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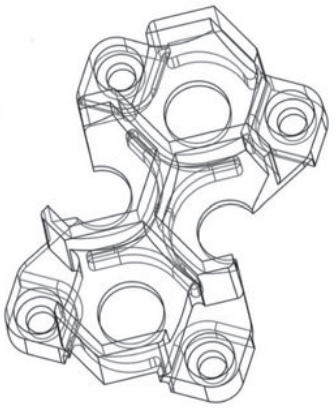

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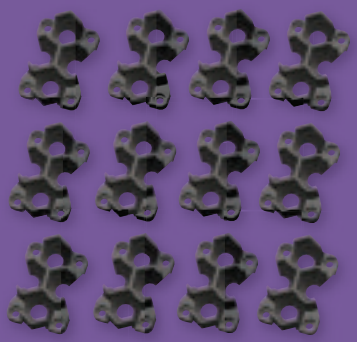

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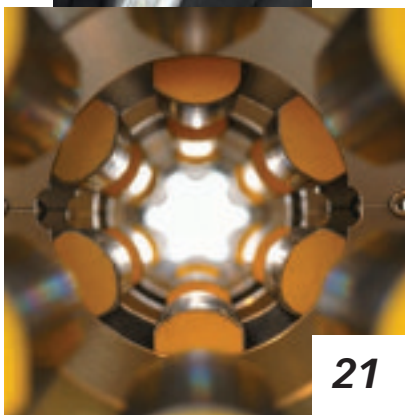

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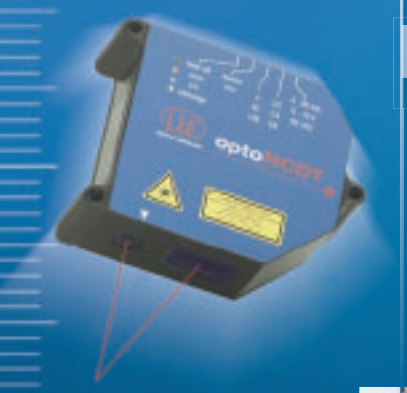

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EV technology is moving forward

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

The presence on this month's cover of an electric racing car once again raises the ever-divisive issue of the future of low carbon vehicles in the 'real world'.

While the prospect of electric car racing is undoubtedly exciting, cynics would be forgiven for a wry smile at the fact that the races will only take place over 15 minutes. Ostensibly, this is because such races will be 'intense' and appeal to a new generation of fans. This may be true, but the real reason is surely the limited range of electric vehicles?

'Range anxiety', as it is known, is the millstone around the neck of the electric vehicle sector. Whatever advances are made, the comparison of the range available from batteries and that available from an internal combustion engine using fossil fuel is made and it does not flatter the electric vehicles.

For some, this discrepancy has become a reason to scoff at electric vehicles. However, as this month's cover story makes clear, not only is EV technology advancing at a phenomenal rate, but there are also technologies emerging from the research and development process that will offer real benefits in and outside the automtive industry.

Another factor for the dyed-in-the-wool sceptic to consider, of course, is this: if this technology is so unfit for purpose and is never likely to meet our transport needs, why is so much investment from so many credible automotive and industrial companies going into it? Can they all be under some mass delusion?

The fact is that this is a genuinely exciting time to be an automotive designer as the scope for experimentation and innovation are so great. The advances in EV technology may not be coming in giant leaps, but they are coming and they are exciting.

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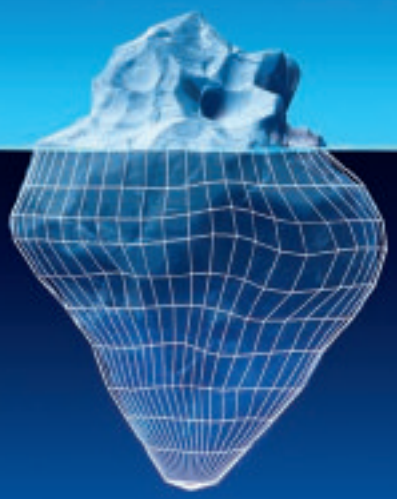

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BEEAs winner benefits from Regional Growth Fund

e2v Technologies, whose Vermiculite Processing System won the 2011 British Engineering Excellence Award, has been awarded £6.25m of funding by the Government's Regional Growth Fund (RGF).

The RGF, which is administered by the UK Department for Business Innovation, has given e2v, of Chelmsford, Essex, £6.25 million of support to invest in capacity and facilities to increase design, engineering, manufacturing and test capabilities and to support wider investment in their ProWave microwave processing systems for a range of industrial applications in resource and energy intensive sectors; offering a cleaner, greener, more efficient technology to the processing of bulk materials. This is part of £29.4 million overall investment expected to create 336 new jobs at e2v and through its supply chain.

e2v recently announced the first delivery of its ProWave vermiculite processing system, for commercial field trial installation, with Silvaperl, the UK's leading producer of exfoliated vermiculite. Vermiculite is a naturally-occurring mineral used across a broad range of industrial and commercial markets, including insulation, protective coatings and agriculture. Approximately 530,000 tonnes of vermiculite are processed each year, through an estimated 400 facilities around the world.

Keith Attwood CEO of e2v said "This project is an integral part of our strategic plan for growth and a result of our close working relationship with our research partner, the University of Nottingham. Today's news is a part of a process which began with the initial grant award announcements last April and today confirms that we can start to draw funds." Adding, "We expect that more than 100 jobs will be created here at e2v by 2014, together with additional jobs in our supply chain. This grant is good news for us and good news for the UK's export figures and technology leadership".

beea
british engineering excellence awards

So far £1.4billion has been conditionally allocated to 164 projects through two bidding rounds of the Regional Growth Fund, creating and safeguarding more than 330,000 jobs.

The chancellor announced in November that an additional £1billion will be added, bringing the fund's total value to £2.4bn. Bidding for the next round of funding will be launched next month.

www.e2v.com

Competition aims to inspire next generation of female engineers

Lola Group has launched a national competition aimed at encouraging young women to pursue further education and careers in science, design and engineering.

The contest, which will be open to all women under the age of 25, will be officially launched at the end of January and will run throughout Spring 2012.

Entrants will be required to produce an original, revolutionary design for a product that is compatible across Lola's portfolio of technologies in aerospace, defence, communications, renewables, motorsport and automotive industries. A panel of expert judges will assess every entry and narrow the field down to a shortlist of ten.

The competition will culminate in a celebration of young female engineering talent at a prestigious award's ceremony where shortlisted candidates and the winner will be announced in front of leading British engineers, government ministers and media.

The top prize will be awarded to an outstanding young woman who demonstrates ability, imagination and passion for engineering. The winner will receive a cheque, a trophy and the opportunity to further enhance and test their winning design at Lola's state of the art facilities in Huntingdon.

Martin Birrane, owner of Lola Group, said: "Lola is determined to support the discovery of Britain's brightest female engineering talent and inspire young people to pursue their passion in science, design and engineering."

www.lolacars.com

Engineering Design Show – Call for Papers

The Engineering Design Show is formally announcing a preliminary Call for Papers for its 2012 Conference Programme.

Taking place on 10-11 October this year at the Jaguar Exhibition Centre at the Ricoh Arena, Coventry, the Conference will run alongside the exhibition and will focus on a broad range of themes and topics focused on the requirements and realities of design engineering within the UK. With subjects ranging from materials development through to regulation, the conference will bring together high profile speakers from across industry, government and academia.

Design engineers will be able to book a pass for the whole conference or for individual sessions, allowing you the opportunity to plan your visit to the show to fit exactly to your requirements.

The Engineering Design Show is now making an open call for submissions for this event. Should you wish to propose a topic on any design engineering-related subject, please contact Paul Fanning on pfanning@findlay.co.uk

**** A number of leading companies have confirmed that they will exhibit at the Engineering Design Show. These include: Agentdraw; D Young & Co LLP; and Data Plastics.***

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www.kistler.co.uk

EXPLORER RANGE EXPANDS

SKF has upgraded, and expanded, its SKF Explorer self-aligning roller bearing range, thanks to an innovative new method of processing bearing steel that offers an enhanced level of performance and longer life, even in applications where there are high levels of contamination. All SKF spherical roller bearings, CARB toroidal roller bearings and most spherical roller thrust bearings will now carry the SKF Explorer performance class designation.

The enhanced strength of SKF Explorer has been achieved via a new heat treatment process for the hardening of bearing steel, which includes a lower temperature processing stage that enhances material properties yet further without necessitating a commercially unviable process time. The next-generation bearing steel also has a finer microstructure than the traditional material.

www.skf.com

AirLINE offers flexible solution

Burkert's new AirLINE Quick offers a reliable, compact and time-saving solution for the direct mounting of Burkert's type 8640 valve islands and AirLINE 8644 automation system into control cabinets, eliminating the need for bulkhead connections and internal piping.

Manufactured in a high-quality stainless steel version, and incorporating features such integrated exhaust check valves, the AirLINE Quick adapter allows an altogether smaller design of control cabinet for hygienic process actuation in the food, beverage or pharmaceutical industries.

The AirLINE Quick mounting system consists of an adapter plate integrated at the pneumatic connection of the AirLINE automation system. The adapter plate enables fast and easy mounting directly on the wall or floor of the control cabinet. An additional plate on the outside provides for added stability.

www.burkert.co.uk

Liquid-cooled servomotor delivers more power

SEM has extended its range of high and low inertia servomotors with the addition of a compact liquid cooled HW series, generating more than twice the power of the standard servomotor equivalent and excellent improved dynamic performance.

Through use of ingenious design and manufacturing techniques SEM has added the integral cooling jacket to the motor, without any significant increase in the size of the motor housing, while at the same time increasing stall torque on its 190 frame models to 134Nm with output power rising to 29kW.

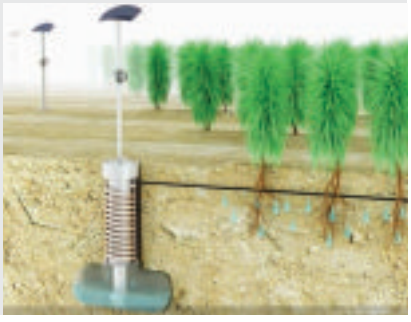
www.sem.co.uk

Solution to last month's Coffee Time Challenge

The solution to January's Coffee Time Challenge of how to harvest water in arid conditions has won The James Dyson Award for 2011 and is a piece of clever biomimicry developed by Edward Linacre of Swinburne University of Technology in Melbourne. He has tapped the Namib beetle – a desert-dwelling species that survives in the most arid conditions on Earth – to create an irrigation system that can pull liquid moisture straight out of dry desert air.

Airdrop, as the system is known, borrows a trick from the Namib beetle, which can live in areas that receive just half an inch of rain per year by harvesting the moisture from the air that condenses on its back during the early morning hours. A hydrophilic skin helps to snare water molecules passing on the breeze, which then accumulate into droplets of consumable liquid water.

First, a turbine draws air underneath the ground into a network of pipes. When the air reaches its condensation point, the water pours down into a underwater tank. A submersible pump pumps the water back up through the central column of the piping and this is pumped through to the roots of plants through a process called sub-surface drip irrigation. This is the most efficient method of irrigating crops because you don't get evaporation.



A huge breakthrough was made by putting copper wool inside the pipes. The wool was cooled by the pipes and this increased the surface area within the pipes that was cool enough to cause condensation to take place.

www.jamesdysonaward.org

Servo motor range expands

Servo control specialist, Inmoco, has extended its precision servo motor range with the introduction of the Kollmorgen KBM Series of frameless brushless servo motors. The frameless design of the KBM series provides a cost-effectively, compact solution to achieving positional accuracy in a smaller, more reliable motor package. It gives system designers the flexibility to specify a motor that fits the specific performance and dimensional requirements of the application, without incurring expensive engineering costs.

Derived from the proven and extensive portfolio of Kollmorgen servo motor designs, the KBM brushless series delivers optimised torque, power and speed within a cost-effective package and compact footprint. A wide range encompasses 14 frame sizes, from 60mm to 825mm in diameter, for 240V ac or 480V AC operation. In addition, to meet specific customer requirements, additional motor windings can be provided to allow optimised performance at lower voltages, typically 12VDC or 24V DC.

www.inmoco.co.uk

IncOder range expanded

Sensor company Zettlex has massively expanded its IncOder product range to include a choice of 600 different products.

IncOders are precision angle encoders suitable for harsh environments such as industrial, military and aerospace equipment – where optical sensors are likely to prove unreliable or pancake resolvers are too expensive.

The new IncOder range allows customers to mix and match a range of options so that the final product matches their exact requirements. Options include a choice of mechanical mounts, radial or axial connectors, six different data protocols and three different power supplies.

www.zettlex.com

New triaxial accelerometer available

Variohm EuroSensor has added a new triaxial accelerometer to its vibration sensor range that has improved in-band signal fidelity and a 50% increase in dynamic range over previously available models. The new 993B-7-M12, from Variohm's distribution partner, Meggitt Wilcoxon Research, has a rugged hermetically sealed design that is well suited for general purpose preventative maintenance use on motors, pumps compressors and other critical rotating equipment.

www.variohm.com

Electric racing brings wider

The sheer amount of technology transfer that comes from the motorsport sector is hard to beat. From advanced materials to sensors technology, innovations developed for the track often end up on day to day road cars, or somewhere radically different than initially intended. Indeed, it is probably only the aerospace and defence industries that can compete in terms of technology transfer.

It is an exciting development then, when one of the UK's premier motorsport manufacturers' teams up with the former Minister of State for Science and Innovation Minister to develop and race an all-electric Le Mans Prototype (LMP1) car. This opens up the potential to develop technologies that can have applications to more mainstream industries. And that is something the project has at the top of its agenda and wants to capitalise upon.

"We see a tremendous business proposition and opportunity," says Lord Drayson, managing partner at Drayson Racing Technologies and current president of the Motorsport Industry Association. "I am certainly not doing this as an enthusiast."

Lord Drayson has long been an advocate of introducing cleaner technologies in to motorsport, beginning with a bio-ethanol powered Aston Martin DBRS9 GT3-spec racing car in the British GT Championship in 2009. He then went on to develop and race a 'flex-fuel' LMP1 car with Lola powered by a V10 engine from Judd in 2010.

"We raced that very successfully and came third in the Intercontinental Le Mans Cup behind Peugeot and Audi," says Lord Drayson. "And we got the first ever win for a biofuelled car. Coming at it from a transferability and proprietary technology point of view, we have a project with Aston University. They are working with us on some interesting technology around fuel pumps for biofuels, which we think is going to be a very interesting new product. This has come directly out of racing experience."

The next stage for Lord Drayson on his quest for cleaner motorsport is a natural evolution and sees the development of the Lola-Drayson B12/69EV, an all-electric LMP1 racing car. The chassis is taken from the 2010 Lola LMP1 series, but is completely state of the art.

Being used for the first time on the car are A123 batteries. This new generation of Lithium Iron phosphate batteries give the necessary power and energy density, equivalent to an 850hp engine, which is required for racing at speeds up to 200mph.

The electric motors are made by YASA Motors, a spin-out company of Oxford University. YASA specifically developed its proprietary yokeless and segmented armature motors for this application. Four YASA-750 axial flux motors will propel the 700V system. This is a fairly new type of axial flux motor that has shown great promise in improving torque density when compared to other axial flux motors. The design is based around a series of magnetically separated segments that form the stator of the machine.

The step change in the specific torque of the motor is 30-40Nm/kg and is typically at least two to four times better than the best alternatives and comes from the combination of patented improvements in the magnetics, the cooling and the packaging of the motor. The direct drive motor measures 350mm in diameter and 70mm wide and will fit within the space of the front or rear differential of a typical vehicle. The motors give a peak torque of 750Nm and a continuous torque of 400Nm

benefits

Electric cars have reached a stage of maturity where they can be raced. Justin Cunningham examines how this could actually be beneficial to mainstream industry as well as fans.

Design Pointers

drayson racing ELECTRIC DRIVE

An all-electric race series set up by the FIA will race in city centres around the world in short 15 minute heats

The technology developed will be spun out where possible in to both road cars and also into other industrial applications

The LMP1 car will use four state-of-the-art YASA motors and advanced batteries to produce the equivalent of 850hp of power. Each motor will give 750Nm of peak torque

Composite manufacturing knowhow is a key area of technology transfer

in a lightweight package of 25kg.

"We have got four of those motors, two on each wheel so there is plenty of torque," says Lord Drayson. "There is no differential; it just uses a single reduction gear to match the speed of the motors to the wheels. We then had to look at other systems on the car such as regenerative dampers. These dampers regenerate electricity, which is another key factor to this type of race car. That is another area where we went to market and the technology specific to our needs didn't exist. So we spent some money on R&D and turned it into a product ourselves."

The development of the car coincides with an announcement by the FIA last year, of a new World Championship exclusively for electric cars; the FIA Formula E Championship. From 2013, all-electric machines will race around city centres on street tracks.

The series will be made up of short intense races, partly because of the technology's limitations, but also because that is what, the FIA say, will appeal to a new generation of fans. These more intense short races will have a number of heats, at the moment planned to be 15 minutes long with a 30 minute charge time in between. Although this sounds relatively short, the power required to race at speeds of 200mph for 15 minutes at a time is really pushing the boundaries.

To facilitate such a quick charge time, Drayson is teaming up with a company called HaloIPT, recently taken over by Qualcomm. They are developing wireless charging technology that is based on induction principles. HaloIPT uses inductive power transfer (IPT) systems for wirelessly charging electric vehicles already. Its unique wireless charging technology will be used to power high-performance cars as they race around the track.

The partnership also aims to pioneer the deployment of dynamic (in-motion) charging of zero emission electric vehicles. The racing cars, fitted with HaloIPT technology, will pick up power wirelessly from transmitters buried under the surface of the road or race track, transferring power directly to the vehicle's electric battery. This will ensure that the vehicle receives constant charging on the move.

Dr Anthony Thomson, chief executive of HaloIPT, says: "HaloIPT's technology has a proven heritage in dynamic charging and we are excited to be transferring this expertise to the electric vehicle market. The deal with Drayson Racing demonstrates the appetite for technology that makes driving an electric car more convenient, and this is certainly the case in the motorsport sector. Nothing could be more convenient

than a race car that re-fuels itself on the track."

This innovation is made possible because HaloIPT's tried and tested technology which provides a significant tolerance to misalignment over a transmitter pad and automatically adjusts for changing vertical gap. The system has the ability to intelligently distribute power, ensuring a consistent delivery of power at high speed.

HaloIPT and Drayson Racing will work together on the development of electric drivetrain packages and trackside charging systems to replace the internal combustion engine and fuel pit stops. HaloIPT's technology will be marketed by Drayson Racing to the motorsport industry as affordable, practical systems for race cars and race circuits.

Lord Drayson says: "Dynamic wireless charging will be a real game-changer, enabling zero emission electric vehicles to race over long periods without the need for heavy batteries. Motor racing is the ideal environment to fast-track the development of this promising technology and to prove its effectiveness. This is a milestone innovation that will have a dramatic effect not just on racing but also on the mainstream auto industry. We're looking forward to putting this technology through its paces as it charges electric race cars at speeds of up to 200 mph."

Motor racing is famous for many things, but perhaps the roar of the engine is one of the most defining amongst the onslaught on the senses. While Lord Drayson concedes that it is not going to be like hearing a V8 or V10 tearing down the straight, he does say that the new electric cars sound "pretty cool".

He says the lack of engine and exhaust noise means that spectators will hear a lot more of the aerodynamics. The tyre noise and whir of the electric motors will also add to the soundscape, and although it is different, it is none the less exciting and far more compatible with street circuits in city centres. And after all, it is really the racing that fans want to see.

Sam Smith, from the Lola Group, says: "Le Mans last year probably had one of the best fights for the win in recent years. We had two Peugeots and one Audi all on the track at the same time and you can't hear them, as they are diesels. But no one seemed to mind about that, as the racing was amazing."

Like other series of motor racing, particularly F1, the UK has an opportunity to be a leader in developing the technology and innovations which in turn should filter down in to the more mainstream engineering world.

"It is very important that Britain invests in these future technologies and manufacturing capacity which is a really good strong growth area," says Lord Drayson. "The technologies that we are innovating here from racing activities are applicable to many other sectors; aerospace, clean energy, marine, they all need technologies that are, for example, lightweight, or have embedded sensors."

Lola has applied its composite manufacturing knowhow specifically looking at renewable. It works with a company called Quiet Revolutions and a couple of years ago they manufactured 'figure of eight' blades and was able to apply its lightweight composite knowledge to this project.

"So many people say Britain doesn't make anything anymore," says Lord Drayson. "Well that is rubbish. And this is an example of state-of-the-art manufacturing and having the knowhow to make composite parts of this complexity. Having been Science and Innovation Minister, it is such a pleasure to be able to have a vision and be able to go to British companies and get the very best technology development. We just need to shout a bit more about just how good we are at this stuff. I would say in terms of the new, innovative technology on the car, about 95% comes from the UK."

Ultimately the plan is for this all-electric race series to produce cars that are faster than existing cars and spark technology transfer and track testing possibilities that will push the technical envelope of all electric powertrains forward and on to everyday road cars.

From its simulations, Lola and Drayson Racing Technologies say that its all-electric LMP1 will be as quick – if not quicker – than the conventional LMP1 cars. One thing is clear, however, the motorsport world will keep a very close eye on these developments. But so to should the rest of the UK's engineering industry, to seize the opportunities from the technology it will develop and take inspiration in its success.

www.draysonracingtechnologies.com
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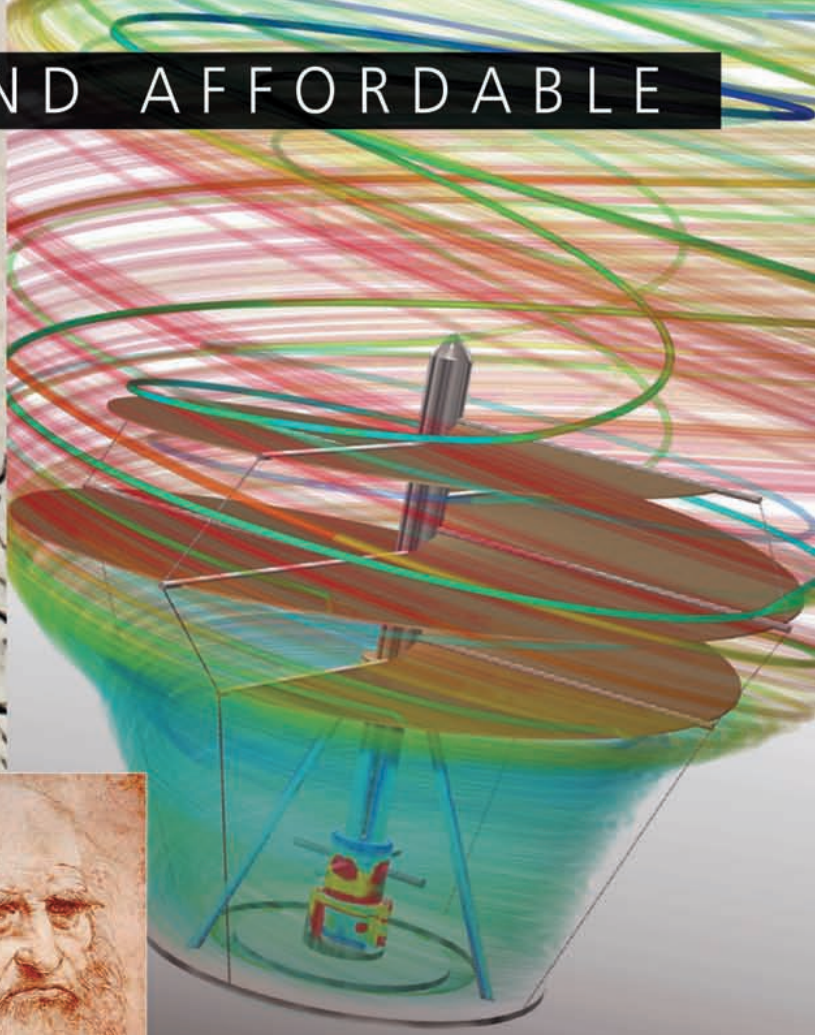

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Tunnel vision

Philip Taysom, Joint CEO of Peratech talks to Paul Fanning about the success of the Quantum Tunnelling Composite.

As joint CEO of Peratech, Philip Taysom is in the unusual position of running a company that not only controls the intellectual property of a product and process, but of a complete area of material science.

This is because Peratech has created and patented a completely new class of material called Quantum Tunnelling Composite (QTC). First produced in 1996, QTC is a composite material made from metallic or non-metallic filler particles combined with an elastomeric binder, such as silicone rubber.

The unique method of combining these raw materials results in a composite where the electrical resistance varies according to the force being applied. It enables solid state, long life replacements to be made for traditional switches and variable resistors that have none of the drawbacks of the latter such as mechanical breakdown and sparking between contact points.

Taysom's involvement began in 2006, when, having been involved in technology start ups for a number of years, he first encountered QTC. He says: "I saw Peratech and its technology and realised it was the most revolutionary thing I'd seen in my entire career. From 2006 I completely changed the business model; refinanced and restructured. It went from being a small scientific R&D company to being a company that is now a 100% exporter."

Of course, given the uniqueness of the technology, the question that springs to mind about QTC is why it has taken so long to achieve the success it is currently enjoying. The answer, says Taysom, lies in a combination of factors, many of which, sadly, will be all too familiar to anyone with any knowledge of the difficulties involved in launching 'technology products' in the UK.

"Partly it was because of being under-leveraged and lacking support," he says. "If we'd been a US company, we'd have had access to venture capital, advice and skills, and structuring advice. In the UK, we just don't have that and it is one of my great sources of frustration. We just don't support technology companies in this country and it drives me nuts. If we'd been in the US, things would have happened much more quickly."

Nonetheless, QTC has achieved success via its business model of licensing the technology for specific applications. This has seen it secure agreements with companies such as Nissha and Samsung Electro-Mechanics and the ambition is certainly there to increase the company's global reach. "We intend to be a much larger company than we are today," adds Taysom. "We are seeing our number of licences grow by a factor of two each year and we would like to increase that."

The fact that no-one else can make QTC without infringing Peratech's patents and that there is no competition other than from old-style switches does not mean that the IP landscape is any easier for Peratech to navigate than it is for anyone else. Taysom says: "The reality is that if anyone says they have their IP sewn up, they're nuts. It is always within the wit of man to make something cheaper. As soon as you have something worthwhile, someone will find a way to work around it. That means that you have to be viciously focused on IP, and we are. IP is our largest cost after headcount. We spend an inordinate amount of money on IP and, of course, the older your IP gets, the more expensive it becomes to support."

"I saw Peratech and its technology and realised it was the most revolutionary thing I'd seen in my entire career"

The scale of the problem becomes clear when one considers the sheer number of patents Peratech holds.

"We have a library of about 250 patents, of which about 35 are granted US patents," he says. "And we're creating around 15 or 20 per year. Also, as we acquire companies, we are increasing our patent base."

The problem is exacerbated by the fact that, as Taysom puts it: "Every time you come up with a new idea or way of using the technology, that in itself can spawn a whole new family of patents. We work very closely with our customers to do that. It's something that we keep an ever-watching brief on and which takes up most of our CTO's time."

Obviously, any predictions about the company over the next decade are difficult to make, but Taysom is certainly emphatic about Peratech's future ambitions, saying: "Rather than being a flash in the pan, we want to give shareholders enduring value. Ultimately, any switch you see anywhere, our technology can provide better technology and cost performance, so we won't rest until we've replaced all of those mechanical devices with our technology. So, when you look at just how big that opportunity is, we've got an awful lot more work to do."

www.peratech.com.

Track record

With a 25 year career in computing and telecommunications businesses, Philip started developing music and copy protection utilities for the early computer games industry in the mid 1980's. This led to his appointment as Activision's European Technical Co-Ordinator.

Philip co-founded Planet Online – Europe's largest business to business ISP – and later the creator of the wildly successful Freeserve service.

Hybrid actuation doubles benefits

The combination of electric and hydraulic actuation technologies looks likely to make its mark in industrial applications. Paul Fanning reports.

Electric and hydraulic actuation are often seen as rival technologies, but there are an increasing number of technologies that combine them for a range of industrial applications.

The first of these to emerge was Parker Hannifin's Compact EHA electro-hydraulic actuator, which has won a strong following for its combination of power, speed and durability, making it an ideal choice for space-critical, portable and remote applications. With the launch of Compact EHA generation II, Parker has added universal orientation and the option of a manual release function, providing greater versatility for the designer and enhanced safety for the operator.

Compact EHA is a fully self-contained, double-acting actuator which offers exceptionally high power density at operating speeds of up to 84mm/sec. This makes it a robust and maintenance-free alternative to conventional hydraulic, electro-mechanical and pneumatic systems, in applications ranging from military and aerospace, to marine, leisure, construction and general industrial use.

The new generation of Compact EHA offers benefits for both the designer and end user, making for easier specification, enhanced versatility and greater operator safety. Universal orientation also reduces the need to stock different variants as all new Compact EHA models will work in any position. The new manual release option allows the operator to manually move the load in emergency conditions such as loss of power. Where a complete, single source solution is needed, Parker now offers a bespoke design service including wiring harness, switchgear and power supply.

A benefit of the Compact EHA is that it is free-standing

The design of Parker's Compact EHA sees all components integrated into an anodised aluminium one-piece housing, resulting in a rugged and compact construction. The unit comprises a high performance, double-acting hydraulic actuator, driven via a reversible gear pump, which is powered by an integrated 12v or 24V DC motor. The pump is enclosed within the hydraulic fluid reservoir, with pressure relief and check valves also being incorporated within the system assembly.

Actuator piston rods are manufactured from stainless steel, with a micro-finished cylinder bore featuring buna-nitrile and polyurethane sealing elements, to prevent both leakage and the ingress of contaminants. Trunnion pin mounting holes are set within the base of the housing and at the end of the piston rod for ease of installation. Compact EHA is corrosion resistant and sealed to IP67 standard, and is supplied by Parker fully tested, flushed and filled with fluid, ready for operation. Commissioning requires only mounting pins and motor connections.

According to Andy Lindgren, cylinder applications engineer at Parker Hannifln, this ease of application is a major advantage. He says: "One of the virtues is that it's very easy to implement. Mounting it is essentially just a pivot at either end and driving it is essentially just a 12 or 24V power supply. So it's very easy to integrate without a great deal of design work into all sorts of applications."

Moog's Electro Hydrostatic Actuator

In terms of applications, the new Compact EHA's chief benefit is that it is free-standing. Says Lindgren: "When you need a high force that cannot be provided by an electro-mechanical unit. Normally, the only way to do it is to put a power take-off unit onto an engine and drive a

pump and a valve. There are many applications where you don't have that facility available, but you need that force, positioning and holding ability."

The design and construction of the Compact EHA actuator enables it to produce exceptionally high levels of force, delivering up to 21.3kN on extension and up to 16kN on retraction. By comparison with conventional ballscrew or linear motion systems, Compact EHA is free from problems of backlash and does not require any form of gearing, so is unaffected by wear and loss of positional accuracy.

The new actuator can be used at operating temperatures of between -34ºC and +65ºC, and generates less than 70dB of noise. Compact EHA is offered with a range of options for motor, pump, bore and stroke length, making the new system an ideal choice for machine builders looking for a simple and efficient method of providing fast, high power linear motion.

Another example of hybrid technology was revealed by Moog Industrial Group at the IPC Drives Show 2011, held in Nuremburg in November last year. It consisted of a prototype for a new Electro Hydrostatic Actuator (EHA). Combining hydraulic and electric technology in a self-contained system, Moog's EHA concept deploys the company's expertise in both electric and hydraulic technologies to develop this optimised energy-efficient and reliable system. Moog has been providing industry-leading EHA systems for flight controls for over 18 years and now has begun working with machine builders to apply this expertise to industrial applications that require high force, energy savings, environmental cleanliness and elimination of hydraulic piping.

The Compact EHA has a range of military applications

"At Moog, we refer to ourselves as 'technology-neutral' because we design both hydraulic and electric solutions," says Dr. Sherif El Henaoui, Moog Industrial. "Therefore we have developed a deep understanding of the advantages and disadvantages of each technology for particular applications. This solution leverages this know-how to create innovative hybrid designs that combine both technologies, in compact, reliable and highly efficient systems."

The design of the Compact EHA enables it to produce exceptional levels of force

Unlike an electric actuator, Electro Hydrostatic technology requires no screws or gearing. It differs from hydraulic actuators in that it requires no hydraulic piping, thereby reducing cost and improving reliability. The system is fully self-contained as all hydraulic and electric components are highly integrated in the actuator assembly.

Electro Hydrostatic Actuators receive power from an electric source by wire and transform a typically electronic input command signal into motion. EHA uses fluidic transmission between the electric motor and actuator. Motors rotate only when movement is demanded, saving energy and wear. Low duty cycle or actuation on demand applications, that require the high force density of a hydraulic system, can benefit greatly from the energy savings of an EHA system. EHA includes hydraulic components and fluid, both are self-contained within the actuator assembly, eliminating the potential of leaks and environmental contamination.

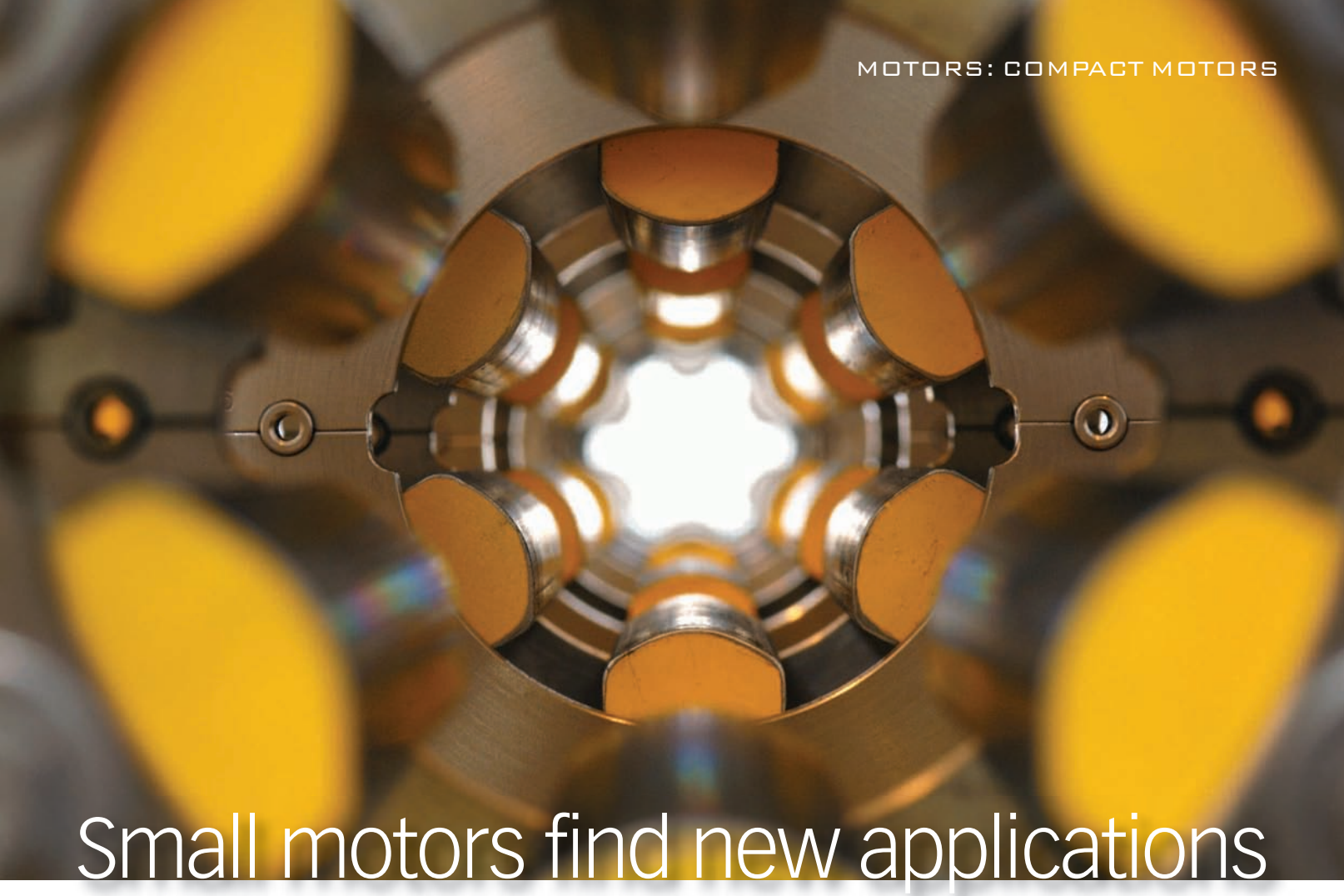
This hybrid solution of hydraulic and electric drive technology allows the selection of the benefits of both technologies: The low energy consumption of the electric system by power only on demand, the easy energy storage for the fail safe movement and the high reliability of the hydraulic system.

EHAs also offer a number of overall system benefits and cost savings. Moog's EHA design offers machine builders high energy efficiency and reliability, reduced envelope size, less wear on components and up to 40% less weight. The self-contained EHA package removes the need for long hydraulic line lengths and rotary couplings, offering significant cost savings in applications such as oil and gas, and power generation equipment. The integrated systems approach means greater reliability for the customer as less individual components are required, lowering costs and downtime. Redundancy and fail-safe features are also fully integrated offering minimal impact on cost, weight, envelope and reliability.

EHA is an ideal option for applications that have high force requirements and require redundant or advanced fail-safe systems, while also delivering energy, cost and environmental benefits. Typical applications include power generation, industrial machinery and oil and gas equipment.

The motion control industry is seeking new technologies that address the need for better energy efficiency and reliability at lower weight and size," concludes Dr. El Henaoui. "Smart systems like EHA hybrid technology offer a new and innovative solution suited to a range of industrial applications."

www.parker.com
www.moog.com



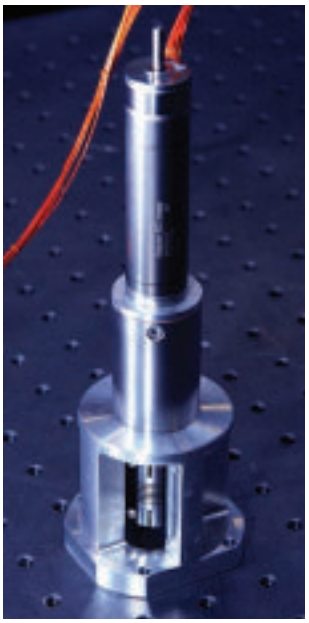
Small motors find new applications

The application of compact motors is growing. Paul Fanning looks at the technology and its uses.

Design engineers in all industries are faced with the ever-increasing challenge of designing solutions to drive functions that deliver more from a smaller package size. Ordinarily they are looking for inherently more power from a smaller package size, with greater efficiency and longer life, to reduce power consumption in general and extend simple usability in the case of portable handheld devices. This is where the use of small motors comes to the fore.

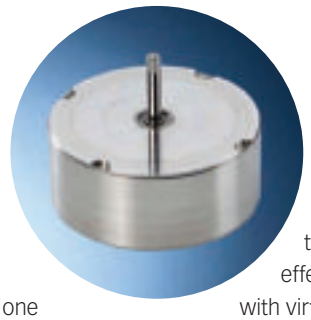
In today's market of miniaturisation of portable batterypowered devices, the need for ever more efficient small motors is apparent. Quite how small such motors are can be gauged from Faulhaber's tiny brushless motor 0206, which is just 1.9mm diameter. Using rare earth magnet materials and a minute skew wound ironless rotor, this motor can deliver 100,000rpm. Additional motor series have been developed giving motors in 3 and 5mm diameter, with available planetary gearheads in the same diameter and with the option of integrated lead screws for precise linear movement.

"However," says Stewart Goulding of Faulhaber distributor EMS, "design engineers are not only interested in size but also about functionality, with an increasing bias towards system solutions with on-board speed control or full motion control, negating the need for supplementary electronics. Faulhaber has extended its range of four pole brushless DC servomotors with the introduction of the BX4 series with integrated speed control and the world's most compact drive with integrated motion controller. High reliability, high torque, compact slot less design with no cogging torque, and robust construction without the use of adhesives make this new series ideal for demanding applications like robotics, automation, medical devices and aerospace.



Piezomotor technology is also a growing industry and offers design engineers unique characteristics that are not present in conventional DC motors. Piezo technology is simple and reliable, using very few parts and only elementary motion. Using Piezo motors negates the need for many supplementary components simplifying the design and extending lifetime. The astonishing power and precision of the small Piezo motors offers unique advantages when compared to traditional DC motors of the same size.

Piezo LEGS, from Swedish company PiezoMotor is in essence a walking machine constructed in a single piece. The construction consists of four legs with each leg being able to elongate and bend when electrically activated. By electrically pairing the legs and observing the transition and sequence of movement, two legs remain constantly in contact with the secondary interface resulting in propulsion of this part. Piezo LEG is available in different constructions so that a linear or



rotary movement can be achieved. As the motor relies on friction and the legs remain in contact with the interface at all times high torques can be achieved without the need for a supplementary gearhead and as a consequence no unwanted backlash is introduced into the system. The result is a motor that delivers a step resolution of 1 Nanometre in the linear format and 25 Nanorads in the rotary format. In addition the friction element ensures that the motor remains self-locking with no power applied making them ideal for handheld battery powered devices.

An intriguing recent application of a small, brushless motor can be seen in Maxon Motor's collaboration with Instrument Design Technology (IDT) to customise a small, brushless motor to perform in the extreme vacuum conditions of the synchrotron within the Diamond Light Source particle accelerator in Oxfordshire.

Since its commissioning in 2007, the Diamond Light Source particle accelerator in Oxfordshire has been used for projects as diverse as analysing the effects of strain on aircraft wings, studying the behaviour of the HIV virus, and even reading ancient letters without opening them. The 45,000m^2 facility works by accelerating electrons to 3 Giga Electron Volts (GeV), generating beams of "synchrotron light", up to 10 billion times brighter than the sun, in order to understand molecular structures.

To prevent electrons being lost in collision with air molecules, the whole process is undertaken in a vacuum, around one billion times lower than atmospheric pressure. Clearly, creating scientific instrumentation for such conditions requires great specialist knowledge, and Widnes-based Instrument Design Technology (IDT) supplies to the world's leading synchrotron facilities.

Diamond specified that the Double Crystal Monochromator for its new X-Ray Spectroscopy Beamline B18 should drive the crucial Bragg rotational axis with a DC motor rather than the usual stepper motor. IDT managing director Paul Murray explains: "The goal was to achieve higher rotation speeds, with a lower motor temperature and smoother drive train than the stepper motor we had used previously. Stepper motors are inherently noisy, and are often sources of vibration. Eliminating this issue would immediately improve results from the DC motor – but the new motor would have to work flawlessly in a vacuum of 10^{-8} Torr."

Because the vacuum in the synchrotron must not be compromised, each individual aspect of the motor and its construction had to be analysed for possible outgassing. However, the real challenge for us was effectively to create a brushless motor with virtually no glues or plastics, an incredibly high temperature tolerance, and excellent performance."

High vacuums of 10^{-7} Torr and greater can pull gaseous compounds from materials such as plastics and glues, compromising performance and contaminating the vacuum: a problem known as outgassing. Each component in the motor was individually tested, and upgraded as necessary. For example, standard PVC cable coating was replaced with a more inert, Kapton version. It was therefore important that the EC22 HD was already substantially made from stainless steel, rather than plastics.

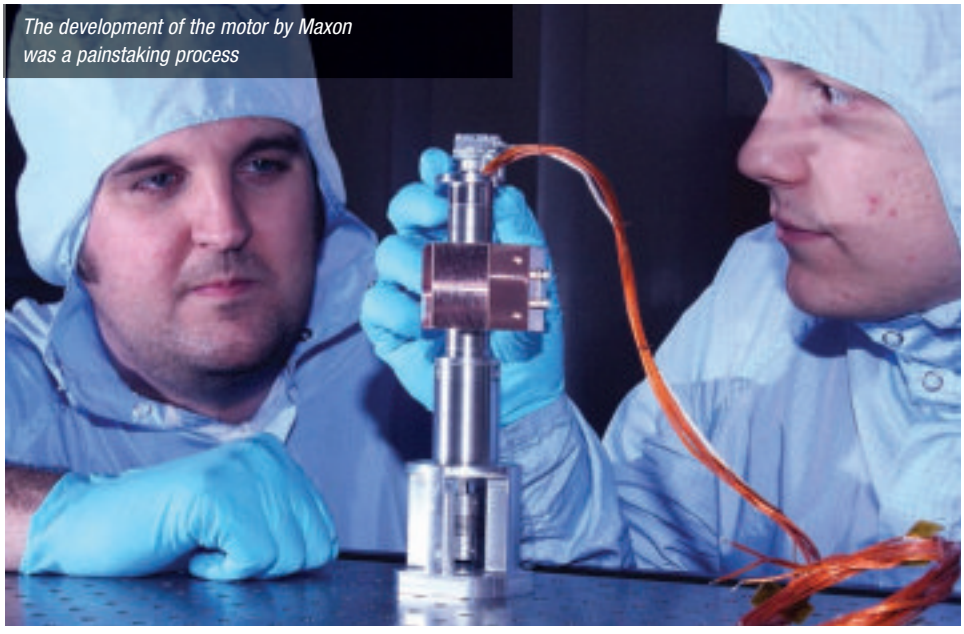
Because of the potential for outgassing, the usual glues and epoxies could not be used, and the motor was put together using extensive micro laser-welding. Other areas required a still more innovative solution, such as attaching the motor's magnets to the shaft by encapsulating them within a specially developed, laser-welded sleeve.

The starting point for the custom motor was Maxon's EC22 Heavy Duty. Although originally developed for sub-sea oil applications, the 22mm brushless motor's laser-welded stainless steel construction and broad temperature range already addressed many of the needs of high vacuum applications. And, being a brushless DC motor would immediately be more efficient, quiet and responsive than the previous stepper motor.

Nonetheless, further challenges lay ahead. Says Maxon senior engineer Paul Williams: "It really was a painstaking process, effectively taking the motor apart and putting it back together, piece by piece. "We had to create an entirely new way of encapsulating the magnets, in order to attach them without epoxies. Without maxon's experience in micro laser welding, I don't think it would have been possible."

The Double Crystal Monochromator, incorporating the special DC motor, is now in active service in Diamond Light Source's Beamline B18, playing its role in key experiments on a daily basis. The Beamline has recently been praised for the quality of data produced.

www.ems-limited.co.uk
www.piezomotor.se
www.maxonmotor.co.uk



The development of the motor by Maxon was a painstaking process

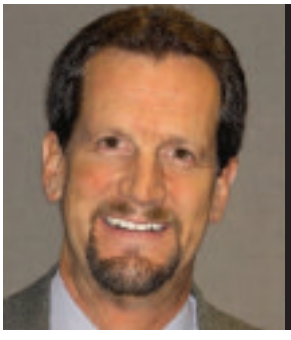
Bridging the translation gap

Migrating CAD data is a difficult process to manage and a bigger issue than many realise. Paul Fanning finds out more.

Globalisation, higher product complexity, more demanding customers and brutal competition are all driving the need for ever-more effective collaboration. This, in turn, depends on a core competence in sharing product data. Although there has been much progress in recent years, poor product data interoperability remains as an enormous technical barrier to effective collaboration and is believed in some quarters to be the single largest source of cost and waste in engineering.

Interoperability problems appear in many places and the most visible of these issues occur when trying to read data from one CAD system into another. However, even different versions of the same CAD system are often unable to share models. According to Longview Advisors' 2011 Collaboration and Interoperability Survey "there are countless other sources of wasted time and energy — which could be spent innovating — caused by poor CAD interoperability".

According to David Prawel of Longview Advisors: "Companies involved in lean initiatives often consider the cost of waste in manufacturing, but fail to understand these impacts in their CAD departments. They see 3D models rotating on computer screens and assume productive design is ongoing. The vast majority of these managers have no idea that their CAD users are often wasting a huge amount of their time fixing errors or recreating lost or corrupt data in their models, instead of creating new products or adding value in product development processes."



"Companies involved in lean initiatives often consider the cost of waste in manufacturing, but fail to understand these impacts in their CAD departments."

David Prawel

Quite how many man hours are spent on this process is genuinely shocking. According to the Longview survey, 41% of respondents report that more than 50% of their product design and engineering employees are involved with CAD interoperability or data exchange activities, and 9% have all of their product development and engineering resource involved. Additionally, 22% of design or engineering professionals at companies self-described as OEMs spend more than one day of a typical work week reworking and/or recreating CAD data. This situation is worse for suppliers, which report that 29% of their design or engineering

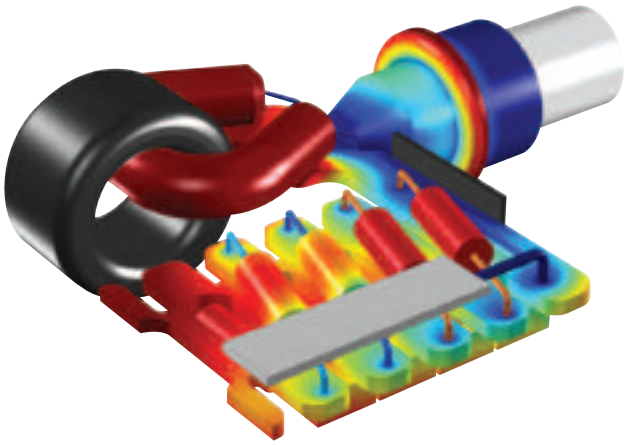
professionals spend more than one day of a typical work week reworking and/or re-creating CAD data.

Perhaps the single most time-consuming and risk-laden aspect of this process is that of data validation and checking. Stuart Thurlby, managing director of data exchange specialist Theorem Solutions says of this process: "Everyone assumes that the validation and checking have been done properly and that everything is wholesome and perfect. That's the theory, but it's never actually done! If you ask most big companies they'll say they do it, but they don't and they never have because they just don't have the time or manpower to do it. The vulnerability that gives you is that you may send out something that is not of the right quality or that doesn't contain everything. Or, similarly, you may receive something that is not appropriate and the danger is that you might start to do something that is based around bad data."

This problem has become particularly acute as key manufacturing data is increasingly incorporated within 3D CAD models. Says Thurlby: "What used to happen was that a 3D model was sent along with a 2D drawing, which was used for manufacturing. The problem, of course, is that as more and more people are just sending the 3D data, the need for validation and checking is even more important because, were there's a separate drawing and model, you might have a better chance of picking up discrepancies, if there is just one neat package, it becomes imperative that proper validation takes place."

However, the technical requirements of CAD data validation and checking are fairly daunting. CAD systems are different, even if they use the same internal kernel for holding data. The different ways in which they work and the different tolerances that they apply, can result in a perfectly valid translation producing a model that is not quite the same as the pre-translated source model. Where the CAD systems have entirely different kernels, the possibility that there may be differences is even greater.

These differences are important to engineers because they need to measure, make comparisons and to ensure that design measurements are carried through to the manufactured part. Sometimes the differences that can be identified between pre translated source models and post translation destination models is so small that it really is insignificant, but it is equally possible that even after a successful translation the differences are mathematically significant and sometimes large enough to be significant in engineering terms.



"One of the most difficult aspects of CAD translation is verifying that the resulting translated model or drawing is the same as the original source data."

Stuart Thurlby

For example, even assuming that no errors were reported during the process of a translation, a comparison of the mass properties of the source and destination models may show differences. Moreover, it is possible that the mass properties are shown to be so similar as to be considered the same and yet the shapes could be different. Comparison for the purpose of CAD model validation and checking is not simple and it should include procedures to compare both mass properties and shape.

The complexity of the comparisons required to establish that the data is within acceptable engineering tolerances and the volumes of data likely to be involved indicate that it is not practical to carry out manual verification and checking processes. Such an approach would be costly in terms of equipment and software licences, would require many dedicated man hours and would be error prone.

According to Thurlby, the process of data validation is fraught with difficulty. He says: "One of the most difficult aspects of CAD translation is verifying that the resulting translated model or drawing is the same as the original source data. Where transitions are done interactively, unless a designer has access to both CAD systems, he may have no idea at all what the pre-translated data looks like and his only view is the one he gets once the translation has actually taken place. At this stage, the most likely actions a designer will take are to visually inspect the model and drawings for obvious flaws and to run a system check to see if the CAD system believes the model to be wholesome. It takes time and expertise to be sure that everything is as it should be."

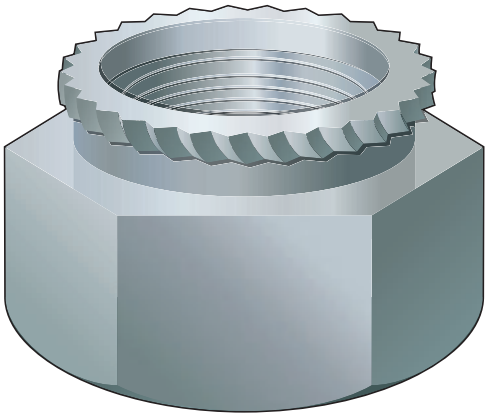
The challenge facing most engineering companies is that their engineers are fully employed adding value to the company through their core competence. There are not normally free man hours that can be applied to devising and implementing a validation and checking process. Moreover even within a pool of experienced CAD and IT specialists, not many companies would have the experience and skills to undertake such a project. This, of course, opens the door to specialist companies such as Theorem Solutions. Says Thurlby: "I could introduce you to a senior engineer who spends 40% of his time on data translation. It's an unwarranted, unwelcome cost and it's not what he signed up for. That's basically where we come in. We also offer validation and checking for Theorem and non-Theorem applications. We'll do validation and checking for third party applications as well."

Given the size and complexity of the task – and the risks involved in it going wrong – it is understandable that many choose this option.

www.theorem.com
www.longviewadvisors.com

Securing innovation

Justin Cunningham reports on some recent innovations from the fastening industry.



A number of new fastening innovations have come to market since the New Year. Among these is one from Sussex-based TR Fastenings, which is introducing a nut that can be used on sheet metal and plastic which is normally too thin to tap by conventional methods.

It has developed the K-Series nut specially designed for use in applications with a minimum sheet thickness of 1mm. The nut, which offers a permanent female thread, can be installed without the need for specialist tooling. Once fixed, the product offers a permanent thread with a high prevailing torque and pullout resistance.

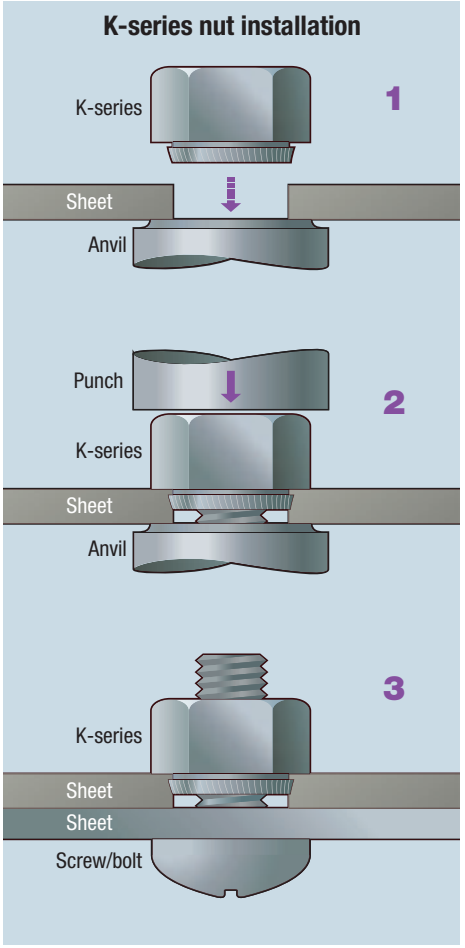
"It is designed for use on sheets with a minimum thickness of 1mm," says Steve Wallis from TR Fastenings. "It allows a thread to be inserted in to sheets that you aren't normally able too. And it is easy to install, it is punched in to a pre-punched hole and twists in to the material. It is smaller in diameter than a lot of products out there, for example sheet metal, so it is good for those areas where space might be a premium. It is steel plated, has high torsional resistance, high pull out resistance; so it is quite a tough product."

K-Series nuts are manufactured in a case hardened carbon steel, plated and tested to ISO898, though stainless steel can be supplied to order. Sizes range from M2.5-M16, with three different spigot lengths, the body of the product is hexagon with a serrated spigot.

"It can be used anywhere where you have sheet metal and you need to put in a thread," says Wallis. "It will find applications with sheet metal contractors and fabricators, the telecommunications industry, the automotive industry, and white goods and electrical industries.

"The great thing about the K-series nut that sets it apart is that it is quite small in the hole size required and the diameter of the body. It is much smaller when compared to self clinch nuts and rivet bushes. So this gives it the other added advantage of where space is a premium, perhaps in the telecommunication or electronics industry."

Additionally, PEM Fasteners has developed fasteners to allow easier mating of the threads in thin sheet metal applications. Although this sounds relatively simple, those using the fasteners frequently will save significant time and it should help alleviate the potential of strip threading.



The fasteners possess a unique 'float' capability that enables easier mating during attachment and promotes design flexibility for relaxed tolerance applications. The family of floating fasteners includes captive panel screws and self-clinching nuts, all easily installed in thin sheets.

Floating captive panel screws can have either knurled cap or smooth cap reliably install into metal or non-metal panels as thick as 1.6mm, enabling subsequent access to an assembly and compensating for up to 1.52mm mating hole misalignment.

Its patented MAThread anti-cross threading technology corrects off-angle installations, aligns components, and slides through clogged internal threads and a shoulder on the retainer portion of the fastener helps simplify installation. Thread sizes range from 4-40 through to ¼-20, and from M3 through to M6. The fasteners are available in a scratch proof DuraBlack finish and assorted coloured plastic caps.

Floating self-clinching nuts can be specified with non locking threads or self locking threads and provide permanent load bearing threads in metal sheets as thin as 0.97mm and permit a minimum of 0.76mm adjustment for mating hole misalignment. Their unique design allows the fastener threads to extend fully into the retainer shank to impart added strength and support in an assembly.

The floating fasteners are RoHS-compliant and free part drawings can be downloaded from its website.

www.trfasteners.co.uk
www.pemnet.com

Solutions that turn heads

Justin Cunningham finds out why a technologically advanced quick access fastener is turning heads in the market.

Three years ago, inventor of the quarter turn quick access fastener, Dzus Fasteners, developed the D8. The fastener incorporates an advanced and unique manufacturing technology using a rolled cam form process which is exclusive to parent company Southco. The quick access fastener has seen sales increase by 28% overall, including 60% growth in the US, in the past year alone.

Its D8 range is a culmination of over 80 years experience of quarter-turn fastener technology and is designed to be an effective alternative to the screw. The key features which make the D8 line a leading choice for a wide range of applications is its oriented head to cam feature.

"The D8 came about because we recognised the limitations of traditionally machined fasteners," says Ben Goater, product manager at Southco Global. "It has many advantages including improved quality, reliability and feel.

"After significant investment of resource and leveraging extensive experience, it has taken us eight years to develop a technological solution that allows us to roll a cam form on a stud that is orientated to the head feature."

The Dzus D8 range is becoming increasingly popular in the industrial market place because of the significant benefits it offers to users. The D8 is particularly popular for fastening access panels in the automotive, HVAC, lighting, enclosures and industrial machine sectors, and for motorcycle fairings applications.

"Undoubtedly, our ability to orientate the head feature to cam feature is the key catalyst to the success of the D8," says Goater. "It has enabled us to offer a much more reliable cam form than the one that is machined. Traditional milled studs have the potential to generate cutter wear or cutter breakage whereas, when manufacturing a rolled stud, the machine incorporates a force monitor which not only stops the machine but also ejects the bad stud if anything goes wrong."

It is also offered at a lower price point than milled stud alternatives. Other significant attributes include its precision fit, quick assembly, improved ergonomics, and choice of receptacle styles. The receptacle styles include clip-on, self-clinching, front-loaded, rivet-on, side-mount, and front-mounted variants. In addition, the D8 also has a better tolerance on varying panel and multi-panel thicknesses when compared with rival quarter turn fasteners on the market.

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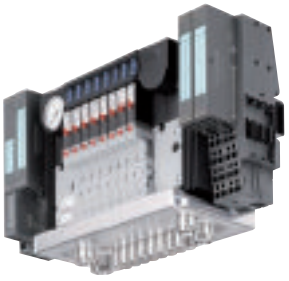
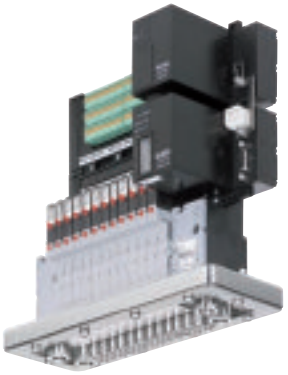


AirLINE Quick automation system type 8644 with interface module and I/O modules from cooperation partner Siemens ET 200S, 16 valve island



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Disc provides high performance at lower cost

An ultra-durable automotive brake disc is using a metal matrix composite to give top level performance at lower prices. Justin Cunningham reports.

Manufacturers have long sought to improve the durability and performance of automotive brake discs, which are subject to tremendous temperature and pressure changes. The current range of brake discs are mostly made from cast iron, except for very high performance discs which are made up of a ceramic composite.

At present, cast iron discs are used on many standard cars but these are both heavy and relatively underperforming when compared to the more advanced cermic composite brakes. However, due to the expense, ceramic brakes are usually reserved for the likes of high performance road and track cars, and competitive racing cars.

Although cast iron brake discs offer strength, they are heavy and have a far from perfect operating profile. Iron also does not adapt well to the demands placed on different sections of the disc and rotor. A brake disc usually has three functional zones, each of which requires a material with distinct strain and thermal properties to function optimally. Temperature and pressure changes across the surface are often a major cause of wear, warpage and potential failure.

As a result, US researchers from the Polytechnic Institute of New York University have teamed up with aerospace and transportation component supplier, REL, to find a better solution. The aim is to use a lightweight material, that enables high-performance braking but at a similar cost to cast iron brakes.

Adam Loukus, vice president of REL, says: "As auto companies strive to meet increasingly high efficiency and low emissions targets, there's a tremendous business opportunity in creating novel, lightweight components that reduce overall vehicle weight and increase vehicle performance."

The team is developing a one-piece brake rotor uniquely tailored to meeting the extreme and variable temperature and loading conditions experienced by a typical car over its lifetime. REL received a $150,000 research grant to develop the initial product design, material and manufacturing process. It was given the brief to produce fibre reinforced metal matrix composite (MMC) brake rotors, that are aimed at the mass market and are therefore easy to manufacture.

The team replaced the traditional material with a high-temperature aluminium alloy reinforced with functionally-graded ceramic particles and fibres to create a lightweight, but extremely durable material. This combination of material also permits the ability to customise the composite to best suit each section of the disc and rotor. The result was a brake disc that weighs 60% less than a cast iron alternative but with triple the life expectancy.

Professor Nikhil Gupta from the Polytechnic Institute of New York University, says: "The hybrid material allows us to provide reinforcement where additional strength is needed, increase high temperature performance, and minimise stress at the interfaces between the zones. Together, this should boost [disc] life significantly, reducing warranty and replacement costs, and the weight savings will improve the vehicle's fuel efficiency."

In addition to the automotive market, metal matrix composite brake discs have a great deal of transferability in to other vehicles; from bikes to military vehicles. The team is in the process of researching the other possibilities including work on some military fleets, where 'up-armoured' vehicles operate at weights well above their design capacity. While the development of lightweight armour remains a long-term goal for the military, any weight savings on the vehicles themselves will immediately improve fleet efficiency, which can be critical to mission success.

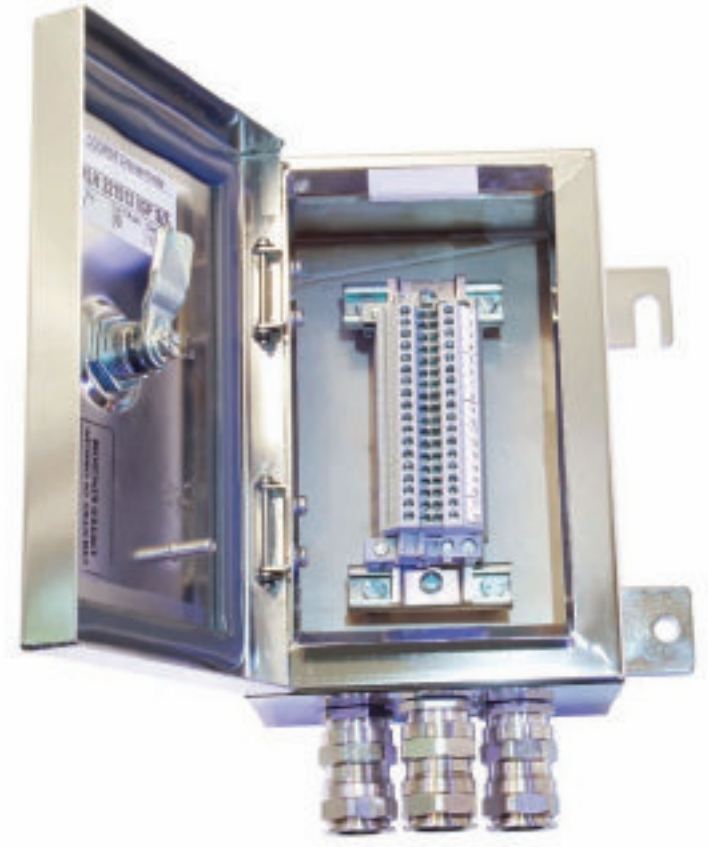
www.poly.edu
www.relinc.net

Understanding the design hazards

***Eureka* finds out about the materials and design considerations for using and specifying enclosures for hazardous area applications.**

The function of an enclosure is to protect the internal components from excess heat, humidity, dirt, dust or water. Whether sourcing an enclosure from a hazardous environment such as an oil and gas platform, or for a dusty environment such as a flour mill or sugar production plant, vital components inside need to be sheltered from the conditions in which they operate.

Engineers can often fail to fully appreciate the difference between Ingress Protection (IP) ratings and other requirements such as being fully certified for use in hazardous gas or dust environments. Enclosures for these environments are normally manufactured from stainless steel or glass-reinforced plastic (GRP), but there is an increasing number of materials from which they can be manufactured.



"It is generally accepted in the oil and gas industry that hazardous area enclosures need to be manufactured from 316L stainless steel as a minimum," says Gary Johnson, technical manager at Cooper Crouse Hinds UK. "In reality, however, most of our hazardous area enclosures are made from electro-chemical, polished 316L high-grade stainless steel as standard, as this offers enhanced corrosion resistance over other finishes."

GRP enclosures also offer technical advantages. The material can be graphite-loaded in order to avoid a build up of electrostatic charge. This is obviously of particular importance in hazardous areas.

Moulded, non-metallic enclosures enable the manufacturer to construct very modular or flexible design features for the customer, including quick fitting of components such as pushbuttons, switches and lamps. This type of enclosure also enables it to be designed with 'low-sided' enclosures for easier wiring.

Moulded enclosures have one specific shortcoming; no inherent attenuation to the passage of electric or magnetic fields. In many applications, this deficiency is of no consequence, but if radiation emitted by the electronics or their susceptibility to external fields is a potential problem, the lack of screening could be an issue.

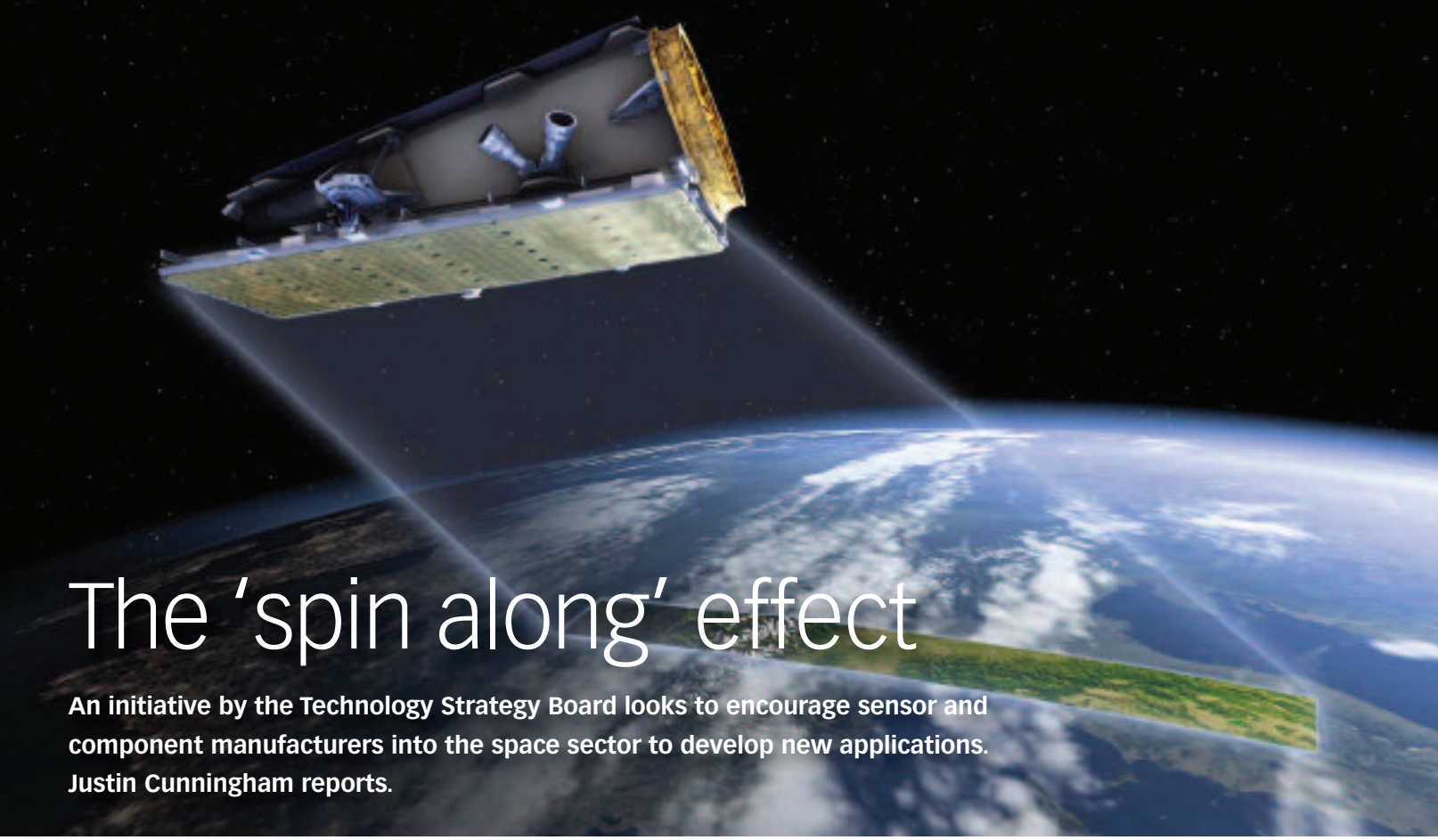
Enclosure manufacturers have typically addressed this issue by adding conductive coatings to the inside of the enclosures, although some products are moulded from a conductive plastic. Whichever approach is used, the design of the mouldings can have a significant impact on the screening effectiveness of the conductive coating.

Suppliers of conductive coatings have developed several different main materials for spraying on the inside of enclosures to achieve different levels of attenuation versus cost. Vero Technologies has worked closely with its partners RF Solutions and Polymer Coatings to offer three coatings that will suit more than 95% of possible applications, with other coatings available for highly specialised uses.

Hazardous area enclosures are subjected to a series of mechanical impact tests, in places that are considered to be the weakest points of the enclosure. If the material is considered to have a reduction in resistance to impact at lower temperatures, the box is also impact tested at the lower end of its operating temperature range.

"These tests are important," says Johnson, "because once installed in a harsh hazardous area, it is often difficult to service an enclosure due to the hazardous area or it could get inadvertently knocked or bashed in a working environment. This is why it is important that the enclosure must remain intact."

www.coopercrouse-hinds.eu
www.verotl.com



The ‘spin along’ effect

An initiative by the Technology Strategy Board looks to encourage sensor and component manufacturers into the space sector to develop new applications. Justin Cunningham reports.

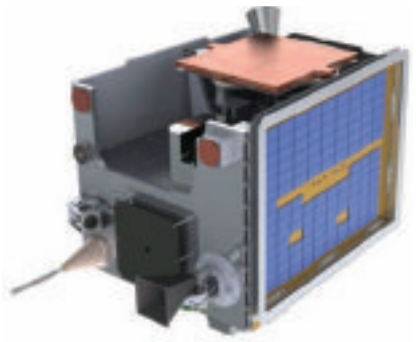
The space sector has long been a trying environment for the engineer. It is one of the harshest environments known to man and getting systems and components to reliably operate there continually pushes the envelope of technology.

Engineering for space flight has brought about many technical innovations and its continual operation has become part of mainstream, daily functionality. GPS, weather predictions, Google Earth, telecommunications; commercial space operations are now touching everyone.

The UK seems to be adept at designing and producing these space bound assets, and as a result the Technology Strategy Board (TSB) is to establish a Catapult Centre, a technology and innovation hub, to help develop satellite based products and services.

Tim Just, lead technologist of space and satellite navigation at the TSB, says: “What else can we do with the next generation of sensors and what does the user require that doesn’t already exist? If you think about a cheap space mission costing from $20 to $100million, trying an idea out requires a pretty hardcore entrepreneur to put that sort of money up.”

This has led to the Catapult Centre initiative being set up. Historically the driver for the space sector has come from what is available. Companies that already operate in space think about what they can do for other sectors, and then come up with proposals to sell. What the Catapult Centre is aiming to do is turn that round and ask those people what they need.



“The insurance sector might need rapid revisit images,” says Just. “For example, when an area is flooded they can quickly identify the damage in a couple of hours; the actual resolution is less important. You then work out that you might need five satellites so need to build a satellite at 20% of the normal cost. This initiative is looking to help companies demonstrate that kind of application driven technology and show it can be done cost effectively and quickly. Although it might not be a commercial service, if it was only flown on one satellite, it provides a technical demonstration for the application.”

The Catapult Centre is being tied in with another programme being run by the TSB, the TechdemoSAT1. This provides a platform for interested parties to fly hardware such as a sensor, a novel material, or mechanical component that can’t consider it normally due to the high cost involved in space missions.

A separate issue is the need for flight heritage to get anyone to buy and have confidence in a product sold to the space sector. But this creates a chicken-and-egg situation as it needs to be flown first. The TSB hopes that this programme will help break down that barrier and allow firms to fly whatever sensors, instruments or components they want on low-cost, three-year missions.

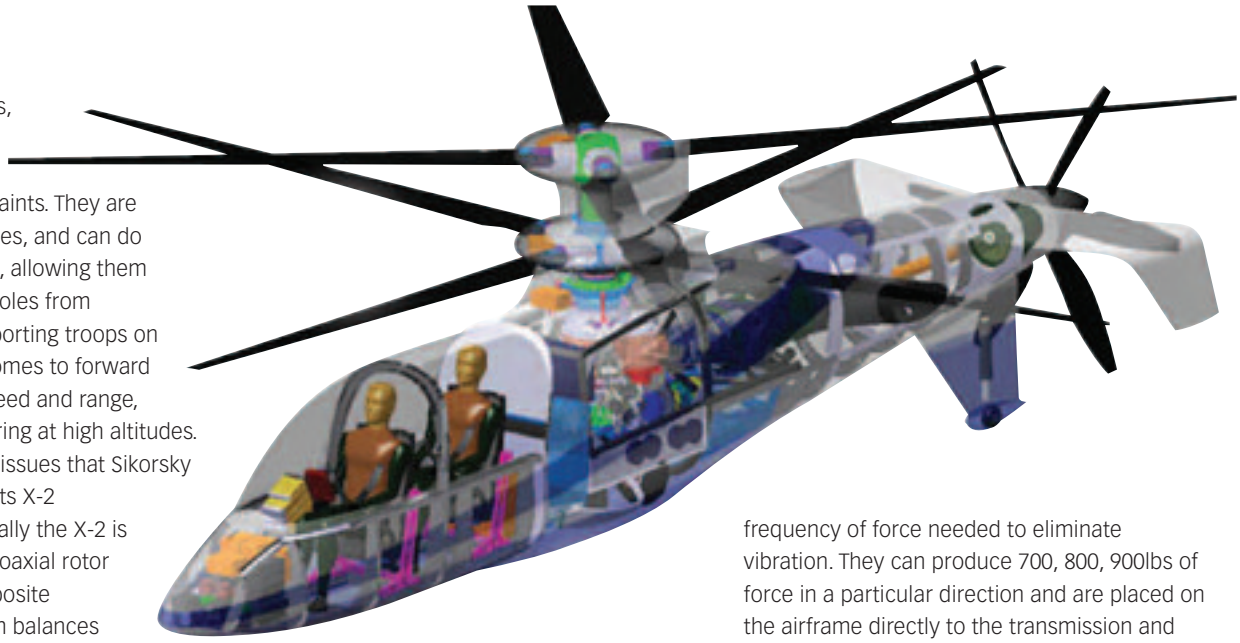
The initiative is less about developing new technologies and finding commercial spin outs, but rather about ‘spin along’. The hope is that firms that have technology with potential untapped commercial value for operations in space, but are not doing so due to the engineering and financial difficulties, can come into the programme and change that. So in essence, it is as much about introducing existing technology in to space to open up new applications, as it is about developing engineers.

“We not only put components into a ridiculous environment in terms of temperature changes and radiation levels, but are also expecting them to work unattended for up to 20 years,” says Just. “So if you end up with all sectors supplying in to the space sector then you are using new techniques and producing to a very high standard. You might only sell one or two to the space sector and obviously there is a price attached to that, but the technologies developed and expertise gained to meet those standards can then be spun along in to other domains.”

www.innovateuk.org

Controlling vibrations

The innovative rotor setup of the X-2 overcomes problems of the past using modern technology. Justin Cunningham reports.



With all the advantages, helicopters still possess a number of distinct operational constraints. They are excellent hovering machines, and can do so for long periods of time, allowing them to be used in a variety of roles from search and rescue to supporting troops on the ground. But when it comes to forward flight they have limited speed and range, and can have issues hovering at high altitudes.

These were the design issues that Sikorsky set out to overcome with its X-2 development aircraft. Visually the X-2 is not conventional. It uses coaxial rotor blades which rotate in opposite directions. This mechanism balances the torque and effectively gets rid of the need for a tail rotor.

Steve Weiner, Sikorsky's director of engineering sciences and chief engineer for the X2 programme, says: "The drive shaft that goes to the back can now be used for more important things, in this case a propeller. This allows the forward speed of the aircraft to be much faster than usual."

The X-2 takes its design philosophy and flight principles from an experimental research aircraft called the XH-59 advanced blade concept, built and flown in the early 1970's. The XH-59 possessed a lot of the features that Sikorsky wanted to incorporate, specifically the coaxial rotor setup which provided excellent manoeuvrability, high altitude performance and speed.

"The XH-59 had a lot of problems though," says Weiner. "The technology at that time did not provide a means for keeping vibration in check. It also required two pilots as there was nothing like the modern fly-by-wire systems available. So we wanted this type of vehicle but in the modern context."

One key enablers for the improved functionality was down to the use of Computational Fluid Dynamics (CFD). This enabled the engineers to 'dial in' the lift to drag ratios on the rotors and really understand the aerodynamics of such an innovative rotor setup. The sheer amount of virtual analysis that went in to this program meant that the aircraft only flew for around 20 hours, in comparison to 2500-2600 hours in the simulator. Despite limited flying hours, the aircraft set the unofficial speed record for helicopters flying at 250knots.

The other major innovation comes from the ability to tame the vibration that plagued its predecessor, the XH-59. Active vibration is a system that consists of a series of sensors that are connected to a computer and force generators. The force generators are basically eccentric masses on a common shaft which rotate at a particular rpm to provide the frequency of force needed to eliminate vibration. They can produce 700, 800, 900lbs of force in a particular direction and are placed on the airframe directly to the transmission and rotor system, counteracting the forces produced by the rotors.

"Vibration control has really improved quite a bit," says Weiner. "We use active vibration control on most of our production helicopters and we proved that by using these systems and having them acting directly on the source of vibration on the rotor system, we could keep it to a point where we could get a very comfortable ride and cruise at 250knots."

The X-2 is the forerunner of the planned S-97 Raider by Sikorsky which is now undergoing detailed design. It will take the same rotor setup, flight principles and engineering concepts that have be proven on the X-2 and take them closer to production.

"It will have the capability of carrying six passengers, have a pilot and a co-pilot, armament, and be a larger aircraft," says Weiner. "It will have extremely good hot day hover and specific mechanical changes to improve its operational capabilities. We expect to be flying the S-97 from 2014."

www.sikorsky.com

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READER INTERVIEW

STEWART DAVIES, PRINCIPAL ENGINEER, SCHAEFFLER UK

Q How did you get into engineering?

A As a child, I liked taking things apart and then trying to assemble them again. At the age of 17, I therefore decided to take an engineering apprenticeship at a local architectural/ironmonger company. Originally, I wanted to become a maintenance fitter, but I was deemed as very technical in my thinking and so was encouraged to go down the technical apprenticeship route, which eventually led to me becoming an applications engineer at Schaeffler (formerly INA Bearing Company) in Sutton Coldfield in 1987.

Q What does your job involve on a day to day basis?

A My job here in the engineering office involves working very closely with customers on various applications, helping to select the most suitable bearing solutions for their application.

This involves all Schaeffler products, not just rolling bearings, but linear guidance systems, automotive engine components and so on. Primarily, this involves bearing design and calculation work for specific customer projects.

Q What interesting projects and technologies have you worked on?

A Too many to mention really! However, recently the most interesting projects are where we have been asked to develop specific bearing solutions for electric vehicles, hybrid electric vehicles, motorcycles and off-highway/construction vehicles. I've also worked on some very advanced bearings for gearboxes on renewable energy systems, including the latest wave/tidal energy technologies.

Q Are there any new technologies that particularly excite or that you see as being quite revolutionary to the wider world?

A Some of the new bearings that we've developed for the all-electric and hybrid electric vehicles are genuinely revolutionary in terms of reduced friction and weight.

Q What is the biggest issue/driver facing your industry?

A In the automotive industry, rising fuel prices and stricter legislation means that our customers now require even more compact, lightweight bearings that also offer reduced friction, which in turn leads to reduced CO2 emissions from the vehicle. In other markets such as marine, renewables and power generation, we are being asked to develop environmentally friendly bearings that are also able to withstand extremely harsh environments, often for up to 20 years. It is encouraging to see the UK taking the lead in many of these new technologies.

Q What advice can you give to younger engineers just entering the industry?

A Get as much practical exposure and experience as possible in terms of bearing manufacturing processes, design and application engineering. While there are lots of academically bright young people out there in the UK, our industry is lacking people with practical knowledge and experience of how things are actually made! One solution to this is to encourage more young people into engineering apprenticeships.

Q How do you see the bearings industry changing going forward?

A Within the UK, the bearings industry is moving towards serving new market sectors such as renewables (wind energy in particular) and hybrid electric vehicles. Also, condition monitoring is becoming more attractive to customers now, as it enables companies to maximise the efficiency of existing plant and equipment, as well as holding less stock.

Stick to it!

Sticky tape is great, but has its limitations. Is there anything that can improve on it?

There is little doubt that, since its invention in the 1920s, adhesive tape in its various forms has been a great boon to mankind. Whether used to render torn banknotes back into legal tender, removing fluff from an item of clothing, providing temporary repairs to everything from car wing mirrors to the wings of aircraft or even just to stick one bit of paper to another, it has become an indispensable item in the home and workplace.

However, it does have limitations. For one thing, its very nature as an adhesive substance prevents it from being used again effectively, having lost some of its adhesive properties on the surface to which it was previously adhering and also possibly as a result of picking up dirt, grease or dust that renders it less sticky.

Another drawback, of course, is that normal adhesive tape cannot be used on wet surfaces, restricting its usefulness to situations where it is possible to ensure that the surface on which the tape is being placed is clean and dry.

The Challenge

The challenge this month, then, is to develop an adhesive tape that does not suffer these disadvantages. This new substance will have to be stronger, reusable and capable of operating in conditions in which traditional sticky tape cannot.

The solution does not have to involve adhesive in the traditional sense, of course. It could involve magnets, for instance – although that would obviously present other drawbacks, not to mention limitations!

Perhaps, then, some arrangement of spikes could allow the tape to the surface to which it is attached? Undoubtedly this would adhere, but the damage done to the object may make users think before deploying such a solution.

As ever in the Coffee Time Challenge, we do have a particular solution in mind. In this instance, it is one that has borrowed heavily from nature in order to achieve its end. It is a dry adhesive tape that not only boasts impressive bonding strength, but can also be attached and detached thousands of times without losing its adhesive properties.

This solution is ingenious, fascinating and will be revealed in our March issue, but who is to say you can't do better?

The answer to last month's Coffee Time Challenge of how to collect water in arid, drought-stricken areas can be found in the Technology Briefs section on page 8

Adhesives

Radically Improved Instant Adhesive

Loctite 3090 is a clear, two-part cyanoacrylate that increases the versatility of instant adhesives. Alongside traditional benefits, 3090 allows exposed adhesive outside of the joint to harden within minutes – removing the need for a post-assembly activator. Gap sizes up to 5mm are readily accommodated and the gel viscosity means it's suitable for vertical or overhead application.

It can be used on plastic, rubber, wood, stone, leather, fabric or metal and can withstand a force of 20N/mm². Easy to use, 3090 comes in a pack containing a dual syringe with seven mixer nozzles – and no application gun is required.

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

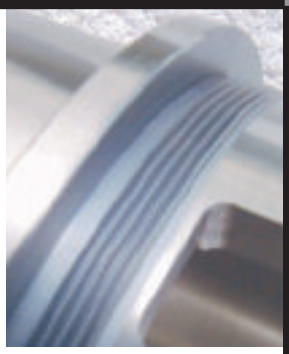
www.loctite.co.uk/3090

Adhesive Tapes

www.tesa.co.uk

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.

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Die-cast Enclosures

Die-cast enclosures in three interesting new shapes

Responding to customer requests from several different sectors for die-cast enclosures to provide a strong and robust environmentally sealed housing with good EMC screening in a non-rectangular shape, Hammond Electronics has extended its popular 1590 family with the introduction of the 1590TRP and STP models. The first applications for the new shapes have been for audio equipment, guitar stomp boxes, industrial remote controllers, desktop switch arrays and hand-held test equipment controllers. The octagonal 1590TRP is 133mm across the flats and 39mm high; it will house a circular PCB up to 126mm in diameter. The two 1590STP trapezoidal units are also 39mm high; the smaller portrait format unit is 112mm long, narrowing from 79mm to 62mm, the larger landscape format one is 95mm deep and narrows from 151mm to 122mm. All three types are available in natural finish and in a smooth gloss polyester powder paint, which does not chip after machining and provides a good surface for labels and silk screening.

@: sales@hammondmfg.eu
✆: +44 1256 812812

www.hammondmfg.com

Laser Marking

Laser Marking Beverage Glass using Synrad CO2 Lasers

UK distributor, Laser Lines Ltd, offers the complete range of Synrad C02 lasers which are ideally suited to laser marking glass. Marking curved surfaces is easily achieved using WinMark Pro software and a simple stepper motor.

Laser marking steeply curved surfaces is difficult even for 3-axis heads. Line of sight issues eventually become a problem due to the geometric constraints of the surface being marked. This means that marking the circumference or even the side wall of a cylindrical object is impossible with stationary markers. However with Synrad's WinMark Pro's radial bitmap marking feature and a simple stepper motor, steeply curved surfaces or an entire circumference can be easily marked, using a standard Synrad FH Flyer marking head. This set-up means the beam is always perpendicular to the part surface and the mark is always centered under the marking head to maintain perfect focus.

@: info@laserlines.co.uk
✆: 01295 672500

www.laserlines.co.uk

Steam Technology Centre

Spirax Sarco opens new state-of-the-art Steam Technology Centre

Spirax Sarco shows its continued commitment to world-class training with the opening of its UK Steam Technology Centre. The centre is the only training facility in the UK to offer a fully-operational steam system with SCADA control. This enables it to enhance the quality of training across Spirax Sarco's array of steam engineering courses, as well as supporting live technology demonstrations. The revamped centre offers a variety of training courses to help steam system operators address key issues, such as improving energy efficiency and carbon emissions, reducing downtime and operating costs and ensuring safe operation. Using leading-edge steam control technology, the training rig will showcase the modern approaches to process control, energy efficiency and carbon impact. SCADA linked systems allow delegates to observe all aspects of the boiler house and steam system design in real time.

@: training.centre@uk.spiraxsarco.com
✆: 01242 535211

www.spiraxsarco.com/uk

Mechanical Design Engineer

Location: Hampshire
Type: Contract
Salary: £25-£28 per hour

Design Engineer urgently required within the Hampshire area. The company, part of a global group of companies, produces a variety of sensors for aerospace applications and is looking for an ambitious individual to join its team.

This main focus of this position will be to design and develop engineering solutions across the whole development lifecycle, in accordance with customer requirements and business needs.

To be considered for this position, your experience will cover:

* Degree qualified - mechanical or aerospace design (or equivalent)
* Minimum of two years experience gained within aerospace or related industry
* Experience of robust New Product Introduction (NPI) techniques
* Understand and apply technical risk management techniques
* FEA analysis experience
* Computational Fluid Dynamics (CFD) experience

For full details online enter reference: JS-MD2321/LD

Mechanical Design Engineer

Location: Hampshire
Type: Permanent
Salary: By negotiation

QinetiQ comprises teams of dedicated people; experts in defence, aerospace, security and related markets. We draw on our extensive technical knowledge and intellectual property to provide the know-how and support to solve some of the world's most challenging problems. Our people make the critical difference to customers by providing unique approaches to problem solving.

We have a requirement for an Investments Lead Systems Engineer to provide the technical and engineering lead on one or more investment projects, driving the projects' technical and engineering activities through the whole engineering life cycle from requirement specification and system architecting, through design and development to integration, delivery and acceptance.

For full details online enter reference: JS2033

Design Engineer

Location: Hampshire
Type: Permanent
Salary: £30k-£33k per annum + benefits

SE Controls is a market-leading specialist ventilation company and, with over 30 years' experience, has shown significant growth to lead the market in the design, manufacture, installation and maintenance of smoke and natural ventilations systems and window automation products.

As Design Engineer, you will project manage the development cycle of new products (conceptual design, development, prototyping and testing). You will provide technical support on new and existing products, and liaise with suppliers on the technical aspects of integrating new products.

Responsible for the design and delivery of training in line with new products, you will also provide technical updates and compile product installation operating manuals. In line with our commitment to ISO 9001, you will oversee the continuous improvement and value engineering of existing products.

For full details online enter reference: JSSECONTROLS

Mechanical Design Engineer

Location: Petersfield
Type:Permanent
Salary: £50k-£65k per annum + benefits

Frazer-Nash Midhurst is internationally renowned for its specialist design and manufacture, responsible for supplying special purpose equipment to some of the world's best known volume manufacturers.

A seasoned individual is sought to join its engineering team. Each of the company's projects is unique, with the solution being tailored to the customer's requirement. We are looking for individuals who can understand how to take an idea from concept to finished manufactured product. Working with the project team, your role will be to:

- Understand the customers' requirement
- Help design a solution from whole systems to individual piece parts
- Define materials, specify tolerances, understand system constraints
- Working with the machine shop on how to produce complex parts
- Oversee the assembly and testing of the final product, etc.

For full details online enter reference: JSFNM-1025

Principal Marine Engineer

Location: Devon
Type: Permanent
Salary: Negotiable

The main purpose of this role as principal marine engineer includes:

- Provide marine system support to projects
- Key skills and knowledge
- Knowledge of shipyard working practices
- Knowledge of classification society and SOLAS (MCA) design codes and standards
- Ensure the design meets customer specification requirements and is fit for purpose
- Ensure adherence to company procedures for ship design and construction

You will produce system designs from first principles, based on customer specifications; evaluate equipment and components for ship's systems (eg, engines, pumps, purifiers, sewage plant).

Complete sign-off of design reviews of all ships systems, as well as of technical reviews of equipment tenders for various projects; maintain a database of the above reviews to show compliance with specification for final delivery, etc.

For full details online enter reference: JS/MK/ME

Senior Mechanical Engineer - Water Industry

Location: Caerphilly
Type: Permanent
Salary/Rate: circa £40k per annum + benefits

Job Details: This organisation is responsible for providing an essential public service to more than 3 million people and looking after £25 billion of assets. It is now seeking a Senior Mechanical Engineer to join them.

The role offers a unique opportunity to a proficient mechanical engineer with experience in the water industry to join its highly skilled team within their asset strategy and planning teams.

As a senior mechanical engineer, you'll be responsible for the development of technical and design specifications, in relation to water supply and waste water services.

You will own the mechanical input into the overall asset strategy and planning, including reviewing scheme designs and cost, in accordance with specification and asset strategy scoping documents.

For full detailfs online enter reference: JS/307014-DWRSM2702/SWS

Control & Instrumentation engineer

Location: Scotland
Type: Contract
Salary: Excellent

You will assist the project management team on all control and instrumentation issues and act as a technical specialist, advising on all aspects of safety instrumented system design and implementation. You will liaise with project engineers and other team members and develop and maintain relationships with other discipline leads.

You should have a degree in instrumentation engineering and at least 10 years experience of the oil and gas industry. With significant experience in the design of safety instrumented systems, you should also demonstrate leadership in the design of distributed control and SCADA systems.

Substantial knowledge of the instrumentation and control design functions would be an advantage, as would be the ability to plan, organise and direct a large design team.

For full details online enter reference: JSPE160112

Mechanical Engineer

Location: North West England
Type: Contract
Salary: Negotiable

A leading company in the North West of England is looking for a Mechanical Engineer with Solid Edge experience on a six month contract. The successful candidate must have experience in design and problem solving on large scale vehicle projects. This role will involve design and problem solving on body, trim and door systems, using Solid Edge for all the design work.

Candidates will need to have a full UK driving License, as the role will involve travel to customer sites.

Applications should be able to show experience in the use of 3D CAD Packages and Solid Edge mechanical design skills. Vehicle design skills should include body, trim and door systems. Fault finding experience will be a benefit.

For full details online enter reference: JS32929

Mechanical Engineer (CFD/Fluid Dynamics)

Location: London
Type: Permanent
Salary: Up to £55k per annum + benefits

A stable, profitable and growing company based in South London is looking for a mechanical engineer to become its expert in fluid dynamics and to become actively involved in developing scientific apparatus and instrumentation used to save lives.

You will need to demonstrate a professional track record in a highly regulated or safety critical environment and be competent in fluid dynamics, including CFD. You should understand how gases/air mix, flow and interact and how to use pneumatic controls, valves, switches and similar equipment.

Applicants will be expected to have experience in fluid dynamics, pneumatics, aerodynamics, hydrodynamics and similar fields.

For full details online enter reference: JS-BBBH33606

HVAC Engineer

Location: Suffolk
Type: Contract
Salary: £26 to £29 per hour

An HVAC engineer is required to join an experienced business providing fully integrated turnkey solutions to clients within the oil and gas industry.

The successful candidate will be able to demonstrate experience in 2D and 3D design using AutoCAD, as well as knowledge of working from P and IDs to size and position all items. Experience is necessary in jacket, accommodation, topsides process, FPSO and civils.

All activities and deliverables are required to be produced in a cost effective and timely manner according to schedule and in compliance with the company's project procedural requirements and standards. You will check and produce intelligent 3D models and 2D drawings, provide support through the construction phase and offer sound construction advice to lead engineers.

For full details online enter reference: JS-33632/LD

Maths Modeller/Research Technologist

Location: Hampshire
Type: Permanent
Salary/Rate: Very Good & Benefits

This is a fantatstic opportunity for a recent PhD graduate or someone who has completed PhD and is doing a fellowship to work in a company looking to use the latest math modelling and information extraction techniques to break into new markets in aviation and beyond. All candidates must have a strong experience with MATLAB or .NET and a strong academic background biased towards maths software.

The company's Advanced Technology Group is a world leader in the applied research and development of Integrated Vehicle Health Management solutions to real world data rich problems.

The successful candidate will undertake software algorithm research for decision support and advanced data analysis systems. You will design and develop advanced data analysis tools for decision support and work closely with the technical fellow and analytics applications team to develop core toolsets.

For full details online enter reference: JS/MCL/SD/MATHS

Mechanical Stress Engineer

Location: South Yorkshire
Type: Contract
Salary: Negotiable

Job Details:
This engineering company is looking for a mechanical designer with stress engineering experience, to work initially on a six month contract.

The immediate project is to integrate turbines with steam boilers. The company is buying the turbine and steam boiler and the successful candidate will need to integrate the turbine and boiler using steam pipes, thermal equipment and stress analysis parts.

Experience in designing pipelines, vents and systems using Inventor is required, as is an understanding of designing systems under heavy pressure (60bar) and high temperature (400°C).

You should have steam plant or thermal plant experience and be confident in the use of AutoCAD Inventor.

For full details online enter reference: JS39477

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