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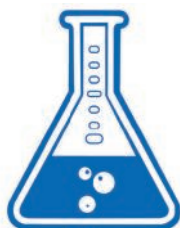
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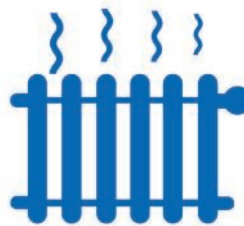
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EXTREME ACCURACY

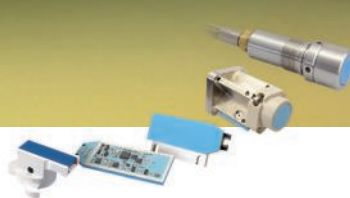


Bugs are able to build amazing structures, many of which surpass human technology in their complexity. Wasps in particular, demonstrate accuracy and efficiency when designing their honeycomb, achieving close tolerances of between 4.9 and 5.1mm.

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Taking quality for granted



Paul Fanning, Editor (pfanning@findlay.co.uk)

It was instructive as always, while attending the recent British Engineering Excellence Awards, to reflect on the sheer variety of fascinating industries and products that were represented there.

To list them all would take more than the length of this column, but to give just a couple of examples, the keynote address was given by Dimitris Katsanis, who designed the bicycles that won Britain so many golds at the 2012 Olympics. His address offered a fascinating insight into the engineering behind a genuinely great British success story. Equally, perhaps because he was talking to fellow engineers rather than a lay audience, Mr Katsanis was free to go into details that really brought this story alive to his audience.

Another example was in one of the shortlisted finalists, Crawley Creatures, whose brilliant animatronic creations have graced untold films and TV, as well as appearing in museums and exhibitions for many years. Indeed, the company has won several awards for its work including two Baftas and four Bafta nominations, an Emmy and three Emmy nominations in Visual Effects, two Royal Television Society awards, a TRIC and a Millennium Products Award.

Of course, this aspect of showbusiness begins and ends with engineering, but how many people would make the connection? After all, any animatronic used in the entertainment industry is by its nature supposed to appear real. This means that if the viewer is spending their time wondering at the engineering behind it rather than simply accepting it as part of the narrative, it has failed.

And this perhaps points to an underlying truth that may explain why it is sometimes so difficult to get the public to associate end products with the engineering behind them. After all, a well-designed and engineered product simply works faultlessly. It is designed for purpose and meets that purpose perfectly, affording its end user the luxury of taking it for granted.

All too often, the only time an end user will even consider the engineering of a product is if it goes wrong or dissatisfies in some way. This is perhaps natural, but does make the task of selling engineering as a profession all the more difficult. Of course, those of us inside the industry will carry on celebrating the engineering that underpins achievements. However, until that association is made in the public mind, convincing people of the fundamental role engineering plays in their lives will remain an uphill struggle.

Senior engineering consultant takes BEEAs Grand Prix

Sebastien Cuvelier Mussalian, a senior engineering consultant with Team Consulting, has won the Grand Prix prize at the 2013 British Engineering Excellence Awards (BEEAs), held today at 8 Northumberland Avenue in London.

Winner of both the Design Engineer of the Year category and the overall Grand Prix, French-born Sebastien Cuvelier Mussalian has worked in the UK since graduating in 2002.

He has shown a strong track record of developing complex products and of leading multi-disciplinary teams. Latterly, he was lead

engineer for the OrganOx liver perfusion system – winner of the Design Team of the Year Award at last year's BEEAs – and takes the time to work with schoolchildren to highlight engineering and in student groups in the 'Engineers Without Borders' scheme. Sebastien was selected to receive the Grand Prix unanimously by the Judges – the first time this has happened in BEEAs history. Chairman of the Judges, Eric Wilkinson, said: "The standard of entries to the BEEAs continues to improve. Through every category, the judges have been deeply



impressed by the quality of engineering put forward and the talent behind it. From large companies to small, all the entries have found that the deployment of engineering excellence, backed up by hard work and

British Engineering Excellence Awards 2013 winners

CONSULTANCY OF THE YEAR

(Sponsored by Eureka magazine)

Bytesnap

ByteSnap Design took the honours in the Consultancy of the Year category thanks to the way it maintains a competitive position in its market through training, development and recruitment. The company was formed in 2008 with the ambition of being the best embedded hardware and software consultancy in the UK. From modest beginnings, the company now has around 50 active clients. Turnover has risen significantly, as has its profit.



SMALL COMPANY OF THE YEAR

(Sponsored by D Young & Co LLP)

Oxford Digital

Great technology that works well, is easy to

use and meets customers' needs is the simple philosophy that led to Oxford Digital being awarded Small Company of the Year. Although the company started as a consultancy without any IP, it has reinvested revenue to develop technologies that it now licences, including



TinyCore: an audio DSP core and tool chain which has unique advantages in time-to-market, reduced maintenance costs, small silicon footprint and efficiency.

START UP OF THE YEAR

(Sponsored by Cambridge Consultants)

Versarien

Versarien is focused on bringing to market advanced materials that are capable of having a game changing impact on a variety of industries. Based in Cinderford,

Gloucestershire, it boasts a rapidly growing workforce and has secured contracts with several blue-chip multinationals. By taking inspiration from nature, the company has been able to bring an innovative, high performance thermal interface material to market.



DESIGN TEAM OF THE YEAR

(Sponsored by Anglia)

Zytronic

An ambitious project that overcame the obstacles of developing a large format, ruggedised, touchscreen interface won Zytronic the Design Team of the Year award. Through this ambitious design project, the company looked to bring a multi-touch sensor solution to market that had a true fully scalable sensor solution combined with a robust construction that could be applied to



imagination, has enabled them to compete on the world stage.

"As we emerge from what has been a tough few years for the economy, all of our entrants have the right groundwork in place

to kick on and take advantage of an ever more dynamic world market. My personal congratulations go to all those entrants that were short-listed and of course to the eventual winners."



displays with much larger sizes than had previously been possible.

The Judges also awarded Highly Commended in this category to Land Instruments International.

GREEN PRODUCT OF THE YEAR

(Sponsored by National Instruments)

Nampak Plastics

The environment played a significant role in a number of entries this year. Napak

Plastics was awarded Green Product of the Year thanks to its work on cutting the amount of plastic needed for milk bottles and increasing their recycled content. Through a focused engineering approach, the company was able to reduce the weight of the four pint Infini bottle by 20% to 32g, cutting the amount of resin used by 10,000 tonnes.



MATERIALS APPLICATION OF THE YEAR

(Sponsored by Engineering Materials magazine)

Sensor Coating Systems

Sensor Coating Systems was set up in 2012 as a spin off from research undertaken at Imperial College. Its technology, based on oxide ceramics, enables accurate temperature detection, corrosion and erosion monitoring and life time predictions on industrial components.



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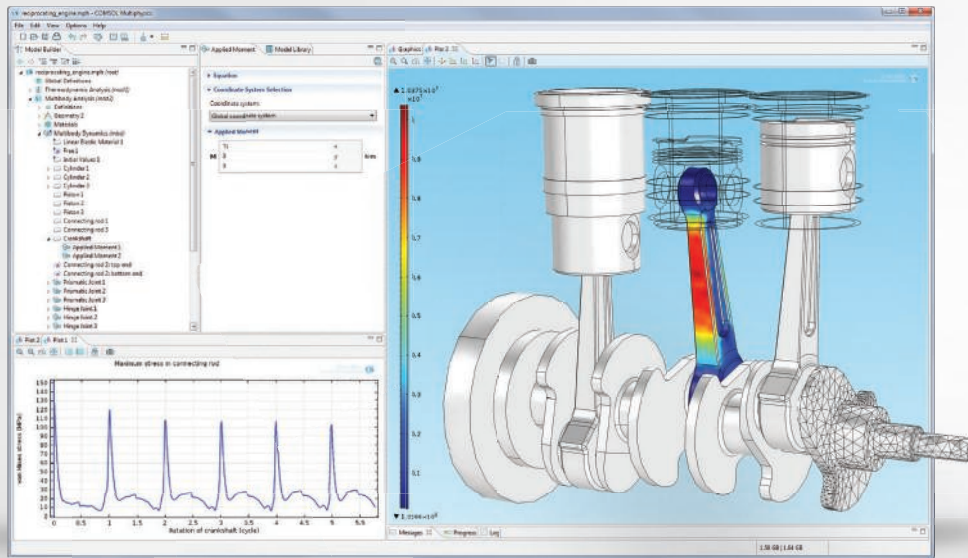
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The Judges also awarded Highly Commended in this category to Versarien.

ELECTRONIC PRODUCT OF THE YEAR

(Sponsored by Digi-Key)

FTDI Chip, FT800



An integrated solution which reduces the complexity and eases development of intelligent display systems saw FTDI Chip take the honours in the Product of the Year (Electronic) category for its FT800 device. The chip has an integral four wire touch controller and a single channel audio controller, which supports high quality sound. Applying the device enables a less complex design approach.

MECHANICAL PRODUCT OF THE YEAR

(Sponsored by Igus (UK))

Fugro Seacore

When it came to New Product of the Year (Mechanical), the vast scale of the winning Fugro Seacore WaveWalker project was the first thing to impress the Judges. WaveWalker is a 'Walking' jackup barge (self-elevating work platform – SEWP). The target market is any



marine work operation which requires deployment of an SEWP, where operation with traditional SEWPs is uneconomic due to prevailing local swell and/or weather conditions.

YOUNG DESIGNER OF THE YEAR

(Sponsored by RS Components)

Jack Bolton

The Judges faced a hard task in identifying the Young Design Engineer of the Year, where five strong entries ensured a long discussion. But Jack Bolton of Selex ES won the day. Jack's entry showed a willingness to acquire new skills – often by teaching himself. He is engaged with the engineering community and constantly pushes and promotes engineering inside and outside his job. He is a member of



the Chelmsford Science and Engineering Society and is president of its younger branch, Future Engineers and Scientists. He is, as the Judges agreed, an outstanding entrant in the most fiercely competitive category.

The Judges also awarded Highly Commended in this category to Rosie Linehan and Adam Malpass

DESIGN ENGINEER OF THE YEAR

(Sponsored by Mouser Electronics)

Sebastien Couvelier Mussalian

For more than five years, Sebastien Couvelier Mussalian has worked at Team Consulting as a



senior engineering consultant. During this time, he has developed an international reputation for the design, development and industrialisation of innovative, robust and capable medical devices. A strong project and technical leader, he challenges and encourages his peers and team members to improve themselves. Sebastien has also worked on a variety of community projects with school children and young engineers to give them the skills to think through challenges.

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 **NATIONAL
INSTRUMENTS**

Drew Cadman

A LAZY DAY IN THE ACME DESIGN OFFICE

DESIGN OFFICE

GOOD DESIGNERS BORROW, GREAT ONES STEAL

TWEAK! POLISH! REFINE!

Cool! Almost finished

ENTER IVOR PROB

You look relaxed Drew. You must have finished. Can I see the product documentation?

Ooh, no-one told me you needed that

crikey! How am I going to get out of this?

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DESIGN ENGINEERING

More screws needed... colour is wrong

TECHNICAL PUBLICATIONS

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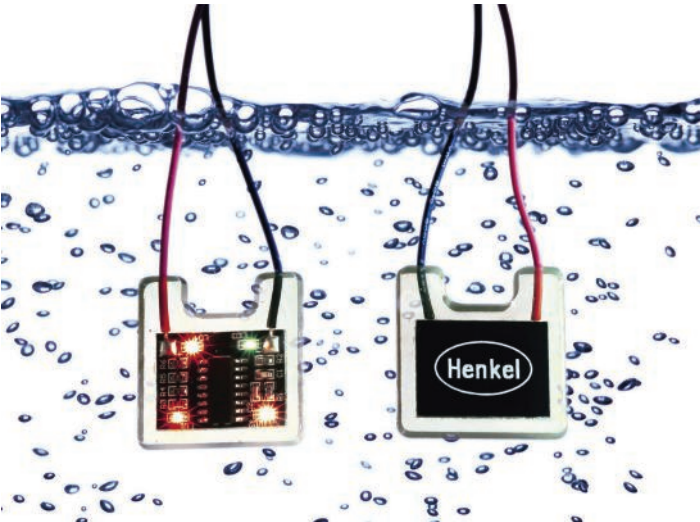
Henkel not only offers Macromelt hot melt low pressure moulding technology for protecting delicate electronic components, but also a choice of encapsulating compounds for tough specifications relating to temperature resistance.

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Invertek VSDs used in solar energy research

Variable speed drives (VSDs) from Invertek Drives are helping Italian academics to create a new generation of solar energy systems with much greater flexibility and efficiency thanks to the control capabilities of the Optidrive E2 Single Phase drive.

Researchers at the Solar Tech laboratory, housed at the Department of Energy at Italy's largest technical university, Politecnico di Milano, are undertaking pioneering experimental work to identify how developing the use of solar energy could help address some of the complex problems currently affecting the global energy sector.

Optidrive E2 single phase drives have been installed in a key project which is testing solar energy conversion systems under real conditions and developing prototypes for use in residential applications. The results of this research could have significant implications on ever increasing household energy bills.

Invertek's Optidrive E2 Single Phase Output inverter is uniquely designed for use with single phase permanent split capacitor (PSC) or shaded pole motors, giving precise speed control and superior efficiency compared to other single phase motor speed control solutions. This is of key interest in solar power applications seeking to make best use of the available solar energy under all conditions.

www.invertek.co.uk

Solution to last month's Coffee Time Challenge

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The solution to October's Coffee Time Challenge of how to stop metal theft on the railways comes from North Yorkshire-based Ellis, which has successfully design and developed a tamper-proof cleat that is stopping thieves in their tracks.

It identified that one of the biggest issue with railway copper theft was the ease and speed with which thieves were able to disconnect and remove long



lengths of the materials. Ellis' tamper proof cable cleat is designed to make removing copper cables nigh on impossible. Its box

design makes the job of detaching the cleat from the cable it is securing laborious and time consuming, while the requirement to fit the cleats at regular intervals along cable lengths means thieves will simply not have the time to remove cables before the police arrive.

"Quite often the best solution to a problem is the simplest and our tamper proof cleat is certainly a simple, but effective deterrent,"



added Richard. "By delivering a great level of security, both in terms of the strength and number of the fixings, we are confident that it will help bring an end to copper cable theft."

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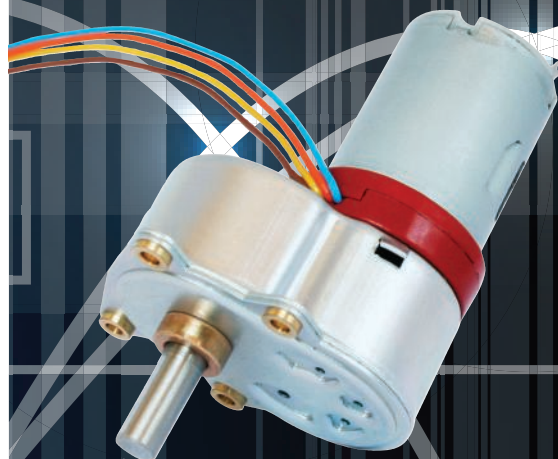
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New electro-mechanical joining modules



The new NCFB electro-mechanical joining modules from Kistler Instruments have been value engineered to provide a cost effective solution to many assembly and joining processes. Two versions of the new design are available, each with two measuring ranges. The smaller version has measuring ranges of 5 and 15 kN with 200 mm stroke at a speed of 250 mm/s and the larger version has ranges of 25 and 50 kN with a 400 mm stroke length at 150 mm/s. Both types retain the precision and flexibility of the NC modules with stroke length repeatability in real world conditions of 0.01 mm.

The ram is driven by an electronically-commutated AC servo motor controlled by servo electronics to ensure constant rotational and therefore translational speed. The integrated piezoelectric force sensor with integral charge amplifier and absolute displacement encoder provide accurate and

reliable operation over the module's long service life of approximately 5 million cycles. Standard functions such as block pressing, position pressing and force feedback controlled pressing as well as intermediate positioning are all supported.

www.kistler.com

FDB Rocfast offers corner gasket solutions

The FDB range of self-gripping extruded gasket has served specialist enclosure and cabinet builders well for many years, but fitting to square corners has always involved either cutting or deforming the gasket so limiting the sealing degree achievable.

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Exploring the Red

Of all the space missions to capture the imagination, exploration of Mars surely comes ahead of the rest. Here, Paul Fanning finds out about the design challenges such a mission faces.

Mars still holds a particularly cherished place in the minds of all those concerned with space exploration. After all, we are fortunate enough to live in a time where we take all the benefits bestowed by satellite communications for granted and in which rockets heading into space barely garner a mention in the news. Given this, it takes something special to excite our interest and – in that context – Mars is it.

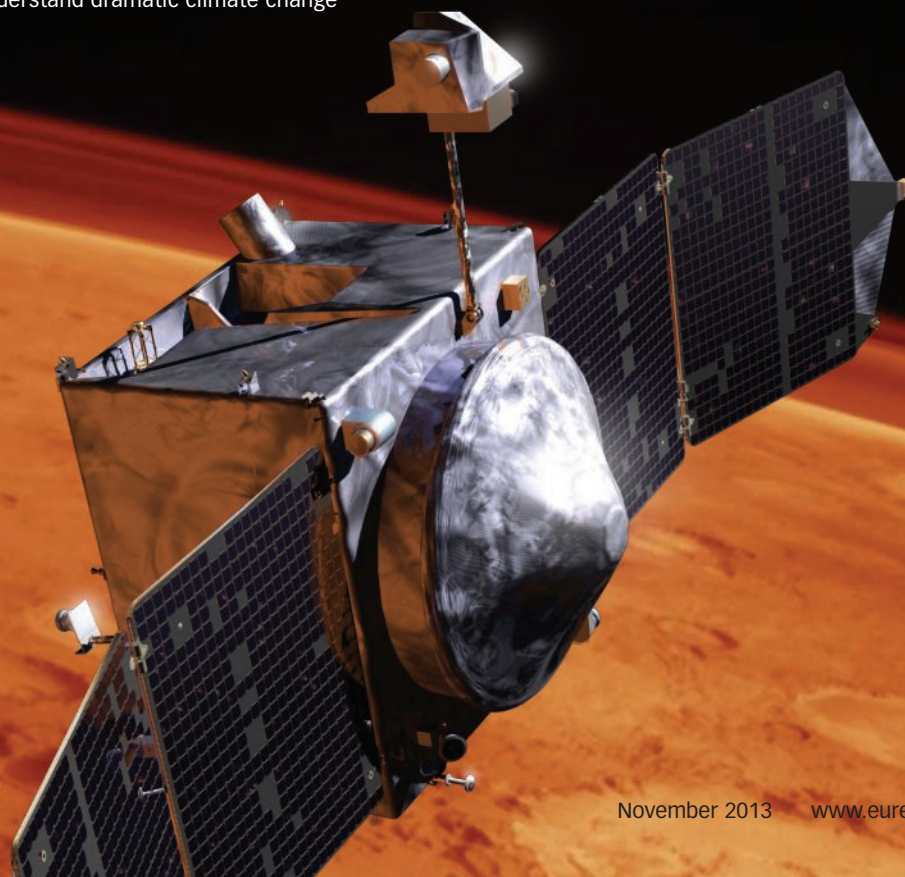
This is because, as our closest neighbour in the solar system and the planet that has become synonymous with alien life forms, Mars exercises a particular fascination in the human mind. Science fiction aside, however, the reality is that Mars is more easily explored and more capable of sustaining life than any of the other planets in the Solar System. This fact has made it a prime target for exploration, a process that has been ongoing for some years now and whose latest incarnation is the MAVEN (Mars Atmospheric and Volatile Evolution).

MAVEN is the second mission selected for NASA's Mars Scout programme, an initiative for smaller, low-cost, competed missions led by a principal investigator. Responsive to high-priority science goals listed in the National Academy of Science's 2003 decadal survey on planetary exploration, MAVEN will obtain critical measurements of the Martian atmosphere to help understand dramatic climate change on the red planet over its history.

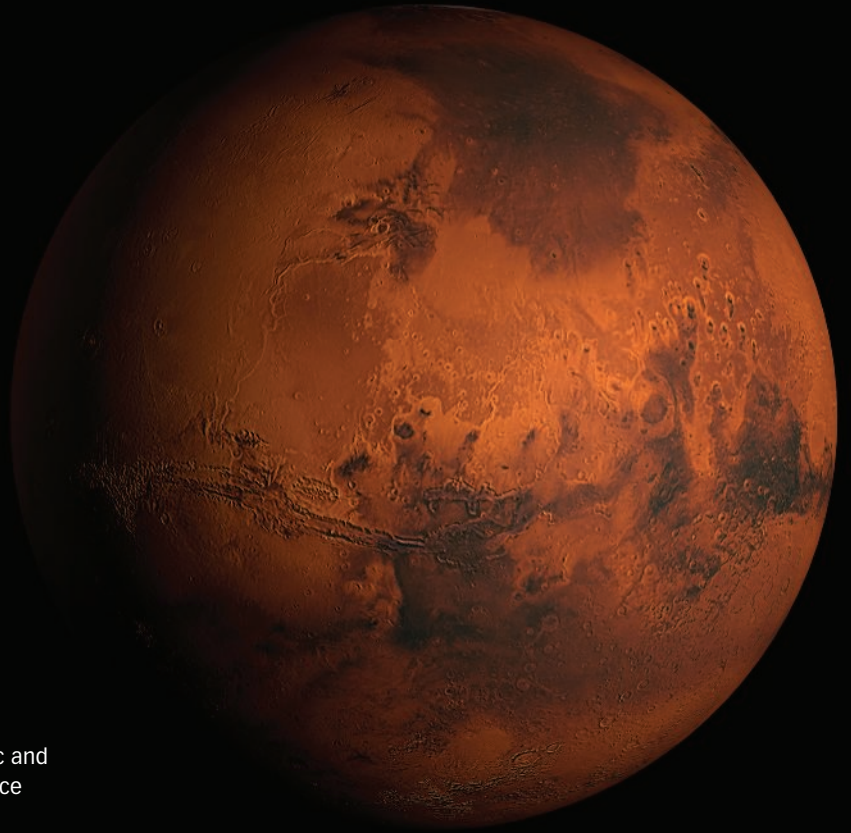
Long ago, Mars had a denser atmosphere that supported liquid water on the surface. At that time, the planet might have had environmental conditions to support microbial life, as the long-term presence of water is necessary to life as we know it. However, as part of dramatic climate change, most of the Martian atmosphere was lost to space long ago. Features such as dry channels and minerals that typically form in water remain to provide a record of Mars' watery past, but the thin Martian atmosphere no longer allows water to be stable at the surface.

MAVEN will provide information on how and how fast atmospheric gases are being lost to space today, and infer from those detailed studies what happened in the past. Studying how the Martian atmosphere was lost to space can reveal clues about the impact that change had on the Martian climate, geologic, and geochemical conditions over time, all of which are important in understanding whether Mars had an environment able to support life.

The first spacecraft ever to make direct measurements of the Martian atmosphere, MAVEN will carry eight science instruments that will take measurements of the upper Martian atmosphere during one Earth year, equivalent to about half of a Martian year. MAVEN will also



Planet



dip to an altitude 80 miles above the planet to sample Mars' entire upper atmosphere. The spacecraft may also provide communications relay support for future landers and rovers on the Martian surface, much as Mars Odyssey and Mars Reconnaissance Orbiter have done for the Mars Exploration Rovers and Phoenix.

The craft weighs 1,784lb and will carry vital research equipment developed by partners, including NASA's Goddard Space Flight Centre and their Jet Propulsion Laboratory, the University of Colorado at Boulder Laboratory for Atmospheric and Space Physics and the University of California at Berkeley Space Sciences Laboratory.

Guy Beutelschies is MAVEN project manager and the chief systems engineer at Lockheed Martin, which is the company leading the way on the project. Not only has it built the spacecraft for NASA, it will be responsible for the launch of the spacecraft and mission operations as it makes its ten month journey towards the planet.

Beutelschies says of the mission: "There are certain things that all Mars Missions share and certain design challenges they all pose. The first of these is distance. With a Mars Mission, it can take up to 20 minutes for any signal to reach Earth and another 20 minutes to respond. This means that there is a real need to put enough 'smarts' on board to deal with the time lag."

The 'smarts' in this context include software that tells the craft exactly where it is in its orbit to allow it to automate a certain number of procedures. Says Beutelschies: "Because we only communicate with the spacecraft twice a week, we needed to put some software onboard to let the spacecraft know where it was in its orbit because the orbit changes over time and we have investigations we want to trigger when it is at periapsis [the point at which an orbiting object is closest to the body it is orbiting] and is actually grazing the upper portion of Martian atmosphere."

This development of this sort of automation also serves another key purpose with a view to future, manned space exploration. Says Beutelschies: "Everybody's trying to make spacecraft more affordable. We tend to focus on the hardware, but it's easy to forget that people cost a lot of money as well. The more we can automate, the fewer people we need and the more money we can save."

The other big obstacle such a mission faces is what Beutelschies calls 'the thermal challenge'. "Put simply," he says, "it's hotter near earth and colder near Mars. That poses great difficulties in terms of coping with the effects that those wildly differing thermal conditions have on the instruments and the vehicle itself. This is further

complicated by the fact that heat costs power."

Says Beutelschies: "Lockheed Martin has built every NASA Mars Orbiter so far, so we have a great deal of expertise to fall back on." One of the key areas in which this expertise is made manifest is in the highly-robust testing procedures and dynamic atmospheric simulation models the company has developed

Summarising some of the other challenges that face the mission, Beutelschies says: "How do you make sure a spacecraft can survive in space? Facing the sun, surfaces can get hotter than any desert. In the shade, it is colder than any winter in Antarctica. The vacuum of space can wreak havoc if you don't use the right materials. Launch is even tougher. If you've ever been lucky enough to see a launch in person, you can feel the vibration rumbling in your chest from over a mile away. Now imagine what the spacecraft is experiencing as it sits on top of that 'controlled explosion'."

Naturally, a space module has to undergo a huge amount of testing. After all, as Beutelschies puts it: "Once we launch, there is no bringing it back to the shop for repairs. It's not like you can just push it through the atmosphere to see if it holds up OK." These tests are arranged in roughly the same order as the spacecraft will experience in its mission. That means that launch is addressed first. It may not be readily obvious, but the sound during launch is so intense that it can actually cause damage. To simulate this, Lockheed Martin put the spacecraft in a special test chamber with enormous speakers and crank up the sound to deafening levels.

Next comes a vibration test. Here, the spacecraft is put on a large device called a shaker table that moves a plate back and forth to



The construction and testing of the MAVEN unit is a highly complex and exhaustive process – not least because it requires the replication of conditions in space and because the unit cannot be ‘brought back to the shop’ once it is launched.

provide the vibration that the vehicle will get on the rocket. After shaking it in the horizontal axes, the piston-like device on the shaker table is rotated in such a way that it moves the spacecraft up and down.

Soon after launch, the solar arrays have to be deployed. This is a difficult test to perform on Earth because of the gravity. This makes it necessary to make sure gravity is not ‘helping’ the arrays deploy during ground testing. To mitigate this, it is necessary to turn the spacecraft and deploy the arrays to the side so that the hinges are perpendicular to the ground. Special stands were also used to support the weight of each array while allowing them to move

freely across the floor as they deploy. The team followed the same process for deployment tests on the Articulated Payload Platform boom and the Solar Wind Electron Analyzer boom.

The third major environmental test involves radio waves. Most of the regular tests use cables between the ground equipment and the spacecraft to send commands and receive telemetry. During the mission, of course, the only link to the spacecraft is through radio signals.

For this test, a special acoustics chamber is set up to block out all outside radio signals that might interfere, and then special ground antennae were used to talk to the spacecraft antennae as if MAVEN were out in space. The tests also make sure that the various portions of the spacecraft do not interfere with each other and that the radio waves from the ground do not interfere with equipment on the spacecraft.

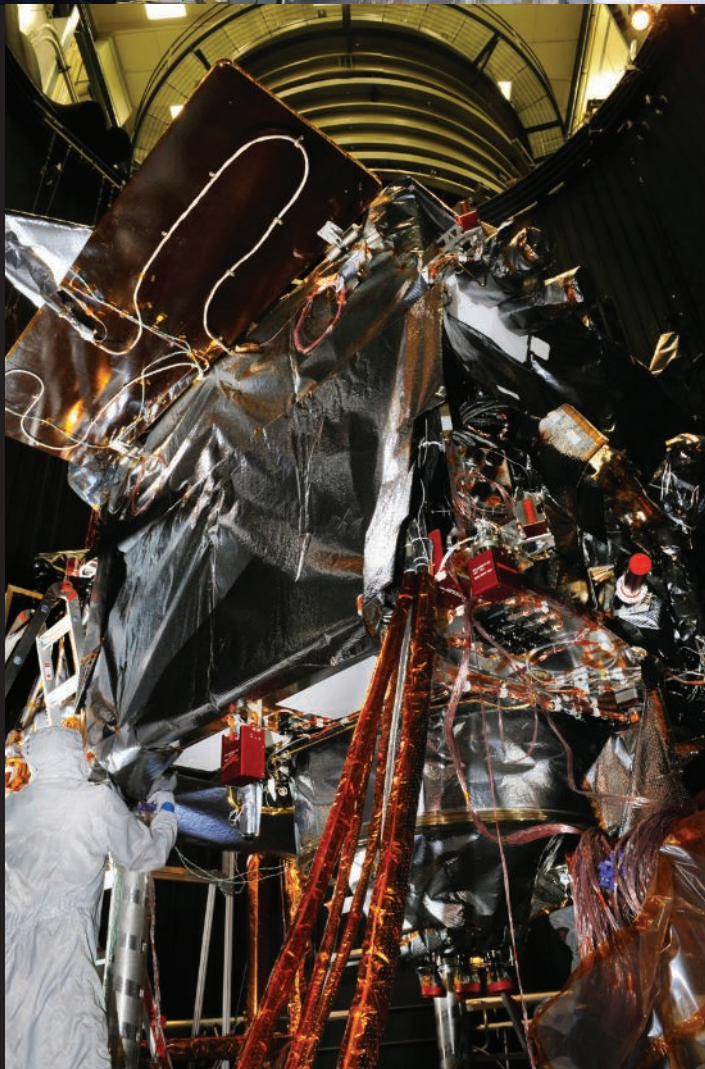
The final environmental test is the biggest. The MAVEN spacecraft is put in a thermal vacuum chamber (“think giant thermos bottle”, says Beutelschies). Once inside, the air is pumped out and the hollow walls flooded with liquid nitrogen, bringing the temperature down to -290 degrees Fahrenheit. Giant lamps in the ceiling simulate the direct heat from the sun. This test makes the spacecraft “feel” as if it’s in space.

The team spend several weeks in vacuum simulating the entire mission from the heat of the sun you get being near Earth, to the cold it will experience in the shadow of Mars. It is almost as tough on the team as it is on the spacecraft because the test consoles need to be monitored around the clock for the entire test.

Says Beutelschies: “This regimen of environmental testing may sound like a lot of work, but after spending years designing and building it, we want to make sure everything work correctly. If something needs to be fixed, we want to learn about it while it here on the ground.”

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Biography

Peter Digby trained as an engineer with British Airways before joining the Williams Formula One team when he was 21. He left as production manager after six years, having obtained a Masters Degree and following a brief spell with the Team Haas Formula One team, joined Xtrac in 1986 – just two years after it had been established by Mike Endean.

Top gears

Xtrac is a UK engineering success story par excellence and the company's managing director is a major factor in that success.

If one were to point to a British engineering success story, it would be hard to improve on Berkshire-based Xtrac. The company has become a world leader in the design and manufacture of gearboxes, differentials and driveline components, which are used throughout international motorsport.

Founded 30 years ago and winning the Queen's Award for Exports in 1992, Xtrac has a long history of entering new growth areas around the world at the right time and is often cited as a UK industry benchmark and exemplar for small and medium size enterprises (SMEs).

And yet, beyond the industry itself and the motorsport cognoscenti, it is probably fair to say that Xtrac is some. Admittedly, this may have changed somewhat with the company's recent inclusion in a recent 'Best of British' episode of 'Top Gear', but the point nonetheless stands that this world-leading company remains relatively obscure.

However, some recognition has been forthcoming recently in the form of Xtrac's managing director Peter Digby, managing director being named 'Global Director of the Year' and overall winner of the influential Director of the Year Award presented by the UK Institute of Directors.

Under his leadership, Xtrac grew rapidly and in 1997 Digby led an unusual management buyout in the sense that it included all employees, who still make up 100% of the shareholders. Xtrac is now the world's most successful motorsport transmission company with a turnover of £40 million – having achieved its best annual sales ever.

One of the critical assessments made by the IoD was determining the systems Xtrac has in place to ensure on going professional development of its entire staff – including the company's apprenticeship training programme.

"With hundreds of candidates chasing just a few positions each year, we have honed and developed our skills in selecting and training young, enthusiastic and extremely talented individuals," says Digby. "Through our programmes, they attend colleges and universities collecting ONC, HNC, degrees and PhDs, with Xtrac's full support and financial backing."

"I have been greatly rewarded by being able to personally, and actively, encourage more than 100 young apprentices, trainees and graduates to successfully enter the world of high-performance, world-class engineering, also working with the most advanced machinery in our 90,000 sq ft factory. Our employees are of course our most valuable asset. That's why I ensured they could all become shareholders, which successfully engages and motivates everyone."

"Not surprisingly, we enjoy outstanding employee retention figures, especially amongst our most experienced staff, many having more than 20 years of service. This loyal, experienced and highly qualified group of

engineers is, however, kept fresh by our award-winning undergraduate training scheme. And we continually invest in the latest, computer aided engineering and machine tools. This investment saves lead time and reduces costs, ever more important in a tough global economic climate."

The IoD is not the only body to recognise the initiatives Xtrac has employed under Peter Digby's leadership to encourage employee engagement across all levels of the organisation. Xtrac is now consulted by the Rt Hon Vince Cable at the department of Business Innovation and Skills (BIS), and other government departments, on how its experience can help the training needs of the UK's engineering and manufacturing sectors.

Commenting on the role of the motorsport industry in the broader automotive context Digby says it has realised its collective responsibility

"I have been greatly rewarded by being able to personally, and actively, encourage more than one hundred young apprentices, trainees and graduates to successfully enter the world of high-performance, world-class engineering."

and opportunity to help develop new fuel-saving technologies, which Xtrac has fully embraced. "Motorsport is leading the way in creating smaller, lighter, more efficient engines and gearboxes," he says, "with a rapid rise in the introduction of kinetic and thermal energy recovery systems combined with advanced electronics. Many race formula regulations now actively reward efficient fuel consumption. Xtrac has placed itself at the forefront of these new, energy-efficient

technology developments, not only by using advanced lightweight materials and gear designs, but also by designing and patenting revolutionary new engine and gearbox and electric motor hybrid powertrains."

"These technologies demonstrate that high performance does not require large, multicylinder engines and that substantial fuel consumption and CO₂ savings can be achieved with multi-speed lightweight drivelines. A change in public perception will take time but is now well underway, with Xtrac playing a leading part through our motorsport and automotive engineering divisions."

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"A diverse range of exhibitors, choice of conference/workshop sessions, all within a highly professionally presented exhibition – and not too large so your feet don't ache!"

"For the talks alone, the show is worth booking early"

"Great exhibition"



The success

The big question after 2013 was whether this year's Engineering Design Show could go one better? Paul Fanning answers the question.

The second Engineering Design Show opened its doors at 10am on 2nd October at the Ricoh Arena, Coventry. When those doors closed 29 hours later, 3,155 design professionals had graced the show with their presence, having been treated to a range of exhibitors, workshops and conference speakers unmatched in the engineering design sector.

These visitor figures easily surpassed the original target of 2,500 and nearly doubled last year's figure of 1,600 visitors.

In one sense, however, this should come as no surprise. After all, the Show, which this year was co-located with the inaugural Electronics Design Show and featured Engineering Materials Live!, was always billed as being bigger and better than last year's.

However, it's one thing to bill it as such, but another to deliver on this promise. And that is something that the Engineering Design Show 2013 has achieved without any doubt.

Featuring more than 170 exhibitors over all three of the Jaguar Exhibition Halls, more than 60% of whom have already agreed to take part

in next year's event, the show was greeted with huge positivity.

Ed Tranter, executive director of organiser Findlay Media, was understandably delighted, saying: "It has been great to watch the Engineering Design Show build on last year's success to grow into something even bigger and better. It's also been great to receive so much positive feedback from visitors and exhibitors alike."

Of course, the exhibition itself was far from the only attraction at the event, with a full Conference programme over the two days that featured a range of speakers. To choose just a



"It is unusual to find a show that ticks 90% of the boxes. I spent 5 hours walking around and talking to potential new suppliers. The quality of the people on the stands was also to a high standard... Go for it"

"If you are looking for technology suppliers, go to this show"



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few, these included a packed session where Dr Caroline Symcock, the global compliance and approvals manager for Dyson, talked about the design philosophy that underpins this iconic British brand, with particular reference to the way in which the frustration of knowing that something could be made better is a spur to innovation.

Also speaking to a full house was Simon Smith, associate director of products and systems with Cambridge Consultants. Here, by storyboarding a customer's journey, he illustrated the five rules of innovation that make

the difference to a successful product.

Other highlights of the Conference included a presentation by Andy Bradford of Surrey Satellite Technology Limited, who addressed the challenges facing the design engineer preparing a product for the rigours of space travel and Will Carleymith, head of design for Brompton Bicycles, who talked about the design behind his company's success.

Meanwhile, the sole panel session of the programme featured Eureka editor Paul Fanning chairing a discussion with leading lights of the 3D printing industry. Under the title 'Additive

Manufacturing – What's in it for Me?', the session set out to uncover the reality behind the hype of this eye-catching technology.

In addition, a highly successful workshop programme attracted many hundreds of visitors keen to get hands-on, practical advice from leading companies in the field.

Summing up his feelings about the show, Ed Tranter said: "Findlay Media is committed to bringing high quality information and learning to engineers and we really believe that we have developed an event that is a positive force for the UK's design engineering community."

"The Engineering and Electronics Design Shows were an excellent opportunity to gain access to cutting edge technology showcased by leading providers and to network within the design, manufacturing and service communities, in a cost effective manner. Well worth committing a day to visit this show."



"An excellent UK-based show with a wide range of exhibitors, conference papers and workshops covering engineering, design and materials to help one keep up to date with latest developments."

"If you want to keep up with the latest in design, 3D and rapid prototyping techniques then visit this show"



"If other engineers need encouragements to attend this kind of technology event being held locally than I seriously doubt if they can call themselves a professional engineer who is aware of development in the latest technologies."



"A good, broad show in terms of what's on offer but not one that requires you to walk a marathon over two days to cover the ground."

"Good, compact event with diverse selection of quality manufacturers and suppliers."



"Keep up to date, raise your profile and be sure to talk to as many experts as possible!"

"I had a fantastic time meeting new people with a common interest and found everyone to be enjoying the great atmosphere a show like this brings. I'll be back next year."



"This is the best event of its kind I have attended in Europe during decades of working in my field."

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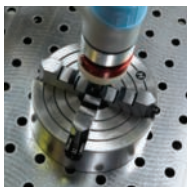
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2014 – Even bigger. Even better



Engineering
design show

electronics
design show

Engineering
Materials
LIVE!

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Building on 2012's success is great, but the ambitions for 2014 are even greater. Like any engineering project, continued progress and development are essential – and the Engineering Design Show and Electronics Design Shows are no exception.

Between 22nd and 23rd October 2014, these combined events will occupy all of the available space within the Jaguar Exhibition halls at the Ricoh Arena – a floor space of 6,000m² – and next year this will also expand into the EON Lounge – incorporating an additional 1,000m² of stands, workshops and high-value content.

This expansion will include growth of this year's popular addition to the Engineering Design Show, Engineering Materials Live! and will offer even more scope for visitors to see the latest in rapid prototyping and additive manufacturing technologies.

A brand new event

Next year will also see the launch of the latest addition to the Design Show family – the Embedded Design Show. Located within the EON Lounge, here at the Ricoh Arena, this brand new event will link suppliers of embedded software and hardware with design engineers so that they can share the latest thinking, developments and technology

in this crucial sector of electronics design.

While the topic of this show is very specific, it retains the guiding principles that were used when originally developing the Engineering Design Show. This is not expansion for expansion's sake, the embedded sector is playing an increasingly important role in the broader electronics design sector and we see the Embedded Design Show providing a crucial component in this growth.

As with its sister events, Findlay Media will ensure it offers embedded designers the best keynotes, workshops and assembled collection of market-leading suppliers. Having developed an event that is a positive force

within the British design community, the company is certain that next year's show will be even better. We look forward to seeing you there.

To find out more about our plans for 2014 or to book your place for next year, visit:

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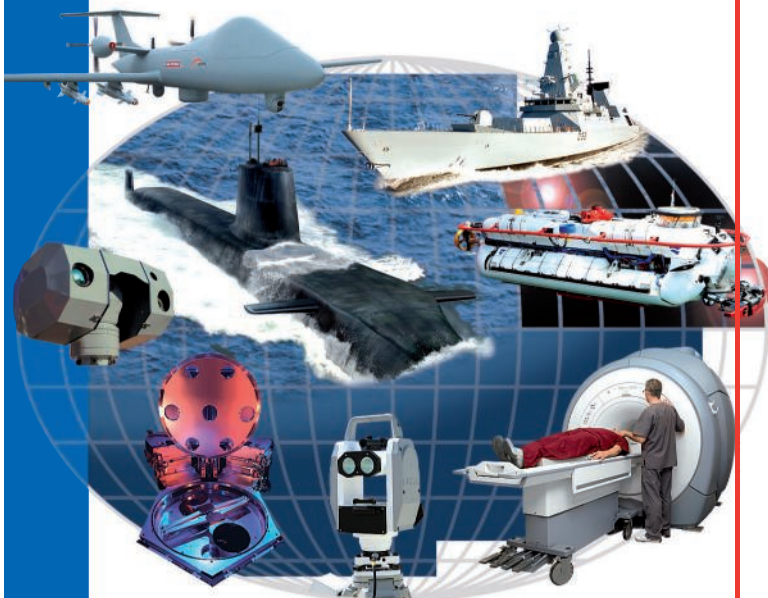
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Machined springs *take the strain*

If you use spring assemblies within your designs it may be worth considering the machined spring from Abszac rather than traditional wound springs.

The standard wound spring is a mainstay of virtually all mechanical applications, but it has its limitations. Not the least of these is the fact that, by virtue of how they are manufactured, they suffer considerable residual stresses that limit their reliability and performance.

This is the case because, when asked to move, a traditional wound spring will attempt to deliver all six Cartesian axis potentials (x, y, z and then the rotational axes ROTX, ROTY and ROTZ).

A machined spring, in contrast, rather than being manufactured by deforming a wire and around a set form to produce the spring, is actually machined from a solid piece of material. This means that it can be designed to offer only a single degree of freedom or machined to deliver multiple axis potentials.

Machined springs can provide very precise, linear deflection rates because virtually all residual stresses are eliminated. As a result, there are no internal stresses to overcome before deflection occurs, which can be the case in the wire wound spring.

The stress found in machined torsion springs is predominantly a pure

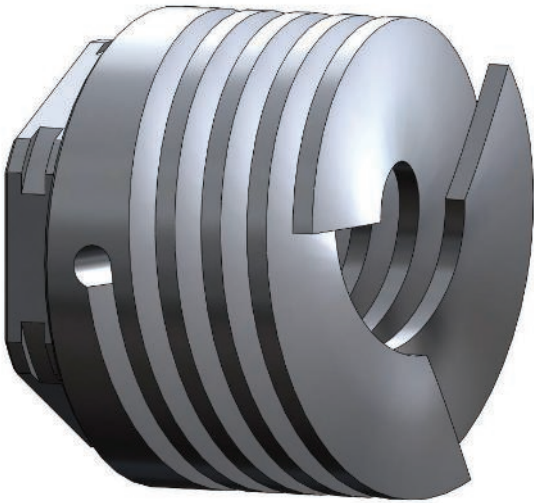
bending stress, providing a more reliable and accurate part. Most wound torsion springs can achieve a rate of around 15%, but the machined alternative can easily achieve 10% on rate and can be tuned to $\pm 2\%$ for the more demanding applications. Abszac, which offers these springs, describes this benefit as 'Precision Elasticity'.

Using machined springs, it is possible to have more than one spring coil in the single-piece construction or multi-start configurations, which deliver quite outstanding performance advantages. In fact, the fact that the machined springs can be supplied in multiple start spring coil configurations takes the performance and reliability to levels not achievable by the traditional wound spring format.

Naturally, the most common configuration is the single-start spring, which consists of a single continuous coil element starting at one end and terminating at the other, much like its wire-wound counterpart. The double-start (or indeed a triple-start) spring has two or three intertwined continuous coil elements, still within the same single-part construction.

In effect, this puts multiple independent helixes in the same cylindrical plane, thus providing greatly enhanced spring performance. On multiple-start machined springs, virtually all internal moments are resolved within the spring itself and the double-start machined spring configuration is the closest single Cartesian co-ordinate deflection part available with today's technology.

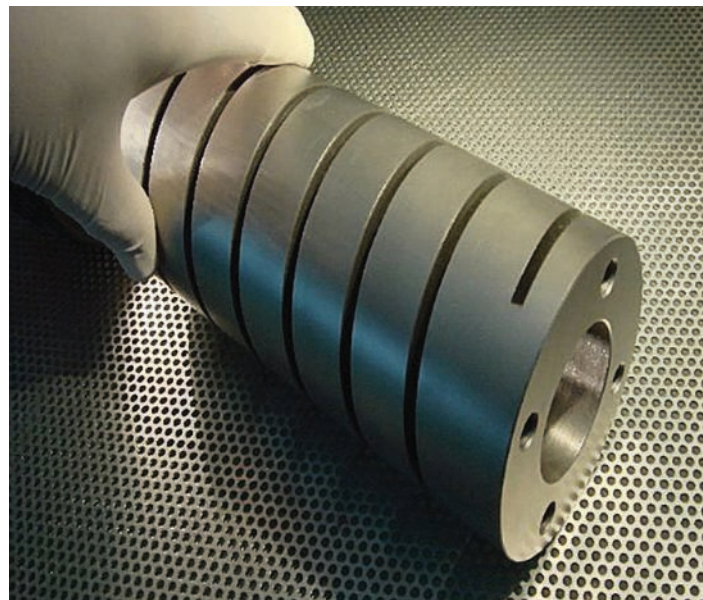
Multi-start springs have many advantages. When applied to compression and extension springs, a single-start spring provides a



reaction force plus a moment. On multiple start flexures, all internal moments are resolved within the spring itself, which translates into excellent compression or extension parallelism. Multiple-start spring configurations also unify the lateral bending and lateral translation forces and moments around the spring's circumference given a lateral deflection.

The most common machined torsion spring configuration is the single-start spring, which consists of a single continuous coil element, which starts at one end and terminates at the other end, much like its wire wound counterpart. We can supply both unwind and wind up torsion springs and in both cases the spring rates achieved are as linear as the geometry will permit.

However, it is not only the accuracy of rate which is an advantage. Since the part is machined, it is possible to incorporate any form of end attachment into the torsion spring. It is important to remember that it is possible can supply an attachment integral to the machined spring that allows the pure moment to be resolved.



In the wound torsion spring format, tangs are produced by bending the last portion of wire into a set position. These tangs are bent inward or outward upon which a force can be applied. This not only limits the actual attachment designs available, but also induces high stress into this attachment area. In the machined torsion spring the tang is integral and without stress making it a far more rugged and reliable attachment.

Tang usage is designed to provide a moment on a torsion spring. To accomplish this, a force at a distance is employed. The spring provides the moment reaction, but there needs to be an additional reaction to the force. Typically with wound springs, using a tang, they are called upon to resolve this force by the ID or OD of the spring rubbing on a guide.

With a machined torsion spring, however, the application of a moment is possible using a pure couple design. Some examples of this being double tangs (external internal and longitudinal), slot, splines (internal and external) and bolt circle configurations.

The next time you require a spring in a critical or high duty cycle environment, the machined spring from Abssac Limited may be the answer. The product is machined to meet exact customer size and performance requirement. Indeed, once the working dynamics of the spring are calculated and agreed, it is then possible to look at the method of attachment. In many cases the machined spring incorporates other parts of the working mechanism into the single part, such as flanges, gears, splines etc, making the final item more reliable.

The advantages of the machined spring product are numerous having proven itself in medical, aerospace, semiconductor and motor-sport industries to name a few. Wherever a wound spring is not able to meet your performance criteria or a new spring design requires ultimate accuracy and repeatability, the machined spring is the ideal partner.

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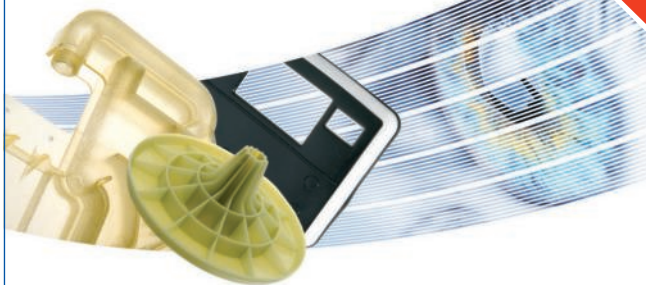
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Behind the hype

At the recent Engineering Design Show Conference, a panel session looked at the realities behind the hype of 3D Printing. Paul Fanning reports.

Participants (l-r): Graham Bennett, Technical Director, CRDM; Rob Jeffries, 3D Printing and 3D Scanning Consultant, Inition; Stijn De Rijck, Marketing Manager, Materialise; Mark Hester, Principal of Design Development, PDD Group

Problems

GB: "The main problems for the technology are: the speed of production of parts, which is a couple of orders of magnitude slower than other manufacturing techniques; the quality of materials, which is nowhere near good enough for manufacturing applications (the only exception to which would be metals, which are certainly improving in leaps and bounds); and the sheer cost of running the machines."

SDR: "You can build almost anything perfectly using 3D printing. The only question is why you would do that when you can make it faster and more cheaply using another technology?"

GB: "Qualifications and standards are a big issue. If an injection-moulded part is produced to the goods inwards department, the guys there know what to look for and know what standards they're working to, but if we produce a 3D-printed part, there are no standards to work to so they have a great deal of difficulty approving the part."

Hype and misconceptions

GB: The press – picking up the story about 15 years later than the engineering community – is stating that it's going to be a manufacturing revolution. The danger for me is that this hype actually kills it off because it doesn't deliver what it's said to deliver, so it receives less and less interest."

SDR: If you believe the press, then by next year we will all be wearing 3D printed clothes and driving a 3D printed car. And, of course, people will get disappointed by this. I would expect that in the next year, there will be a lot of disappointment from people who thought that 3D printing would change their lives and it definitely won't do that.

MH: "I think there's a misconception that you can just press a button and get a great part. A bad



design is a bad design however you make it and if you don't understand the reasons why it's a bad design, then 3D printing it won't help you.

RJ: The problem we have now is that it's been in the media so much that people have unrealistic expectations. In the next 5-10 years, the price will come down and there will be moves to multiple materials. Those things will happen, but good development takes time.

GB: I've been doing this since 1995. The arrival of rapid prototyping, additive manufacturing, freeform manufacturing, 3D Printing – whatever you want to call it – was always just a couple of years away in terms of its widespread use in industry – and it probably still is.

MH: "We still have clients who, when they see a prototype say 'Great! Let's hit the button,' thinking it's a finished product. There's a lot of education that has to go on there."

Advances, Advantages and Opportunities

SDR: "There are a number of industries that have changed significantly as a result of 3D printing. For instance, if you look at orthopaedic surgery or hearing aids, these are industries that have been turned upside down by 3D printing. For people in business, it is important to keep an eye on 3D printing to see if it can change their industry as well. Because if it has the potential to change it, it will."

MH: You can iterate very quickly. You can find a problem and solve it more quickly – as long as you understand the process of solving it.

RJ: "Obviously, it was created as a prototyping tool and is embedded in a lot of industries as such. As the material development has improved, though, certainly the metals are now capable of being used in manufacturing. They are now mimicking more classic manufacturing materials."



MH: "We've used additive manufacturing for over 10 years and it's nothing new in that context. However, where we have noticed the difference is in the surface finishes and the materials. So when we used to get a prototype in, there was still a lot of hand finishing required. These days, that time is compressed. It's now hours rather than days."

Advice

SDR: "We believe at Materialise that 3D printing should be part of every designer's toolbox. But that means that designers have to learn to design using 3D printing not just as a prototyping technology, but as a manufacturing technology."

We have a number of companies who were early adopters and they send us their files and they're still designed for injection moulding. And that's from people who have a familiarity with the technology."

MH: It requires a different way of thinking. It's not just a tweak to the way we did things before and it's not just about being able to get parts faster. If you want to design a part for 3D printing, you really do have to think differently in terms of how the part's constructed, how it will support, how it will function, surface finish – all those things. However, because we're producing prototypes all the time, so time is of the essence – and that's where 3D printing really wins.

RJ: "If you know you're going to be using 3D printing for the end product, it allows the designer to be much closer to the final product. A lot of the time, you will have a conceptual design that goes through a design engineering process that means you lose a lot of design intent in that. Whereas, if

you have a 3D printed product, a designer can really think about the final product and include all the functionality from the beginning of a design, which is one of the really powerful things that 3D printing brings."

SDR: "Choose the right application for 3D printing. Materialise created 3D print Barometer where we showed the three most important parameters on which to base any 3D printing design."

If you want your parts 3D printed and they are end use components, then they will have to be treated completely differently to how they would if they were simply being rapid prototyped. Make sure they're not treated as prototypes."

RJ: "Talk to the experts first. Use the expertise of the bureaux – they want you to use 3D printing, so ask them. Also, use tools like MiniMagics, which is a Materialise tool for testing files to see what's wrong with any CAD file for 3D printing."

GB: "If you're going to use 3D printing, you must consider the CAD package you use and how you're going to use it."

The Future:

GB: "It's brilliant – absolutely fantastic – for prototyping, it's very good for some limited, low-volume series applications, but the general conception that it's going to dominate manufacturing is, I think, wrong. It's a very good tool, but like CNC, casting, etc, it's just a tool. It's never going to be the only manufacturing method people use."

RJ: "There are now companies in, for instance, the dental industry, who are now building manufacturing plants that have no manufacturing

machines other than 3D printers. They allow the flexibility of not having to build tools and the machines produce whatever's on the file you give them. In that way, it becomes a manufacturing plant that allows you to change what you're manufacturing very easily. In any application where that applies, 3D printing will be used."

SDR: "Five years ago, wherever I went, I felt I knew more than almost all the people I was talking to. Now it's the other way around and they're telling me things I didn't know."

GB: "The companies in the market aren't big enough to change the industry quickly. HP withdrew in part because the market wasn't as advanced as they thought it would be."

The notable exception is in metal printing machines. They have a great advantage in that they're printing in known materials. I think if you're going to see a big uptake in the use of additive manufacturing. It will be in metals simply because of the quality of materials you can get."

MH: "I think in terms of the 'Prosumer' market. You're going to see a lot of awful Yoda key rings and in a lot of cases, the 3D printer will go the same way as the breadmaker and go back in the cupboard – never to return. In terms of the pro market, though, it will find and establish its places."

SDR: "For a number of industries where mass customisation is a requirement, it will turn them upside down."

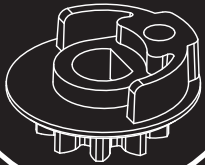
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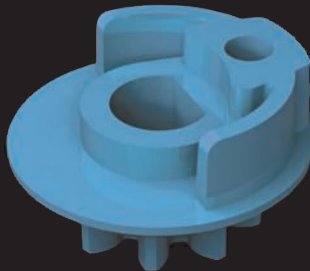


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"People are our number one asset."

Duncan Smith

There's a well known adage about success breeding success and that's certainly the case for Cambridge Consultants. Founded more than 50 years ago, the company has grown to become a leading source for product development engineering and technology consulting – not only for 'blue chips', but also for start ups.

Although headquartered in Cambridge, the company has a facility in the US and has recently opened operations in Singapore. What unites these locations is the quality of the engineering staff; if you're looking for innovative solutions which reduce time to market, increase return on investment and decrease risk, those are the challenges Cambridge Consultants' staff relish.

Duncan Smith, head of the company's products and systems division, admitted the ability to work with leading edge technology is an important element, but added: "People are our number one asset. If you ask our engineers why they're here, they'll tell you it's the people they work with and the variety of projects on which they can work."

Cambridge Consultants works with a range of leading technologies, applying these to a range of end markets. It has a global reputation for developing medical and wireless solutions, but is finding business in a number of sectors, including oil and gas. "Our business has held up during the recession," Duncan noted, "and our diverse range



Cambridge Consultants is looking to expand its wireless design team by 20% this year.

of markets continues to grow year on year."

Cambridge Consultants has its heritage in engineering, hardware and software. Over the last few years, this has expanded to encompass the physical sciences. Now, it finds itself increasingly dealing with companies looking to take advantage of such skills as maths and the life sciences. But, with success breeding success, finding the right people for the job is always a challenge. And Cambridge Consultants is looking for people who are up to the challenge.

Duncan explained some of the issues:

"Cambridge is a great area for high tech, but when it comes to oil and gas; well, it's not Aberdeen."

Testament to the working environment at Cambridge Consultants is its recent award as Employer of the Year in the Cambridge News Business Excellence Awards. The judges heard how the firm puts its emphasis on allowing people to pursue their own ambitions. In fact, the citation noted it was an environment 'where staff can follow their dreams'.

The company's clients don't have easy problems – they have problems they can't solve. So it needs exceptional people to work on these problems.

Here are a couple of recent examples. In the Instant Wild project, satellite connected and motion triggered cameras are sending near real-time images of animals from remote areas of Africa. Users anywhere in the world can view the photos and identify the animals by cross-checking with the field guide provided in the app. At the same time, the system provides early warning of illegal poaching activity, as well as evidence for prosecutions.

Cambridge Consultants has also collaborated with Ingenia Technology to develop a high speed laser scanner for use in brand protection, product authentication and 'track and trace' applications.

The scanner, typically fitted above a production



Cambridge Consultants relies on the talent and creativity of its staff to help its clients to create and perfect new products.

line, records a fingerprint based on the surface micro-structure of each item it sees. The scanner can operate on production lines moving at up to 10m/s and carrying up to 50 items per second.

With new business opportunities arising in a range of sectors, Cambridge Consultants is looking to double in size – and it's looking for the right people to join its team. Alongside the need to recruit graduates, Duncan said the company is also looking for experienced engineers – people who have 'the scars', he explained.

"What we're looking for are people who have worked on tough projects, who have learned things from these projects and, because of that, got better at their jobs. What we really want to see are people who are interested in the world and who are interested in what affects technology."

Duncan said that if they have experience with relevant companies, that would be a bonus. "But we set our standards high, not only in terms of brains, but also in terms of attitude."

With a range of challenges in a range of market sectors, there's room for all types of engineer at Cambridge Consultants. "We have a lot of people who can see the 'big picture'," he continued, "but who are also implementers." He also pointed to a mixture of single and multi-taskers at the company. "Some of our engineers love multi-tasking," he noted, "but we can accommodate both types.

Some of our engineers like nothing more than getting their head down on a project for two years; others can't work that way and need to have two or three projects 'on the go'.

And if it's variety in which you're interested, then Cambridge Consultants is well placed to meet that need. "The variety of work not only draws people to us," he said, "but also keeps them interested. If they want to move from a medical project to a consumer one, we can accommodate that; they don't have to leave the company to find a new challenge."

Engineers can also feel undervalued in some companies; sometimes they perceive commercial people get paid more, for example. But Duncan challenges that view. "That's not the case here," he asserted. "One of our big 'plus points' is career development; we have a dedicated programme which values the different kinds of people who work here. We might hire a technologist, for example, but they could quickly become a project manager or get involved with business development. All paths are valued, but we all remain business focused."

Cambridge Consultants also challenges its employees to be innovative – to involve themselves in 'blue sky' research. "It's a very important element," Duncan said. "Engineers like to be able to come up with ideas and have people

back them. If our people come up with good commercial ideas, that's good."

He noted that, because Cambridge Consultants is not overly hierarchical, decisions can be made quickly by small groups who can authorise such projects. "We can't predict when people will get their good ideas," he continued, "but when they do, we want to make the most of them. Equally, bad ideas will get 'killed' quickly."

One of the questions which will be asked is 'have you talked about it over lunch?'. "Our canteen is like the Dragons' Den," Duncan pointed out. "If your idea hasn't been shot down there, then it's probably a good one."

When it comes to graduates, Duncan is looking for people with brains. "We need those who understand the fundamentals, who have mental agility and who can transfer across different projects: people who are 'nimble'.

"But we also want them to have 'dabbled'. Someone with a brilliant academic record who hasn't built anything in their shed isn't as attractive."

Whoever works at Cambridge Consultants needs to retain the ability to continue learning. "Oil and gas is an example," Duncan concluded. "It takes our engineers out of their comfort zone. But everyone has to be prepared to 'unlearn' to move forward. It's something we want them to do."

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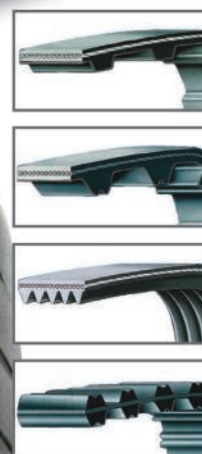
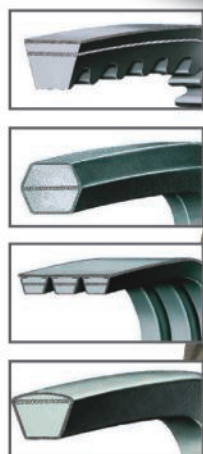
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Engineering past turbo lag

Pressure charging devices are widely used to boost engine performance and cut CO₂ emissions, but can lead to 'turbo lag'. Paul Fanning looks at a technology designed to avoid this.

Adding forced induction to downsized engines is acknowledged to be one of the most effective ways of reducing CO₂ emissions and as a result, the automotive industry is rushing to downsize. Typically, a three-cylinder 1-litre engine will now replace a four cylinder 1.6-litre model, with a pressure charging device added to emulate the performance of the larger engine, while retaining superior fuel economy.

However, mass uptake of this technology is hampered by the issue of 'turbo lag' that conventional boosting devices produce. The driver experiences this as poor responsiveness and driving feel at low speed and so finding a low cost

solution to this problem is an industry priority.

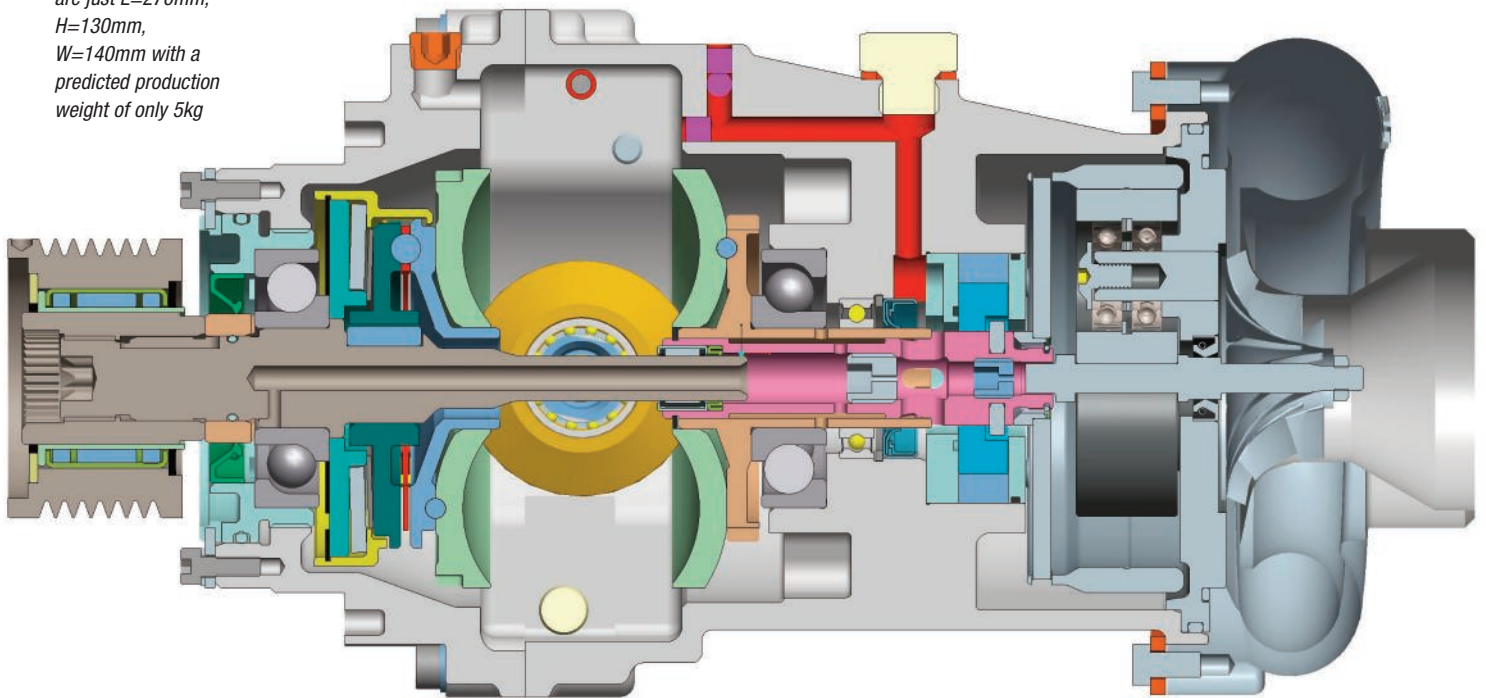
As a leading developer of gearless traction drive technologies, Lancashire-based Torotrak has sought to address this problem with its V-Charge variable drive supercharger for gasoline and diesel engines. V-Charge allows downsized engines to maintain their superior emissions levels, whilst retaining the driving feel, urgency and enjoyment of a larger engine. Compact and easy to install, V-Charge offers a substantial cost advantage over more complex devices.

By accurately and rapidly varying boost pressure independently of engine speed, V-Charge ensures that the engine responds

instantly to any driver demand. The optimum mass of air can always be delivered to the cylinders, at any engine speed, without any of the lag often associated with turbochargers. This remains true even at very low engine speeds where conventional boosting systems struggle.

The second generation of the V-Charge (called the V-Charge V2) was presented at the Dresden Supercharger Conference recently. The new unit is 2kg lighter and 50mm shorter than the earlier, proof-of-concept design and is production-feasible, with the potential to use die castings, pressings and powder metal components in its construction. V2 also has improved efficiency,

The dimensions of the V-Charge V2 unit are just L=270mm, H=130mm, W=140mm with a predicted production weight of only 5kg



"Since successfully demonstrating the proof-of-concept design in a 1.1 litre car that drove like a naturally aspirated 1.6 litre, we have put our emphasis on optimising the design for production,"
Andrew de Freitas.



lower power consumption and a greater drive ratio spread than its predecessor.

"Since successfully demonstrating the proof-of-concept design in a 1.1 litre car that drove like a naturally aspirated 1.6 litre, we have put our emphasis on optimising the design for production," explained Torotrak product director Andrew de Freitas. "By integrating the design more fully and using purpose-designed components to replace proprietary parts, we have reduced the parts count, size and weight of the unit, making it lighter and easier to package."

V2 is 50mm shorter, 25mm narrower and depth is reduced by 20mm compared to its predecessor, making it easier to install on the front end accessory drive (FEAD) of an engine and simplifying the engine bay integration task. Its weight will ultimately reduce from 7kg to 5kg.

V2 also outperforms the earlier units. By using an electric oil pump instead of a mechanical type, the power consumed in lubrication drops from 1kW to just 30W. Ratios are now changed by electro-mechanical control with a 10W actuator instead of hydraulics, and no power is required to hold the unit at a given ratio. Hydraulic requirements, and power consumption, have been further reduced by introducing a ball-and-ramp end load system to the variator assembly,

instead of applying hydraulic end load.

The ratio spread has been increased from 6.25 to 8, allowing greater boost at low engine speeds without an efficiency penalty at higher speeds. The traction epicyclic assembly, which provides a fixed step-up ratio to the compressor impeller, has been reduced in complexity.

"Our push for improved overall efficiency reflects the importance of minimising parasitic losses, not just when the unit is boosting, but when off-boost as well," said de Freitas. "We also have the potential to disconnect the drive at small throttle openings. In this respect we have a big advantage because superchargers normally generate a huge inertial shock on the FEAD when re-engaging, but our variable drive can reduce the ratio and the referred inertia from the supercharger at the moment of re-clutching."

The variable drive in the V-Charge system allows the supercharger to increase engine torque from 0-95% in less than 400ms, cutting the time-to-torque by up to 70% compared with the latest state-of-the-art single turbocharger technologies. Torotrak believes that V-Charge is the most cost-effective way to produce the level of performance enhancement required on the latest generation of downsized engines.

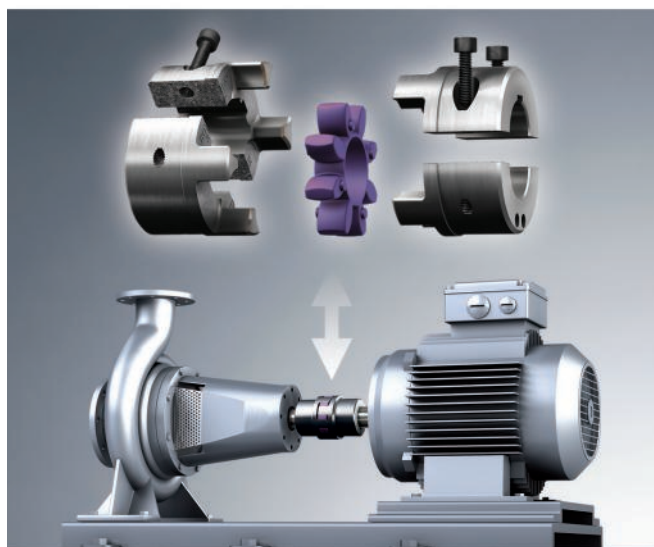
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V-Charge Features

- "Cold Side" Installation - no need for exotic materials; freedom of system location; doesn't impede exhaust gas
- High Ratio - typically provides a compressor speed to engine speed ratio range of 15 to 95
- Industry Standard Control - the ratio is controlled by a low force, low cost electromechanical actuator, which is fully compatible with engine ECUs and therefore integrates fully with the existing engine management strategy
- Industry Standard Belt Drive - can be driven by a conventional belt drive that is easily integrated with the existing auxiliary belt drive on most engines

V-Charge Benefits

- Rapid response and "Time to Torque" - delivers from 0 to 95% of target torque in just 400 milliseconds and removes boost just as quickly when not required. This minimises energy use and creates 'lag free' driveability at low engine speeds, with excellent transient response
- Exceptional Refinement - extremely smooth and near silent operation with unparalleled levels of Noise Vibration and Harshness (NVH) refinement; no requirement to bypass or vent air via a wastegate
- Superior Performance - the ability to vary speed outperforms complex multistage turbochargers whilst using only a simple fixed geometry compressor. Location on the inlet side of the engine means no impediment to exhaust gas flow
- Low Cost, Small Package - compact and power dense package comprises a small, two roller, single cavity traction drive variator. Low component count and innovative manufacturing techniques provide a highly competitive cost, while the variable speed drive also removes the need for additional air handling subsystems
- Proven Boosting Technology - this is the same as the compressor stage of a conventional fixed geometry turbocharger and is easily matched to any engine.



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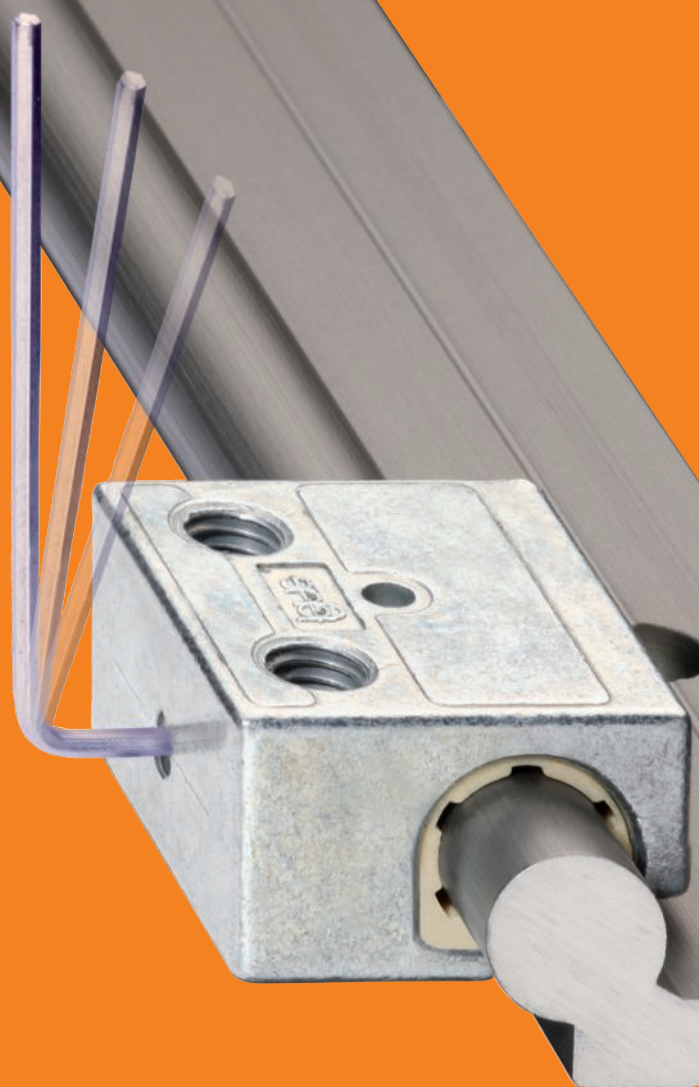


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The cutting edge of sensing

Imagine a sensor you could cut to any shape you require with a pair of scissors. Well, as Paul Fanning discovers, that is now a reality.

People often customise the size and shape of materials like textiles and wood without turning to specialists like tailors or carpenters. In the future this should be possible with electronics, according to the vision of computer scientists from Saarbrücken.

Together with researchers from the MIT Media Lab, they have developed a printable multi-touch sensor whose shape and size everybody can alter. A new circuit layout makes it robust against cuts, damage, and removed areas. Today the researchers are presenting their work at the conference "User Interface and Technology" (UIST) in St. Andrews, Scotland.

Jürgen Steimle has a doctoral degree in computer science and is doing research at the Max-Planck Institute for Informatics. He also heads the Embodied Interaction research group at the Cluster of Excellence on Multimodal Computing and Interaction.

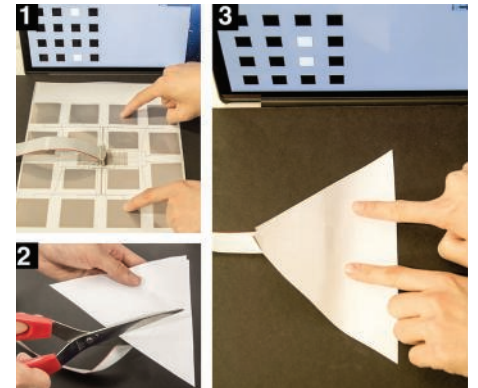
Simon Olberding is the doctoral candidate and the lead developer of the new sensor. He sees a further application of the new technology in so-called interactive walls used for discussions and brainstorming. "So far, such a wall frays and scuffs quickly as we hammer nails into it, stick notes or posters on it, and damage it while removing them. By customising and pasting on our new sensor you can make every surface interactive, no matter whether it is the wristband of a watch, a cloth on a trade fair table, or wallpaper", Olberding says.

As basic technology the scientists use so-called 'printed electronics'. This term summarises electrical components and printed devices. The approach is similar to that of inkjet printers. Instead of printing with normal ink, electrically-functional electronic ink is printed on flexible, thin films (so-called substrates). "The factory costs are so low that printing our DIN A4 film on our special printer in the lab costs us

about one US dollar," Steimle says.

But you need more than printed electronics to make a sensor robust against cuts, damage, and removed areas. So far the circuit layout of a multi-touch sensor has been similar to graph paper. The wires run horizontally, vertically, and parallel to each other. At the intersection of one parallel and one horizontal layer you find the touch-sensitive electrodes. Via the wires, they are connected to a controller. This type of layout requires only a minimal number of wires, but is not robust.

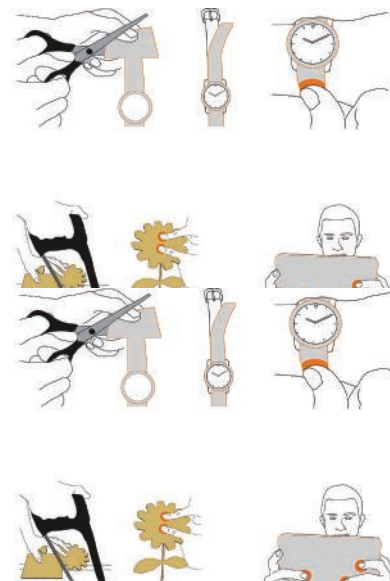
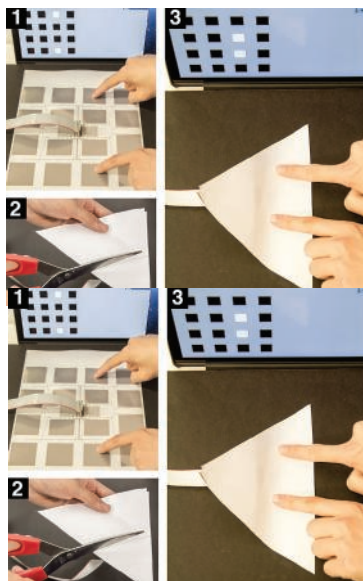
Since each wire addresses several electrodes, a small cut has a huge effect: many electrodes become unusable and possibly large sensor areas do not work anymore. "It was not easy to find an alternative layout robust enough for our approach", Olberding says. They took their inspiration from nature, looking at the human nerve system and fungal root networks, and thus came up with two basic layouts. The so-called star topology has the controller in the centre. It is



connected to every electrode separately. The so-called tree topology also has the controller in its centre connected to each electrode separately. However, the wires are bundled similarly to a tree structure. They all run through a vertical line in the middle and then branch off to reach their electrodes. The scientists found out that the star topology supports often-used basic forms like triangles, rectangles, or ovals best. Furthermore, it is suitable for shapes commonly used for crafts, like stars, clouds, or hearts. In contrast, with the tree topology it is possible to cut out whole areas. The researchers were also able to combine both layouts in a space-saving way, so that the sensor supports all basic forms.

"We assume that printed sensors will be so inexpensive that multi-touch sensing capability will become an inherent part of the material. Users can take it to create interactive applications or just to write on it", Steimle explains.

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Design from the outset

With the recent opening of a new production facility, the induction encoder manufacturer Zettlex is on a mission to get design engineers to understand its technology. Justin Cunningham reports.

It might not be what one might class the 'sexy' end of engineering, but nonetheless a Cambridgeshire sensor company is getting engineers excited by the possibilities of its encoders.

"We are enabling engineers to see what an encoder can actually do in terms of added functionality in a product," says Martin Wooler, business development manager of Zettlex. "While some see encoders as having a role in specific sectors, we are finding its use in more mainstream products as engineers discover the potential benefits."

The encoder produced by Zettlex – called the IncOder – uses induction to measure the exact position of two moving surfaces. The IncOder uses a unique process of printing circuits on to flexible substrates to enable induction measurements to be made. These are highly

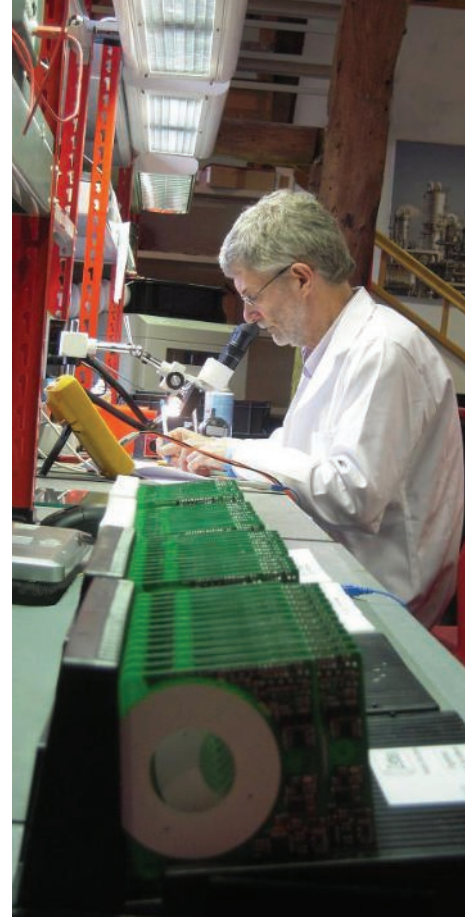
accurate and operate with no contact, need for bearings or maintenance.

Applications for its products have grown significantly since the small technology start up began trading in 2004. While encoders measure displacement, this data can be used monitor and record a number of key parameters including weight, vibration, strain, shock, tilt, pressure and even temperature (by expansion). The use of PCBs means that bespoke shapes and sizes can easily be engineered for specific applications.

The company is sure it is offering some unique capabilities and has recently expanded in to a new production facility to fill demand, much of which is coming from overseas. Around 50% of sales are exports with the company expecting this figure to grow to 75% next year. It has also managed to infiltrate the German market will machine builders specifying its IncOder technology over other – well established – encoder manufacturers.

"It is still quite early days and its taken time for us to become known by engineers, and for them to recognise what an encoder can actually do for them," says Wooler. "Certainly we are replacing people like Renishaw, though they will certainly always be around, but we feel we can offer an advantage in some applications over other encoder technologies."

Redundancy is a classic example given by the company. Whereas optical encoders will usually require two components to be part of an assembly, Zettlex is able to integrate two sets of electronics, effectively two sensors, on the same PCB but keep them



entirely separate apart from the material encasing them. This approach can be scaled with triple and quadruple redundancy possible as demonstrated on the IncOders that have been successfully used on satellites.

"It's a very elegant solution," says Wooler. "This is fit and forget, and for any engineer it means they can sleep at night. But we are still opening people's minds to the fact you need to be thinking about this at the outset."

The resulting IncOder is produced in a number of standard products in terms of size, speed and accuracy. However, the design of the IncOder makes it inherently customisable with the company continuously overcoming many of the assumed shortcomings of its technical approach and philosophy. An induction based sensor can start to lose position if rotational speed becomes too fast as effectively there is a coil going over another coil which transmits the signal that is then digitally processed.

"We have just done a job for an engine manufacturer where they were getting up to 120,000 rpm," says Wooler. "So, if we know from the outset about certain challenges we can usually design around them. As new markets emerge we would build something for one customer that we can then use in other applications."

"We are on a mission to get design engineers to understand the technology so they can design it in to a system, at the frontend."

www.zettlex.com

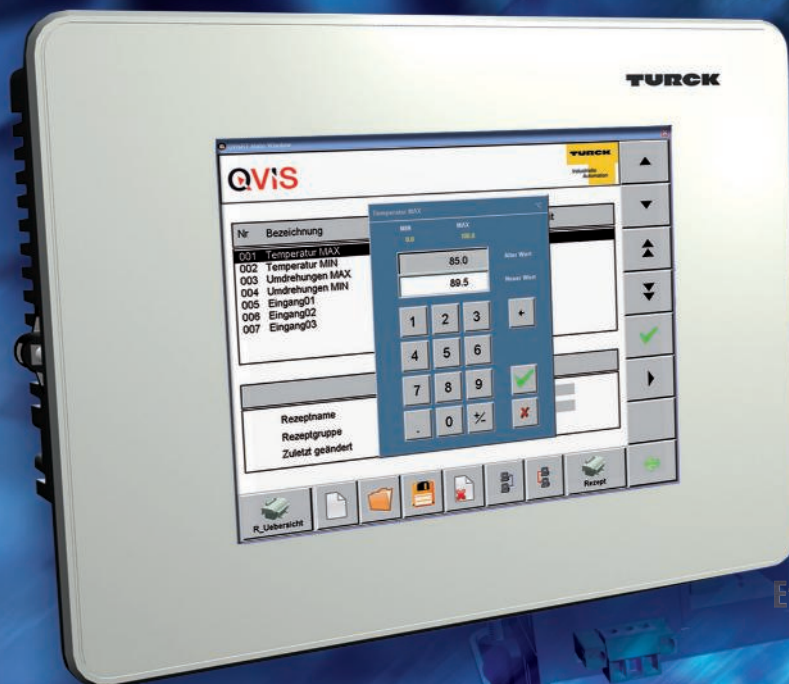


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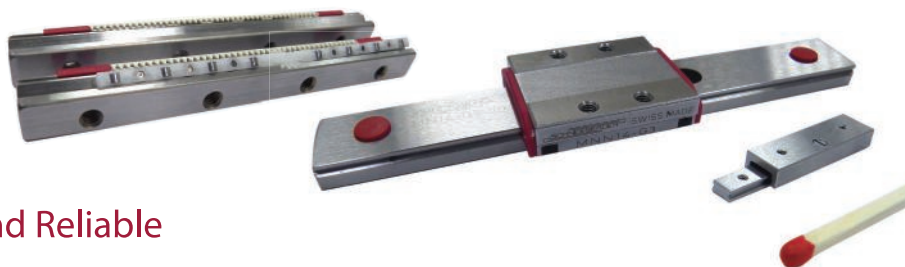
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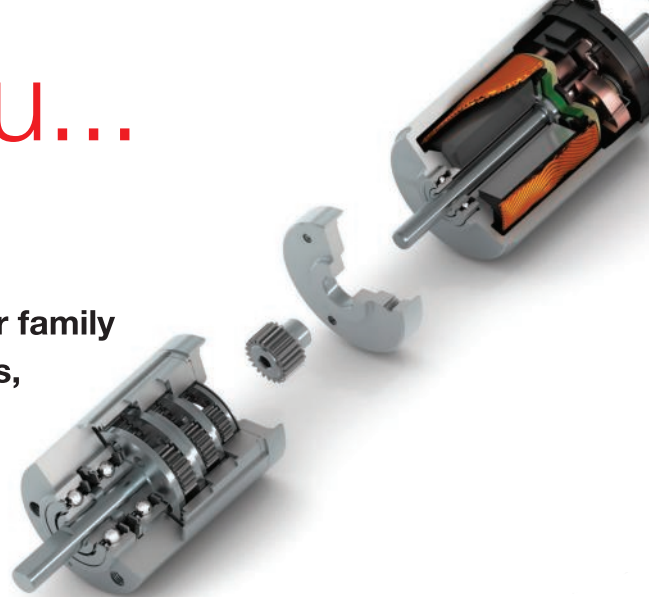
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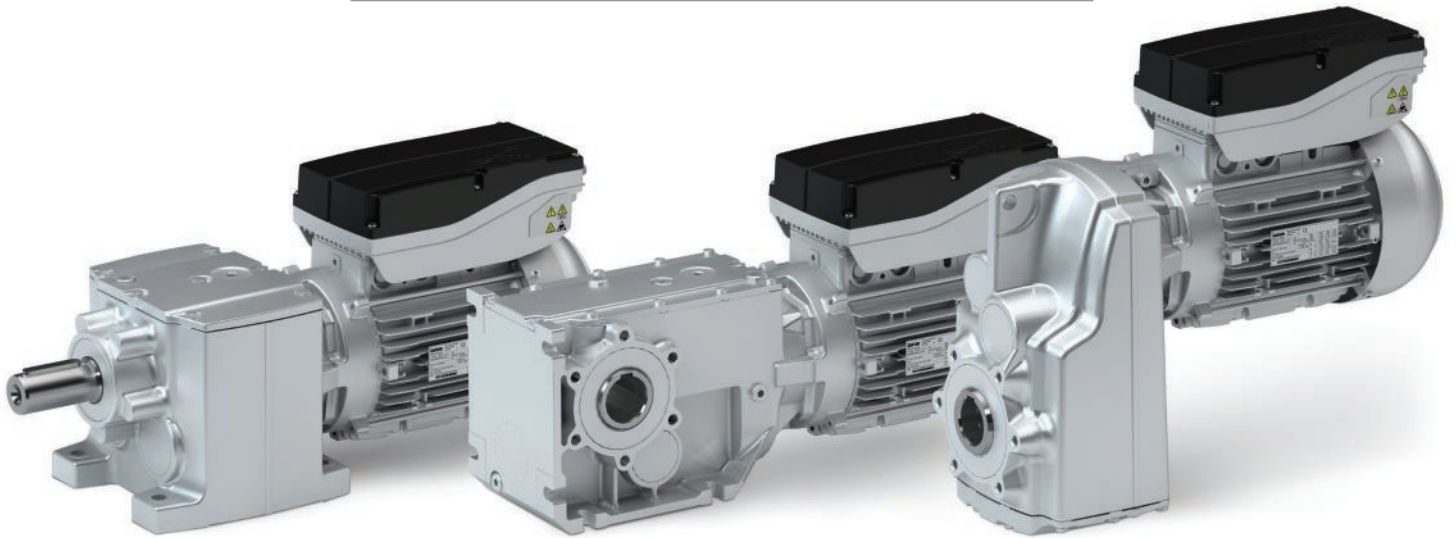
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Mechatronics puts intelligence in the drive

Lenze has deployed integrated mechatronics to produce even more efficient drive and motor solutions. Paul Fanning reports.



Lenze recently used its international press conference to reveal some of the steps it has taken to create ever more light and efficient drive and motor solutions for the industrial sectors.

Following on from the MF motor, which was originally developed specifically for speed-controlled operation with frequency inverters, came the Smart Motor. The Lenze Smart Motor essentially allows fixed speeds to be set at will in applications, although in fact it offers a range of other advantages.

The company describes the Smart Motor as exemplifying intelligent, mechatronic solutions; in terms of using silicon instead of copper or “intelligence instead of a battle of materials”, with electronics being an integral part of the motor.

Because it is designed completely differently to other motors, the Lenze Smart Motor offers a range of advantages in terms of both dimensioning and energy efficiency. One of these is that it will not require conversion to

meet the IE3 regulations in 2015-2017, while in fact occupying much less space in comparison to conventional, mains-operated IE2 and IE3 motors. In fact, according to Frank Maier, a member of Lenze’s executive board, the size and light weight of the Smart Motor mean an energy saving compared to using IE3 motors that are so heavy that, he claims, they can sometimes mean the use of even more energy than the models they replace.

Equally, the Smart Motor offers precise dimensioning to the maximum torque, because of which, it is able to optimise its energy efficiency in partial load operation.

The Smart Motors’ smooth start is another plus. Here, Lenze undertook experiments using the motor and a geared equivalent in a water tank to show the difference in vibrations between the two. Needless to say, the Smart Motor barely caused a ripple in the tank.

Now, to complement the Lenze Smart Motor, the company has unveiled a range of three new gearboxes. Designated the g500 range, these

offer efficiency rates of between 94% and 96%, much lower weight and a more aerodynamic design.

Developed to transform motor speed into torque as intelligently and accurately as possible and due to make their debut at the SPS/IPC/Drives trade fair in Nuremberg, the g500 range again offers a number of key advantages. These include exact dimensioning to the application by an especially fine torque gradation possible, high torque density and elimination of interference contours.

The gearboxes’ considerable weight reduction is achieved by the use of aluminium and optimisation of the housing by means of Finite Element calculation. This weight reduction is significant – as can be seen from the fact that the model it replaces – the GFL06-2M, while offering the same torque (660Nm), is 7900ccm in volume and 40kg in weight. By contrast, the comparable g500-S660 model has a volume of just 6050ccm and a weight of just 23kg – improvements of 20% and 42%

respectively.

This improvement is partly a consequence of using aluminium in the gearboxes' construction, but also of a more aerodynamic construction, which both improves torque density by approximately 20% and eliminates interference contours, making integration into the machine much easier.

The weight reduction achieved with these units has very real consequences in application, as with four or five gearboxes being used, a 60kg reduction in weight becomes possible. Such a weight reduction saves 10,000 kWh of electrical energy per year, which is equivalent to saving €1,500 per annum.

"Intelligence is all about rethinking existing solutions to suit how they are used in actual applications, and bringing them to life in a way that offers maximum benefit to mechanical engineers and plant operators," explains Rune Friis-Knutzen, Head of Strategic Product/Market Development Electromechanical Drives at Lenze.

With the g500 gearbox range, Lenze is proving that there is still valuable potential for new developments in the field of electromechanics. The specialist in Motion Centric Automation has succeeded in developing a finely-tiered series of gearboxes

with an efficiency of over 94% across the entire transmission range. "We went right back to the drawing board and asked ourselves some serious questions about everything we've achieved so far," notes Rune Friis-Knutzen, before adding: "As the losses are so minimal, the motor has less energy to generate, which improves the bottom-line efficiency of the entire system. What's more, the lower level of generated heat increases the overall service life." These successes have been made possible as a result of working with the latest calculation and simulation methods throughout the development process.

The g500 range essentially represents Lenze's next step in pursuing the objectives it had already set out with its Lenze Smart Motor: to maintain the simplicity of an AC motor and use improvements in design to eliminate known imperfections – with the ultimate aim of producing a high-performance, efficient solution.

One of the outcomes of taking this broader view of the mechatronic elements is that the speed of the Lenze Smart Motor can be adjusted directly on site simply by using a smartphone app and near field communication (NFC). As a result, just one variant of the equipment is enough to cover motor speeds of



"The size and light weight of the Smart Motor mean an energy saving compared to using IE3 motors."

Frank Maier

between 500 and 2600 revolutions per minute at a constant torque.

With this extensive speed range already well established, the new g500 gearboxes are now adding yet another dimension by enabling a huge range of possible speeds and torques to be covered with just one type of gearbox motor. Not only that, but the high levels of efficiency offered by the Lenze Smart Motors and gearboxes also offer clear benefits when it comes to energy efficiency, with the units already conforming to efficiency standards that will apply in the future. Besides the Lenze Smart Motors, the g500 gearboxes can also be combined with the IE2 MH three-phase AC motors, the inverter-optimised MF motors, and the MCA and MCS servo motors from Lenze to create packages that are intelligently tailored to specific applications.

The helical, helical-bevel and shaft-mounted helical gearboxes will be coming onto the market in two phases: Lenze is starting with the smaller sizes of 45 to 600 Nm in a newly-constructed aluminium housing, before launching gearboxes with higher ratings of up to 13,000 Nm (produced in cast iron) roughly one year after that.

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Offering fresh potential

With sheet metal being as popular a raw material as ever, are the methods of joining and fixing it into assembly about to change? Justin Cunningham examines the potential for using adhesive bonded studs over more traditional welded studs.

Sheet metal is one of the fundamental materials used in metalworking. It can be easily cut and bent into various shapes with countless everyday objects relying on the process for manufacture.

Industrial applications use a wide variety of techniques to fix components to metal sheets, but one popular method is by welding thread studs on to parts. However, many are finding the process has increasing limitations when modernising the design of products.

Though it is a reasonably efficient process that can be automated, stud welding reaches a limit with sheets that are less than 0.5mm or when metal substrates makes welding impossible. This puts the process at odds with changes being made in many high-throughput sectors.

Here, the use of aluminium, magnesium and other more exotic materials is becoming much more common, as is the use of thinner gauges of ultra high-strength steel sheets. In addition, welding is restricted to non-lacquered metal components. These factors make the more traditional approach of welding studs to sheet metal components much less viable.

One alternative has come from adhesive specialist DELO, which has developed a process in conjunction with mechanical joining expert Böllhoff. The pair have been developing and

testing a process of bonding studs to sheet parts using a high strength adhesive. While the process might not seem all that original at first glance, they claim it offers some unique advantages while addressing many of the shortfalls traditionally associated with the technique.

The Böllhoff and DELO solution is known as the Onsert method and can be used on thin sheets, more exotic metals and even composite panels. The process uses fixing elements that are initially moulded using a transparent plastic to allow the adhesive to be cured by an LED lamp. This allows the process to be fully carried out within a short cycle time.

Another advantage is that bond studs have been shown to need significantly less energy to process compared to welding. Welding requires joined substrates to be melted – an energy intensive procedure – while the Onsert method only uses an LED lamp with a wavelength of just 400nm for curing.

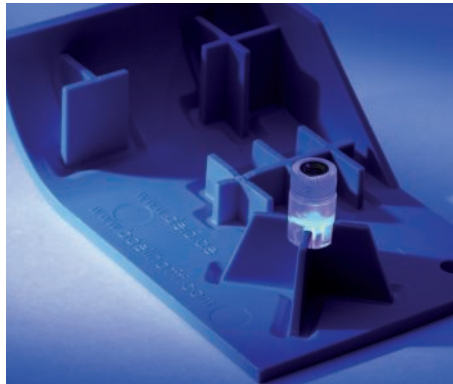
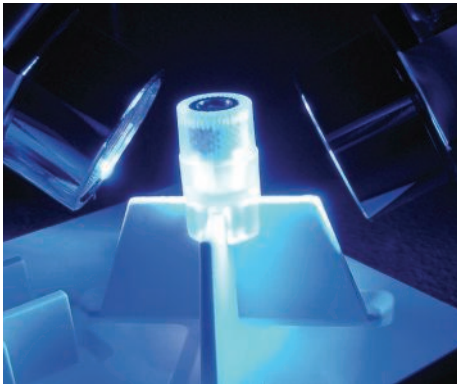
To weld a stud with a thickness of 6mm and a circular projection to a zinc plated sheet with a wall thickness of 1mm, an effective welding current of around 18,000A is required at a resulting voltage of 2V and a welding time of 100ms, with 3.6kJ effectively implemented. For resistance welding, a typical efficiency factor of 0.53 is indicated. This equates to an energy demand of 6.8kJ per stud.

By contrast, the Onsert method – including the curing lamp including the cooling system – consumed around 117W at an amplitude of 100%. The energy required for a normal irradiation time of 5s is therefore 0.6kJ per element offering a significantly more energy efficient process.

The process is not without its disadvantages, however. As with most adhesive processes the time to cure is indeed longer. Taking the example above, the cure time of 5s compares to a weld time of just 100ms. While both can be considered relatively quick processes that fit high volume manufacturing processes, welding does offer a higher output capability overall.

In addition, one of the most commonly cited disadvantages of using adhesive bonds is poor resistance to high temperature which can cause the adhesive to lose stability, melt and lose its bonding ability. The same is true at very low temperatures where the adhesive can become brittle and lose mechanical integrity.

The Onsert has the potential to operate at temperatures of 150°C and, while this is suitable for most applications, other adhesives can theoretically be used where heat cycling or higher temperatures become a main driver over throughput. The space industry, for example, is known to use stud bonding on honeycomb panels and has proven the capability of the



process in continuous and considerable heat cycling environments.

Indeed, elastic adhesives can be used where change in temperatures can cause significant expansion and contraction between different substrate materials. This applies if stud bonding as a process is used on between a composite panel and a steel stud, any two substrates with significantly different rates of thermal expansion. Here, adhesives can be used to absorb any shear stress and strain to stop it localising around a stud or insert.

And compared to welding processes, stud bonding avoids the issue of heat-affected zones and also eliminates metal grinding, potentially lowering unit cost and arguably improving aesthetics.

Indeed, stud bonding offers another advantage in multi-material manufacture that relies on traditional bolted joints. The use of bonded studs eliminates the corrosion associated with metals with different galvanic potential, such as a steel and aluminium joint.

Böllhoff and DELO are not the only ones that

have been able to successfully develop and implement a bonded stud variation. Bournemouth-based BigHead has been successfully applying bonded fastenings for some time.

Its focus, however, is based less around metal sheets, but instead on allowing composite panels to have studs, nuts and fastenings applied to them to allow easy assembly, and disassembly, as required – as opposed to being permanently bonded.

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While bonded studs offer many advantages, they are unlikely to replace welded studs completely for sheet metal applications. Welded studs continue to be used everywhere where connection elements are irremovably joined to metal carriers. Their application is versatile, widespread and can be found in many objects of everyday life from household appliances like washing machines and cooking stoves to ship and aircraft construction. The advantage of this technique include its high loading capacity thanks to full area welding, high productivity thanks to short welding times, and ease of automation.

www.delo.de/en

www.boellhoff.com

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The use of bonded studs and fasteners is likely to continue with the proliferation of composite and other more exotic materials in prime, high-volume, industries.

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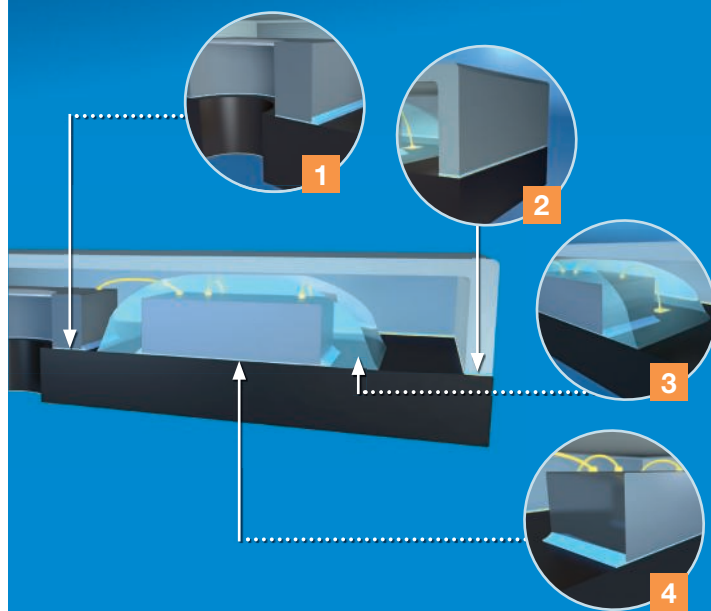
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Henkel bonds student success

It's been another highly successful motorsport season for UH Racing based at the University of Hertfordshire. At the German heat of Formula Student 2013,



the team finished in a very respectable 23rd position in a field of around 90 in the Class 1 category. Indeed, it gave UH Racing the accolade of being the most successful UK Formula Student team of all time. It also picked up a fistful of prestigious

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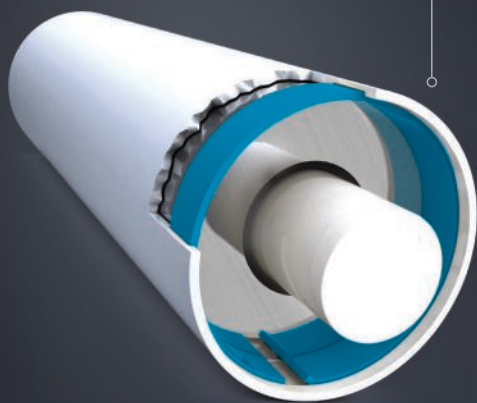
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What does the Unitary Patent and Unified Patent Court mean for you?

The proposed Unitary Patent (UP) and the Unified Patent Court (UPC) will bring the biggest change in the European patent landscape since 1978. Here D Young & Co LLP summarises what is changing, what it will mean and what as a business owner or manager you should have firmly on your radar.

The proposals to create a new unitary patent system throughout most of the EU have been signed by the intended participating countries, but still need to be ratified by the national governments. There remains a considerable amount of detail (especially in relation to costs and renewal fees) requiring further clarification.

However, there are essentially two main proposals:

1. A Unitary Patent covering most EU states
2. A Unified Patent Court system (intended to apply to existing European patents and, importantly, pending applications as well).

The Unitary Patent (UP)

The catchphrase being used is "A European patent with unitary effect". It is hoped, with time, it will become the preferred option for participating countries. It is important to note that it will not replace national patent systems and will not have effect in non-EU countries of the European Patent Convention (EPC) (such as Switzerland, Norway and Turkey) nor those EU countries which do not want to participate (currently Spain, and possibly Italy and Poland).

The cost of the unitary patent is not yet fully known. Of particular concern is the amount of annual renewal fees (the fee to keep the patent alive) which are to be shared by the participating countries. Clearly this will be a major factor when deciding on your IP strategy.

In theory, such a unitary patent is sensible in furtherance of the single market in the EU, but the practical difficulties are considerable. The fact that not all EU countries are covered and that unitary patent coverage may change as successive states ratify, uncertainties as to filing and renewal costs and the lack of clarity

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Key speakers from D Young & Co will discuss the latest UP and UPC developments.

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regarding the Unified Patent Court system all mean that most patentees should be very cautious at this early stage.

The Unified Patent Court (UPC)

Unlike other unitary rights (such as the Community Trade Mark (CTM), which is litigated in national courts), the system proposes a unified single court system. This is a substantial change from the existing position, where patents are litigated nationally.

Unfortunately, due to certain political compromises, the proposed system will be complex, with central, regional and local divisions, and significant uncertainties exist in the drafting of the legislation as to whether (for example) infringement and validity will be decided together by the same court and as to what law is relevant to issues such as accessory liability, experimental/research use exemptions and fair, reasonable, and non-discriminatory (FRAND) disputes. There is also likely to be considerable scope for 'forum shopping'.

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As noted above, the new court system will automatically apply to existing patents granted by the European Patent Office (EPO) and pending EP applications unless you 'opt out'.

Our Advice

It is too early to provide any definitive advice and you should not make any irreversible decisions on patent strategies. However, you may wish to look at your IP strategy with the following in mind:

- National patent applications remain a viable option for recent filings and for pending Patent Cooperation Treaty (PCT) applications.
- You can opt out of the UPC regime during at least the first seven years, and possibly up to 14 years. It may be advantageous for owners of valuable patents to opt out on the first available day to avoid exposure to centralised revocation. Hence patent owners will have more litigation options available to them than at present whilst limiting potential adversaries' options. You may want to decide soon whether there is any reason not to opt out all of your existing EPs, or at least ensure that all key patents are identified for opting out.
- Consider identifying competitor patents which would be convenient to revoke centrally before the owner opts out.
- For those patentees who designate many states, it may be more cost effective to apply for a UP, and for others it will be necessary to wait to see what the costs are before deciding on a strategy taking into account other factors such as the uncertainty regarding the litigation system.
- The new system is unlikely to come into effect for, at least, two or three years and possibly longer but it is best to be prepared.

The big chill

Cooling down drinks is a must at parties, but is it possible to do it in seconds?

As winter draws in, it may be difficult to remember, but there was a summer this year and, as ever, we British celebrated with barbecues and outdoor parties accompanied with the odd cold beverage (in moderation, of course).

The problem with cold beverages, of course, is that they don't start out cold and must be chilled. Normally, a certain amount of preparation is sufficient to ensure that there are enough cold drinks. Stocking up the refrigerator will do for a start, but if the gathering exceeds a certain size, one fridge won't be enough.

So what about ice buckets? These work, but still take time to chill things – plus there is the disadvantage that soaking wine and beer bottles can remove the labels, making it potentially difficult to distinguish between a low-alcohol and a full-strength lager – with potentially worrying results. Equally, ice melts and water warms up in the sun. And, of course, the chilling process still takes time.

And time is of the essence if the temperature's pushing 30°C and all you have is warm beer. Of course, drinks can be chilled reasonably quickly in the freezer, but this requires a careful eye to be kept on the time. Few things are more depressing than remembering too late that you've left drinks in the freezer, only to find a collection of

burst bottles or cans and a range of beer or wine-flavoured ice lollies.

The Challenge

So this month's problem is to find a way of chilling drinks rapidly and effectively – in seconds, ideally, rather than minutes.

Some options suggest themselves, but each has its disadvantages. For instance, the

deployment of liquid nitrogen would definitely chill the liquid rapidly – albeit to somewhere between -346°F and 320.44°F.

Alternatively, there are commercial methods for rapid cooling such as blast chillers, but these are expensive and even they may not be able to do the job in seconds. The solution we have in mind is relatively low-tech, but makes use of basic thermodynamic principles to achieve the desired result. However, there is nothing to say that something better could not be achieved by Eureka's readers. We look forward to reading your ideas.

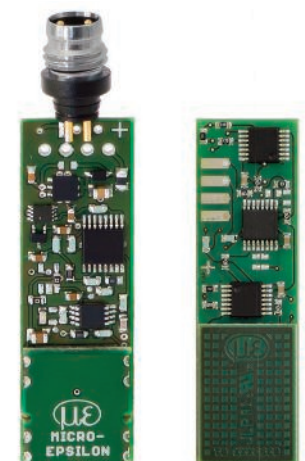
*Acme Personal drinks chiller**
(*please do not try this at home)



The answer to last month's Coffee Time Challenge of how to prevent theft of metal on the railways can be found in our Technology Briefs section on page 11.

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Disc Springs

Spirol Disc Springs meet braking systems' needs

A mechanical back-up design using Spirol Disc Springs has been developed for use with braking systems for off-highway vehicles. Such braking systems are commonly designed to be hydraulically actuated and in most cases, braking occurs when pressurized fluid compresses stationary plates against plates that rotate with the drive shaft. The amount of friction between each set of plates controls the deceleration of the vehicle. However, without an additional fail safe system, this design alone has limited reliability. If a hydraulic seal is compromised, or the hydraulic cylinder loses pressure for any reason, the brakes fail.

With Spirol's design of mechanical back-up system, under normal circumstances, the hydraulic system holds a constant pressure on Disc Springs stacked in series. If pressure fails to be maintained, the stack of Disc Springs decompresses to actuate the braking mechanism. The reliability of this safety system is dependent on the consistent performance of Disc Springs. In this critical application, the Disc Springs' performance and level of predictability improves product quality and ensures overall safety.



www.spirol.com

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 ☎: +44 (0) 1536 444800

Pumps

Hydra-Cell Mono-Block Pumps Ease Installation & Service

Wanner International has introduced an optional Mono-Block style pump head on its Hydra-Cell G03, G13 and P200 seal-less pump models.

The new Mono-Block pump head combines the traditional valve plate and manifold into a single component, allowing easy access to the cartridge style valve assemblies. The valves are accessed easily without the need to disassemble the pump or disturb the system pipework. Routine maintenance, valve inspection and, if necessary, replacement, can be carried out quickly and efficiently and causes very little downtime while cutting service and maintenance costs. A further benefit of the Hydra-Cell with Mono-Block pump head is its ability to prime quickly at slow speeds. Mono-Block pump heads are available in brass or 316 stainless steel. Diaphragms are available in a range of materials from PTFE and Viton to Buna, Neoprene and EPDM, to suit the requirements of the liquid being pumped.



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Sensors

New cost effective and flexible ETP temperature sensor range covers all bases for mounting and measurement

Variohm EuroSensor has released its new ETP range of temperature probes based on a MEAS thermistor. To suit the broadest range of industrial, automotive and scientific applications for precision temperature measurement, four basic packaged design types are available that each offers a choice of options. The four designs conveniently mount the industry standard thermistor in a choice of Ø 4 mm PTFE or Ø 5 mm brass housings, ring terminal probes, or hexagonal head bolts. Within each packaged design, a standard off-the-shelf stock version is available with a 10K3 sensor fitted and the comprehensive list of optional features offered for each type include; housing diameter and length for the cylindrical probes, ring terminal mount diameter/size, and metric thread size for the hexagonal bolt version. The leadwire length for all types is similarly specifiable.



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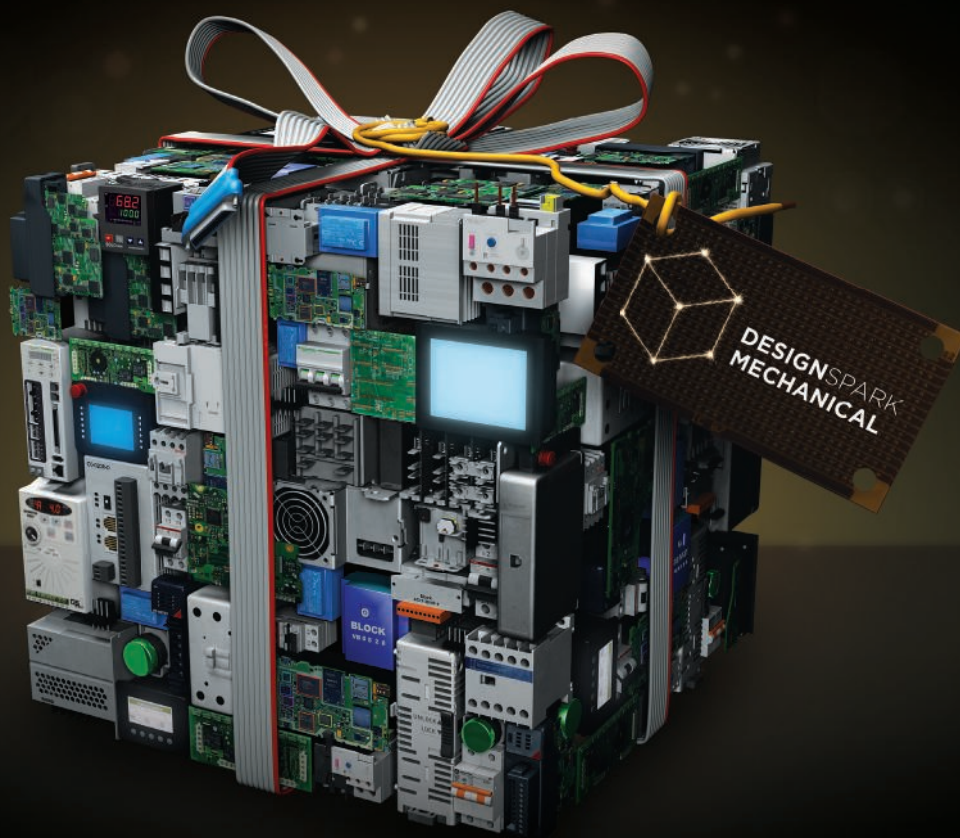
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