideration is that as an inter-array cable exits a turbine there is a short radius bend before the straight cable runs to the next turbine. Conventional trenching equipment cannot trench to a short radius and thus secondary protection methods such as mattresses or rock dumping must be employed to protect the cable up to the buried section. This secondary protection method is expensive and increases the difficulty of cable maintenance or repair operations. The ideal solution was for a crawler system, capable of staying on-station in strong currents, to be able to trench straight from the base of a turbine including the trenching of the short radius bends.

Stephenson commented: "The biggest design challenges were the packaging of all of the required equipment into a relatively condensed platform and to design a rotating depressor, which can allow safe cable burial operations around those short radius bends."

The Hi-Traq features independent track steering allowing three forms of steering: crab, skid and wagon steering. This allows the small radius trenching required for the inter-array cables. The tracks are independently driven which provides increased control and mitigates the track skidding that would occur when trenching in wagon steering mode.

The four track drive and four track steering system also enables constant cutter face pressure ensuring maximum efficiency from the cutting tool. The non-parallel wishbone levelling geometry for the vehicle was designed to keep the virtual pivot point at the ground to cutter interface, which enables the vehicle to cut a constant depth trench on side slopes. The vehicle also has a patented tilting function using the levelling system to trench around a radius, and avoid undercutting the outside trench wall.

Independent track levelling provides more than 2.15m of vertical movement for obstacle climbing. The independent pitch on all four track units of $\pm 20^\circ$ prevents spanning as the vehicle ascends a slope and provides a smooth transition over the top of crests compared to two-track systems which have a tipover point. The vehicle's self-levelling system automatically adjusts to keep the chassis level which ensures constant trench depth and vertical trench walls even when negotiating sand waves and uneven terrain.

Beyond trenching, IHC EB aims to use the Hi-Traq chassis as a platform for peripheral tooling.



The four track system provides a low ground contact pressure to allow operations in soft soil conditions. Stephenson added: "The Hi-Traq uses inter-changeable tooling cartridges to operate different trenching tools and additionally uses tooling packages on a plug and play basis to

"The biggest challenges was the packaging of the required equipment into a condensed platform and the design of a rotating depressor that can allow safe cable burial operations around short radius bends."

William Stephenson

conduct other operations such as subsea excavation and subsea handling."

The Hi-Traq has the capacity to stay on-station in the high currents and wave action found at offshore renewable locations and so reduces operational downtime associated with conventional equipment.

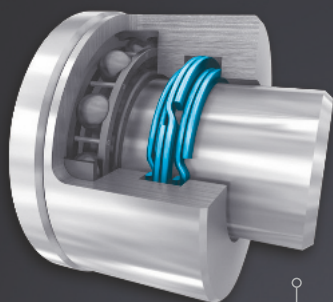
Cost is all important – and its ability to work in bad sea and subsea conditions makes the Hi-Traq's availability critical in controlling costs. "Accordingly the vehicle will be able to perform

more operations in a given time period, which reduces the number of required vessel days," said Stephenson. "Vessel days are expensive - in the region of £80k/day - and so any improvements to efficiency, and thus a reduction in vessel days, can create significant cost savings. Additionally, the Hi-Traq can trench closer to the turbine than many alternative vehicles, which reduces the requirement for second-end operations such as rock placement or mattresses. Both of these activities are expensive and require significant vessel time over an entire offshore wind farm."

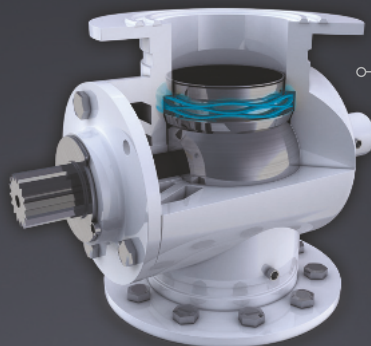
Such advances are critical if the offshore renewable sector is to grow, as Stephenson explained: "Presently the industry as a whole is working towards lowering the LCOE for offshore renewables to make the sustainable energy sources more competitive with fossil fuel alternatives. Continual technology advancements are required to make installation, operation and maintenance, and ultimately decommissioning operations less expensive in order to reduce our reliance on fossil fuel powered energy generation."

The technology is scalable and therefore adaptable to clients' requirements ranging from a lightweight jetting only vehicle to a platform for larger scale installation and decommissioning operations. The first Hi-Traq IHC will bring to market is approximately 42 tonnes and is specifically aimed at the North Sea market.

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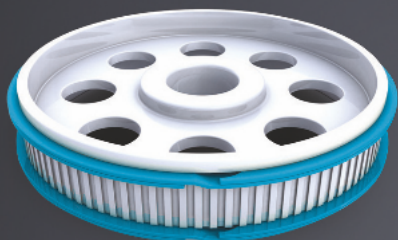
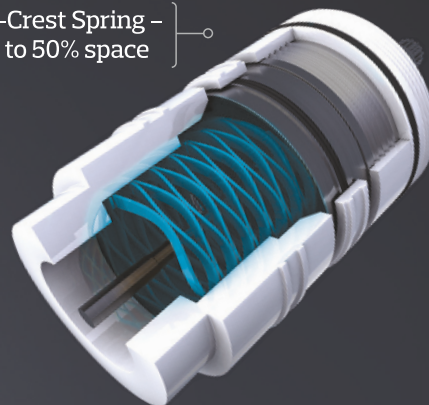


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The strange phenomenon of solar flight

The idea of flying around the world in a solar aircraft might seem like an exercise in technical bravado, but its success could have real potential. Justin Cunningham explains why.

It's weird enough that we drive around in machines powered by dead plants and animals from millions of years ago, but flying around in machines powered by sunbeams?! The latter part of this peculiar reality is the result of more than 10 years work, which is currently seeing the Solar Impulse aircraft circumnavigate the globe fuelled by nothing more than sunshine.

While it is easy to label this project as a flight of fancy for engineers – a technical exercise to prove the possibilities without practical purpose – Solar Impulse has become all about proving people wrong. While practical outcomes are abundant (more on that later), the project has broken frontiers and is capturing the imagination of people young and old in much the same way as the early years of flight.

Engineering is often seen as safe and calculated, and it is all too easy to forget about those inspiring engineering success stories from yesteryear. Solar Impulse along with Bloodhound SSC have taken the torch and are doing amazing things no one thought possible. And that is making everyone sit up and listen.

"Solar Impulse promotes a pioneering and

innovative spirit, particularly in energy saving and renewable energy," said Claudia Durnat, media relationship manager on the project. "Our success will come from completing a round the world tour without fuel, but also in motivating people to reduce dependence on fossil fuels."

Solar Impulse 2 is the culmination of decades of iterations and development. The first solar-powered airplanes date back to the 1980s but they could only fly during the day as there was no way of storing energy. Solar Impulse is the first plane to be able to store solar energy accumulated during daytime flight, in order to fly at night.

And some big leaps forward have come in the last five years, as the team stepped up the capability of the originator, Solar Impulse 1.

"Solar Impulse 2 is not about one revolutionary technology, but a mix of many solutions," said André Borschberg, the co-founder of the project. "It's the sum of all the efforts by our engineers."

The most striking change has been to the overall wingspan. Now, at over 70m, Solar Impulse 2 has a span just 8m shy of the world's

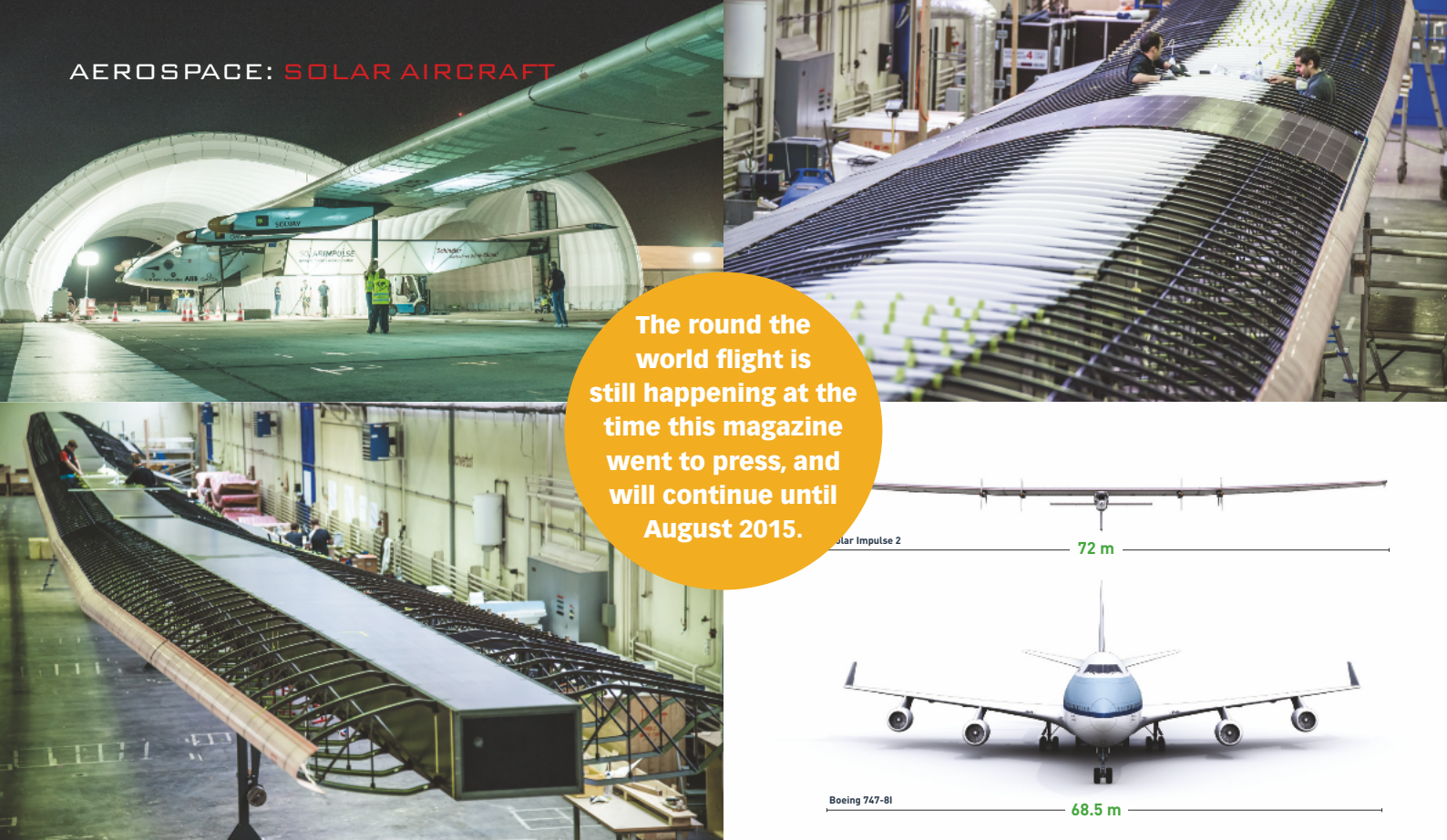
largest airliner, the Airbus A380, and is actually greater than a Boeing 747-800. This shows the size of the project, and the aircraft itself.

The top of the wing, fuselage and tail plane are covered in photovoltaic cells that charge four large lithium-ion batteries (weighing 633kg), which power four large motors to turn propellers. It all provides enough propulsion to cruise at a normal 27,000ft (8,500m) and 87mph (140kph). But, at over 2,300kg, it's a wonder Solar Impulse ever gets off the ground.

"The plane needs a lot of batteries, and batteries are heavy," explained Geri Piller, head of structural analysis at Solar Impulse. "Yet the aeroplane gets only a small amount of energy [from the solar cells], so it has to be really light."

The batteries are essential. Unable to be reduced, these are a fixed weight that engineers have had to design around.

Solar Impulse 1 already used most of the obvious tricks of the trade in terms of reducing weight, with all the easy pickings exhausted. It meant that any further weight reduction was going to be a daunting challenge in itself, only exemplified by the wingspan that needed to be



The round the world flight is still happening at the time this magazine went to press, and will continue until August 2015.

increased nearly 10m. The corresponding greater surface area was needed to go from 11,628 photovoltaic cells rating the aircraft at 45kW peak, to 17,248 photovoltaic cells and 66kW peak.

In addition, the motors increased from 7.5kW to 13kW, and propellers from 3.5m to 4m. But perhaps the biggest weight gain came from the batteries, almost doubling output from 4 x 21kWh to 4 x 41kWh, adding an additional 183kg. It was clear more than just good design was required.

"We had to simulate to get the strongest lightest structure possible," said Durnat.

The structural analysis team used Femap with NX Nastran software, from product lifecycle management (PLM) specialist Siemens PLM Software. But while some simulation had been used on Solar Impulse 1, the challenge facing the team would be pushed to breaking point.

In July 2012 during the physical structural test of the wing spar, the part suffered catastrophic failure. It was a harsh reminder of the close margins the designers are having to work within.

Swiss engineering company AeroFEM was contracted to perform special analysis like aero-elasticity and rotor dynamics. The analysts initially used the CAD geometry of the wing's outer surfaces to create a simple model to look at load paths. Later, using Femap, they added 3D solid elements representing the Kevlar-aramid paper honeycomb core for more detailed analyses such as local and global buckling. It was a critical part of getting the parts failure free, and ready for flight.

Disproportional size v weight

The single-seat cockpit of the plane that is flying around the world is tiny, just 3.8m³. But it's actually three times larger than the cockpit of the Solar Impulse 1. However, despite being three times larger, it weighs less than twice as much as the original, 60kg compared to 42kg.

The wing, also, consists of a Kevlar honeycomb core covered with advanced carbon fibre composite. As well as additional weight from the increased wing area, Solar Impulse 2 also flies that bit faster, meaning its wings have to withstand greater loads.

As Femap has its own modelling functionality, composite materials that make up a large portion of the aeroplane could be improved. Carbon fibre plies were highly optimised to meet the new loading conditions with the least amount of added weight. This also allowed the team to go from a carbon fibre weave weighing 100g/m² to 25g/m².

Similarly, the motor gondola has to carry a heavier load but the weight increase was kept to a minimum. This was done, in part, by changing from a framework structure with a fairing to a sandwich structure. In addition, FEA was vital in optimising components such as facings and spar caps.

The future of solar flight?

The aim is not to revolutionise the photovoltaic industry but change the mindset of how people see renewable energy.

"Solar Impulse wants to show that clean energies combined with energy savings can allow us to accomplish things that were previously considered impossible," said Durnat. "This is a way of encouraging their use."

And the deliverable in this pretty amazing engineering effort is the abundance of technology transfer opportunities.

She concluded: "For the Solar Impulse 2, insulation materials were used that can be used in all homes and household appliances. The [motors] can also be used for electric cars. Batteries have also progressed as a direct consequence of our project."

The other potential for solar flight, more generally, is to replace satellites. Satellites are hugely expensive to build and launch, and once in space they are virtually untouchable. Solar flight offers the possibility for drones to fly high in the atmosphere out of the way of normal flight paths. They can land and take off for maintenance, change hardware, be updated, or whatever. They can be quickly repurposed to improve mobile phone coverage during large events or sent to an emergency site.

So while some might label this as a modern day flight of fancy, actually, it has real potential to change the world.

www.solarimpulse.com

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WHERE DESIGN IDEAS COME TOGETHER



Difficult disinfection

We've all been there. You're flying off somewhere exotic on holiday, you board the plane, get comfortable and settle in for the long haul. Aside from the obvious leg room bugbear and of course the crying baby, there is one person you definitely do not want to sit near, the sickie. A sneeze or sniff, cough or splutter, or fierce nose blow will kill that jubilant holiday feeling in a heartbeat.

Arriving at a destination feeling lousy – and not just sleep deprived – is something we are all keen to avoid. We know aircraft are notorious breeding grounds for germs, but aside from the annoyance and inconvenience of catching a cold mid-flight, there is actually a far more serious issue when it comes to health on an aircraft. This has been highlighted by recent cases of Ebola being flown around the world.

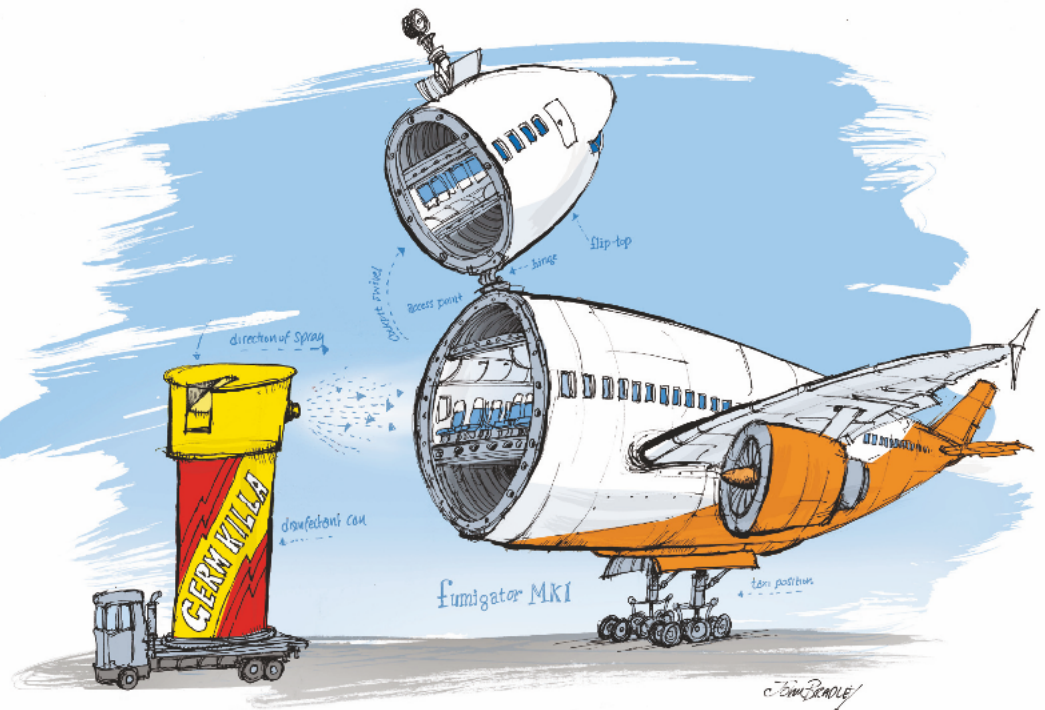
If people are carrying highly contagious diseases of one type or another, it is at risk of actually staying on the aircraft, being incubated, and infecting countless other travellers thereafter.

The challenge

The challenge this month is therefore to come up with an effective way of disinfecting aircraft between flights. At the moment, apart from any obvious spills, there is not much in the way of cleaning trays, seats or the cabin generally. And with such quick turnarounds, hundreds of people can sit in a seat before it is properly cleaned during a prolonged maintenance period.

While a filter system might well keep air quality in check, this is specifically about making sure that any germs do not stay onboard and infect the next lot of passengers. And it is near impossible for flight attendants to wipe down every surface that someone with an infection has touched.

Solutions should keep in mind that disinfection needs to be done



quickly, and well within the turnaround time of an aircraft, say 15 to 20 minutes. And it needs to kill near enough all known germs, certainly in excess of 99% of them.

The main areas that should be targeted are the seats, head rests and tray tables, as this is where you spend most of your time while in the air. And any method needs to be residue and odour free, as the last thing anyone wants is to board a plane with a thick smell of disinfectant, or be greeted with a wet seat fresh from cleaning.

The idea we have in mind will be revealed next month. In the meantime, see what you can come up with. If there are any ideas you want to share with us please go to the Coffee Time Challenge section of the website and leave us a comment, or email your idea to tfryer@findlay.co.uk

The answer to last month's Coffee Time Challenge – to get the perfect amount of sun regardless of the person – can be found on p10 of this issue.

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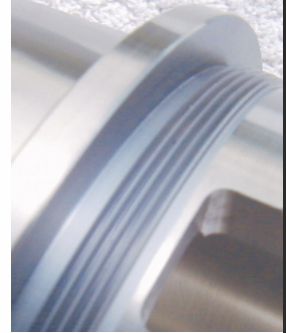
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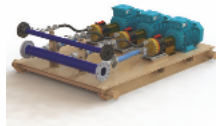
When three pumps are better than one

Engineers at Wanner have designed a high flow rate skid that incorporates three of the Company's Hydra-Cell G35 pumps operating in parallel.

The system can pump up to 420 litres per minute at 83 bar pressure or up to 200 litres per minute at 100 bar pressure. Installing three Hydra-Cell pumps means three times the flow as they are true positive displacement pumps. This is not the case in a centrifugal pump system. With Hydra-Cell pumps the flow is maintained but the friction losses manifest themselves in increased system pressure.

Some users choose the three pump option using two pumps to achieve service while keeping one for back-up. In many instances, where footprint is not an issue, the three pump approach can save on acquisition costs and energy costs while improving the overall reliability and efficiency of the system.

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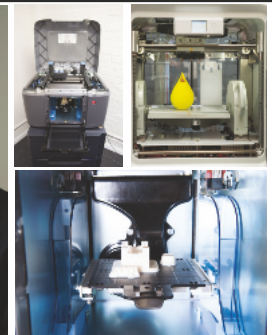
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Rotork CQ Compact actuators - power and performance where space is limited

Rotork CQ Compact actuators

The launch of the Rotork CQ Compact introduces a range of fully concentric, balanced design pneumatic and hydraulic valve actuators that deliver a reliable and efficient self-contained solution for applications demanding functional integrity and safety where space is limited.

In addition to providing reduced dimensions when compared with conventional scotch-yoke actuators, the CQ's symmetric design also presents a perfect weight balance on the valve, enabling increased efficiency for assembly and disassembly. The totally enclosed, rugged CQ weatherproof housing contains a helical mechanism which transforms linear piston motion into 90° (+/-5°) rotation for the operation of quarter-turn valves. As an option, rotation can be increased to 180°. Complete customisation of the torque profile is available to suit individual valve requirements.

The CQ range features a choice of cylinder sizes and different actuator builds for many diverse applications. In all cases the CQ design incorporates the removable valve adaptation within the overall dimensions for maximum compactness and actuators can be easily and safely disassembled to access internal parts for field maintenance. Internal coatings provide enhanced corrosion protection for long term reliability. External epoxy finishes and a wide choice of seal materials can be specified to meet industry and customer requirements.

CQ Compact actuators are available for single or double-acting operation with output torques up to 600,000 Nm. Pneumatic operation is available using instrument air, nitrogen or clean natural gas at 12 barg pressure, whilst 210 barg is recommended for hydraulic operation. Environmental and hazardous area certifications include IP66M/IP68M, PED, ATEX, IECEx and GOST. The actuators are also suitable for SIL3 safety related duty.

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