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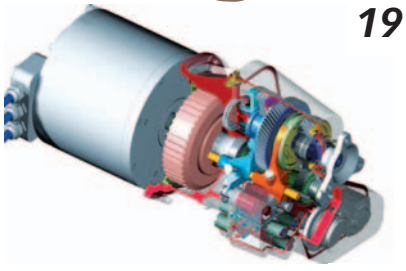

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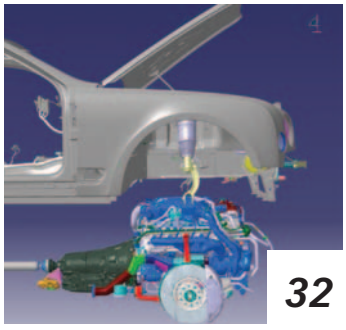

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ISSN-0261-2097

Eureka (incorporating Engineering Materials and Design and Design News) is free to individuals who fulfil the publisher's criteria. Annual subscriptions are £78 UK (£115 overseas or £150 airmail).

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

Origination
CTT
Printed in England by
Wyndeham Heron Ltd

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

No time like the present

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

While it is one of the roles of *Eureka* to keep its readers informed about the legislation that affects their daily working lives, it is at the risk of sounding like we're nagging.

However, the deadlines facing industry in relation to energy usage are becoming increasingly urgent and the worrying impression we get from the market is that many companies have not yet acted upon them.

The fact is that the CRC Energy Efficiency Scheme is already in its reporting stage and is going to have a significant impact on all levels of manufacturing. It means that any organisation that has used more than 6000MWh of electricity in 2008 will have to purchase and surrender allowances each year to cover their CO_2 emissions. The Government has set very aggressive targets on carbon reduction and the legislation will not allow those businesses affected to do nothing. If they fail to act, they will be heavily charged for their inaction and that charge will escalate over time.

Of course, one of the problems is that, for many companies, this will understandably come a long way down their list of priorities, after meeting customer needs and making a profit. Often, responsibility for compliance will be shared between different departments, with no one person taking ownership. In most cases, however, it will come down to engineers to research, specify and install the solutions that ensure companies meet their commitments.

This will place an enormous burden on already swamped engineering departments, but it is one that must be borne. Reducing energy consumption is a good business decision, regardless of the environmental considerations, and needs to be made sooner, rather than later.

Expect big problems

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Farnborough sets the scene for exciting debuts

Business secretary Vince Cable, centre, with Ian Godden of A|D|S, left, and Alex Dorrian, head of Thales UK. In the background, the Red Arrows and the refurbished Vulcan

The 2010 Farnborough Airshow saw the unveiling of the Bloodhound life size show car, as well as a number of firsts for the UK aerospace industry.

At 12.8m, Bloodhound SSC is longer than four Minis parked end to end. The 1:1 replica is the result of three years of aerodynamic study and 10 design evolutions to perfect the shape and aerodynamic package.

Aerodynamic research using computational fluid dynamics was conducted by Swansea University, MathWorks and EPSRC, and, according to Bloodhound, at key moments the project utilised more computing power than the Met Office.

The aerodynamic team, lead by Ron Ayers, generated millions of mathematical equations to investigate how the air around the car would react as the car accelerates to its maximum design speed of 1,050mph. Using this information they then designed an efficient shape that would be stable at supersonic speeds and controllable a sub-sonic velocity.

The show, which was opened by Vince Cable, Minister for Business, Innovation and Skills, also saw the eagerly awaited International debut of the Boeing 787 Dreamliner passenger airplane offering buyers from around the World the first opportunity to tour the aircraft. Airbus, meanwhile, presented in-flight demonstrations of its two flagships, the A400M and the A380.

According to the show's organisers, Farnborough this year saw £31bn ($47bn) worth of orders placed, a figure that, while understandably lower than 2008's record figures, was well ahead of the 2006 show.

At the Show, BAE Systems pledged to invest millions of pounds to hunt out 'untapped talent' from the UK's engineering pool. The defence giant has launched a 10-year plan to seek out hundreds of designers, engineers and potential management in a bid to help support multi-billion pound military projects.

Boosts given to green technology

Grants of software and services from National Instruments have been of significant assistance to four British and Irish green energy projects.

Romax Technology in Nottingham, Magnomatics, a spinout from the University of Sheffield, Wavebob, a novel wave power generator in Galway and Sunamp in Scotland grants all received up software and services. Because of its success, the scheme is being continued.

Nanotech centres 'unlikely' to survive funding cuts

Britain's 24 nanotechnology centres may be victims of cuts to the UK science budget.

Science Minister David Willetts told the Parliamentary Science and Technology Committee there were too many small 'sub-critical' research centres and called for centralisation. He added that it was 'most unlikely' that the nanotech centres would still be open in 18 months.

He is currently in negotiations with the Treasury about what will be axed from the science budget in October's spending review.

Although Willetts said he was determined to protect 'blue skies' scientific research in the UK, he added that he also wanted to avoid simply drawing up a list of 'sexy sounding' subjects, such as biotech or space, to be protected from cuts, as this had proved to be the wrong approach in the past. Willetts said that there would be a more rigorous analysis of what should be protected.

Briefs

COMPOSITES ENGINEERING SHOW ANNOUNCED

The Composites Engineering Show will be held at the National Exhibition Centre, Birmingham, on the 29th and 30th September 2010. Developed to bring together participants from the UK's rapidly expanding composites design and production engineering community, the show will feature product and process applications from a wide spectrum of industry sectors, including aerospace, motorsport, transportation, marine, medical, construction, oil & gas, telecoms and consumer products.

BOSCH ESSAY WINNERS ANNOUNCED

The winners of this year's Bosch Technology Horizons Award were (in the 19 to 24 years old category), third year Loughborough University aeronautical engineering student Thomas Dean and Caitlin Willis, from Chelmer Valley High School in Essex in the 14 to 18 age group. There were nearly 800 entries and Thomas Dean walked away with £1000, while Caitlin Willis received £700. The subject of this year's Bosch essay competition was 'Are engineering and technology essential for future development?' Prizes were awarded by Andrew Castle, vice president, Bosch UK.

3D TECHNOLOGY OPEN DAYS

CDG's 3D Scanning & Printing Technology Open Days will take place on 7 and 9 September 2010 at the company's offices in Alton. Presentations will include the latest news from ZCorp on 3D Printing; the latest on 3D scanning from Breukmann and the latest news on 3D engineering. To register, email **info@cdg.uk.com** with your name, company and prefered date.

Parker enhances piston range

Parker Hannifin has broadened its range of bent axis piston units, offering greater choice and flexibility in terms of size, while providing the same high performance operation to boost production output and profitability. The latest addition to the F11 series, the F11-6, has been introduced to offer exceptional degrees of speed, efficiency and pressure in many motor applications, including fan drives, saw motors and construction machinery.

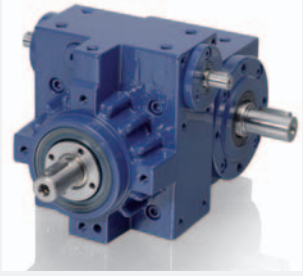
In common with Parker's existing F11 series piston pumps, the F11-6 features a compact, lightweight, robust and reliable construction with few moving parts for dependable operation at pressures up to 420 bar, at high speeds and accelerations. The use of heavy duty roller bearings enables each pump to withstand substantial external axial and radial shaft loads, while laminated piston rings ensure low internal leakage and excellent resistance to thermal shocks.

www.parker.com

PHASE ADJUSTING GEARBOXES REGAIN POPULARITY

Vogel phase shifting gearboxes provide mechanical adjustment to the phase angle of two rotating shafts. Adjustment can be made intermittently or continuously leading to widespread use for print registration, wrapping on packaging machinery and tensioning in paper making plants. Whilst many of these applications have transferred to servo technology in recent years, the use of phase shifting gearboxes is once again gaining ground as customers recognise the value of mechanical simplicity and low cost.

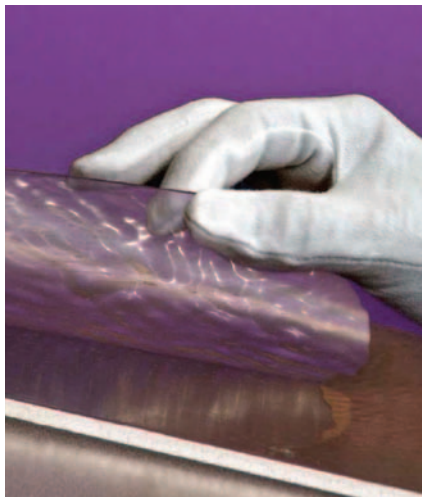
Phase shifting gearboxes are a variation on a planetary design



where the outer ring can be rotated. It is turned by a shaft with worm gear connection to the ring. Thus rotation of the worm shaft superimposes a motion between the planetary input and output shafts, adding or subtracting a phase angle.

www.techdrives.co.uk

Maskant protects in harsh environments



SpeedMask 730-BT from Intertronics is a DYMAX masking resin, formulated to provide excellent surface protection during chemical milling/etching, plating, anodising and aggressive grit-blasting operations The resin aids in the manufacturing, overhaul, repair and rework of turbine engine blades, vanes and other turbine components, as well as many other metal finishing applications. Said to be impervious to most acid and alkali solutions, this next-generation maskant is trimmable for complex configurations while still maintaining edge tension to prevent leakage and damage to the substrate underneath.

SpeedMask 730-BT is designed for spray, dip, or brush masking of components. Used as a temporary protective coating, it is a convenient replacement for environmentally hazardous and time-consuming solvent or water-based maskants.

www.intertronics.co.uk

Solution to last month's Coffee Time Challenge

Last month's Coffee Time Challenge urged you to find a good, low cost and totally reliable way of absorbing the shock of somebody falling off a roof.

The solution exists in the form of the Constant Force post, which has been developed by Devizes based Latchways. Its design is protected by patent.

Insides its 150mm long containment is a coiled steel rod. When a shock load is applied, this is pulled out, reducing maximum force to 10kN over several hundred mm during a time period of more than 150ms.

The system is tested with loads of 300kg, which is three times greater than that required in EN 795; the standard governing the testing of anchor devices.

The testing programme includes installations on 6 x 6m sections of complete roofing systems.

www.latchways.com

Insulative adhesive wards off shocks

Polymer System EP31 has been developed by Master Bond. This two-part system features extraordinary adhesion with a lap shear strength exceeding 4600 psi, a peel strength surpassing 40 pli, a tensile modulus of more than 410,000 psi and a flexural strength of more than 13,000 psi.

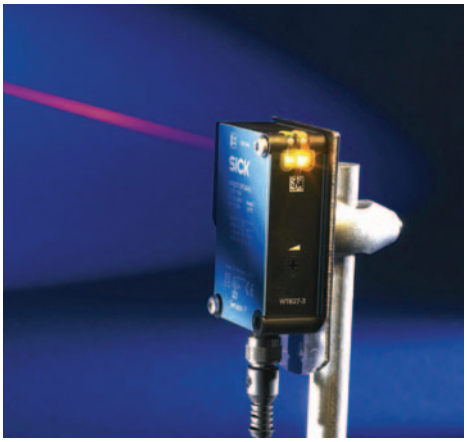
With excellent resistance to many chemicals, including water, oil and fuels, it is also an outstanding electrical insulator. EP31 has a versatile cure schedule and can cure at room temperature or more quickly at elevated temperatures.

Other notable characteristics include a Shore D Hardness of greater than 75 and low shrinkage upon cure. It is easily processed with a convenient 3 to 1 mix ratio by weight and has a service temperature range of -60 to 250°F.

www.masterbond.com

LED gets to the point

SICK (UK) has increased the intensity, brightness and accuracy of opto-sensor technology with the new Pin-Point LED. The



Pin-Point, which delivers performance comparable to a short-range laser scanner, will significantly broaden the range and performance of SICK's LED-based photoelectric switches and photoelectric proximity switches.

A new design of LED, the Pin-Point vastly increases light spot intensity and concentrates the energy on a much smaller area. Pin-Point boasts greater functional reserves, improved detection reliability and the capacity to detect longer ranges.

Using the Pin-Point, SICK photoelectric switches can detect much smaller objects, down to 1mm, and distances up to 500mm, providing an innovative alternative to Laser diode photoelectric switches.

www.sick.co.uk

Straight shank design for inserts

The family of Atlas Plus+Tite blind threaded steel inserts has expanded with a newly introduced version featuring a straight shank design. This fastener joins Plus+Tite pre-bulbed inserts in offering superior pullout resistance when installed permanently in plastics or thin sheet metal. Both types provide reliable and reusable threads for 'blind' attachment applications, including tubing and extrusions, where only one side is accessible for fastener installation and component assembly. A single mating screw completes the final attachment process.

Atlas Plus+Tite inserts can install permanently into single, variable, or multiple-thickness materials as thin as 0.02in, or 0.5mm. The straight shank design will accommodate a smaller mounting hole and the pre-bulbed inserts will require less installation load.

www.pemnet.com

Innovation thrives in the

This is a nervous time for the defence sector. The Strategic Defence and Security Review (SDSR) due this autumn could mean cuts of up to 15% in the MoD's £37billion budget. While that is significantly less than the 25% cut required of other government departments, it will undoubtedly pose a significant threat to a range of procurement programmes.

Figures from A|D|S show that the UK defence industry has a 21% share of the world's defence export market. It supports 300,000 people and is worth around £35bn per year, with an additional £5bn per year on average coming from exports.

The global nature of the ongoing financial retrenchment means the UK is not the only country where this applies. Other big defence procurers, such as France, Italy and the US, are also reducing defence spending and, given that for some UK suppliers the US Department of Defense is as significant a customer as the MoD, this is clearly a worry.

However, this country remains embroiled in a long-term conflict in Afghanistan and that means that there will continue to be a need for new and innovative design in this sector for the 'foreseeable future'. Equally, there are a number of long-term projects to which the Government remains committed, which means that innovation in design remains at a premium.

Unmanned vehicles

Certain trends are clear in the defence industry at present. Chief among these is the increased demand for unmanned vehicles to do some of the 'dirty' and dangerous jobs required in combat theatres. The unmanned air vehicle (UAV) has proven its value in Iraq and Afghanistan, clocking up more than 1million flight hours and providing invaluable visual intelligence, as well as offering a significant attack capability.

The latest and most spectacular leap in this area came with the unveiling at its Warton site of BAE Systems' Taranis prototype unmanned combat aircraft. Named after the Celtic god of thunder, the concept demonstrator will test the possibility of developing the first ever autonomous stealthy Unmanned Combat Air Vehicle (UCAV) that would ultimately be capable of precisely striking targets at long range – even in another continent.

Taranis is an informal partnership between the MoD and industry stalwarts such as BAE Systems, Rolls Royce, QinetiQ and GE Aviation. It is designed primarily to provide the MOD with critical knowledge on the technical and manufacturing challenges and the potential capabilities of Unmanned Combat Air Systems.

The most significant technical challenge overcome in the development of Taranis has been the difficulty of combining a number of elements within one vehicle, including autonomy systems developed for existing unmanned craft such as BAE's Mantis, according to Nigel Whitehead, group managing director, programmes and support, for BAE. "A number of the individual technologies involved have been looked at in the past, but bringing them all together was a considerable challenge," he said.

Other specific technological issues that the Taranis designers faced included positioning the craft's power source within the middle of the body to help make it invisible to enemy sensors across the electromagnetic spectrum. Aerodynamics were also a considerable challenge as the craft is finless, so it was necessary to find a way to create directional stability.

For all its technical innovation, however, it is clear that the unveiling of this prestigious project was undertaken with one eye on the SDSR. Speaking at the event, Whitehead said: "Without wishing to pre-suppose the outcome of the Strategic Defence and Security Review, and any changes to the Defence Industrial Strategy that this may spawn, there is a clear and compelling need to realign the way in which the MoD and Industry work together. The Taranis programme holds many of the clues as to how this should work."

In response, Gerald Howarth, Minister for International Strategy Security, said: "Evidence from Taranis is already being used to shape the

Main picture: The Taranis Unmanned Combat Air Vehicle
Above right: The Supacat SPV400

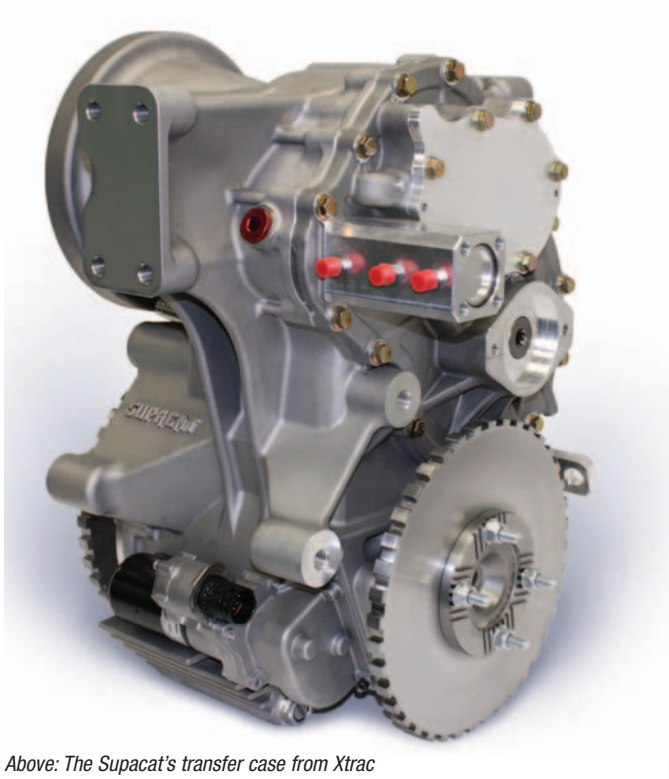
face of cuts

The UK defence industry is one of the most successful in the world, but faces threats in the shape of government spending cuts. However, as Eureka discovers, there is no shortage of novel designs.

direction of future defence research and will ultimately help us to make decisions on the effectiveness of remotely commanded Unmanned Aircraft operating alongside manned combat aircraft", but warned that the SDSR "may mean giving up some cherished but outdated capabilities in order to reinvest in new ones".

So where does this leave design innovation in the defence sector? Clearly value for money is going to be a major consideration. However, given that Howarth said of the SSDR that it 'will balance the needs of current operations in Afghanistan, which is our top priority, against the need to plan for other future conflicts', it seems reasonable to conclude that projects appropriate to that theatre are likely to continue to receive funding in the short term.

One such project is the Light Protected Patrol Vehicle (LPPV), designed to replace the Snatch Land Rover, the use of which has proved so controversial in Iraq and Afghanistan. There are currently two main contenders for this at the moment, namely the Ocelot, which is the result of collaboration between Force Protection Europe and Ricardo and the wholly British-owned Supacat SPV400. Both vehicles stem from efforts to produce vehicles that will protect their occupants against the improvised



Above: The Supacat's transfer case from Xtrac
Below right: The Questar vehicle from Marshalls Land Systems

explosive devices (IEDs) which have become a major feature of the Iraq and Afghanistan campaigns.

Because of this need, both vehicles feature V-shaped hulls. In the case of the Ocelot, the hull contains a Steyr 3.2 litre straight six diesel powerpack, propshaft, six speed ZF gearbox, AxelTech differentials, fuel tank and all the suspension gear except for a torsion bar, which is mounted alongside the hull. In the event of an attack, the vehicle can keep moving, even if it has lost a wheel as the rest of the automotive parts are protected.

The Supacat SPV400 combines an integrated blast and ballistic protection system, including a protected all composite crew pod and V-shaped hull. Using the latest composite and ceramic armour systems, the crew pod is constructed as a separate module, sealed off from potential secondary projectiles, such as kit and electronic devices, which are housed in a rear compartment. All seats are mine blast protected.

Technology transfer

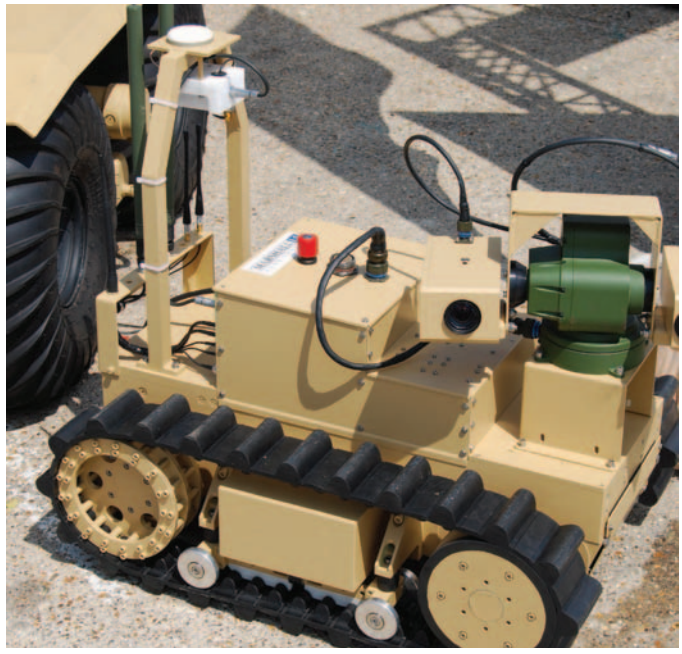
One interesting aspect of the Supacat's design is the way in which technology has been transferred from motorsport into the military arena. It has employed the expertise of Xtrac, a leading designer and manufacturer of high technology gearboxes, differentials and driveline components, which are used throughout motorsport. For this project, its transfer case features high and low range gears, which can be actuated whilst the vehicle is on the move, enabling rapid transfer between on-road and more extreme off-road terrain. The transfer case centre differential provides a 50:50 torque split to the front and rear axles and is electronically controlled. The unit also has provision to drive a power take-off (PTO) as well as the power assisted steering (PAS).

Xtrac has also developed front and rear axles for high mobility military vehicles. The new axles employ a speed sensitive locking differential, which is less aggressive for the application than the usual torque sensitive configuration, and is thus better able to deal with sudden shock loads. Designated 'Milspec 1002', the differentials are passive and lock automatically without intervention from the driver. They come from the same stable that helped Volkswagen win this year's 14-day Dakar Rally with a 1-2-3 victory. The axles have been designed and packaged to be fully compatible with an 'existing vehicle platform' and have been successfully tested over 'thousands of miles' without failure.

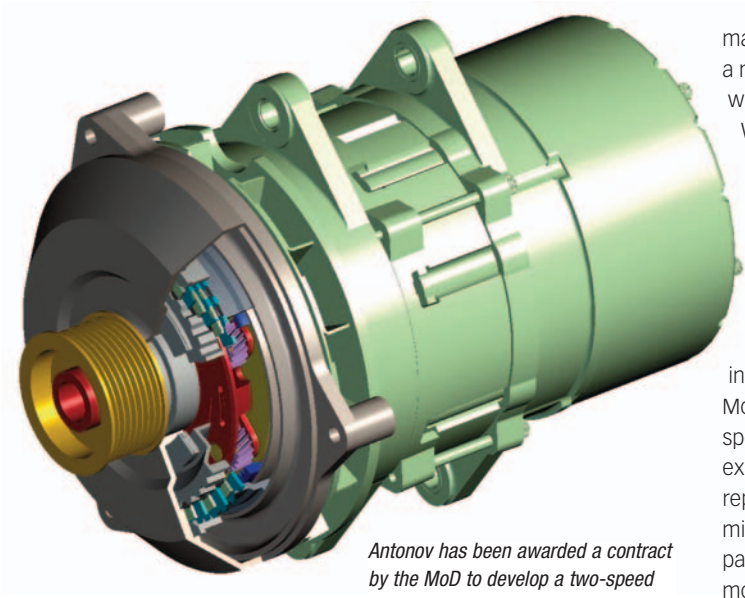
Of course, this 'two-way street', whereby technology developed for the defence sector migrates to civilian applications and *vice versa* is a long-standing aspect of the industry. Many of the companies at the recently held DVD and Farnborough Airshow events are active in both fields and were only too keen to talk about non-military applications for their technologies.

Another major raft of technologies to come out of the Afghanistan campaign has been the need for improved sensor-based systems and information sharing, in order to detect threats and enemies before they have a chance to inflict much damage. Here again, the value of unmanned systems is shown to be paramount. At the DVD exhibition, John Harris from Marshalls Land Systems showed both a 'Trakkar' unmanned mobile 'follow me' platform to run behind soldiers and carry some of their kit, and a small 'Questar' vehicle that can be remotely, semi- or fully autonomously-controlled. Equipped with a camera, it has been developed from the 'Saturn' system that was part of Team Stellar which won the RJ Mitchell Trophy in the MoD Grand Challenge in 2008.

But what stands out about the system is what can be done with



information from the video camera. Using software developed at Cranfield University, it is possible to identify enemy soldiers from their behaviour. Harris said that, for the Grand Challenge, the vehicle had a radar so it could detect weapons. But Matt Breach, chief engineer for collaborator Finmeccanica Battlespace Solutions, said that it now just used a 'classification approach, threading and weeding' and identified hostile actions correctly approximately 80% of the time. In terms of potential civilian applications, it had already shown it could classify cars, correctly identifying 4x4s for example, and had the potential to identify sick animals or people or malfunctioning machines. It is unlikely to be as accurate as an alert human, but humans are not always alert or looking at the right screen. Breach said there are plenty of 'dull, dirty and dangerous' situations which are better watched over by machines, if only in order to alert humans when something significant is happening.



Antonov has been awarded a contract by the MoD to develop a two-speed alternator for military vehicles

This will not work, of course, for land mines, once they have been laid, but after 40 years of R&D, US company Non Intrusive Inspection Technology (NIITEK) offers a technology, originally invented by German scientist Günter Wichmann, that enables reliable identification of buried explosive hazards. This uses ground penetrating radar with a bandwidth of from 200MHz to 10GHz. Asked about the basis of this success, Juan Navarro, NIITEK's executive vice president and general manager said: "The key is signal fidelity – the signal must be very stable and very clear." The company was awarded a $106.5 million contract from the US Army for the supply and support of 76 Husky Mine Detection Systems for high reliability clearance of buried mines in support of US peacekeeping operations around the world in June 2010. Deliveries will be made over the period to May 2011.

Some 100 million land mines are buried in 65 countries. Most of the casualties are civilians. Information on where land mines and enemy and friendly forces are located needs to be shared as soon as it is acquired.

A Generic Vehicle Architecture initiative aims to link systems in different vehicles so that all can have access to their positions; and with sensors such as sniper detection and infra red camera systems, where the enemy is and what they are doing. Participants include: the MoD, IBM, Selex/Galileo and Iveco. A new Defence Standard 23-09 is to apply to both legacy and future systems, which can hopefully be plugged in and used with minimal cost and delay. Until now, the task of integrating a range of different systems successfully with each other has been far from trivial, but there was a working demonstration that mapped where the various elements of a convoy were as they moved round the site at the DVD event, a system that is now ready for deployment.

According to unmanned aerial vehicles vendors, the integration of battlefield information including that derived from UAVs has long been a 'Holy Grail' for system developers, but attempts at deployment in Afghanistan show that it has yet to become a reliable reality on the battlefield. Hopefully, that situation is about to change.

Businesses too often succeed or fail according to whether management can see what is really going on and here too, there is often a need for interfaces to allow IT islands of automation to communicate with each other and to management systems. Lieutenant Colonel Paul Winchcombe of the MoD described an FLIS (Future Logistic Information Services) initiative at DVD to try to reduce their current 275 applications to two. Release 1 is already being rolled out, to be followed by full rollout in 2014. The remaining potential delivery partner – the only other one dropped out – is Boeing. The JAMES (Joint Asset Management Engineering) ERP application for the land environment will be rolled out separately.

All IT and smart weapon systems require electric power, and with increasing demands, Antonov has been awarded a contract by the MoD to develop a two speed alternator for military vehicles. With two speeds available, it can match the output of a larger and more expensive single speed alternator in its low speed range and could also replace the multiple generators that are often required for heavy-duty military vehicle applications. The project has been undertaken in partnership with a 'major manufacturer of alternators and starter motors'. The two speed alternator provides full electronic control of the speed change through an active clutch mechanism. The project has currently reached the stage of detailed engineering design.

'Bullet-proof custard'

Other interesting developments in the sector include BAE Systems' corrosion monitoring system that consists of sensors made of materials and coatings similar to the substrate of a vehicle or structure, that are attached at various locations to measure corrosion rates electrically. It is one of the developments to come out of the company's Advanced Technology Centre, as is a shear thickening gel called 'Liquid Armour' (nicknamed 'bullet-proof custard'), which thickens and becomes sticky on impact and sounds like a potential alternative to d3o's shear material used to protect against sporting injuries.

www.adsgroup.org.uk
www.xtrac.com
www.ricardo.co.uk
www.marshallsv.com
www.finmeccanica.com
www.niitek.com

A natural curiosity

With a 21-year career at Schneider Electric, Dale Wrangles has always been an engineer at heart. "I spent most of my young life taking things apart," he says. "Anything my family had that was electromechanical or electronic, I would take it apart. Most of the time I couldn't put it back together. I was trying to figure out what was inside all these things and what they did. I always had a natural curiosity about how things actually worked."

Hitting the targets

The Carbon Reduction Commitment may be concentrating minds on energy efficiency, but there is still some way to go. Paul Fanning talks to one of those who is trying to spread the message.

There are few people that would disagree about the need for industry to reduce its energy costs. Over and above the environmental question, rising fuel prices mean it makes sound business sense. And, looming over the market at the moment is the mandatory CRC Energy Efficiency Scheme, which aims to reduce the UK's carbon usage by 20% by 2020 (as compared to 1990 levels). Already in its reporting stage, this scheme is going to have a very significant impact on all levels of manufacturing, meaning as it does that any organsation that has used more than 6000 MWh of electricity in 2008 (roughly equating to £500,000 spend) will have to purchase and surrender allowances each year to cover their CO_2 emissions.

Despite all this pressure, however, Dale Wrangles, director of Industry at Schneider Electric UK, finds that the message is still not getting through. He says: "I think there's going to be a dash at the last minute to resolve a lot of problems. I suspect it's going to be a panic situation in many cases."

Many of Wrangle's views have been informed by Schneider Electric's recently commissioned 'Energy Management Report', which provides an insight into the likely future of energy management over the next 20 years. "You can get hooked up in what you think and not think about what the market actually wants. This report has produced findings to support what's actually really happening out there and ways to manage energy efficiency in the future," he says.

While larger corporate organisations in the UK understand their environmental impact and the need to be what he calls 'good corporate citizens', the same cannot necessarily be said of their smaller counterparts. He says: "For the smaller companies in the marketplace, it's a completely different discussion. They don't necessarily see it as their duty to be a good corporate citizen. It's all a distraction. They are quoted, in the report as being busy getting orders in the door. I don't need to make any investment, nor have personnel involved in that responsibility."

In many cases, he believes, this is due to a failure to persuade many of those within industry of the urgency to reduce carbon consumption and also of a general scepticism about government initiatives. "There is a job to be done explaining that this is an opportunity rather than just a burden," he says. "I don't think people are particularly swayed by legislation or government initiatives. Many feel that these initiatives are fads. So the buy-in from many companies is not immediately there."

One of the findings of the report was that, while the environmental case for energy reduction may not convince companies, the financial case will – and not just because of the costs that will be incurred by companies who fail to comply (although he concedes that 'it's always a great motivator when you get a huge bill from the Government because of your carbon frailties'). He says: "Carbon reduction and the danger to the planet are not necessarily ideas that all companies buy into, but what they do buy into is the idea of saving money."

Given that Wrangles estimates the average savings possible by energy reduction measures at around 30% and the average payback time being less than two years, it would seem an obvious move. However, he feels that companies are being held back by the need to make capital expenditure and an innate scepticism of the technologies involved. He says: "I've lost count of the number of people who've said to us 'if you fit one variable speed drive on one of our machines and it does what you say, we'll buy it and fit them throughout the plant. After all, it's not as if VSDs are a new technology!"

"That's where our growth is: in consultancy services. We need to be able to provide a solution rather than just a bag of products."

Another factor, he believes, is that many companies have 'de-skilled' and no longer have the personnel competent to undertake the necessary measures. Here, he believes, is where companies such as Schneider Electric have a role to play. Says Wrangles: "We need to fill that void by offering consultancy services on installation, design and specification. For instance, we've an energy efficiency team."

This type of consultancy is an aspect of the business that Schneider Electric is currently growing. Wrangles notes: "That's where our growth is: in consultancy services. We need to be able to approach organisations with a solution rather than just a bag of products."

The issue of skills is one dear to Wrangles' heart, not least because it affects Schneider Electric in much the same way it does the rest of UK industry. "You get worried about the industry going forward when you see so few universities focusing on engineering. We have been recruiting on the motion and drives side and we're going to send them round the world for a year to learn the industrial applications of motion and drives. For a job like that, you'd expect to see a long list of job applications, wouldn't you? But unfortunately, that hasn't been the case."

Nonetheless, Wrangles sees the future as positive and sees Schneider Electric having a more and more integral role to play in his customers' businesses, particularly as it relates to energy saving. "Our job is to create demand, service our customers' needs and find new, innovative ways of doing things," he says.

www.schneider-electric.co.uk

Complex materials boost performance

Tom Shelley reports on partly bio-based materials that outperform conventional resins.

Considerable performance and cost benefits can be obtained by adopting composite constructions of novel materials, including some that derive from wood pulp, banana fibre and castor oil.

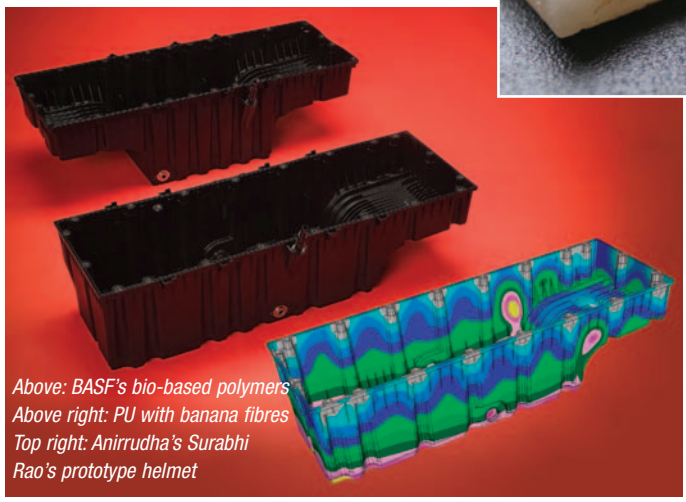
Any reduced environmental impact from their partly plant-based origins might be of interest, but it is their reduced weight and costs and enhanced performances that make them worthy of consideration.

For instance, structures made of corrugated cardboard treated with an acrylic waterproofing compound are being used in novel cycle helmets. They are lighter and more effective at absorbing impact than polystyrene foam and, if produced in volume, are likely to be much cheaper to manufacture.

Design graduate Anirudha Surabhi Rao showed some of his prototype helmets at this year's Royal College of Art summer show and claims that, as well as being protected by a patent application, he was already producing them to order for customers.

The cardboard is cut to form interlocking girders and treated with Acrylex 100, which has been developed by United Coatings to replace solvent-based enamels. Rao said that tests at Imperial College showed that the new helmets exceed the requirements of BS EN 1078 'Helmets for pedal cyclists and for users of skateboards and roller skates' by a factor of four. The fabrications are about 100g lighter than their polystyrene equivalents and equally recyclable.

The University of Las Palmas Gran Canaria, on the other hand, has found benefits in reinforcing vacuum cast polyurethane parts with fibre from local banana trees. Fibre can be extracted from almost all parts of the plants and has long been used to make fabrics in some parts of the world because of its high strength (540 MPa) and low elongation (3% to 5% at break). Adding banana fibre to polyurethane is said to both increase strength and reduce weight. The research at the University has been undertaken as part of the Spanish IBE-RM project framework, which focuses on rapid prototyping and rapid manufacturing.



Above: BASF's bio-based polymers
Above right: PU with banana fibres
Top right: Anirrudha's Surabhi Rao's prototype helmet

One company that has done a lot of work on bio-based polymers is BASF and the company states that 'Whenever possible and practical, BASF offers materials based on renewable resources'. However, it also recommends that a proper 'Eco-Efficiency Analysis be carried out before using bio-based materials as an alternative to plastics.

As an example, BASF cites the case of two hypothetical car intake manifolds with a designed service life of 200,000km. One design is made of a polyamide called Ultramid S Balance, 60% of whose base comes from sebacic acid, derived from Castor oil and conventional PA 6. The Ultramid S Balance series has lower density and reduced moisture uptake relative to PA 6 and PA66, but cost significantly more. Performing a full Eco Efficiency analysis then shows the higher costs outweigh the slight ecological benefit of the Ultramid S Balance, most of which derives from weight saving rather than the plant basis of the castor oil. A further problem is the volatility of the price of sebacic acid, which is typical of products derived from crops.

This does not mean that the S Balance series should not be of interest to engineers, however, since these materials offer great resistance to hot water and steam, as well as resisting environmental stress cracking when exposed to aggressive chemicals such as calcium chloride. The materials only exhibit a slight difference in mechanical properties between dry and conditioned states and are stronger, stiffer and have higher heat deflection temperatures than PA 12.

www.anirudharao.com
www.unitedcoatings.com
www.iberm.es
www.basf.com

Sintered plastics control fluids on micro scale

Tom Shelley reports on some of the applications of very fine-grained, high-purity, sintered plastic.

Sintered plastic with micro pores can be used for filtration, wicking, venting, fluid control, and the mixing of emulsions.

Many of the potential applications are medical, such as making catheter vents that shut off when liquid is encountered, but devices can be made that are hydrophobic (water hating), which is how they are naturally, superhydrophobic, oleophobic (oil hating) or hydrophilic (water loving), allowing them to be used in an increasingly wide range of applications.

'Vyon' and medical grade 'BioVyon' are both made by Porvair Filtration, based in Wrexham, in sheet, tube or almost any three dimensional form in a range of pore sizes from 10 to 100µm.

Market development manager Claire Jarmey-Swan, chairing a discussion at the recent Medical Innovation Forum in London, showed samples and said that the manufacturing process was 'like making a biscuit'. Porvair's most common products are made by sintering PP (polypropylene) or PE (polyethylene) beads to produce white sheets with up to 50% voids, but she said it was possible to apply the process to PEEK (polyetheretherketone), PTFE (polytetrafluorethylene), PA (polyamide) and EVA (ethylene vinyl acetate). It is also possible to encapsulate other materials within the sinter, such as active carbon to absorb chemical substances, and polymers that swell when they get wet. This is how the catheter vent shutoffs work.

Unlike other microfiltration media, the material is robust. Samples and small production quantities can be made by rapid prototyping methods, reducing project time and time to market. The clean room based manufacturing process does not require expensive tooling as is the case with conventional plastic moulding techniques and is automated to reduce potential contamination and bioburden. It has also been found possible to laminate on membranes with a to 0.1µm pore size.

The plastics are approved by the US Food and Drug Administration and by the Water Regulations Advisory Scheme and have passed the requirements of the United States Pharmacopeia and ISO 10993-5 Class VI for mammalian cell growth.

Mechanical structures impregnated with cells or bacteria are used in a number of pharmaceutical preparation processes. Biomedical extraction processes based on passing liquids through impregnated, sintered discs in columns are used routinely. Such constructions offer considerable advantages over extraction columns full of beads, which suffer from channelling through bead beds and also possible bed compaction at higher flow rates. There was also a lot of discussion at the Forum about structures for medical implants that would permit a good interface developing with growing tissue, for which sintered structures sounded very suitable.

Jarmey-Swan said that if two immiscible fluids were pumped through a sintered filter with fine pores, the mixture tends to emerge as an emulsion. This is of particular importance to the food and cosmetics industries. Other applications include: water and chemical filtration, solids handling, sound attenuation, battery venting and vacuum tables in market sectors that include general engineering, aerospace, electronics and beverages. Sintered plastics can relatively easily be made to include other materials such as solid lubricants. Wicking effects are the basis of marker pens but can also be used to apply controlled amounts of liquid lubricants. Production is underpinned by an ISO 9001-2000 quality-assurance programme.

www.porvairfiltration.com
www.wras.co.uk

Design Pointers

- Sintered plastic filters can be made in almost any shape to extreme levels of purity with pore sizes from 10µm to 100µm
- They can be made out of a variety of thermoplastics, including PEEK, and while normally hydrophobic, can be made to be superhydrophobic, oleophobic or hydrophilic
- It is possible to laminate on membranes, over mould them and incorporate other solids, and biologically active molecules and species

Vyon and medical grade Biovyon from Porvair can be made in almost any three-dimensional form

Motors | Energy | Automation | Coatings

W22 Three-Phase Electric Motor. Designed for today. Protecting tomorrow.

With electric motors accounting for around 40% of global energy consumption, the world is demanding a truly efficient globally recognised industrial motor. The new W22 motor range meets all global efficiency standards including the European IE 1, 2 and 3, North American NEMA Premium and Australian MEPS. The W22 has been designed, using state-of-the-art engineering, with efficiency at the forefront – from the design of the frame to maximise heat dissipation, ease handling and assist maintenance, to the multi-position diagonal cut terminal box for better cabling access.

The WEG W22 is what the industrial world needs today, to help sustain its future – tomorrow. Visit www.weg22ways.net to find out more.

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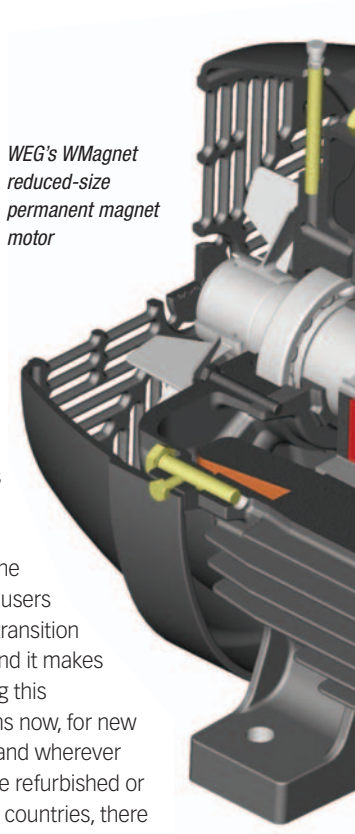
Motors move beyond IE2

Regulations demanding that motors conform to the IE2 standard may not come in until next year, but the technology is already well ahead of that, as Paul Fanning reports.



WEG's WMagnet reduced-size permanent magnet motor

Beginning in June next year, all electric motors will be required to meet the IE2 standard of energy efficiency. The motor efficiency ratings will be based on the efficiency classes defined in the IEC 60034-30 standard published by the International Electrotechnical Commission (IEC). These range from IE1 (low efficiency) to IE4 (super-premium efficiency). It will supersede the voluntary scheme based on the Eff efficiency classifications which has been running in Europe since 1998. Under the scheme, all single-speed, three-phase squirrel-cage induction motors with output ratings from 0.75 to 375kW sold in the EU will have to achieve at least the IE2 efficiency level by 16 June 2011. The scheme applies to motors with two, four or six poles.

In the second phase, which comes into force on 1 January 2015, motors rated from 7.5 to 375kW will either have to achieve the higher IE3 efficiency level, or meet the IE2 level and be equipped with a variable speed drive (VSD). Finally, two years later, the same regulations will be extended to apply to motors as small as 750W. There are no plans to make IE4 motors mandatory – efficiency values have yet to be defined for this class, which will cover 'super-premium' technologies such as permanent magnet (PM) motors.

When these new classifications were announced in March 2009, there was widespread criticism from Government, environmental campaigners and motor manufacturers that they did not go far enough and that the deadlines being set were too lax. And it must be said that the regulations compare less than favourably with other parts of the world. The US, for instance, will make the use of IE3-equivalent motors mandatory at the end of this year.

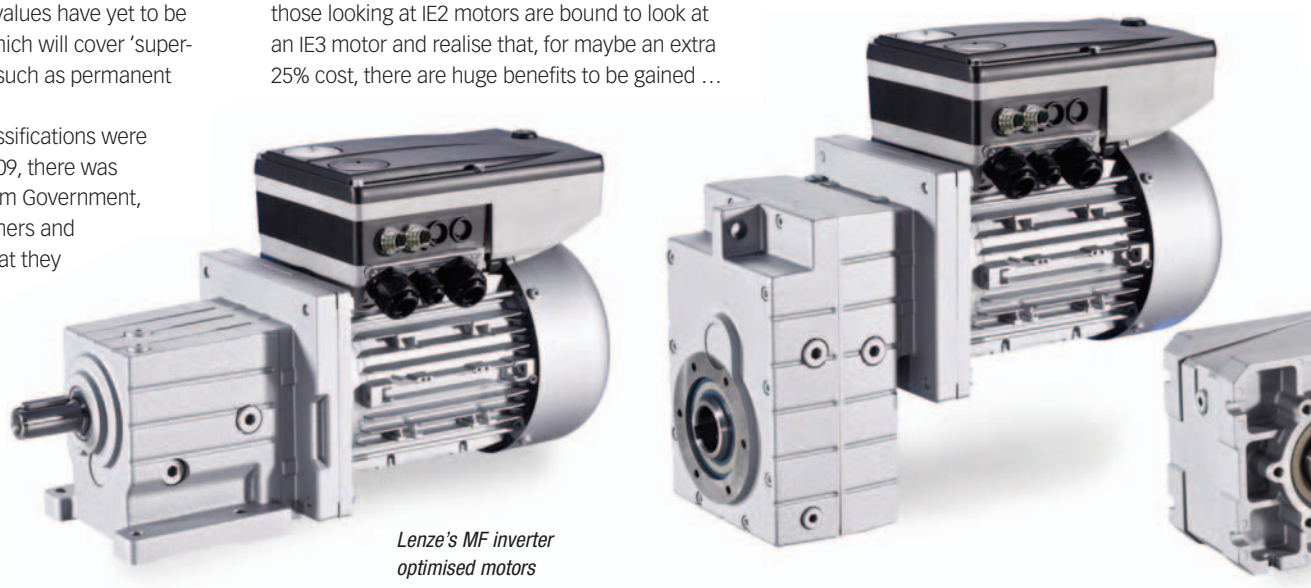
It is perhaps not surprising then, that many motor manufacturers already offer products that far exceed the IE2 requirements, even in some cases believed to reach the IE4 standard. The technology available is some distance ahead of the legislation.

Baldor UK's Robin Cowley is scathing about the IEC's standards, having described as 'criminal' the extent to which the EU is trailing the rest of the world in this respect. Perhaps unsurprisingly, then, he is keen to persuade end users to make the move to higher-efficiency motors sooner rather than later. He also describes take-up of high-efficiency motors as 'poor' and blames poor education, particularly by the Carbon Trust.

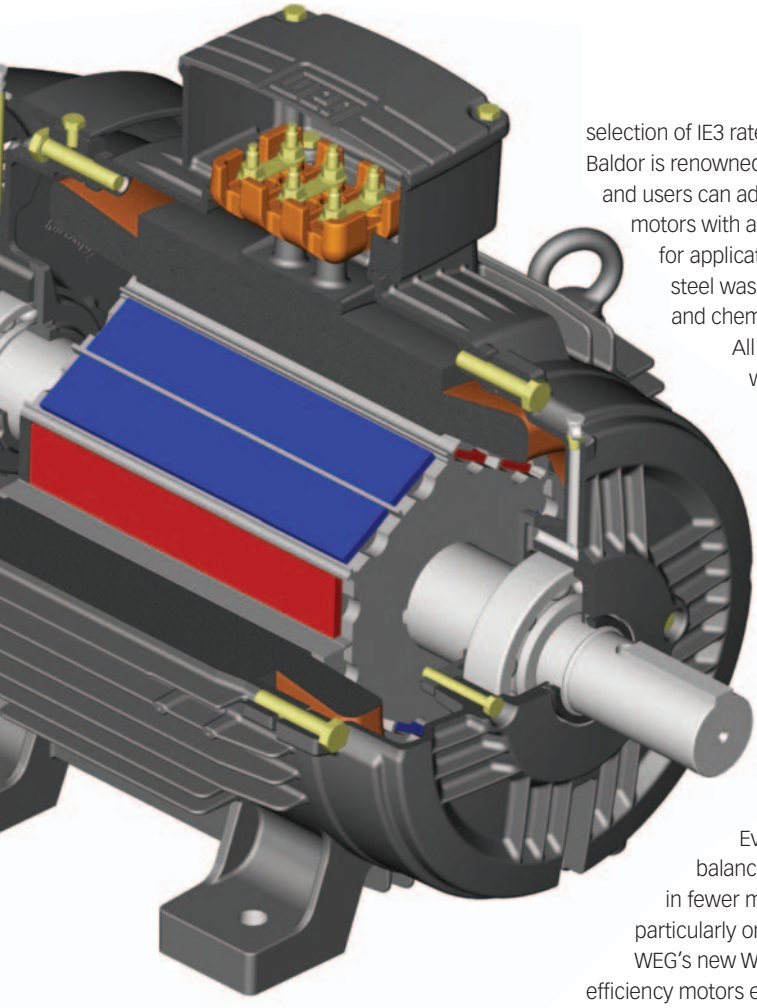
He does, however, believe that the introduction of the standard will concentrate the minds of those installing motors and will encourage them to think beyond it. "Once IE2 becomes mandatory," he says, "education will ramp up very quickly. Word will get round and those looking at IE2 motors are bound to look at an IE3 motor and realise that, for maybe an extra 25% cost, there are huge benefits to be gained … after all, energy costs are only going one way."

"Sooner or later," he continues, "all motor users are going to have to transition to higher efficiency and it makes sense to start building this requirement into plans now, for new equipment projects, and wherever motors are likely to be refurbished or replaced. In some EU countries, there are also tax incentives when installing these motors, such as the Enhanced Capital Allowance (ECA) scheme in the UK. Such actions not only make economic sense, they can play an enormous role in helping corporations to meet their environmental care goals."

Baldor's standard IEC frame IE3 range of AC motors – called Super-E Metric – spans 22 power ratings from 4 to 375 kW, with a choice of three speed options at each rating. Maximum efficiencies at full load start at 89.9% for a 4 kW 4-pole motor, and go up to more than 96.3% for



Lenze's MF inverter optimised motors



high power motors. Baldor also offers higher voltage, ultra high efficiency motors for higher power applications up to 10 MW.

All the standard motors feature cast iron frames for durability, and will run from 50Hz, 380 to 415 V three-phase supplies. They are additionally rated for use at 60 Hz/460 V, also making them suitable for use in the US. Baldor complements this range with an even broader selection of IE3 rated motors in NEMA frames. Baldor is renowned for its customisation ability, and users can additionally specify IE3 rated motors with a range of protection options for applications including all-stainless-steel washdown duty types, severe duty and chemical duty (IEEE 841 compliant).

All Super-E Metric motors are wound with Baldor's ISR (Inverter Spike Resistant) magnet wire, making them up to 100 times more resistant to transient voltage spikes, high frequencies, and short rise-time pulses commonly produced by inverters. This results in all Super-Es being 'inverter ready'. These motors, with improved insulation materials, can withstand peak voltages up to 1600 V peak for extended reliability.

Every Super-E motor is also balanced to a high standard, resulting in fewer mechanical stresses, particularly on motor bearings.

WEG's new WQuattro line of super premium efficiency motors employs a hybrid design to achieve the highest efficiency in the market, exceeding the requirements of the impending IE4 Super Premium Efficiency classification across its entire output range.

The WQuattro is a hybrid motor integrating a conventional three-phase distributed winding, and a rotor with an aluminium cage and internal high energy magnets. This combination makes the WQuattro ideal for direct on-line starting and acceleration up to synchronous speed. With this type of operation the motor speed does not vary with load, despite overload variations, or cases of voltage drop, as long as the mains frequency is kept constant. In addition, there is no requirement for positioning/speed sensors, or special protection relays, and the low bearing temperatures that result from synchronous operation also ensure longer life and reduced maintenance for the motors.

Where the speed of the motor needs to be adjustable, the WQuattro can be used with inverters (V/F and Vector types), offering an extended speed range with constant torque. In addition inverter control also offers the key benefit of multi-motor operation – several motors can operate in synchronism fed by the same inverter.

Importantly, the WQuattro line offers interchangeability with existing installations. It employs the same frame size for output as standard induction motors, and so it is easy to retrofit into existing applications.

WEG also offers reduced-size permanent magnet motors for for applications where constant torque, low vibration and low noise levels are required. WMagnet motors are manufactured with high energy magnets (NdFeB) in their rotors; these deliver a significant reduction in energy losses compared to an induction motor, resulting in a lower temperature rise of the motor, generally, and increased operating life. In addition, as these energy (Joule) losses (RI2) account for a significant portion of total losses in induction motors, the PM motor, the company claims, attains IE4.

Lenze, meanwhile, has introduced its MF inverter optimised motors positioned in this gap between standard AC motors (low cost, moderate efficiency and suit mains or frequency inverter operation) and servo motors with rare earth permanent magnet technology (more efficient but much more expensive). MF motors can not only yield around 5% saving on energy, but also additional advantages of smaller dimensions and a purchase cost that is actually lower than standard AC motors. The energy saving of 5% is significant (at similar powers changing from IE1 standard to IE2 high efficiency motors will only deliver about 3%) leading to long term savings and reduction in greenhouse gas emissions.

The company has taken standard 4 pole motor designs and optimised them for use at 120Hz, equivalent to a speed of about 3500 rpm. The efficiency of these 120Hz optimised MF motors increases by typically 5 or 6% compared to a standard 4 pole motor. For example at 0.75kW the efficiency is practically 80% and close to the IE3 efficiency level which becomes compulsory in 2015. The higher speed increases power leading to a 1 or 2 frame size reduction, and this reduces physical size which leads in turn to reduced costs. A 1.5kW MF motor is 71 frame compared to a standard 1.5kW pole motor which is 90 frame. Moreover the smaller size means lower inertia and more dynamic drives. The performance takes a step towards servo levels with high acceleration and deceleration. Full torque is available over a 1:24 speed range.

www.baldor.co.uk
www.weg.net
www.lenze.co.uk

Electric vehicles shift gear

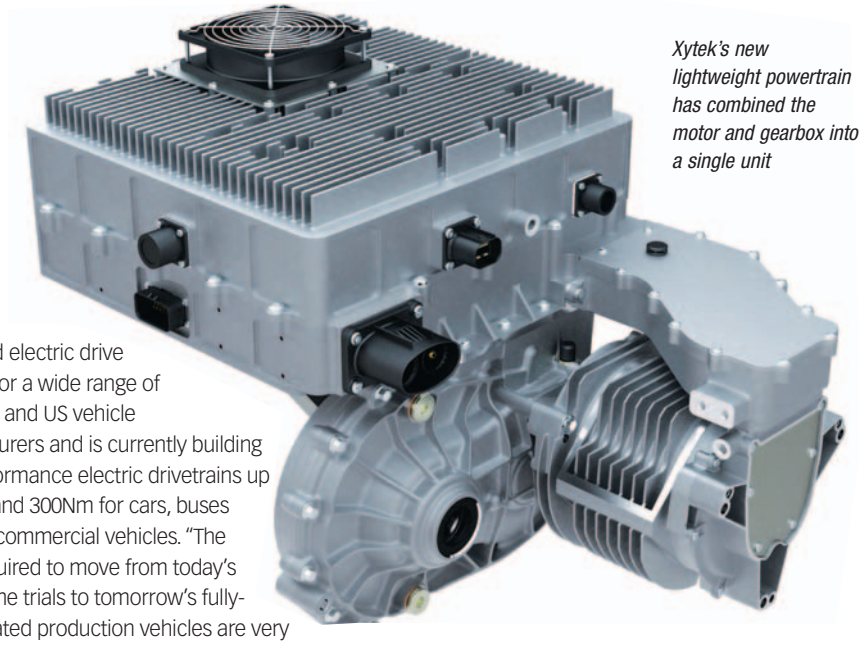
Changes to the transmission systems of electric vehicles could have a significant impact on the commercial viability of electric vehicles, as *Eureka* discovers.

For all the research and development currently devoted to them at the moment, it seems fair to say that electric vehicles still have a long way to go before they become a widely-accepted, mainstream technology.

Range anxiety caused by short battery life, high vehicle costs and a lack of charging infrastructure are the major factors holding the technology back. Thus, in the short term, the most likely niche market for electric vehicles is as second cars, but research nonetheless continues apace.

Battery life and cost are the main obstacles at the moment. As Neil Cheeseman, engineering programme manager for automotive engineering specialist Zytek, puts it: "A typical fuel light on an internal combustion engine (ICE) vehicle comes on with 70 miles to go. A typical electric vehicle starts with 70 miles to go. That's not a good starting point for people who are used to ICE vehicles." While he makes it clear that battery costs and sizes have to improve, he also acknowledges that changes to the powertrain of electric vehicles are necessary to bring down vehicle weight to reduce power consumption and thereby close the gap.

Zytek has designed and integrated electric drive systems for a wide range of European and US vehicle manufacturers and is currently building high performance electric drivetrains up to 70kW and 300Nm for cars, buses and light commercial vehicles. "The steps required to move from today's low-volume trials to tomorrow's fully-homologated production vehicles are very substantial and must not be under estimated," says Zytek Automotive managing director Neil Heslington. "Everything has to be re-evaluated, from development processes to dealer training.



Xytek's new lightweight powertrain has combined the motor and gearbox into a single unit

This new powertrain, combined with our substantial experience of EV and hybrid vehicle production programmes, will take time and cost out of this activity while helping to deliver the quality, refinement and driving experience that discerning customers demand."

The turnkey package Zytek has developed is extremely compact and in air-cooled configuration is up to 45% lighter than today's production EV powertrains. Even the water cooled version, suitable for demanding drive cycles, is up to 30% lighter. Available in sizes from 25kW, the highly integrated modular system can be configured for a wide range of vehicle sizes, applications and architectures. The high maximum machine speed of 14,000 rpm has enabled generated torque and hence machine size to be reduced considerably, bringing further reductions in cost and weight.

One of Zytek's key innovations in driving down the size and weight of the powertrain has been by building the motor and gearbox as a single unit. The benefits of this are clear, as Neil Cheeseman points out: "A typical transverse IC engine gearbox width is about 950mm, is driven by four cylinders

in a row and then a gear cluster on the end of that. The total width of ours is approximately 300mm. So you're looking at a powertrain that is less than a third of the size. This has only been possible because we've put those two items together. So at less than a third of the size, you've got major weight benefits as well."

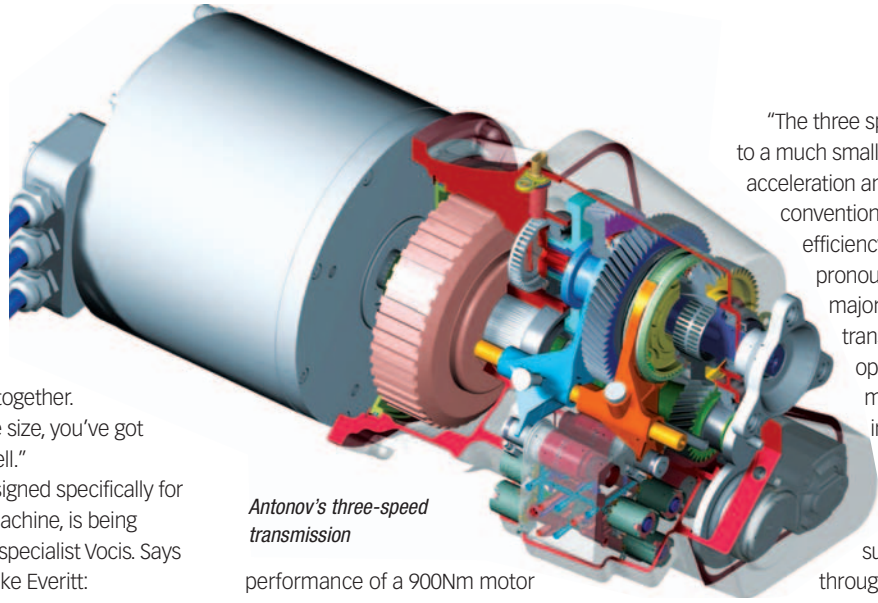
A new transmission, designed specifically for use with the new electric machine, is being developed by transmission specialist Vocis. Says Vocis' managing director Mike Everitt: "Transmission weight is only 10kg, which we have achieved without any compromise in performance."

Because Zytek has increased the speed of the machine to 14,000rpm for the same wheel torque (a figure imposed by off-the-shelf component availability rather than a machine limit), it has been possible to de-rate the torque rating of the machine. Says Cheeseman: "If you want 1000Nm of wheel torque with a 10:1 gear ratio, you'll need 100Nm of motor torque. If you want 1000Nm at a 14:1 gear ratio, you'll need less torque – around 65Nm. Torque in an electric motor is produced by magnets and copper and steel – all of which are expensive components. By increasing the speed, you drive down the number of expensive components in your powertrain."

For use on smaller vehicles, Zytek has opted for a single-ratio gearbox. Says Cheeseman: "There are some arguments for a two and three speed gearbox. But I think if you're designing these two items from scratch, the case for a single ratio gearbox is pretty strong. When you go up in vehicle size, then maybe there's an argument for a two-speed gearbox, but certainly with something this small, with an aggressive pressure on cost, a single speed gearbox is the way to go."

Now that electric drives are once again becoming popular in motor vehicles, there is considerable argument as to whether to have wheel motors or single motors with transmission systems, whether motors should be equipped with gearboxes, and whether people should be going for permanent magnet or induction motors.

There is some debate, however, about whether a transmission is necessary at all. One company that continues to believe in gearboxes is Antonov. "A three speed transmission coupled to a 400Nm electric motor can easily match the performance of a 900Nm motor with no transmission", according to Simon Roberts, the company's chief commercial officer. "The latter is like putting a V8 engine in a dragster; it delivers so much power and torque that you can throw away the gearbox, but it's not very fuel efficient. That's why the automotive industry trend is to downsize the engine and match it to an efficient transmission and driveline. And it's the same principle for traction motors, though in practice not yet generally applied. Smaller and lighter electrical machines use less aluminium, copper and steel. They also require smaller batteries and reduce the need for highly rated power electronics. So the same virtues of downsizing apply to electrical machines."



Antonov's three-speed transmission

In consequence, the company has been awarded a project by the UK's Technology Strategy Board to design and develop a three speed power shift transmission suitable for hybrid vehicles, which will initially feature in Jaguar's Limo-Green electric vehicle research project.

"The three speed transmission can be coupled to a much smaller electric motor, yet deliver acceleration and top speed comparable to a conventional power train," says Roberts. "The efficiency of an electric motor is far more pronounced than the torque curve, so the major benefit of a multispeed transmission is to keep the motor operating as close as possible to its most efficient speed, which will increase vehicle range."

However, there is no gearbox in the Mini E car, as the torque provided by the electric motor is sufficient without multiplication through a transmission, but there is a conventional reverse-neutral-drive shifter on the floor. The car is powered by a single 150kW four pole AC induction motor with inverter controlled magnetic flux, designed by Californian company AC Propulsion. It can accelerate from 0 to 100km/h in 8.5s acceleration. Pressing the accelerator speeds the car, while lifting the pedal applies regenerative braking. The range is said to be about 100 to 120 miles. The only problem with the concept is that the car weighs 1465kg, which includes 300kg of lithium ion batteries, which occupy the space where the rear seats would normally go.

While the economics of the car are excellent in terms of the cost of the power consumed, the cost of the 300kg of lithium ion batteries required to store the 28 kWh would be substantial in the present design.

www.zytekgroup.co.uk
www.antonovplc.com
www.acpropulsion.com

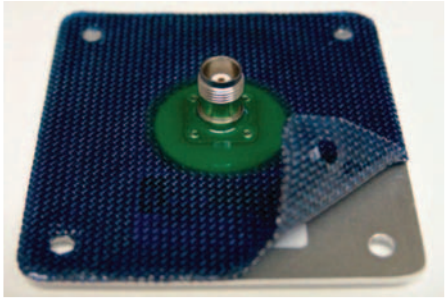
PU stops leaks and stays stuck

Tom Shelley reports on some of the benefits to be obtained by using polyurethane based seals, sealants, gaskets and adhesives.

Much can be done with polyurethane, especially when it comes to sealing round connectors and glass, protecting cables, and performing repairs.

Sealing round antennae cables is a particular problem because it is necessary to prevent both stray electrical signals and moisture getting in to places where they are not wanted. At the same time, it is necessary to avoid electrolytic corrosion caused by attaching metal connector bodies, especially where these act as feed-throughs for antennae, which by definition involve the passage of significant amounts of electric current.

US company Aviation Devices and Electronic Components (AvDec) has come up with a number of products that avoid such problems by making use of the good properties of polyurethane in conjunction with other materials. These include the ability to maintain elasticity over long periods and the absence of solvents (since PU is made by mixing two liquid substances). PU is considered to be considerably less hazardous than some other polymeric adhesives and requires no special handling at end of life. Furthermore, seals and sealants that can be easily pulled off and put back or replaced not only reduce maintenance time, but also improve reliability and safety as they avoid problems associated with gaining access to inspect surfaces for cracks and/or corrosion.



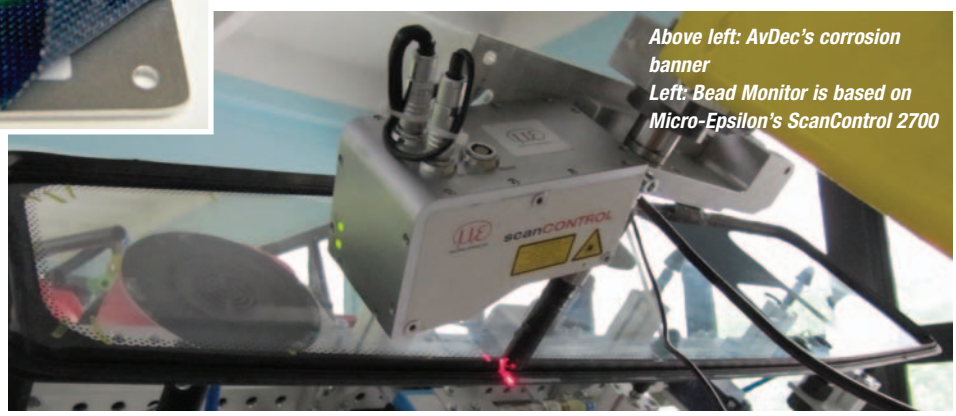
Products offered include Hi-Tak polyurethane conductive gaskets, which incorporate 5056 aluminium alloy mesh as an EMC barrier, or fibreglass for non conductive applications. Die cut, the gaskets come with an adhesive surface that is extremely sticky. The system also maintains its elasticity over a long period, so the gaskets stay stuck despite vibration and repeated thermal expansion and contraction. They also provide easy access for inspection or repair long after the original application. As further aids to good performance, the company additionally offers a StretchSeal polyurethane wrap for coaxial connector sealing and SelfLevelingGreen, a polyurethane sealant for to the connector antenna interface.

Conductive polyurethane and mesh gaskets also offer benefits because they stay elastic, and the company offers both connector gaskets and fuel resistance conductive gaskets, which can be enormously important in terms of enhanced safety. In addition, the firm offers a range of other PU based sealants, including Thixoflex products. Because these are thixotropic, they can be used on vertical or overhead applications without dripping or sagging.

Polyurethane seals and sealants, are of course, not only made for and used in aerospace. AvDec#s products are beginning to find uses in the medical sector in the UK, and Oxford Sensor Technology in Abingdon has developed a 'BeadMonitor' system that measures the height and width of PU bead as it is applied to the edges of vehicle glass during assembly. The sensor head is mounted on a robot arm, directly behind the application nozzles. The system is based on Micro-Epsilon's ScanControl 2700 non-contact laser profile displacement sensor.

Anthony Williams, Managing Director at Oxford Sensor Technology, commented: "BeadMonitor provides a cost effective solution for vehicle assemblers and systems integrators, who need to inspect PU beads before the robot places the glass into the vehicle. Typical cycle times for inspecting adhesive bead and for assembling glass into the vehicle are around 60s, depending on the number of robots employed in the line. The bead measurement process is critical, because if a glass windscreen is incorrectly fitted to the vehicle due to little or no adhesive being applied at a certain point on the glass edge, the result could be a water leak for the driver. Worse still, for many vehicles today, the windscreen has become an integral part of overall vehicle strength and rigidity, so any weaknesses in the glass bonding could pose a safety risk to the passengers." BeadMonitor is currently undergoing trials with a major car manufacturer in Italy.

www.avdec.com
www.specialty-fasteners.co.uk
www.oxfordsensor.com
www.micro-epsilon.co.uk



Above left: AvDec's corrosion banner
Left: Bead Monitor is based on Micro-Epsilon's ScanControl 2700

Defying gravity

Tom Shelley reports on how research into replicating the means whereby insects adhere to surfaces is progressing.

Studies of how insects and lizards are able to walk on ceilings show that they use effects which are very difficult to fully replicate in mainstream engineering.

However, this has led to a product that insects cannot adhere to, to keep them out of places where they are not wanted, and there are always ways in which adhesives and fasteners can defy gravity that are perfectly practicable, if designers care to embrace them.

Dr Walter Federle, who heads the Insect Biomechanics Workgroup at the University of Cambridge Department of Zoology, revealed in a seminar that insect and spider adhesion 'outperforms all conventional adhesives'. They can also attach themselves to substrates that are rough and contaminated and even in some cases anti-adhesive, but quickly detach themselves in order that they can walk about. Their secret, he explained, is that they all use wet adhesion and even when they appear to use smooth pads, have additional tiny hairs called tenent setae.

Gecko lizards also use these tiny hairs, which in their case, are not aided by wet adhesive. These work by Van der Waals forces, enhanced by the sizes and shapes of the tips. There have been many attempts to reproduce this behaviour by creating pads of carbon nanotubes, particularly in US universities such as Berkeley, but while these do show the effect, they only function on smooth surfaces and nothing like as well as the geckos.

Insects and spiders do better because they use both hairs and adhesives. Dr Jan-Henning Dirks has noted that the liquid secretions that aid adhesion are emulsions with watery droplets in an oil phase, only nanometres thick. The emulsions have non-Newtonian properties that combine the benefits of wet adhesion and resistance against shear forces. Using this mechanism, a single insect foot can in some cases support 20 times body weight. Insect feet are designed to ensure good adhesion when feet are placed on the surface, but allow peeling off with a push from the heel when it is time to detach.

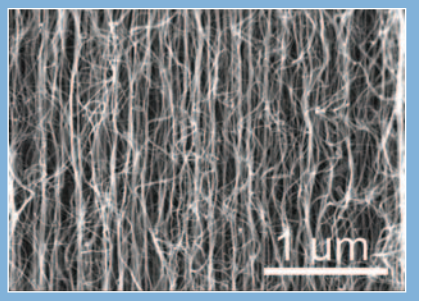
While reproducing insect adhesives is yet to be achieved, Dr Dirks and a colleague have come up with a surface to which insect feet cannot adhere called InsectiSlide, which can be used in tape form and is patent applied for. It works by absorbing the watery phase, leaving only the oily phase for insect feet to slip on. Applications include preventing insect entry to buildings, clean rooms and electrical, electronic and mechanical products. Current features are said to be based on an easily available commodity polymer that is cured on any surface, although the patent covers the general principle of how it works rather any particular formulation. The product is said to be non toxic, eco-friendly, durable, cleanable and weatherproof.

However, if one still needs to defy gravity and cannot wait for the perfect attachment system, there are plenty of commercial ways of doing this. Thixotropic adhesives that can be sprayed or brushed on but don't run down or drip are available commercially from all the usual suppliers. If something is to be attached mechanically to an overhead or vertical surface, TR Fastenings can custom design special fasteners for almost any application, and recently came up with a design of standoff rivet bushes for sheet metal specialist Potters. Much can also be done to overcome gravity using springs, and Southco has just come out with new ST-12C spring counterbalanced hinges which are specified to stay with +20% of rated torque for 20,000 cycles of operation.

www.zoo.cam.ac.uk/zoostaff/federle/Home.html
www.insectislide.com
www.trfastenings.com
www.southco.com

Design Pointers

- Insects adhere to walls and ceilings using fine hairs and a special, natural water in oil based emulsion adhesive, nm thick



- While it has not so far been possible to reproduce this attachment system, it has been found possible to stop it, coming up with an eco friendly way of keeping insects out of places where they are not wanted
- Other ways of defying gravity with fasteners and adhesives continue to be commercially available

WIND TURBINE GEARBOX DRYER PROTECTS LUBRICATION OIL

Brownell has introduced a new self reactivating dry air breather to prevent contamination of gearbox lubricating oil by water and condensation. The REGEN8 has a robust all weather construction with complete automatic process control. This includes a Telemetry option for remote monitoring and control management.

Many lubricating oils have a water vapour adsorption characteristic. Commercially available lubricating oils are delivered by most manufacturers with low residual water content.

Maintaining this low residual moisture level throughout the gearbox life is a major challenge and requires an active moisture control and management system.

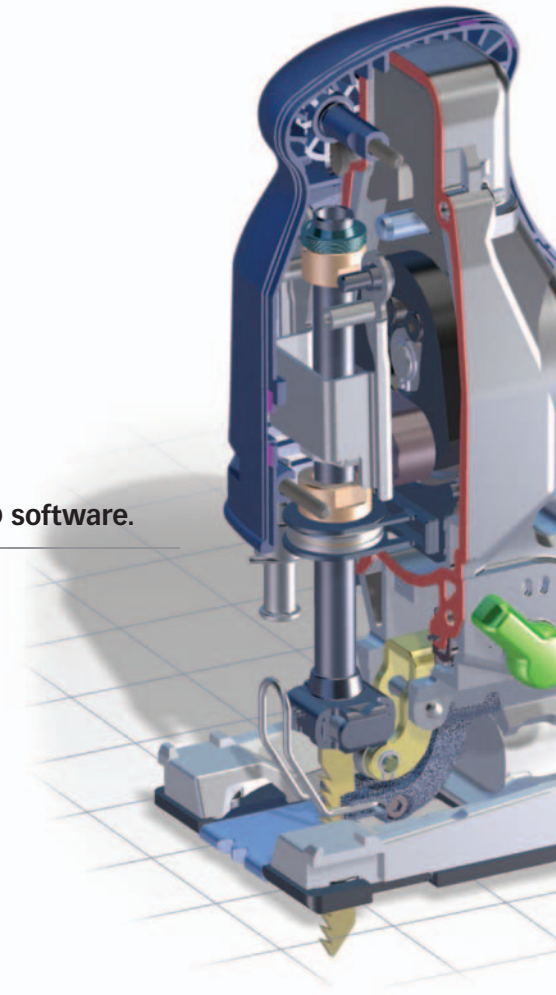
Excessive moisture in a gearbox can result in increased corrosion, a loss of lubrication properties and changes in oil viscosity.

The Brownell REGEN8 removes the water vapour entering the gearbox to a safe level. This relative humidity is equal to the residual moisture of the lubrication oil. The water vapour is adsorbed using an active adsorbent.

REGEN8 can be used for wind turbine gearboxes of up to 1000 litres free air space.

Speedy software gets a boost

Tom Shelley reports on enhancements to the leading brand of explicit CAD software.



A radically updated version of CoCreate shows the commitment of PTC to this type of explicit CAD, which is still very popular among users who prefer to work with this type of software.

Berthold Hug, CoCreate product manager, told attendees at a recent seminar at PTC reseller CSI that Version 17.0 is about twice as fast as V 16.0. and that there were 'nine million lines of code for each new release, and to achieve the speed up, you touch several million'.

Justin Teague, general manager of PTC's CoCreate business unit , made it clear that PTC sees CoCreate as being particularly appropriate for the occasional CAD user. However, speaking to four CoCreate users from UK engineering companies at the event, they all said that they were full-time users who just preferred the simplicity and ease of use offered by CoCreate. Indeed, this was even the case for those who had previously used other CAD packages, one of whom said: "If something is not right, you just change the geometry, you don't have to go back and change something earlier, because there isn't a history tree."

This is, of course, the big difference between CoCreate and other major CAD packages. Most of them now offer some kind of direct model

Tradition maintained by full PLM

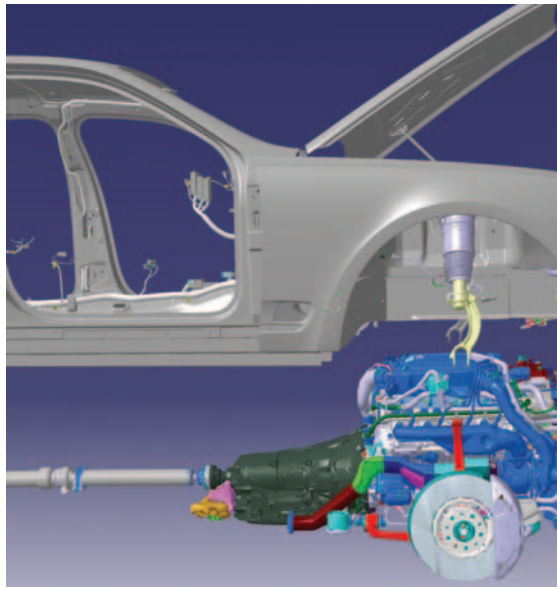
Tom Shelley reports on how every CAD and robotic aid is employed to maintain competitiveness and quality at Bentley Motors.

Bentley may be noted for producing what it calls 'hand-crafted' cars, but that should not imply that the company is anything less than technologically sophisticated. Indeed, it implements every possible aspect of CAD, PLM and CAM software in order to produce vehicles with maximum sales appeal and quality.

CAD strategy manager John Unsworth says: "In previous projects, a lot of time and energy was wasted from changes at the end of the engineering process." He said that now, even though full PLM has now been applied to the Mulsanne model currently in pre-production: "The process is still not perfect, but it is better than it has ever been."

Because Bentley cars are such premium products – the Mulsanne will have a recommended retail price of £220,000 – purchasers expect perfection. Says Unsworth: "We are very much a styling-driven organisation." Thus, the design process begins with use of sketches, clay models and use of Alias and ICEM Surf. Engineering design is undertaken in Catia V5, while the company makes extensive use of Delmia virtual assembly modelling with Enovia to manage the PLM, and 3DVIA composer is used to produce technical illustrations.

A walk round the factory reveals automated assembly lines, robots putting 20 coats of lacquer on the veneered wood trim and leather which is examined and marked up by eagle-eyed inspectors, but which is then scanned and cut on large robotic flat beds. There is a lot of hand polishing and finishing and attention to detail, but computer controlled machines are used wherever they give benefits – CNC machines can, after all, work to precisions not

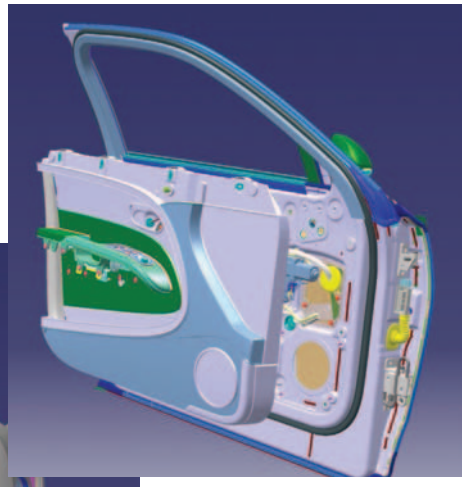


editing, whether they call it, 'Direct Modeling', or 'Synchronous Technology', but there is still a sequence of steps underneath, some of which sometimes have to be retraced in order to be able to go forwards. A user can retrace steps in CoCreate as well, by making use of the 'Undo' facility, but this is not the normal way of proceeding, which is to pick on faces and features to produce the CoPilot graphic and modify accordingly. By making use of the CoPilot, and calling up context-sensitive mini toolbars in both 2D and 3D, it is possible to work on a completely clean screen, without any of the usual toolbars, greatly reducing mouse clicks and mouse travel. This is of especial benefit when performing tasks such as creating and extruding 2D profiles from work planes.

Complex patterns, such as steps in a staircase, are fast to create. They are not quite as intelligent as the ones in Autodesk Inventor, which can adjust themselves to fit, but perfectly good enough for most purposes. Because it is not parametric, you cannot set up formulae to produce different versions of parts, but there is a facility to have stock and finished parts, which can be finished in different ways. In response to a request from users, there is now a facility to import 'Inseparable assemblies', which recognises that, although it may be possible to access components within bought in parts, these cannot be shared and applied to other designs.

Following the acquisition by PTC, CoCreate V17 can directly import files from Pro/Engineer as .prt and .asm files. Since V16.5, it has been possible to exchange files with Pro/Engineer using the company's 'Granite' technology, as well as export them to Advanced Mechanica for simulation, and to Pro/Engineer NC and Tooling, ProductView, and through ProductView or STEP to Arbortext IsoDraw and communicate with Mathcad and Windchill to integrate with company PDM and PLM systems. Sheet metal facilities have been improved in V17, making use of more of the in context mini toolbars, and there have been enhancements to the handling of complex cable harnesses.

www.ptc.com
www.csi-europe.com



possible for unaided humans.

Bentley's owner Volkswagen has clearly invested significantly in the plant and its processes, so it was perhaps not surprising to hear Unsworth say: "We share our experiences with the other branches of Volkswagen, including Skoda and Seat, often on a daily basis… We have taken elements of the process further than other members of the group".

Ian Swann, senior virtual assurance engineering manager, lists the advantages of the Delmia-based virtual build studies: "[It] reduces manufacturing assembly issues, improves build quality, supports the delivery of serviceability, contributes to faster products development and delivers enhanced training and visualisation."

Putting a car together requires 831 operations to be undertaken at 30 assembly stations, while servicing issues investigated with the aid of Delmia included the discovery that changing a sensor in the bumper in the original version of the design would have required dropping the underfloor.

One of the big advantages of running an integrated PLM system is said to be to assist collaboration between teams. The Mulsanne project took four years, but Unsworth says he expects other projects to be done more quickly. For instance, placing the dashboard assembly into the body frame could be investigated as soon as a scan was made of the first clay model, meaning any problems with assembly could be ironed out by the stylists before undertaking detailed engineering design.

The next major step, according to Unsworth, will be to: "Take the PLM wider than the factory gates and integrate suppliers into the design and review process."

http://www.3ds.com/ukisa
http://www.3ds.com
http://www.bentleymotors.com

Design Pointers

- The Bentley Mulsanne is a £220,000 RRP luxury car with a twin turbocharged 6750cc engine enabling it to accelerate from 0 to 60 mph in 5.1s.
- The cars all include leather seats and veneered wood interiors which are machine produced, but with a lot of human attention to detail
- Design and construction is assisted by full PLM, starting with sketches, clay models, Alias and ICEM Surf, followed by design using Catia V5, assembly modelling using Delmia, Enovia PLM and the production of technical publications using 3DVIA Composer.

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READER INTERVIEW

FRANCIS DUTTON
DESIGN ENGINEER
THETFORD

Q How did you get into the engineering industry?

A I started way back in about 1984. I used to work for British Steel and got made redundant. There were different training courses available that had been negotiated by the union, so I went to college for about a year at the Institute for Management Studies. I got on to that because my first ever job was as a management trainee and there was just enough correlation between that and the IMS for me to get on there. The IMS training was all about work study practitioners and method engineering and that's how I got into engineering.

Q How did you find yourself in your current position?

A I went to learn my trade with various firms over the years, just always trying to get a better job. I'm on my third stint here at what was Spinflo, but was taken over by Thetford, an American company, in about 2005.

Q What does your role with Thetford involve on a day-to-day basis?

A As it is now, I'm a temporary project manager. We manufacture cookers and gas fires for the leisure industry – so caravans, boats, etc. We export to Europe, North America and Australasia. We're currently in the process of changing all our taps and burners. Historically, we've always bought them from an Italian company and we're now changing over to a different supplier, so there's a number of design issues associated with that and I'm overseeing that as project manager. I'm making sure that everyone's doing what they should be doing. We've got to make sure we've got the parts in and that, once they're in, we ensure that they've been tested and correlate with the standards we need to hit.

Standards play a very big part in what we do because we're working with gas and there are a huge number we have to reach. We have our own lad who we've had to send on a training course just to make sure we're completely up to speed with all of the standards we need to meet.

Q What are some of the more interesting projects you've worked on?

A The automation of our pressing process probably. We fabricate metal to make the ovens, which requires two cavities for the grill box and the oven box. We used to press them by hand, which meant passing them from one process to the next, knocking out the various holes for control knobs and burner rings. We automated that by buying in seven Trumpf punch presses and I oversaw that installation process.

We also bought an enamel and paint plant and I oversaw the integration of those processes as well.

Q How has the industry changed since you first started?

A We have to be more reactive to what the customer wants. We're quite a niche market and we have to constantly ensure that we're better than our nearest rival in terms of our product offering – making sure that the features on our cookers are better designed and more fit-for-purpose.

We never say no, basically and the only problem with that is that it means we have to keep a hell of inventory to make sure we can meet customers' demand.

Q What are the big issues facing the industry?

A From our point of view, it's the cost of raw materials that's the biggest issue. It's not going down and obviously your customer doesn't like it when your costs are going up. They know the real world, of course and their costs are going up, but they still aren't happy if your prices go up.

The other thing is the lack of training of engineers. We've just taken on an apprentice, which is something we've not done for a number of years, so maybe there's a bit of light at the end of that tunnel, but I think it has been the case that a lot of people have been loath to follow through on training in the last few years.

The other problem is that there are a lot of people who come into industry who have been trained, but they find themselves with their day job to do and they don't have the time to consolidate that training. That's a big factor, because too many people are asked to wear too many hats too quickly.

Q What still attracts you to engineering?

A It's the fact that you get an end result, I think. So you know what you've got to do and it's a question of finding out what you need to do to get there.

There are set ways of doing things, of course, but the job gives you the scope to innovate and allows you to do something that really makes a difference. I would recommend it as a profession to anyone.

Got an interesting project? To be considered as a future 60-second interview candidate contact: pfanning@findlay.co.uk

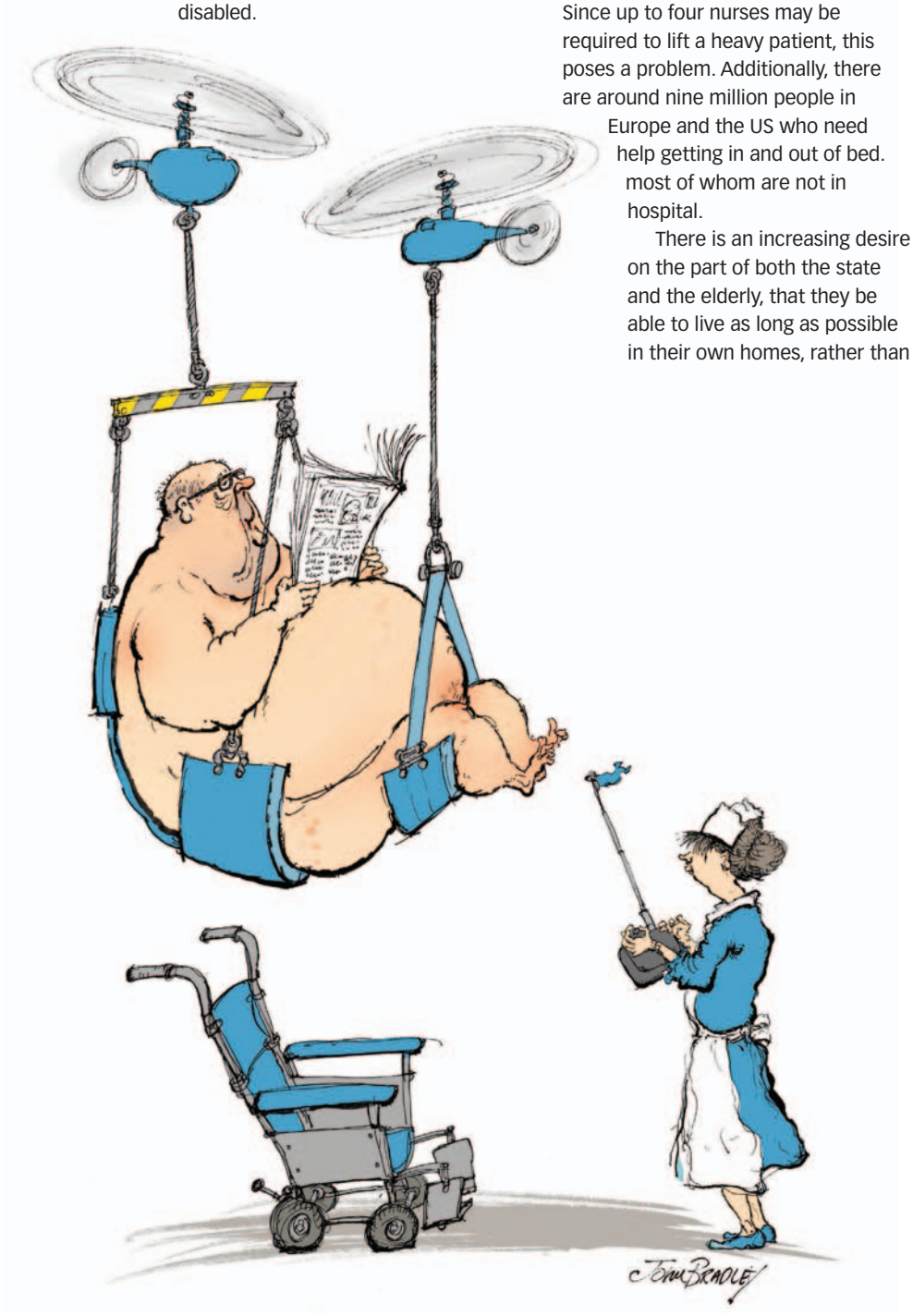
A weighty matter

With an aging population and more obese people, there comes the problem of how to lift them in and out of bed.

Alongside the old and the overweight, the young and fit can suffer spinal injuries that require them to be handled very carefully indeed, if they are not to become permanently disabled.

Nurses are expensive and increasingly scarce, even in hospitals. A normal staffing ratio is now one nurse to 15 patients, with perhaps only one nurse on duty in a ward at night. Since up to four nurses may be required to lift a heavy patient, this poses a problem. Additionally, there are around nine million people in Europe and the US who need help getting in and out of bed, most of whom are not in hospital.

There is an increasing desire on the part of both the state and the elderly, that they be able to live as long as possible in their own homes, rather than become institutionalised. Mechanical aids to allow them to stay at home are therefore highly desirable.



The Challenge

Our challenge this month is how to design a machine controlled by one person that can lift someone out of bed and place them in a chair or vice versa, without either alarming or damaging the patient, or risking the back of the operator.

It should be capable of lifting fat people and thin people, frail people and those with possible back injuries, without causing further damage.

Patient hoists do exist – Stoke Mandeville Hospital has 65 – but they all involve placing some kind of sling under the patient which bends under load, bending the patient. An ideal machine should be capable of lifting somebody without bending them or bend them by a properly controlled amount to place them in a chair.

The solution offered in the Coffee Time Challenge area of the *Eureka* website solves the problem elegantly and could be adapted to lifting and handling large, delicate non human objects.

Although electronically controlled, its operating principle is based on simple mechanics. A full sized working prototype of the solution will be described fully in *Eureka*'s September edition.

The answer to last month's Coffee Time Challenge of how to arrest falls from a height can be found in our Technology briefs section on page 8

150WATT RUGGEDISED DC-DC CONVERTERS TEP150WI SERIES

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Adhesives

Getting The Mix Right

Loctite's popular Hysol 3430 two part epoxy adhesive is available in 50ml, 200ml and 400ml dual cartridge packs. The packaging uses a bi-mixer nozzle so the adhesive is automatically mixed in the correct ratio at the point of application.

Loctite 3430 is an ultra clear, general purpose, toughened epoxy that has a fixture time of approximately 12 minutes, a temperature range of -55°C to +100°C and has good water resistance. It is an effective adhesive for rough and poorly fitting surfaces involving metal, ceramics, rigid plastics or wood. Being ultra clear makes Loctite 3430 ideal for bonding glass.

www.loctitesolutions.com

@: technicalservice.loctite@uk.henkel.com
✆: 01442 278100

Adhesive Tapes

For help and technical advice on our range of double sided, cloth and masking tapes or converted products please phone 01908 500235 for your nearest authorised tesa distributor

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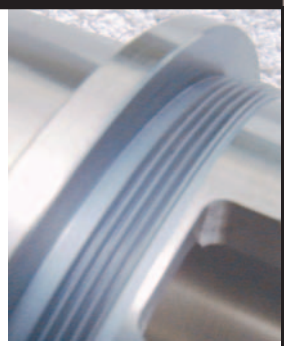
Coatings

WS2 Stops galling of SS and Titanium



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

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

Design Out maintenance problems with WS2!

www.ws2.co.uk

@: sales@ws2.co.uk
✆: 01430 861222

Electric Atomisers

Fine Droplets without High Pressure

The small electric rotary atomiser produced by Newland Design is an efficient way of creating small, consistently-sized droplets by means of high-speed rotation alone, without need of compressed air or any high pressure.

The Newland Atomiser rotates a small porous plastic cylinder at speeds up to 35,000 rpm and emits droplets of less than 40 micrometres in diameter.

Applications include:

- Humidification and Evaporative cooling
- Gas scrubbing and Odour control
- Dust suppression
- Oil misting.

Flow rates up to 25 litres per hour. Power input 24 Volts DC, consumption less than 40 Watts. Evaluation units always available.

www.newlanddesign.com

@: newland.design@btconnect.com
✆: 01524 733 424

Flowmeters

Titan's Breakthrough in Small Bore Flow Metering

Titan Enterprises breakthrough product is now available from £464 EXC VAT!

The new 'Atrato' is a direct and accurate through meter without a contorted flow path which can operate over very wide flow ranges. The ultrasonic technology used offers excellent turndown, linearity and repeatability.

The Atrato is capable of monitoring flow over a range of 200:1 and has accuracy better than ±1.5%. It's simple, yet effective design makes it applicable to a variety of markets, whilst its USB interface makes it extremely easy to install and use.

www.flowmeters.co.uk

@: sales@flowmeters.co.uk
✆: 01935 812790

Heat Exchanger

Spirax Sarco heat exchanger helps Harrogate cure high hydrotherapy heating bills

A compact Spirax Sarco EasiHeat™ steam-to-hot water system is proving to be a vital component in an innovative refurbishment project to help Harrogate Hospital save energy and improve patient comfort in its hydrotherapy unit. By delivering improved heat recovery, temperature and humidity control, the scheme is expected to save over £2,000 per year in heating bills. The new measures are also expected to save almost 300 tonnes of CO2 emissions over the 15-year life of the plant.

www.SpiraxSarco.com/uk

@: Sharon.Graves@uk.SpiraxSarco.com
✆: 01242 521361

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Pressure Transmitters

A-10 goes outdoor

The compact A-10 pressure transmitter from WIKA is now ready for use outside. It lives up to its promises: in winter at temperatures down to -30 °C and also in summer with the greatest of heats.

The A-10 has long been recognised for its excellent quality and its economical pricing. It has been designed for general industrial applications and versatility.

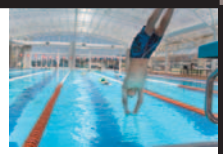
With the option now available for operation over an extended temperature range of -30 ... +100 °C, the application range for the A-10 has once again been considerably expanded.

www.wika.co.uk

@: info@wika.co.uk
✆: 01737 644008

Relative Humidity Sensors

Effective climate control in indoor pools reduces risk of structural damage



Michell's WM33 and WM261 relative humidity sensors are used to keep thousands of swimming pools around Europe dry. High levels of humidity caused by the water vapour and heat in indoor swimming pools create a nightmare for the facilities managers. Without effective dehumidification and ventilation systems to keep the air dry, indoor pools face attack from a host of humidity-related problems such as mould and corrosion. The WM33 and WM261 from Michell Instruments work as an integral part of a dehumidification system to help ensure that the surface temperature of the water remains lower than the air temperature, and the relative humidity is kept at a constant 50 to 60%. Both instruments work effectively with long-term exposure to the aggressive atmosphere created by the pool chemicals. They are also cost-effective, easy to re-calibrate and maintain for long-term accuracy and reliability.

www.michell.com

@: uk.info@michell.com
✆: +44(0)1353 658 000

Sensors

Balluff's new BVS vision based sensors provide advanced rotational search & output logic

Combining vision capability and photoelectric sensor simplicity Balluff's BVS vision based sensor provides reliable error proofing and quality inspection anywhere. Used like a sensor it's far easier to use and more cost effective than complex vision systems. Latest versions include the BVS Vision advanced with 360o part rotation recognition allowing infinite part position recognition. All configured inspections are compensated for the parts rotation, minimizing the need to tightly fixture parts and hence reducing setup costs. The output logic functionality provides the ability to link tools or combination of tools to any output allowing inspections to be customized to a specific production situation. High speed applications are met with the new faster processor.

www.balluff.co.uk/vision

@: sales@balluff.co.uk
✆: 0161 282 4700

Sensors/Switches

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