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Almost human

UK company forges ahead in interactive robotics

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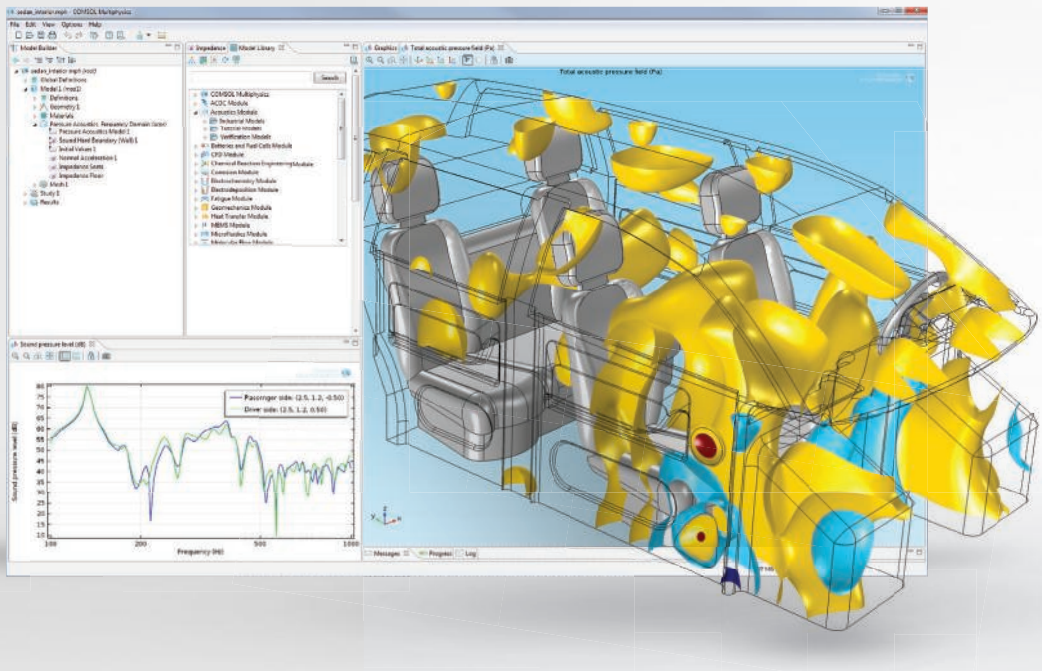

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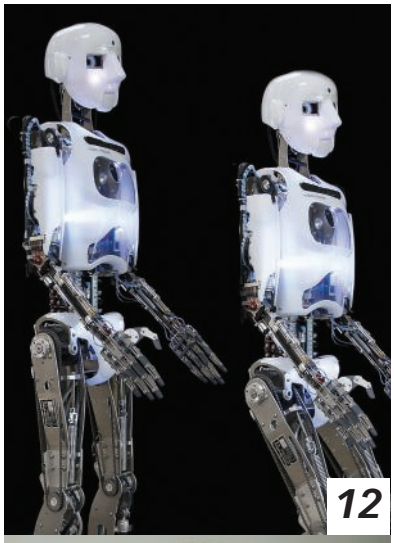

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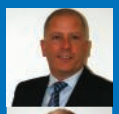

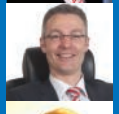

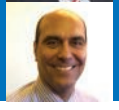

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A good year, but not a great one

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

The end of 2013 looms and, in these circumstances, it's always instructive to take a look back at the start of the year to see how things have progressed.

In January, I heralded some strong PMI figures for manufacturing output and wrote "2013 is beginning as we must hope it will continue".

Well, I'm delighted to say that it has continued in this vein. The PMI figures I applauded in January had reached 51.4, while November 2013's reached 58.4, with new orders at a near-20 year high and thousands of new staff taken on last month. So As we reach the turn of the year, the economy appears to be showing strong growth, with manufacturing leading the charge.

Clearly, this is extremely good news. An optimist might even be tempted to argue that it all the talk of 'rebalancing the economy' that we have been hearing since the dark days of 2008, when it became clear to all that we were going to have to rebuild or at least remodel the economy. After all, a strong manufacturing sector is what we asked for and a strong (or at least 'stronger') manufacturing sector appears to be what we're getting.

However (and you knew there was a 'however' coming, I'm sure), I also wrote these words back in January: "Of all the issues facing the sector, by far the most pressing is the ongoing skills shortage, which threatens to drain the UK's manufacturing base of its lifeblood."

I went on to hope for progress in this area 2013 and here it is harder to find concrete positives.They do exist, though. There are many laudable organisations and initiatives seeking to address this problem. Equally, there does seem to be a genuine acknowledgement of the problem on the part of Government and senior industry figures that this problem must be addressed.

In particular, initiatives such as the recent Perkins review and the announcement of investment in universities and further education colleges' science and engineering facilities would seem calculated to accelerate skills growth in the sector.

The fact is, though, that the figures still point to a long term decline in the number of engineers being produced by this country. Thus, while the progress made by the sector is great news, it is vital not to forget this underlying weakness and the fundamental threat it poses to the long-term health of the UK's manufacturing sector.

BEEAs winner recognised by IET

Multiple British Engineering Excellence Awards winner Team Consulting has received further recognition, this time as the recipient of three Institution of Engineering & Technology Innovation Awards.

Team, which won the BEEAs Consultancy of the Year Award in 2012 and whose senior engineering consultant Sebastien Cuvelier Mussalian scooped both the Design Engineer of the Year Award and Grand Prix for 2013, won the IET awards for its OrganOx metra innovation. These were in the Healthcare Technologies, the Intelligent Systems and the Emerging Technology Design categories.

The OrganOx metra innovation seeks to simplify the transport of organs in between transplants. For decades, livers have been removed from donors, flushed, packed in ice and raced to a waiting patient. Some organs make it, but many don't. The pioneering and largely autonomous metra™ recreates the core functions of the human body and keeps the liver alive, whilst also providing key data for surgeons.

Team Consulting and OrganOx scooped the three awards beating over 400 applicants from 30 countries. The other shortlisted entries came from esteemed companies including Peratech, SmartKem and Renfrew Group International.

Barry Brooks , IET president said: "The Team Consulting and OrganOx team should be very proud to have won an incredible three IET Innovation Awards for their OrganOx metra innovation. They were selected from a highly impressive set of global innovations as one of the most forward thinking, pioneering advances in the field."

Neil Cooper, head of marketing from Team Consulting, said: "We are speechless. To be nominated was amazing, but to walk away with three awards is simply breath-taking. Four years of hard graft with our client Organ Ox has resulted in a groundbreaking product... We couldn't be prouder."

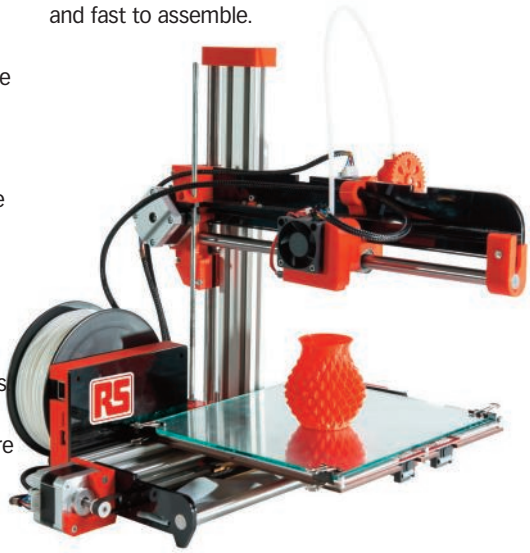
www.beeas.co.uk

RS first to supply new RepRap Ormerod

RS Components has signed a landmark distribution agreement with RepRapPro Ltd that will deliver affordable, open-source, self-replicating 3D printing technology to engineers worldwide. The completion of the deal coincides with the launch of the RepRapPro Ormerod low cost 3D printer, which is available first from RS.

3D printing is fast becoming an essential part of the electronic and mechanical design process. Increasing numbers of companies are beginning to see the benefits of using this technology to create quick-turn-around prototypes and save months in the design cycle. Barriers to adoption in the past have been the cost of hardware and a lack of easy-to-use design software for non-CAD specialists.

When used in conjunction with the free DesignSpark Mechanical 3D modelling software co-developed by RS and SpaceClaim, the Ormerod complete 3D printing kit will enable design engineers around the world to develop sophisticated concepts and products very quickly and inexpensively. The Ormerod is one of the most versatile 3D printers available: it is easy to expand in functionality, fast to replicate and fast to assemble.



The Ormerod uses the FFF (Fused Filament Fabrication) process to build 3D objects in a range of plastics and in a variety of colours. This process enables the user to create almost any shape that can be modelled on a computer, including some that cannot be produced by traditional manufacturing techniques at all.

"The availability of low cost 3D printing technology with the RepRapPro Ormerod, combined with the free and intuitive DesignSpark Mechanical and library of 3D component models from RS, is the dawn of a new era of 3D design and rapid prototyping that will see it move from a niche group of CAD specialists to a much wider spectrum of users," said Mark Cundle, Head of Technical Marketing at RS Components. "It is no overstatement to say these are revolutionary times for engineers, which will massively increase the scope for innovation and faster time-to-market."

500 limited edition RS branded Ormerod printers (pictured), complete with certificate of authenticity numbered one to 500, are available to buy on the RS website while stocks last.

www.rs-components.com

Lotus secures £10m government grant

British luxury car maker Lotus has secured a £10million government grant to support further R&D activities and create 313 new full-time jobs.

The grant, awarded by the Regional Growth Fund, will also be used to up-skill staff at the company's headquarters in Norfolk.

Speaking during a tour of the Norfolk facility earlier this week, Business Secretary Vince Cable said: "Lotus is an iconic British car maker, with some of the most innovative engineers in the business.

"I am pleased to announce today that our flagship economic plan to create jobs outside of London - the Regional Growth Fund – is awarding Lotus a £10million grant which will help them develop their next generation of cars and create over 300 new jobs in East Anglia."

The government has already supported more than 400 projects with £2.6billion of Regional Growth Fund money, promoting growth in regions across England.

The latest round is open until 9th December 2013. All businesses with a plan to support jobs in their local areas are urged to apply.

UK universities win cash for post-graduate engineers

Some of the UK's leading universities have been awarded funding to set up training centres for post-graduate science and engineering students.

More than 3,500 students are to benefit from the £350million scheme, which was announced by David Willetts, Minister for Universities and Science, last week.

The 70 new Centres for Doctoral Training (CDTs) will be spread across 24 UK universities. The aim is to support innovation in areas including advanced composites, autonomous and robotic systems, advanced materials (including graphene), turbine aerodynamics, additive manufacturing and 3D printing.

Sir James Dyson, whose firm is involved in seven CDTs, said: "To compete internationally, Britain needs to export world beating inventions which are the result of intellectual property developed by our companies and universities. We must support British engineers and scientists at all levels, rewarding them properly for their work...This investment is heartening, but genuine research and development takes time."

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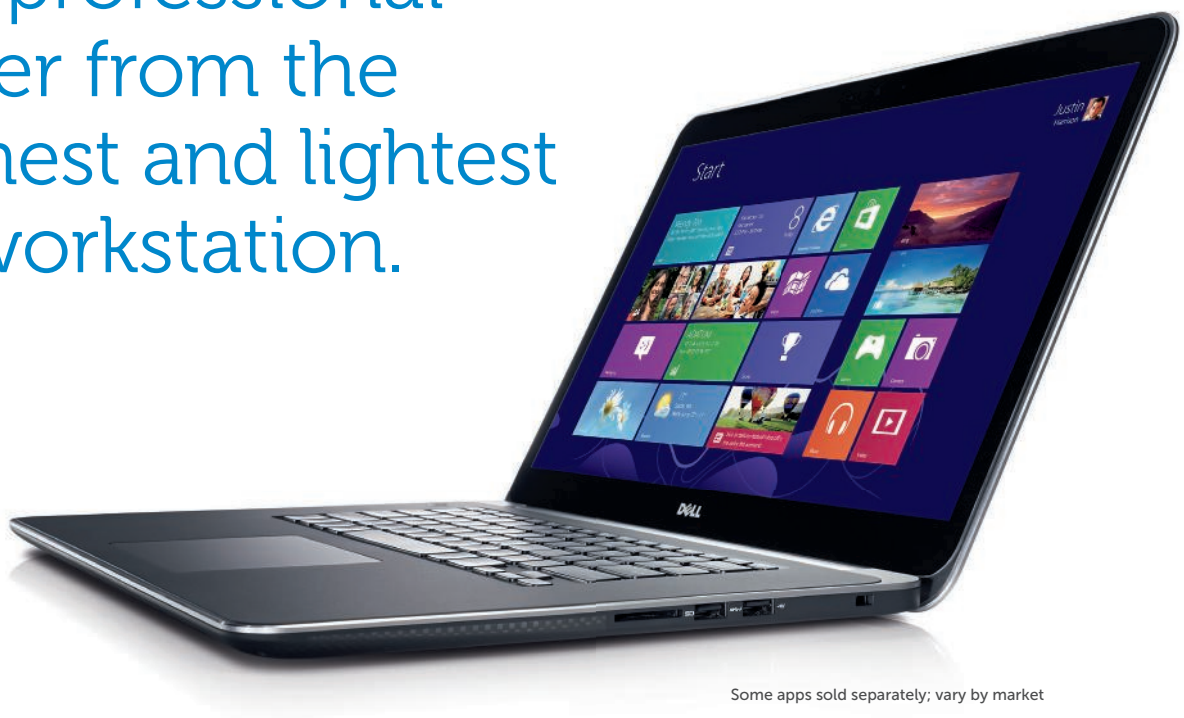
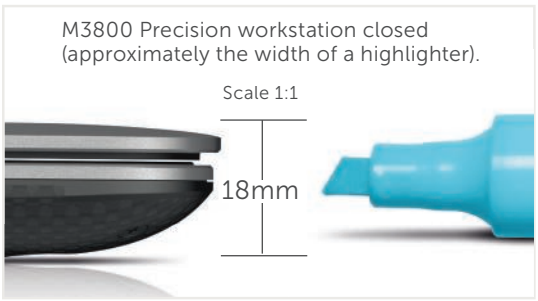


Some apps sold separately; vary by market



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Plastic hinge features quick fit facility

The innovative new 1056 180° hinge design from EMKA packages a number of features of value to specialist enclosure and cabinet builders where it offers rapid fixing, together with high performance and low cost. This new 1056 programme hinge is highly suited to simple box and lid installations where substantial quantity production is envisaged at low component cost.

The novel clip-together design is executed in robust and corrosion-resistant polyamide, complete with plastic push rivet fixings. Since two identical hinge parts are used, they may be clipped together and installed on site using either the expanding pin system or conventional countersunk M5 screws.

Both options provide high load capacity of 430N at 1mm deformation. This is comfortably compatible with similar zinc die hinges while cost of purchase and installation show significant savings. The 1056 is 40mm x 40mm and suitable for left hand or right hand fitting.

www.emka.co.uk

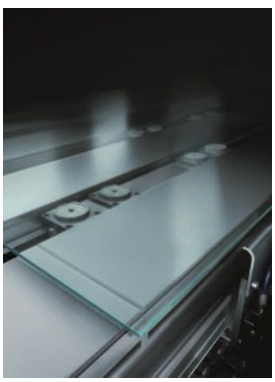
Festo launches air cushion plates for reliable transport

Festo has launched its new ATBT air cushion plates, which are the first choice for fast and gentle transporting of flat panel displays and photovoltaic substrates, as well as cell packs for electro-mobility. They make contactless handling of substrates easy, regardless of their size and weight.

The ATBT air cushion plates generate a thin air cushion on the fine surface, which enables the glass panels and delicate films used in the solar and electronics industries to glide evenly. The air cushion plate uses an air-permeable material with a microporous texture. This ensures an even, constant air flow with low compressed air consumption and allows thin-film modules, coated on both sides, to travel through the manufacturing process on an air cushion without contact.

Electric drives control the modules during the process, while suction cups made of special material don't leave any residue behind on the thin-film cells. A diagnostic module measures the exact distance between the glass and the air cushion plate and uses this to control the air consumption in an energy-efficient manner.

Whether for loading and unloading, intermediate buffers, lifting and centring, holding and clamping items using a vacuum or for use in inspection and test devices, precise X-Y-movement systems or photolithography devices – air cushion plates are the transport system of choice.



For the easiest selection of ATBT air cushion plates, Festo has created an engineering software tool. It allows the design engineer to enter the design parameters and therefore select the correct air cushion plate for their application.

www.festo.co.uk

Sensorless operation of BLDC Motors

As an addition to the ESCON servo controller family, maxon motor now offers a miniaturised OEM plug-in module for sensorless BLDC applications. The compact, powerful four-quadrant PWM servo motor controller offers efficient control of permanent magnet activated sensorless BLDC motors (brushless DC motors, so-called EC motors) without Hall sensors up to approximately 200 Watts. As part of the ESCON family it stands for high usability, exceptional performance, and unprecedented power density in servo motor controller technology. Sensorless operation offers the best conditions for a high reliability at low system costs.

The innovative OEM plug-in module features excellent control properties. The drift-free yet extremely dynamic speed behaviour enables speeds up to 120,000rpm and provides extensive functionality with free configurable digital and analogue inputs/outputs. It perfectly matches maxon's motor range to suit even highest-demand applications and dynamic drive solutions and can be operated in speed controller (closed loop) and speed controller (open loop).

All these features create ideal conditions for the use in cost-sensitive applications as well as elevated reliability requirements. The decisive factor is the low system complexity due to sensorless operation. Thereby, it fully integrates into complex applications with little effort. This has a distinctive benefit: Customers can fully focus on their main task; the development of their own device. For the motor control part they can make use of maxon motor's vast drive know-how already built into the ESCON Module.

www.maxonmotor.co.uk

Captive panel screws install permanently

PEM Type PFC4 self-clinching captive panel screws introduce fastener solutions engineered to install permanently and reliably into stainless steel assemblies. They can be specified for use in stainless sheets as thin as .060" /1.53mm with hardness up to HRB 88 on the Rockwell "B" scale. Their integrated captive screw in a spring-loaded assembly reduces loose hardware and minimises parts count; fully recessed heads in fastened position allow tool-only access; and the fasteners comply with UL 60950 access standards.

Designers additionally can specify MAThread anti cross-thread technology as a safeguard to correct potential off-angle thread mating and promote proper alignment during installation. The fasteners are manufactured from 400 Series stainless steel offering corrosion resistance comparable to zinc plated steel. They are available in assorted screw lengths and in thread sizes #4-40 through #10-32 and M3 through M5.

Installation (using a Pemserter or other standard press) is accomplished by inserting the fastener into a properly-sized punched or drilled hole, placing the fastener into the hole of the anvil, and positioning the mounting hole over the fastener's shank.

www.pemnet.com

Sample box of bearings

Plastic specialist igus UK has launched the dry-tech box, a new ingenious sample box designed to help the end-user quickly find the right bearing for the right application. A set of state-of-the-art card overlays is included, which filters each material according to different criteria – similar to the igus online configurator.

The dry-tech sample box includes a complete array of iglidur bearings, ranging from the iglidur H series, which is ideal for applications in corrosive environments, to the blue coloured iglidur A350 bearings, which can withstand temperatures of up to 180°C and are thus great for the food industry.

The box also contains a user-friendly bearing guide that highlights the key properties of each bearing, making the search for the perfect bearing even simpler. In addition, thanks to its card overlay search method, this sample box makes it extremely easy and quick to find the ideal bearing.

www.igus.co.uk

Solution to last month's Coffee Time Challenge

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The solution to November's Coffee Time Challenge of how to chill drinks quickly comes from Florida-based start-up Spin Chill, which claims to have a solution to this vexing problem with a portable device that turns beverages ice cold in 60 seconds.

Invented by Ty Parker and Trevor Abbott, the basic principles of Spin Chill have been known since access to ice became common. If you spin a can in a tub of ice, it cools faster, because in spinning the can you cause convection in the can, while at the same time considerably increasing the surface area of the can that is actually touching ice.

The prototype was adapted from a power drill, a baby's bottle, and a great deal of duct tape, taking second place at the competition. Later refinements included using 3D printing to print the attachment known as the Chill Bit, which connects the power drill to a beverage container. The latest version of the Chill Bit will spin both cans and bottles.

As very few of us carry power drills around to parties (the inventors are mechanical engineers), the next logical step was to develop a self-contained unit for spin chilling. The resulting Beeroulette is waterproof, and can spin a can or bottle to near freezing in less than a minute without requiring any attention while operating.

Doesn't all this spinning cause carbonated drinks to foam over when opened? Actually, you get less foam. When the can or bottle is spinning, the tiny bubbles in the carbonated liquid rise to the top of the spinning liquid, which is on the rotation axis, where they coalesce into a single large bubble. When the spinning stops, that large bubble is at the top of the can or bottle, where it can escape without fanfare when the container is opened.

Spin Chill is currently raising funds on Kickstarter to bring the idea to market.

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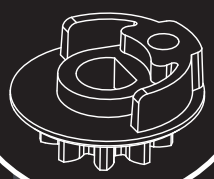

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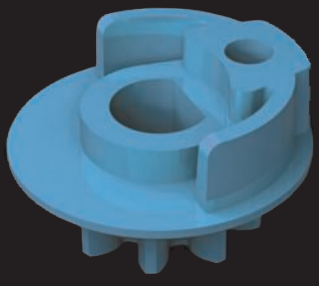

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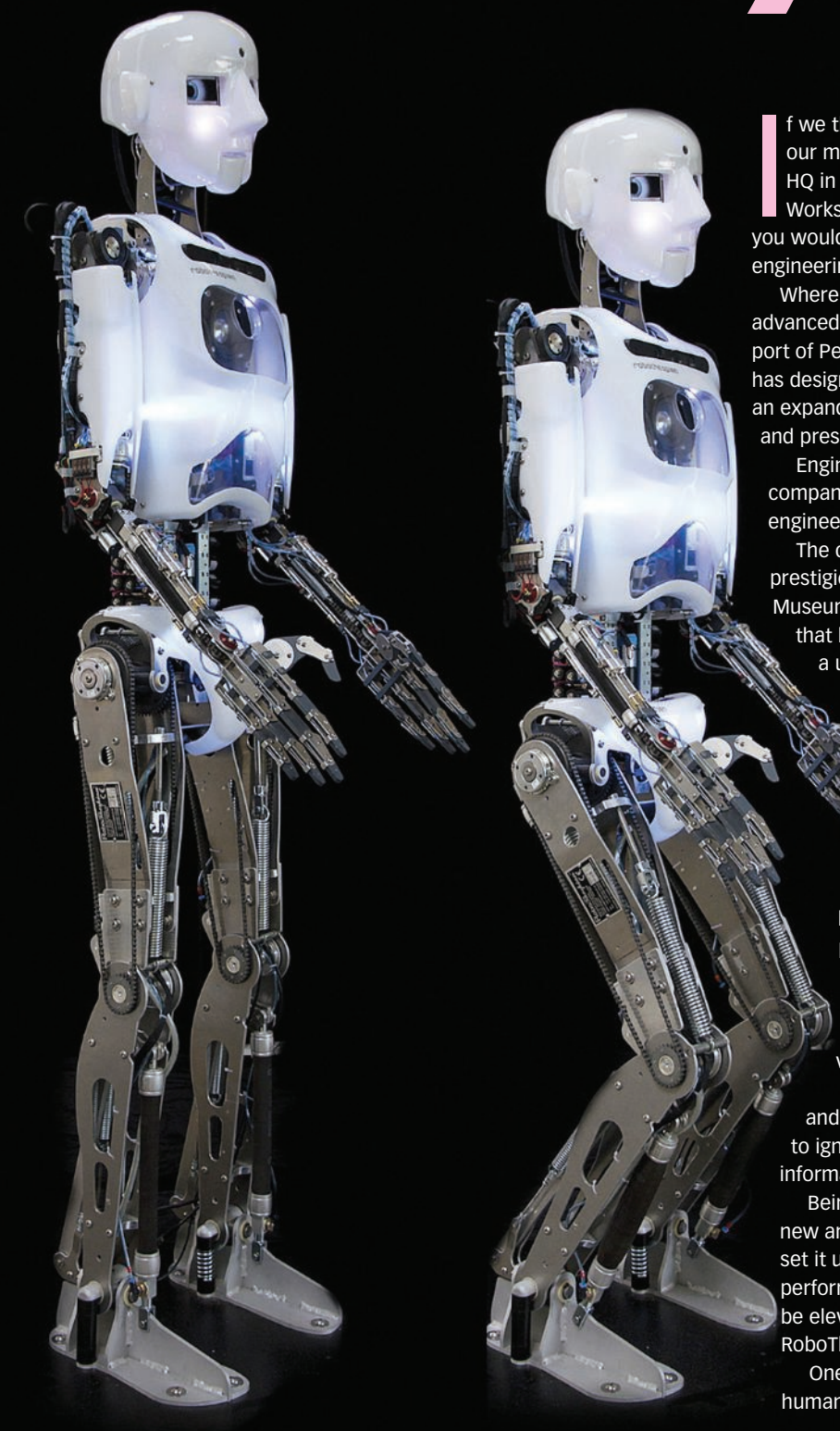


If we think about leading-edge robotics research and development, our minds probably wander to such exotic locations as Honda's HQ in Minato, Japan or Lockheed Martin's world-famous 'Skunk Works'. Even if one were to think about robotics in this country, you would probably put the location either in one of the UK's leading engineering universities or at a defence company.

Where one might be unlikely to locate one of this country's most advanced and successful robotics companies is the ancient Cornish port of Penrhyn. But it is here that a company called Engineered Arts has designed, developed and built a series of robots that are finding an expanding market across the globe in some of the most advanced and prestigious locations.

Engineered Arts sprang up in 2004, the brainchild of the company's founder Will Jackson,who wanted to combine art and engineering to extraordinary effect,

The company started by creating interactive displays for prestigious clients such as Royal Botanic Gardens Kew, Science Museum and Cornwall's Eden Project. And it was this last display that led to Jackson deciding to focus his business on developing a unique product, RoboThespian, a robot actor.

Marcus Hold, Engineered Arts' design and production engineer takes up the story. "We produced three simple robots for the opening of The Eden Project to tell the story of GM crops. People were fascinated with these robots – even though they just had simple wooden faces with clattery wooden jaws- but they triggered something in Will's mind."

What they triggered became RoboThespian, a life-sized humanoid robot designed for human interaction in public places. Today, there are more than 40 of these robots installed around the world in 16 countries. They have been adopted by science museums and visitor attractions such as NASA's Kennedy Space Center, where RoboThespian talks to visitors about the James Webb Space Telescope.

Says Hold: "Traditionally, such exhibits have used notices and posters. However, you can ignore a poster, but it's very hard to ignore a 6ft robot that watches you as you go past and delivers information in an engaging way."

Being fully interactive, multilingual and user-friendly, it offers a new and memorable way to communicate and entertain. Users can set it up for inspirational educational, business or theatrical performances simply by writing their own scripts; these can then be elevated to truly spectacular shows with multiple RoboThespians working together.

One of the singular things about RoboThespian is the smooth, human-like movements and gestures it is able to achieve. It has 30

human

A Cornwall-based company is designing and manufacturing highly lifelike, humanoid robots. Here Paul Fanning finds out more.

axes, powered with a mixture of pneumatic and servo actuators. Its articulated hands each has four independent fingers powered by eight miniature air cylinders.

According to Hold: "We've combined air muscles for human-like movement with servos for accurate rotation, plus high-resolution cameras and sensors that allow the robot to make sense of the world." These air muscles from Festo are used in combination with electric motors, with low-geared, fluid tuning for natural, expressive limb and body movements. The combination of parallel implementations of pneumatic-electric actuators allows for a broader, faster, more precise and more natural-seeming range of movement than that possible with either actuator variety acting alone. Specialised muscle-mimicking material and custom valve design gives an unprecedented degree of control over the non-linear force-driven elements of the robotic system.

This pneumatic fluidic muscle actuation system is capable of generating high tensile forces with a stick-slip-free movement pattern, enabling both slow and fast movements to be executed with equal adroitness. The non-linear nature of the actuation curves provides a highly natural-looking motion. When combined with antagonistic muscle pairings and high-level control algorithms, a sophisticated biomimetic robotic system can be readily achieved.

Since the pneumatic actuators are very low impedance, they can be easily back driven. In addition to the safety aspect, this has the advantage that the robot is able to 'relax', which is not easy to achieve with electrically-actuated robots. In this relaxed state the robot can be guided and manipulated with little to no resistance.

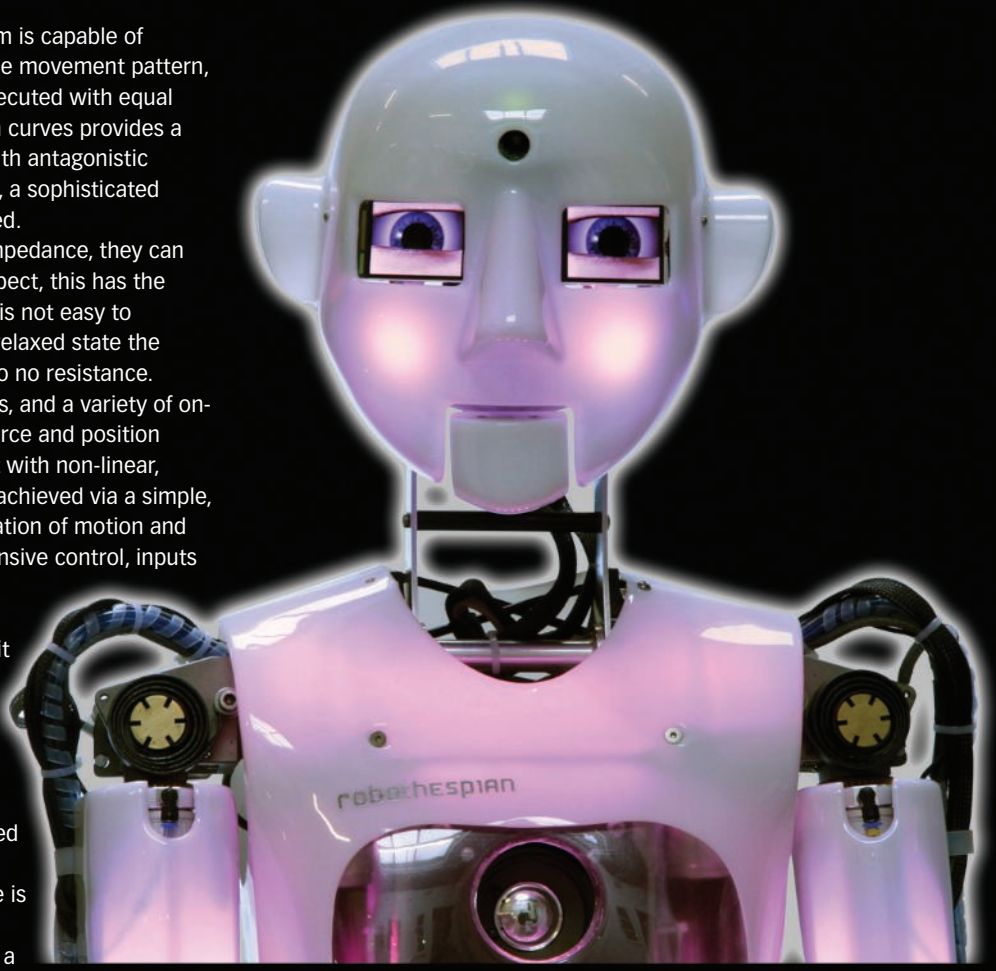
Thanks to parallel pneumatic-electric actuators, and a variety of on-board sensors, RoboThespian offers multi-level force and position feedback and control. This also endows the robot with non-linear, biologically realistic motion. High-level control is achieved via a simple, easy-to-understand GUI which allows quick formation of motion and speech routines. For lower-level, more comprehensive control, inputs and outputs can be accessed and modified via a Python based UI.

Another key point about RoboThespian is that it uses as little energy as possible. Indeed, as Hold puts it: "We've done everything we could in the design to retain energy." For instance, the robot is able to move to a squatting position, which uses a lot of mechanical linkages to maintain an upright position as it squats down without the need to drive servos and thus waste energy.

Another major factor in reducing energy usage is weight and here the fact that the robot uses igus iglidur plastic bearings on each of its axes makes a big difference. The robot employs 85 such bearings from top to toe, as well as using lightweight, aerospace-grade aluminium.

But the real draw of RoboThespian lies in its interactivity. The robot can do remarkable things in this regard, such as recognise when people are in front of him. Says Hold: "He can recognise what pose your body is in and can pick up on waves. He can even tell what your approximate age and gender and can even pick up if you're happy or sad, angry or surprised."

In order to be interactive, the robot obviously needs to talk and RoboThespian currently has more than 40 synthetic text-to-speech voices. The other key thing is that it needs to be able to express itself emotionally. The robot has LCD screens for eyes that allow a range of expressions. These screens also include eyebrows that are large enough to allow your brain to interpret emotions such as anger and



surprise from them. To aid in this process, RoboThespian also has a range of pre-programmed expressive gestures.

The robot also includes sophisticated movement tracking and gesture recognition features that allow it to track multiple people with its gaze; recognise gestures, such as a wave to say hello; or copy a body pose with his arms.

The system's voice interaction features also offer a huge amount. For instance, the RoboThespian can have keywords defined to trigger set responses; or it can get answers from the internet. It is also possible for RoboThespian to listen and try to repeat what you say; meaning visitors can try to catch him out with tongue twisters and rhymes. or tell a story.

Looking forward, of course, there are a number of features that Engineered Arts is seeking to add to the next iteration of RoboThespian. Hold lists some of the areas on which the company is working, saying: "We want him to have more ability to express himself and more interactivity. For the next generation, though, we're looking at a new arm design with a grasping hand that's able to grab and manipulate objects accurately with pneumatic digit actuation for improved grip – the current fingers are just either closed or open. A bi-articulated upper arm design will also allow the hand to move in a constant vector between hand and shoulder, which should allow robot to throw and catch objects."

The big question, however, is when RoboThespian is going to walk? According to Will Jackson: "People have been asking us for a long time when we would make RoboThespian walk. From a cold, rational point of view, there seem to be very few commercial reasons to develop a full sized bipedal robot... But the question doesn't go away: 'Can it walk? Can it walk?'

"Who wants to see a walking robot? – I realised that most people would love to see it. And they can, in perfect safety - at a show or public event. But just walking is not enough. It must run, jump hop and leap. "

For this reason, Engineered Arts is working on a separate, walking robot named Byrun, which is currently 18 months into three-year project and on the third iteration of prototype. Says Hold: "So how will we get our robot walking? Well the first thing is dynamic stability, which is throwing up a number of design challenges, but by using a biomimetic design, we are hoping to achieve a natural gait, more fluid, human-like movement and using force control is allowing us to make elegant compensation for uneven terrain."

Dynamic balance is vital to a human-like robot. Most walking robots that currently exist are statically balanced and their centre of gravity remains over their feet. This means that, if you were to turn off the motors part way through a walking movement, they would remain upright.

However, humans move much more dynamically and are essentially falling from one foot to the other, swinging our legs like a pendulum. Byrun is going to incorporate that into its design to generate a walking, running, jumping, hopping robot.

Byrun will also use custom-built BLDC motors for a greater power to weight ratio, with bi-articulate links between the hip and lower leg. Something you've seen on this robot. The torso maintains an upright position without using any energy.

A series of parallel pneumatic actuators act like tubular springs that can be used to vary the walking gait of the walking robot, while a series of actuators in the lower leg give force control and there are further springs at the back of the leg to maintain angular relationships without sacrificing independent axis control

Says Will Jackson: "Achieving these goals is a daunting task. It requires not just engineering expertise, but radical and novel approaches to the problems of dynamic balance, actuation efficiency, and locomotion. We are creating not just an exciting piece of hardware, but one that will make a great development platform for others to build on. When Byrun takes his next step, so shall we."

www.robothespian.co.uk
www.festo.co.uk
www.igus.co.uk

Adam Hartles
Elite Applications Engineer

"Massive respect to Adam, not only for his knowledge of the software but his patience as well."

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The 'How to Do' man

Human-centred design can be a massive factor in successful product development. Paul Fanning finds out how.

"Doing things outside our comfort zones is the only way we actually grow," says Sergio Malorni. "At the beginning it's painful, but it does pay dividends. " A glance at Malorni's professional history would certainly seem to confirm that this is a philosophy that he practises as well as preaches.

Now principal of medical engineering with leading design consultancy PDD, Malorni began his working life in the aerospace industry and, since venturing into consultancy, has worked in industries as diverse as medical, scientific, industrial, aerospace, and consumer goods. Indeed, his previous clients include Bloomberg, Knoll, Colormatrix, and NASA, with several projects resulting in patents and winning internationally-recognised design awards.

So it is hardly to be wondered at, then, that Malorni should advocate an approach to design that takes engineers out of their comfort zone. Specifically, he is positively evangelistic on the subject of human-centred or people-centred design.

As he puts it "design is ultimately about people" and so to try and design without understanding the human factors is fraught with problems. He says: "You start with a 'discover' or 'what to do' phase when developing a product. However, where a lot of people go wrong is in having the 'what to do' phase without engineers and then the marketing person decides on the solution and lobs it over to the engineers or 'how to do' people."

"One of the biggest disadvantages of separating the 'how to do' people from the 'what to do' phase is that the engineers can end up not having enough empathy for the user a lot of the time."

This, he argues, presents a number of problems. "One of the disadvantages of separating the 'how to do' people from the 'what to do' phase," he says, "is that the engineers can end up not having enough empathy for the user a lot of the time. That's why we insist that our engineers are part of that integrated solution and are involved at the phase of defining the problem and, rather than being prescriptive, are what we call 'solution-agnostic'."

He continues: "Human-centred design prevents the possibility of the tail wagging the dog. It's too easy for a technology-based company to concentrate on how technically complex and innovative a solution is and forget about the end user. You can have technology-inspired innovation rather than just insight-based innovation."

This, he acknowledges, is a particular problem as engineers can be prone to see products as technological problems rather than as things that have to be used by individuals. He says: "In the past, I would review an engineer's work and the engineer would say 'This is easy, you just do this and this and that'. I would have to say 'no' and point out that they were not taking people's differences into account."

These differences are often unexpected, claims Malorni, and are not related to the education, training or profession of the end user. "In the medical field, for instance, doctors – who we take as being at a particularly high cognitive level, still have different sorts of A, B and C personality types and will therefore react differently to a product."

There are a range of additional advantages to this approach, according to Malorni. He says: "To have that way of working – whereby you not only have an engineer involved in the CAD and stress analysis, but also in getting out there and understanding the users of the product makes the job much more fun!"

The forms this involvement take are many and varied, says Malorni. "We've had people in an observatory role in – for instance – operating theatres watching surgery, interviewing; or even participatory activities where they had to wear a particular prototype for a week to understand the issues and problems associated with it."

Another advantage, he claims, is that having people with technical knowledge involved early can make for greater inspiration. He says: "Not only is it fun and engaging. It tames the technology and really ensures it's fit for purpose. The great thing about bringing the how to do people into the what to do stage is that it's not just about solving problems because where you have an engineer who is well-networked with technology, they can actually offer opportunities to add value – you want to introduce those people into the process as early as possible. "

www.pdd.co.uk

Going with the *flow*

Flowmeters come in all shapes and sizes and are used widely. Here, Paul Fanning looks at some of the latest technologies.

Flowmeters measure the amount of liquid, gas or vapour that passes through them. However, there all attempts to generalise about this technology end. There are many types of flowmeter, each with its own specific applications and installation constraints.

Some flowmeters measure flow as the amount of fluid passing through the flowmeter during a time period (such as 100 litres per minute). Others measure the total amount of fluid that has passed through the flowmeter (such as 100 litres).

Flowmeters consist of a primary device, transducer and transmitter. The transducer senses the fluid that passes through the primary device. The transmitter produces a usable flow signal from the raw transducer signal. These components are often combined, so the actual flowmeter may be one or more physical devices.

However, innovation is a constant in this market. One example of this is Siemens' Sitrans FC410, Siemens presents the lightest and most compact Coriolis flowmeter currently available, featuring a measuring accuracy of 0.1%.

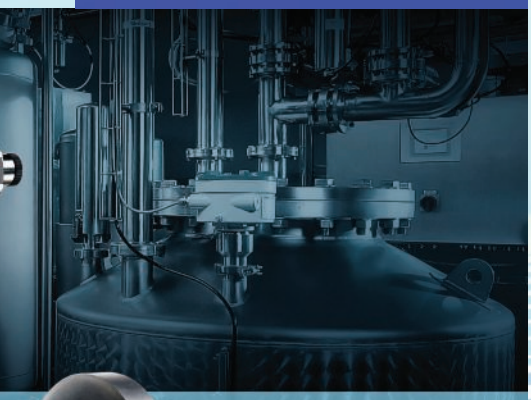
Coriolis meters make direct mass flow measurements based upon the Coriolis effect: the deflection of moving objects when they are viewed in a rotating reference frame. Coriolis flow meters artificially introduce a Coriolis acceleration into the flowing stream. As the fluid is "deflected", the forces generated cause an extremely slight distortion or 'twisting action' of the measuring tube that is directly proportional to the mass flow rate. This distortion is picked up by special sensors and converted to an output signal.

With dimensions of 265mm x 280mm x 90mm and a weight of 4.6kg in the smallest version (DN 15), the meter is ideal for machine and plant construction or for frame-mounted equipment. The combination of compact design, high accuracy, IP67 degree of protection and a wide variety of functions orients Sitrans FC410 toward use in almost any facility, even where space is very limited.

The combination of compact design, high accuracy, IP67 degree of protection and a wide variety of functions orients Sitrans FC410 toward use in almost any facility, even where space is very limited.

With the new Mini Flow Link (MFL) concept, Siemens has succeeded in accommodating transmitter functionalities in the sensor. The digitally based MFL permits a much more compact design without additional assembly work. Sitrans FC410 is therefore flexible enough for installation in confined spaces without any compromise in measuring accuracy or reliability. The digital MFL features a very fast signal update of 10 milliseconds and provides not only flow rate data but also the mass, volume, density, and temperature of the medium.

The innovative CompactCurve design of the sensor developed by Siemens ensures a high level of reliability due to its stable zero point, low-pressure loss, and high immunity to process noise and plant vibrations. Sitrans FC410 is therefore especially suitable for use in challenging applications where accuracy and reliability in measurements of density and mass are required.



Below left: Titan's innovative, robust insertion turbine flowmeter
Left: The Siemens Sitrans FC410
Above: Morgan's gas flowmeters
Above right: The low-cost, high-accuracy Atrato flowmeter

The flowmeter also works at pressure levels of up to 100 bar and temperatures of -50 to +200° Celsius without any loss of measuring accuracy. Sitrans FC410 is certified for use in the pharmaceutical as well as food and beverage industries.

Turbine or paddlewheel flowmeters are mechanical meters that have a freely rotating turbine set in the path of a fluid stream. The flowing liquid or gas causes the turbine to spin upon its axis. The rate of spin will be proportional to the velocity of the flow.

Insertion flowmeters measure the point velocity of the liquid in a pipe. Due to the relatively small disturbance the insertion turbine metering head introduces to a pipe, pressure losses for this type of flowmeter are very low thereby producing energy savings by reducing pumping costs. Typical applications for insertion turbine flowmeters include water distribution mains, fire hydrant monitoring, boiler feed measurement, irrigation systems, district heating and HVAC systems.

Titan's innovative, robust insertion turbine combines proven technology with modern materials and innovative design. The PVDF turbine rotates freely on a 316 stainless steel shaft and has special aerofoil shaped blades to extend the dynamic range of the meter. The specially contoured housing further improves the meter linearity particularly at lower fluid velocities. Installation from the side of the flow line is made via a 1.5" BSP or NPT fitting, and versions are available for 'hot-tap' insertion into pressurised lines. Each insertion turbine meter contains two sensors, one self-powered (for battery operated equipment) and the other an open collector transistor.

Ultrasonic flowmeters, on the other hand, use sound waves to measure the velocity of a fluid from which the volumetric flow rate can be calculated. Unlike most flowmeters, ultrasonic meters do not include any moving parts and thus are more reliable, accurate and provide maintenance-free operation. Since ultrasonic signals can also penetrate solid materials, the transducers can be mounted onto the outside of the pipe offering completely non-invasive measurement eliminating chemical compatibility issues, pressure restrictions, and pressure loss.

The Atrato from Titan Enterprises is a true inline non-invasive flowmeter without the contorted flow path and disadvantages of alternative ultrasonic designs. It can handle flows from laminar to turbulent and is therefore largely immune from viscosity. It also offers excellent turndown, linearity and repeatability. Atrato flowmeters use patented 'time-of-flight' ultrasonic technology that enables them to operate over very wide flow ranges (250:1) with accuracy better than ±1.5% over the whole span.

Constructed from Victrex PEEK polymer, the low cost, high accuracy Atrato ultrasonic flowmeter offers accurate and cost effective flow measurement is increasingly important to industries requiring a high degree of cleanliness including pharmaceuticals, industrial engineering and food and beverages. The Atrato flow meter leverages Titan's patented ultrasonic flow meter technology enabling the direct-through meter to handle flows from laminar to turbulent. The device deploys the 'time of flight' measurement system where a signal is passed along the pipe with the flow and back up the pipe against the flow, the difference in these signals produces the flow rate.

In developing the Atrato, Titan Enterprises selected a high-performance polymer that would enable the thread forms which attach the flow meter to the flow pipes to be moulded. This was not possible to achieve using traditional metal thread forms. The polymer also needed to be chemically resistant and have the capability to operate at high temperature up to 110ºC (230ºF). Due to its intended use in beverage dispensing applications the material needed to be FDA compliant. Additionally, low moisture absorption was a prerequisite for medical and pharmaceutical applications.

Gas flow can also be measured in this way and Morgan Advanced Materials offers a range of ultrasonic sensors developed for gas flow measurement. This technology utilises two or three transducers for smart metering of natural gas or air-coupled level sensing of liquids and solids. Capable of operating in temperatures between -20°C and 70°C in air, and -10°C and 40°C in natural gas, the transducers deliver an assured solution for assessing gas flow measurement.

www.flowmeters.co.uk
www.siemens.co.uk
www.morganadvancedmaterials.com

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VIEW FROM THE TOP

"The biggest turnarounds come when companies see the weaknesses in their existing system and processes"

Ken Christie,
UK Director, EPLAN UK

In this year's View From The Top, Eureka talks to some of the leading lights of the engineering and manufacturing sectors with a view to taking the pulse of the industry as a whole.

At your service

The role of a software reseller may seem obvious, but, according to Phil Read, managing director at Man & Machine, this is far from the truth. The idea that it is simply a case of selling someone else's products is one that the Oxfordshire-based reseller has always sought to disprove.

Man and Machine specialises in the supply of CAD solutions to manufacturers, engineers, architects, and product designers. Established in 1989, Man and Machine is part of a pan-European group, operating in nine countries, with over 750 staff (150 or whom are engineers).

As one of only four UK Platinum Partners for Autodesk – and the largest such company in Europe – Man & Machine is in a prime position to offer its customers solutions to real business problems. Says Read: "Essentially, we are a specialist in the provision of digital design and data management services. We construct technology solutions to help customers solve their business critical challenges."

Read is honest about the nature of the business and what differentiates Man & Machine from its competitors. "We're a services-based organisation," he says. "You have to build your brand reputation on good customer service. I don't really have a differentiator from a technological point of view. After all, there are lots of companies selling Autodesk software for example."

It sounds simple, but Man & Machine clearly has a winning formula. The group turns over €100m (compared to around €25m by its nearest competitor, claims Read). It has over 500,000 installed CAD seats and has acquired 134 brand new customers in the last year in the UK alone. Revenue growth is70% year-on-year, which Read describes as "doing very well in a market that is at best flat".

So what does Man & Machine's commitment to customer service actually mean in practice? What form does it take? Read points to the way in which the company becomes involved with its potential customers to find the right solution.

"What wetend to do is visit the customer, talk through their requirements and come up with a proposed solution that could range from 2-3 days to 2-3 months in deployment, depending on the complexity of the need. We adopt a very disciplined approach which includes a planning and discovery phase, that ensures we have clearly understood the customer need.."

The entire process typically comprises five phases: Planning; Design; Implementation; Operation and Optimisation. This latter stage, says Read, is crucial and ongoing. He says: "There is nothing worse than selling someone a solution, then walking off without giving the customer the means to periodically improve their infrastructure. With any IT solution, if you move on three years from the initial deployment, there is always a need to optimise and improve things. Long term relationships and customer care are a foundational layer in our success."

Finding the correct solution for a customer naturally involves acquiring a strong understanding of their business. According to Read, this involves a lot of customer education. He says: "50-60% of the time customers think they know what they need – and they do to an extent. However, they often don't necessarily understand what solutions are available. What they know is that they've got a business problem that needs to be solved. But it's difficult – if you don't provide these solutions day-in, day-out, you can't know what that optimum solution is or what the latest innovations are. That's where our expertise comes in"

Experience counts for a great deal in these situations and here, believes Read, Man & Machine really scores. He says: "We're able to ask the right questions to allow us to uncover the route of the client's problem and provide the right solution.. So the problem might be that they need to open another shift to meet project timescales or that they can't get the design work done in time for example... We've seen those problems before and are able to respond accordingly with innovative ideas."

How does a software reseller differentiate itself? Service, service and service, as Phil Read of Man & Machine tells Paul Fanning.

Another key factor in Man & Machine's success, claims Read, is training and customer education.

Man and Machine offers a range of Autodesk Accredited 2D and 3D CAD Training courses. The courses range from basic essentials training through to advanced concepts and modelling for designers, as well as courses in data management solutions, such as Autodesk® Vault for engineers and IT professionals.

Says Read: "We have one of the best training academies and facilities in the industry and have just launched the latest Man and Machine Training Academy Brochure which gives some idea of our commitment to this.

"One of the biggest issues our customers will have is that they've bought software they don't make best use of because they haven't invested in training that they need or the training they have received has been inappropriate or badly delivered. We fill that gap. One area in which there is still a need for education is in the value of 3D modelling software over 2D. "There's a broad assumption that this is a saturated market, says Read, "But we have moved a lot of customers from 2D to 3D, maybe 20-30% of our customer base in total.

Products like AutoCAD 2D are still common place in many industries. They are using it because that's what they have always done. Our job is to help them understand the productivity benefits that can be gained from moving to a 3D environment. Speed of design, visualisation and digital prototyping can bring tremendous advantages in customer efficiency and deliver real cost savings."

That said, of course, Read is aware that 3D modelling is not always the right solution, saying: "In some markets – sheet metal work, for instance – you're going to find that 2D is quite common and in all fairness, 2D may be the right solution if what you're doing is fairly simple."

While proud of its status as a Platinum Partner for Autodesk, Read is keen to point out that this is far from being the only string to Man & Machine's bow. A number of our engineers are software developers and in fact 38% of our revenues derive from the development and provision of non-Autodesk software solutions."

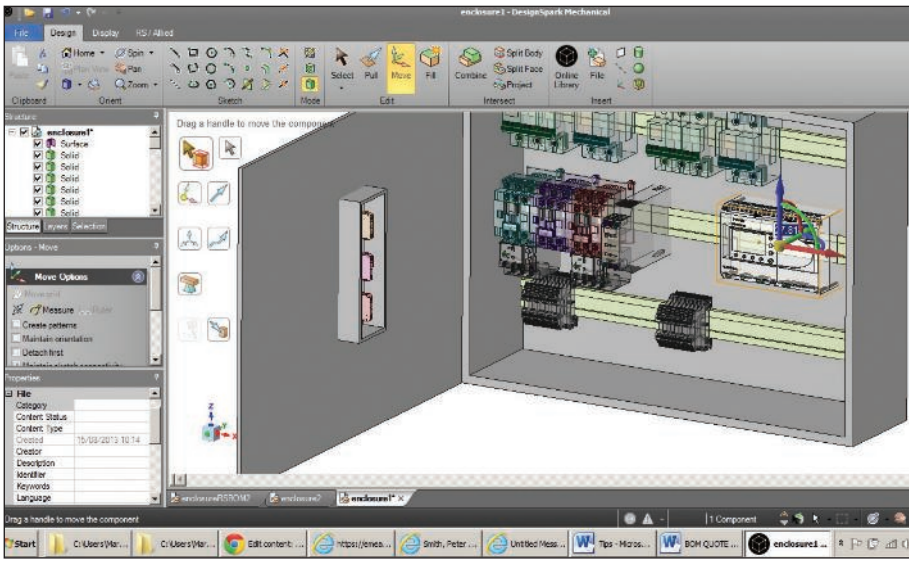
Ultimately, however, everything from Man & Machine comes down to good customer service and, in summing this up, Read says: "The reason you would call Man and Machine is that we're not interested in selling you a product, we're interested in providing a solution to your business problems and giving you the tools to do it at the optimum service level.

"The DNA of our business is providing good customer service. And if that's what customers are looking for, then we're the right company to talk to."

www.manandmachine.co.uk

A new dimension

Once the preserve of only the largest of companies, the ability to create designs in 3D and also quickly build a prototype of that design is fast becoming available to all in a kind of democratisation of design technology. RS Components, a high service distributor of electronics and maintenance products, has recently made two major announcements in this area: new free-to-download 3D modelling software and the availability of the latest low-cost self-replicating RepRapPro 3D printer.



Although the ability to design using 3D solid modelling tools became a reality in 1980s, it has largely been available only to large organisations employing CAD specialists. Traditional 3D software employs what is called feature- or parametric-based methodologies, which essentially has evolved over time as a result of the computing hardware available at the time. Because of the lack of number-crunching performance available, this methodology held the advantage over alternatives as it broke down a design into a list of individual parameter-driven steps or features, which acted as instructions to create the shape of the part and enabled the hardware to create and work with models in something vaguely approaching real time. However, that was then and this is today.

Developed by RS Components in conjunction with SpaceClaim, a leading provider of flexible and affordable 3D modelling software, the free-to-download DesignSpark Mechanical 3D modelling software tool takes full advantage of modern computing power and employs a powerful methodology called direct modelling. Very different from traditional 3D tools, the software uses simple gestures that enable real-time editing and instant feedback, making it possible for engineers and others to create geometry and easily explore ideas and product concepts in 3D. All basic designs can be achieved quickly and easily via the use of four basic tools – Pull, Move, Fill and Combine – in addition to the tool's employment of familiar Windows keyboard shortcuts such as cut/paste, undo/redo, which makes it highly intuitive for new users.

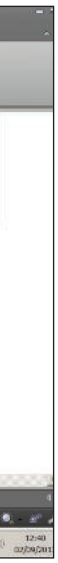
DesignSpark Mechanical therefore overcomes the two major barriers to entry faced by new users that could benefit enormously from the use of 3D modelling to quickly develop sophisticated concepts and products. These impediments are the prohibitive costs and the considerable investment in learning time associated with traditional 3D CAD tools. However, DesignSpark Mechanical is free and its ease of use means that engineers and others involved in product development can become fully conversant with the software within minutes, rather than the weeks or months required to become skilled with traditional 3D software tools.

DesignSpark Mechanical can also be used as a complementary 3D tool in the product development process for the creation of early concept designs, for instance, alongside 3D CAD tools that are already in use today. The tool can remove bottlenecks in the early design process by allowing changes and additions in seconds, rather than having to wait for the CAD department using the traditional 3D tools to rework the design. The tool can also import circuit layout files in IDF format from any PCB design tool, including the award-winning DesignSpark PCB software, which was also developed by RS. In addition, DesignSpark Mechanical enables 3D designs to be exported in STL, the standard file format to enable rapid prototyping builds and computer-aided manufacturing.

All of which bring us to the second element in this democratisation of 3D design: the ability to quickly build a prototype design via the use of 3D printing technology, which is fast becoming available at low cost and can create quick-turn-around prototypes and save months in the design cycle. While the barriers to adoption in the past have been the cost of hardware and a lack of easy-to-use design software for non-CAD specialists, the RepRap open-source self-replicating 3D printer initiative, together with DesignSpark Mechanical, is presenting companies and developers with an opportunity to shorten the product development process and inspire innovation.

The ability to build prototypes rapidly is revolutionising product development – machine skills are not required to deliver prototypes,

Paul Fanning talks to Glenn Jarrett, Global Head of Product Marketing at RS Components about the company's latest moves and innovations.



enabling huge time-to-market benefits as well as delivering a significant increase in design freedom. There has been significant improvement in the product-development process across a wide range of industries and 3D printing is being used to design and test new concepts in companies both large and small as an alternative to employing custom machine tools to make early prototypes of new parts or components. The method allows product developers to have a prototype in a matter of hours or days compared with weeks or months previously. But the process offers more than just saving time and cost; rapid prototyping using 3D printing is producing more innovative and higher quality products. Product developers no longer have to wait for tools or parts to come back from outside machine shops or injection-moulding houses. 3D printers allow the physical testing and further refining and improving of prototypes before committing a product to mass production.

A major dynamic in 3D printing is the movement for open source and 3D printer self-replication. The 'Replicating Rapid Prototyper' project, also known as 'RepRap', was founded in 2004 by Adrian Bowyer, a former Senior Lecturer in Mechanical Engineering at Bath University in the UK, and is an initiative to develop a low-cost 3D printer that can print most of its own components and all of its plastic parts. RepRap specifies that all the remaining components required for the construction of a duplicate machine, such as the electric motor and electronics assemblies and various other components must be relatively cheap and simple to obtain.

RepRapPro, the commercial arm of the RepRap project, has already launched Huxley and Mendel 3D printers, both selling at a cost of a few hundred pounds sterling as a kit of parts, with or without the printed plastic components. The latest RepRapPro design is the Ormerod complete 3D printing kit, which is now available via RS Components and enables design engineers around the world to develop sophisticated concepts and products incredibly quickly and inexpensively. Also suitable for small production runs, the Ormerod is one of the most versatile 3D printers available: it is easy to expand in functionality, fast to replicate and fast to assemble.

The availability of low-cost 3D printing technology with the RepRapPro Ormerod together with the free and intuitive DesignSpark Mechanical, and also an extensive library of 3D component models available from RS, means that 3D design and rapid prototyping is now available to a much wider universe of users and not just CAD specialists.

DesignSpark Mechanical is available for free download from www.designspark.com/mechanical and support for the tool can be found via the DesignSpark community at www.designspark.com. Further information on RepRapPro is available at: www.reprappro.com.

LG Motion

From challenges to solutions

How does a motion control company gain traction in a competitive market? Expertise and trust are the answers Paul Fanning gets from LG Motion.

When asked why his company LG Motion attracts and retains its customers, Gary Livingstone's answer is short and to the point. "We're trusted," he says.

This trust has been built up over the decade of the company's existence and has its foundation in the fact that it and its staff can offer what Livingstone describes as "hundreds of years of experience" in the field of motion control. This expertise has resulted in the company developing a client base that ranges from university projects to blue-chips such as the European Space Agency, Rolls-Royce and BAE Systems.

In fact, such is LG Motion's degree of respect in the market that such illustrious names in the industry as Schneeberger and Heidenhain actually use the company as their system integrator and reseller.

Says Livingstone: "We tend to be strongest on the R&D side of industry, where people don't necessarily know what they want," says Livingstone. "I do sometimes wonder if we get the jobs that nobody else can do," he jokes.

Summarising the type of work LG Motion undertakes, Livingstone says "We make things go up and down, from side to side and whichever directions our clients want." While obviously simplistic, this description does get to the heart of what it is that its customers value about the company – namely its ability to deliver solutions. "In most cases, what we can do is allow them to worry about the bigger picture of the project knowing that we're taking care of the motion control aspect of things.

"A lot of our job is about appreciation and understanding of what our customers want to achieve. A lot of times I sit in meetings with people and the project they're talking about may be way over my head, but I'm able to boil our role in it down to 'you want this bit to go from here to there?' Being able to focus in on that while they deal with the project as a whole is hugely valuable to our customers."

Gary Livingstone

This personal touch is another facet of the company that Livingstone believes gives LG a major advantage. He says: "We compete with a lot of US corporate but, rather than people just ordering from a catalogue and us shipping them a box of bits, we design and manufacture here on site. Also, we're real people you can come and see. In fact, we encourage people to come and see us in our factory in Basingstoke so they can see the sort of things we do."

In this respect, the size and value of the projects LG Motion works on vary as much as does its client base, with work ranging in value from £5,000 to £100,000 and in size from as small as 200mm^2 to 3.2m long and 2.5m^3 in volume. Indeed, says Livingstone, "we currently have two 5-axis systems for non-destructive testing that are 2.5m by 1m by 1m".

LG Motion also invests in its own future, with an apprenticeship programme that involves four on-site apprentices being employed at any given time.

Looking forward, Livingstone is optimistic for the year to come. "We've continued to see growth, but most people see 2014 as the year everything will start clicking again. The big corporate will start releasing more on the R&D side because they have to invest as they're getting no return on money in the bank. Equally, the Government has ring-fenced scientific research spending, so we're optimistic."

www.lg-motion.co.uk

Set the Standards with CAE

Ken Christie, director of EPLAN UK, explains how the latest computer aided engineering (CAE) solutions are being used to offer quality assurance and gain a clear competitive advantage

A modern CAE software package like EPLAN puts integration and automation at the heart of everything it does; providing a variety of end-users with all the core functions required of an electrical design package, and easily-integrated additional tools that can be adapted for industry-specific processes; from fluid and pneumatic engineering to enclosure design.

A subsidiary of Rittal, EPLAN UK is a world-leader in computer aided (CAE) software. For over 25 years, the company has been developing innovative solutions for an array of engineering and industrial manufacturing disciplines.

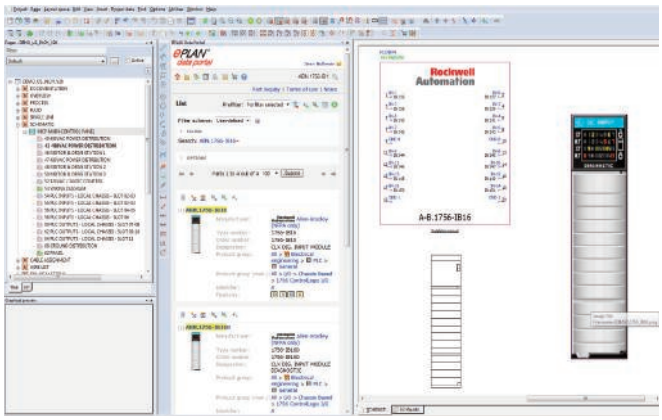
Leaving older systems behind, CAE continues to evolve, reducing the amount of manual data entry and error-checking to be done by engineers at each stage of a project.

Companies are sometimes a little reluctant to change their systems, believing their current methodology works and that the implementation of a new system will hamper them initially. However this is rarely the case, and the biggest turnarounds come when companies see the weaknesses in their existing system and processes and make the decision to upgrade to a CAE infrastructure, as was the case with Bürkert Fluid Control Systems.

When the time came for Bürkert to expand software licenses as part of the companies' effort to remain at the top of their game, the Bürkert took the opportunity to re-evaluate its software and design needs. Consequently, the company invested in EPLAN Electric P8, supported by EPLAN Fluid and EPLAN Data Portal, through realising that EPLAN could help improve design efficiency, productivity and accuracy.

Since adopting EPLAN Electric P8 and the EPLAN Data Portal, the company has been able to reduce project design time significantly and eliminate common editing errors, leading to faster turnaround times. Many tedious tasks, like device wiring and numbering, have also been automated, saving time and improving accuracy.

The EPLAN Data Portal, provides online device data of over 340,000 components that are controlled and managed by 51 manufacturers such as Festo, ABB, B&R and Phoenix contact. As a result, the data portal has delivered another productivity improvement opportunity due to the wealth of information that is immediately available. Order numbers, technical macros for creating schematics, location drawings, function templates and preview screens can be transferred simply and effectively by dragging and dropping from the EPLAN Data Portal into the project. This effectively does away with the time consuming creation of master data. The outcome is faster delivery due to more intelligent planning, more reliable mounting as well as better wiring. Moreover, storing and reusing data opens the way to standardising and modularising product content, accelerating design and manufacturing and enabling large economies of scale in purchasing components.



***Ken Christie** EPLAN UK*

In order to support customers EPLAN also offers a first class complete computer aided engineering package from consultancy through installation, training and helpdesk support.

The newest and sophisticated CAE systems allow the manual and most time-consuming electrical engineering design functions to be performed automatically and instantaneously - with organisations subsequently benefiting from an increase in productivity, shorter project turnaround times and improvements in product quality and security. In an increasingly competitive marketplace, can you afford to miss out?

www.eplan.co.uk

TATA Technologies

Intelligent outsourcing

TATA Technologies is helping customers take a fresh approach to outsourcing. Laura Hopperton finds out how.

Faced with increasing commercial pressures, cutbacks and dire skills shortages, the engineering sector is experiencing a period of great change.

Because of this, a number of companies are looking to service providers to bridge the 'capacity to create' gap. However, as Richard Welford, president of TATA Technologies Europe, points out, what often happens is that outsourcing companies resort to on-site staff augmentation to address a shortfall in capacity.

"Even those organisations that have taken the step into offshore sourcing are often only creating a 'distanced-based staff augmentation model'," Welford explains, "and as a result the incremental management effort erodes much of the labour arbitrage cost saving benefit."

At TATA Technologies, the core focus is on intelligent outsourcing, or iSOURCING as the company calls it.

"What we do is deconstruct the traditional approaches to satisfying demand, and re-assemble the component parts of the problem into a model that focuses on the right outcomes, not realisation of a target headcount," says Welford.

TATA Technologies has developed a number of methodologies to help companies understand what they can and cannot outsource. Its methods look at a number of influencing criteria, including geographical dependency, process-to-process dependency, business criticality and the level of experience required to undertake certain tasks.

"We have found that approximately 80% of an engineer's time is actually spent on non-engineering tasks that, while imperative, don't need to be carried out by them," Welford noted. "Engineers are expensive people, so this simply isn't sustainable."

Having made visible the 'candidates' for outsourcing, considering what is also core and non-core to the client's business, TATA Technologies then applies a number of potential outsourcing models to architect an outsourcing strategy, and a roadmap to achieve it.

"We use tried and tested allocation logic to manage the realisation of the required outcomes through a globally distributed model," says Welford, "addressing an outcome through the use of the best resources from around the world, and utilising lower cost resources in a realistic manner that complements the essential local component of the solution."

Typically, TATA Technologies says it can facilitate cost savings of around 40%. Its advantage over other outsourcing companies, according to Welford, is that engineering is at the core of its business, whereas many others have grown from IT roots.

"What we've learnt over the past 25 years is not just how to outsource," he states, "but the process of product development itself. Because we understand this, we feel we can bring value to our clients through proven competence and business advice from a perspective of real world experience."

The iSOURCING service TATA Technologies offers is open to businesses of any size across the company's core industries of automotive, aerospace and industrial machinery.

Its clients include large OEMs like Jaguar Land Rover, as well as well known names in the supply chains of those OEMs, such as Messier-Bugatti-Dowty.

"It's important to note that we're not suggesting our clients are approaching product development incorrectly today," says Welford. "We are merely being pragmatic to the fact that continuous improvement is essential to remaining competitive, and that the traditional approaches to resourcing product development activities are no longer sustainable."

Welford points to the skills shortage currently plaguing industry. "If recent studies are to be believed, manufacturing and product development companies are facing a significant shortage in engineering skills, which could represent a gap as large as 73% by 2020," he states. "Unless organisations challenge their current delivery paradigms, the cost of engineering will go up, while the resource market will be failing to satisfy demand."

Richard Welford *TATA Technologies*

Welford describes this problem as 'unsustainable and on-going', but believes iSOURCING offers a valuable, viable solution.

"Architectured well, an effective outsourcing strategy will address the macro needs, rather than the point solutions, and each components of that strategy will be synergistic with the others," he concludes. "The potential of our iSOURCING approach is as broad as the topic of product development itself, and the results are actually quite staggering."

www.tatatechnologies.co.uk

Growing gains

Fastening supplier TFC's growth over the last few years has been extensive. Here, Paul Fanning talks to the company's MD Morgan Burgoyne about the philosophy that underpins it.

When referring to how the fastening supplier changes companies it has acquired, TFC's managing director Morgan Burgoyne refers to the process of "TFC-ing" them.

And, as he explains, while this process does involve physical change in terms of equipment and decor – as well as , it is as much a change of culture. "Our philosophy is that you have to respect one another throughout the business," he says. "We're not so big that we don't know everyone's names and we've tried to push that culture of respect throughout the business."

And the fact is that, since 2007, quite a few companies and premises have been 'TFC'd', as the company has expanded by acquisition and start-up across the UK. To be precise, as well as its Head Office and Technical Centre in Heathfield, East Sussex, the TFC family of companies now includes TFC Essex Service Centre in Colchester; TFC Midlands in Walsall; TFC Engineering Services in Keighley, West Yorkshire; and TFC Scottish Premier Fasteners in Airdrie.

Says Burgoyne: "When I and [executive chairman] Martin Clarke came into the business in 2007, our vision was to use our skills in logistics and general fastener knowledge to build on the excellent base of technical products we already had. We had the opportunity to combine the technical and general fastener aspects of our business by keeping the technical centre where it was in Heathfield and building businesses around the country."

This process began in 2007 with the start up of the Colchester Technical centre and will continue in January 2014, when the recently-acquired SFP range of products will be housed in the Heathfield Technical Centre. The impetus for it was simply a desire to meet the needs of as many of TFC's existing customers as completely as possible.

Says Burgoyne: "We knew there were a lot of TFC customers out there – 3,000 of them across the UK – and that we could only meet their aspirations on technical products. In order to meet their needs on our more general product range, we had to become local. As a result, we needed strategic places throughout the UK.

"The focus was to look at the UK and make sure that we could establish a very firm foundation and make sure we could deliver to our customers from a technical, product and logistical point of view. There were two ways of doing this: putting together a local start-up as in the Essex example; or acquiring an existing business as in the other examples. "

Howvever, while Burgoyne suggests that, following the establishment of the Scottish office, the company is "pretty much there now" in terms of UK acquisitions, the same is not true of mainland Europe.

Morgan Burgoyne, *TFC*

The company's German office in Bochum has already been upgraded, moving into a new office and warehouse, but Burgoyne is clear that this is only the start, saying: "Germany is the big prize for us and we need to focus to get that growth. Our aspiration for that business is high – want to use that area to go to customers and compete on general fasteners as well as technical products. Our five-year vision is to organically grow business in UK and start working with potential acquisitions or start up service sites in Germany . We want to take it to the next level."

With this in mind, then, it would seem that a few more businesses will be getting "TFC'd" in the coming years.

www.tfc.eu.com

Handling the untouchable

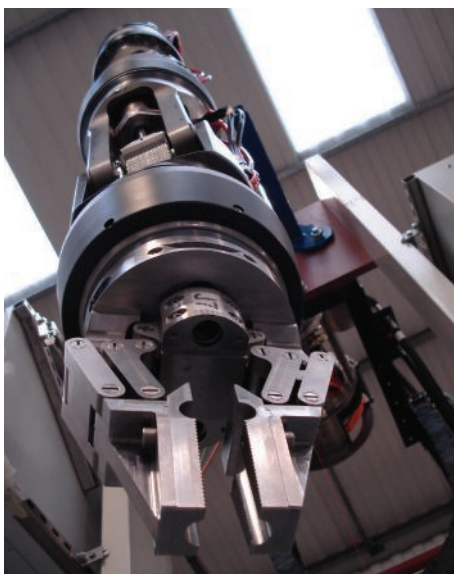
The legacy of UK nuclear power is currently marked by difficult decommissioning. So, just how do you access and remove contaminated parts and high levels of radioactive waste? Justin Cunningham finds out.

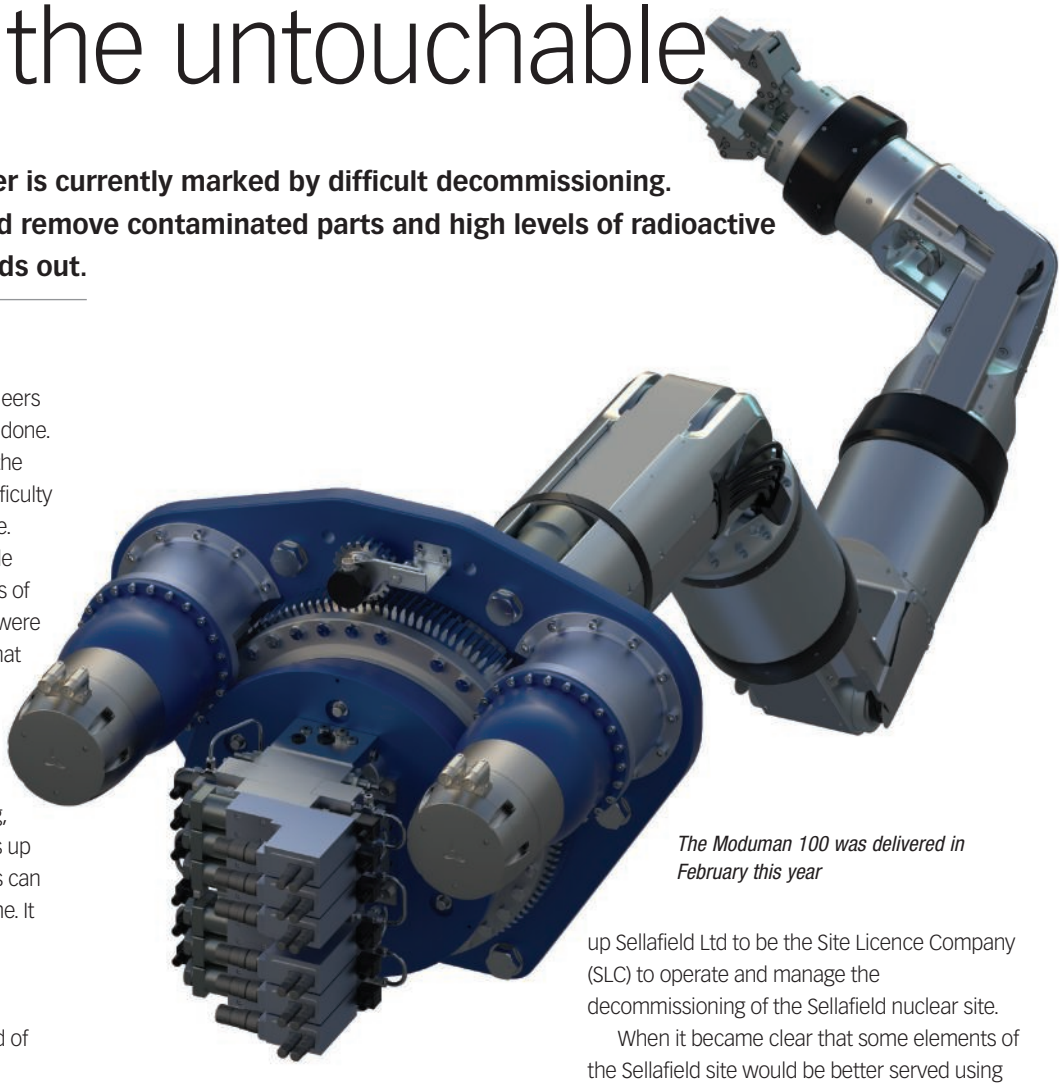
During the 1950s and 1960s, when many nuclear power stations were built, engineers worked with the sole imperative of getting it done. The speed of technology development was the driving force and any thought of potential difficulty when it came to disposal was put to one side.

It should be said this was not irresponsible engineering but was a response to the needs of the time, where thoughts of future clean up were way down the list of priorities. The result is that these once cutting-edge technological marvels are in dire need of disposal, having been exposed to decades of high dose radiation.

To make matters all the more challenging, records and drawings of what exactly makes up the internals of many nuclear power stations can be sketchy, with some detail being lost to time. It means that decommissioning on some sites literally enters the unknown, with engineers unsure of what they might find.

However, decades on from the first round of nuclear builds and decommissioning, re-commissioning and redevelopment work is ramping up. The first new build in more than 20 years was announced last month at Hinkley Point in Somerset, with more sites expected to be announced soon.





The Moduman 100 was delivered in February this year

The impetus for the nuclear sector has of course changed since the 1950s and today engineers work toward the safe removal of contaminated hardware during decommissioning. Here, modern technology is taking a hand by taking human beings out of the loop and thus removing any risk to personnel.

In February, this year, James Fisher Nuclear delivered a manipulator arm (dubbed Moduman 100) to the Sellafield nuclear site. The Energy Act 2004 saw the Government set up the Nuclear Decommissioning Authority (NDA) to deal specifically with the nuclear legacy and manage the decommissioning process. In turn the NDA set up Sellafield Ltd to be the Site Licence Company (SLC) to operate and manage the decommissioning of the Sellafield nuclear site.

When it became clear that some elements of the Sellafield site would be better served using robotics, it chose James Fisher Nuclear (JFN), which specialises in engineering equipment for challenging environments, to design and deliver a remote handling system to assist in the decommissioning process.

"We have a history of developing remote handling solutions for remote inspection, particularly for harsh environments, and with a focus on the nuclear industry," says Dr Carwyn Jones, systems data manager at James Fisher Nuclear. "There is a large amount of waste Sellafield want to process and that is challenging because of the age of the systems there.

"A lot of the decommissioning is low-level radiation, but some of it can be very high. Though 80% could be done using personnel in suits going in with saws and shovels, all it takes is one bit of really nasty stuff and it can be lethal. It is just not worth it. This is why it needs the manipulator, to

deal with that high dose waste."

JFN wanted to design a manipulator arm that it could launch through standard through-wall tubes; a common method used to access areas where there is suspected high levels of radiation. These are usually between 250mm and 270mm in diameter, which set in place an initial restraint for the team in terms of the manipulator's arm diameter.

The difficulty and investment involved in making the Moduman, as well as its flexible operating nature, made JFN take the approach of developing it as a product that could be subsequently applied to other nuclear facilities in both UK and overseas. The flexibility of the system means it can also be mast mounted or attached to a remotely operated vehicle (ROV) for tasks such as future plant maintenance and inspection duties.

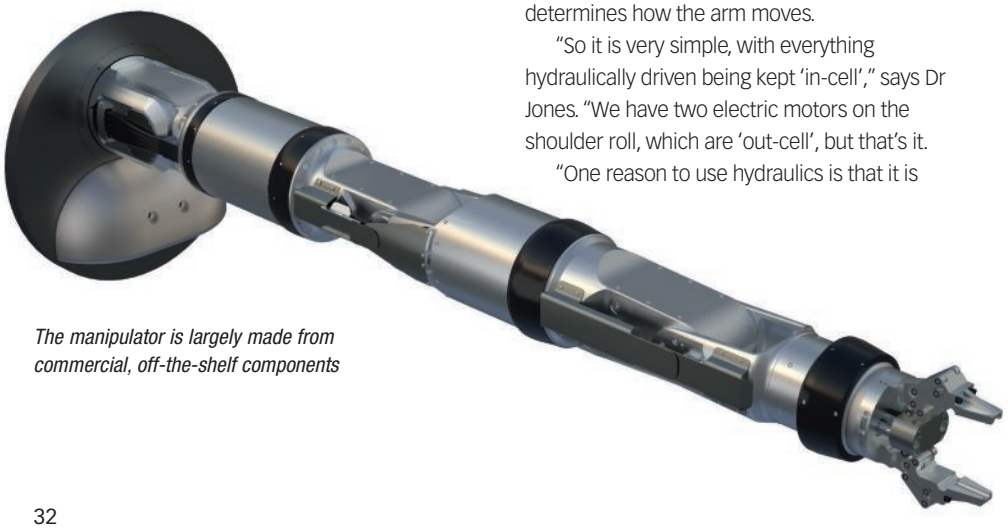
"The 100kg payload of the manipluator arm is for a tool rather than to carry out waste," says Dr Jones. "It has 6-degress of freedom and uses two three-axis joysticks to control them. It is made up of six joints and an end effector and is 2.7m long. The idea is it can go in to very awkward environments that are not just harsh, but humid, hot or acidic."

The manipulator uses a straightforward approach in its hydraulic drive system, which is configured to give maximum reliability as it places vital components outside of its operating cell. The use of hydraulics also offers greater power density, an obvious advantage given the relatively tight envelope the arm has to operate within.

Each arm is driven by two hydraulic rams connected to a chain and sprocket that act in antagonistic pairs (like muscles in the human arm), with the chain always under tension. Varying the pressure, and resulting tension, on each side determines how the arm moves.

"So it is very simple, with everything hydraulically driven being kept 'in-cell'," says Dr Jones. "We have two electric motors on the shoulder roll, which are 'out-cell', but that's it.

"One reason to use hydraulics is that it is simple and provides a high force, but it is different to a standard hydraulic system. The fluid itself is water soluble so it can be decommissioned much more easily than mineral oil, which is a very difficult to decommission using the general method of dilution, for obvious reasons."



The manipulator is largely made from commercial, off-the-shelf components

The manipulator is also largely made from commercial, off-the-shelf components, including the hydraulic rams, the rotary joints that use standard HKS actuators, and the tool rotator which is driven by a Geroler motor.

Critical to the project was the motion control of the manipulator. Given the nature of its operational environment, the team had to ensure repeatable motion of +/- 5mm accuracy at the end effector. To enable the motion control it used the LabVIEW Robotics platform module from National Instruments to configure the motion of the manipulator.

"We were able to programme in the resolve motion, which means you drive and control the end effector, not the individual arms," says Dr Jones. "So when you move your hand, you concentrate on your hand, but there are multiple muscles and joints enabling you to do that. And this is what we configured the manipulator to do."

"LabVIEW is a deterministic system which is really important for our safety critical operation. And you can easily simulate the motion beforehand, which is obviously always good to make sure it works and to train operators."

The intuitive control system uses a Windows-based touch screen and twin joysticks that can be desk mounted or the system can incorporate a portable rig linked to the arm via an umbilical cable. The manipulator can be operated in full joint control, world or tool modes if required, but resolve tip motion has been programmed and fitted as standard. Collision avoidance is another feature that proves handy given the environment as is its diagnosis function should there be a problem. The control system also features a training module that enables engineers on site to test the equipment's capability in a virtual environment modelled on the upcoming requirement.

The flexibility of the control system really is allowing engineers today cope with the challenges of nuclear decommissioning and answers calls of safe disposal at all time with minimal risk to those working on site.

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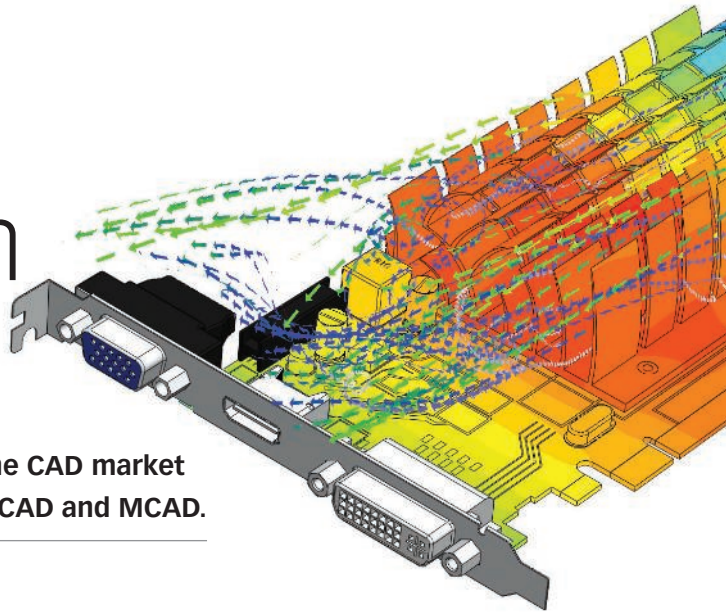
From collaboration to integration



As the lines between engineering disciplines start to blur, the CAD market reflects it. Paul Fanning reports on the crossover between ECAD and MCAD.

At an industry event earlier this year, the speaker asked all those in the room who were mechanical engineers to raise their hands. A sea of arms shot skyward. He next asked only those who were solely mechanical engineers to keep their hands up. Barely any hands stayed up.

The point, obviously, is that there will be very few people reading this whose work as a design engineer does not take in other disciplines. And chief among these disciplines in this increasingly mechatronic world is electronics.

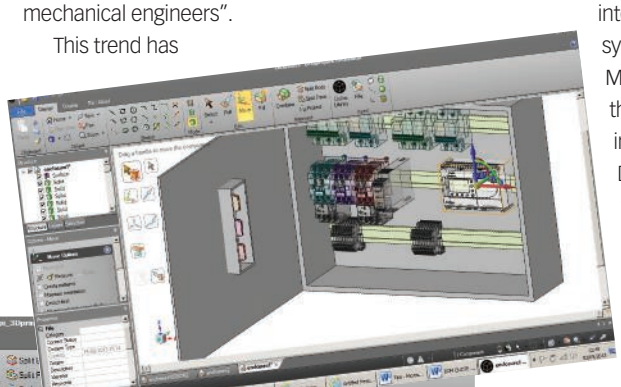
Given that CAD software is a core tool of the design engineer, it is no surprise that mechanical CAD software and its electronic (ECAD) counterparts have been getting ever closer over the years. This process has accelerated of late, with many mechanical and electronic players announcing joint ventures and collaborations.

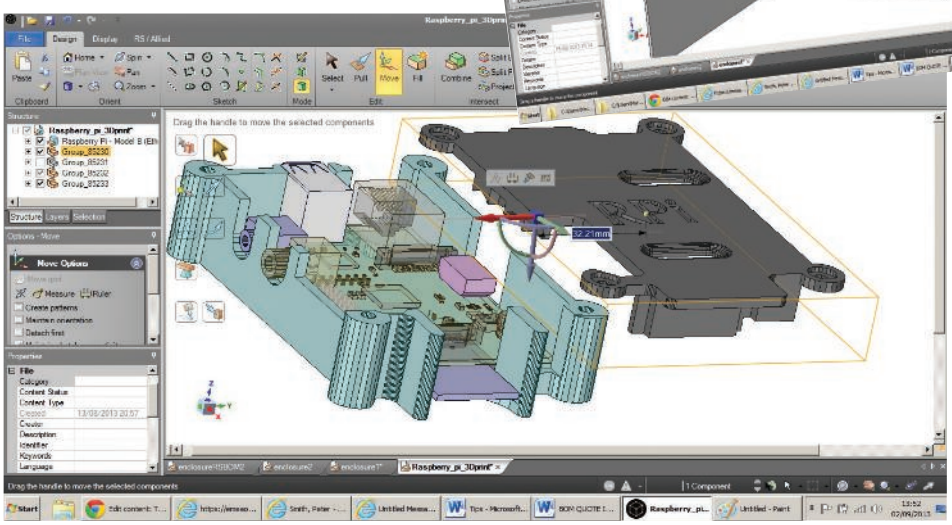
One of the more recent of these was from RS Components, whose product DesignSpark Mechanical (see *Eureka*, October 2013) involved the adoption of mechanical CAD software in the form of direct modelling package SpaceClaim to design enclosures for engineers at all levels now have access to 3D design, without the need to rely on traditional expensive 3D software, or the skill of CAD specialists.

DSM allowed designers to import IDF files from PCB design tools such as Altium and PADS into the mechanical designs. During its launch, it was abundantly clear that this product was designed to address the increasing overlap between electronic and mechanical design, with quotes from electronic designers saying things such as "The mechanical design stage is increasingly coupled with PCB design" and "there's a real need for some common ground between us and the mechanical engineers".

This trend has been echoed in other areas, with many PCB design tools having integrated 3D viewers and offering IDF outputs for use in MCAD tools. More recently, however, things have gone further. One such example came from Altium, which earlier this year announced the launch of announced the availability of the new SolidWorks modeller for Altium Designer. The app was developed by ECAD/MCAD collaboration expert Desktop EDA is the result of Altium's first add-on app development partnership.

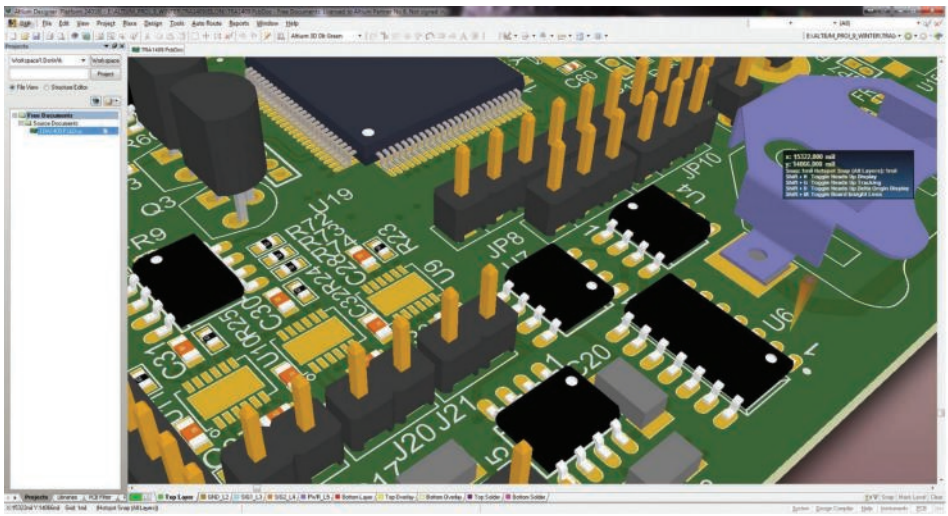
Altium's first app developer partner using the new DXP 2.0 platform, Desktop EDA, has more than 16 years experience in developing 3D MCAD integration tools for electronics design systems like Altium Designer, Protel and Mentor Graphics PADS. Released earlier this month, the Desktop EDA offering includes apps that extend Altium Designer's native 3D PCB design features by facilitating advanced collaboration between MCAD and ECAD designers.





Altium is currently working with other developers to bring additional apps to electronic designers and is targeting a wider release of the distribution and licensing system later this year.

This model of apps for ECAD design appearing on MCAD platforms is by no means new, but is set to grow, according to John Isaacs of Mentor Graphics. "One of our strategies has long been that we take one of our softwares like FlowEFD and embed it in those mechanical systems. For instance SolidWorks' flow simulation product is, in fact, a rebranded FlowEFD. It's also embedded in Creo, in Siemens NX and CATIA. What we mean by embedded is that it's just another button on the menu. The user can push that button and they're immediately into FlowEFD. We basically use the



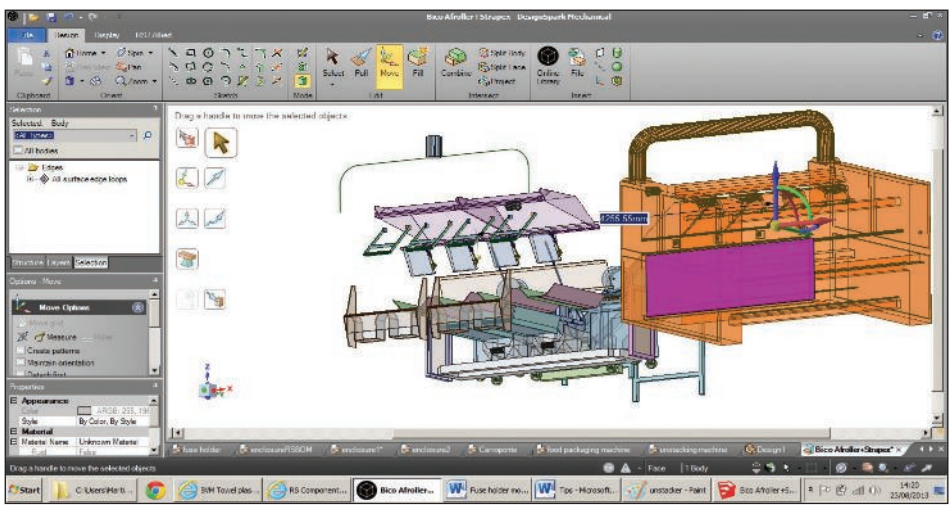
same model – there's no interface."

In addition, Mentor also released FlowTHERM XT earlier this year, following its acquisition of Flowmatics, whose past and expertise resided largely in the mechanical sphere. Says Isaac: "FloTherm XT was a significant step in blurring the line between mechanical and ECAD. It basically supports thermal management from design all the way to verification.

"So a mechanical designer may start by designing an enclosure and maybe a PCB guy will start a conceptual version of the PCB, placing the basic representations of the thermal components on the board to allow analysis to begin with Flowtherm XT really early in the design process. And then, as the design process continued, the interface between the mechanical and PCB sides of things is enabled seamlessly. So now, if a PCB is being designed in detail, they can easily determine if they have a good heat management system in place."

Interfaces go seamlessly into FlowThermXT from both the mechanical and ECAD side. Those interfaces have filters that filter out all the non-thermal information, which prevents the analysis being slowed down by extraneous information.

According to Isaac, while collaboration between the ECAD and MCAD sides of things is no new thing, the moves towards integration are increasingly a necessity. He says: "Integration is more a question of interdependency than anything else. Electronic products are using integrated circuits that are getting hotter and hotter and closer and closer together on the product thanks to advances in PCB technology. The heat density of these products is increasing and is past the point where you can afford not to use good thermal analysis... we see that blurring the line between mechanical and ECAD is increasingly important."



Steve Chidester, head of international marketing for Zuken, agrees about the increased levels of crossover, but makes clear the limits of this phenomenon, saying: "There is a blurring of the two worlds, but it's from an analysis point of view – not from a design point of view. You'll always design a PCB on a dedicated PCB design platform and you're still going to design an enclosure in a mechanical CAD package."

That said, however, Chidester has still seen a lot of change in the degree to which MCAD and ECAD users are having to collaborate. "I started out as a PCB designer many years ago and I'd very rarely talk to the MCAD guys. I'd get maybe a printout of an enclosure to make sure my board would fit with it, but more usually, I'd just be told what my restrictions were and if I followed the rules, things were going to fit. The only time the discussion would take place was if I couldn't follow the rules for some reason."

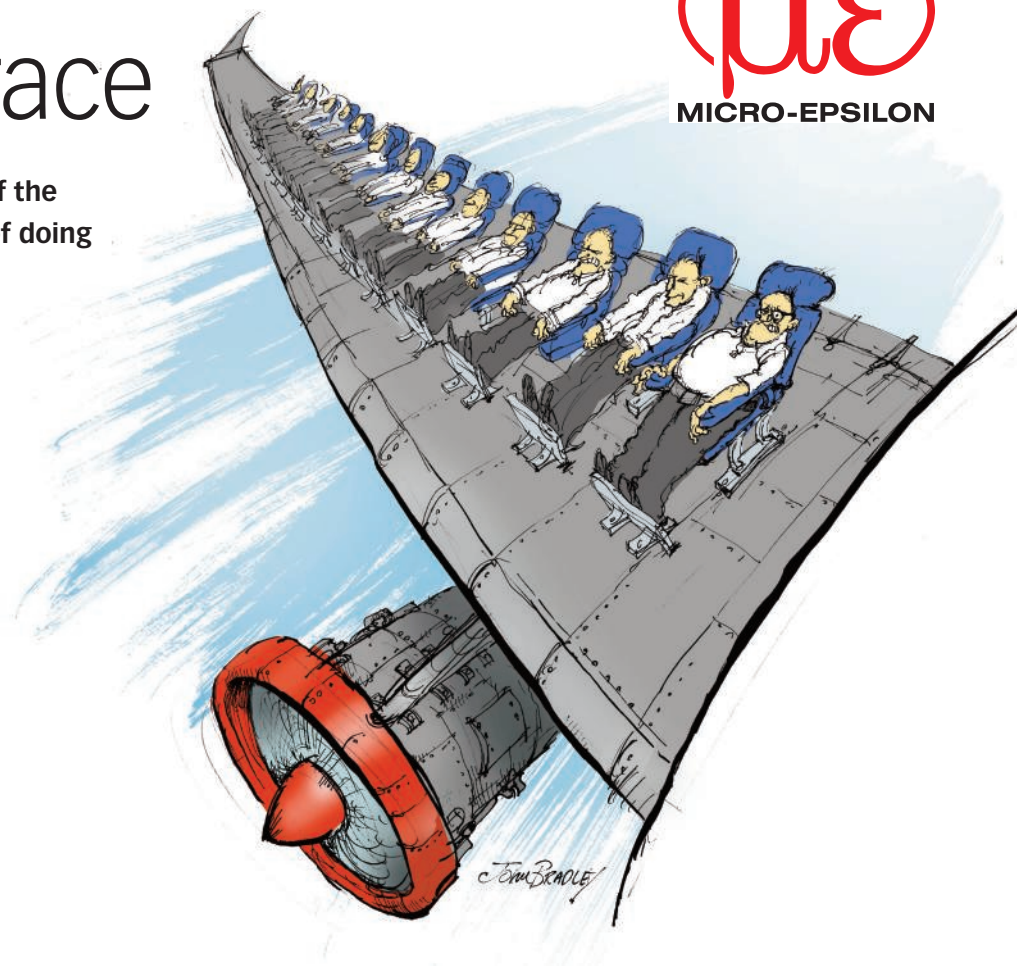
Today, however, as the number of components and computing power has to increase within a given space envelope, it has become impossible for the two disciplines not to work together. Says Chidester: "When I've engaged with mobile phone companies, they tell me that they have had to go back and forth between PCB design and MCAD more than 100 times. And that was because the form factor of the phone was set – a phone can only be a certain size. Now the electronics that go into a phone have to all sit in a PCB – all the components, everything. Now in order to make that happen, a huge amount of collaboration has to take place between ECAD and MCAD."

This collaboration, he believes, is only set to grow. "Communicating with the MCAD players is essential for us because our customers are their customers to some extent and vice versa. Not only do they have to know each other's work, they have to have to be able to share data and they have to be able to talk to each other. You can't just throw it over the wall anymore. Today they've got to talk to each other otherwise you end up going back and forth between the two departments. It's a lot of time and it's a lot of data that has to be translated. As CAD vendors, we are there to act as translators."

www.rs-components.co,
www.altium.com
www.mentorgraphics.com
www.zuken.com
www.solidworks.com

The space race

How can we overcome the problem of the reclining airline seat? Is there a way of doing so that keeps all parties happy?



The scenario is all too familiar. You are sitting comfortably in your airline seat after takeoff. The aeroplane has levelled out, the seatbelt signs go off and people begin moving around in the cabin. You contemplate the next few hours and may lower the seat tray in order to do some work or alternatively set up the in-flight entertainment system in order to combat the inevitable tedium of a long-haul flight.

And then it happens. The person in front of you abruptly reclines their seat, impinging on your personal space, cramping your movement and all but forcing you to do the same in order to recover your allocation of space. This, of course, has the domino effect of passing on the problem to the person in the seat behind you.

There can be little doubt of the inconvenience, irritation and pent-up frustration this scenario engenders among airline passengers. And which of us, faced with such a situation, can honestly say we have not wished all manner of unpleasantness on the person in front?

And yet one of the great frustrations of such a situation is that one can't legitimately complain to the reclinee, since they are well within their rights to recline their seat. After all, the facility exists to do so and, they might argue, they have as much right to comfort as the person behind them.

The Challenge

The Challenge this month, then, is to devise a new design for airline seats that circumvents this problem. Such a solution would have to cope with the fact that there is limited space available and that airlines are certainly not going to accept any option that involves them carrying fewer passengers. After all, airline staff may refer to we passengers as 'self-loading cargo' on the quiet, but they still need us to keep flying.

Equally, any such solution would have to cause as little disruption to the aircraft's internal layout as possible.

The solution we have in mind is an economy seat for airline travel that has been inspired by difference, new materials and flexibility. The seat has been designed to offer passengers choice over the amount of space they pay for and to provide a better fit for more people.

However, that is not to say you cannot come up with something better.

The answer to last month's Coffee Time Challenge of how to chill drinks quickly can be found in our Technology Briefs section on page 10.

3D Printed Parts

Graphite Additive Manufacturing


Image credit: Siemens NX

The BLOODHOUND SSC 1000 mph car will begin its land speed record campaign in summer 2015. Graphite, a supplier of high performance 3D printed parts has been named as the latest Product Sponsor, providing advice on design and material choices for the manufacture of key components.

Graphite will provide 3D printed, carbon fibre reinforced laser sintered parts such as ducts, covers and brackets, which will be ued as final components. The sintered parts will have a temperature resistance of 170ºC and be up to 400mm in length in one piece.

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BOAS Accreditation

Spirax Sarco delivers 1000th BOAS pass

A landmark 1000th delegate has passed the Combustion Engineering Association's Boiler Operation Accreditation Scheme (BOAS) training course, which was undertaken at Spirax Sarco's Cheltenham UK Steam Technology Centre.

BOAS accreditation is recommended in the 2011 BG01 boiler guidance document as the industry best practice for all boiler operators and managers, published by the CEA, SAFed and HSE.

The successful delegate was Robert Watkins, Engineering Team Leader at 2 Sisters Food Group, based in South Wales. "Training at Spirax Sarco helps us stay up-to-date with technology advancements and new legislation," says Mr Watkins. "Not only do Spirax Sarco's experts and facilities deliver highly professional training, but it was very useful to meet other trainees to learn about their experiences and best practices."

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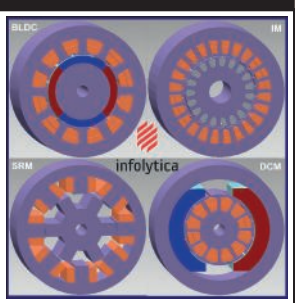
Electromagnetic Design Software

Infolytica state-of-the-art Electromagnetic design software



Infolytica state-of-the-art Electromagnetic design software is used worldwide by Engineers in a wide range of industries including electro-mechanical, non-destructive testing (NDT), induction heating, sensors, industrial transformers. Infolytica also offers a truly innovative design tool – MotorSolve – for IM, SRM, Brushed and Brushless DC motor design. It has built-in thermal analysis including various cooling strategies, and can couple to 3rd party software, for example OPAL-RT for Hardware-In-Loop real time analysis.

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Remote Access Tutorial

Invitation – To take a closer look - Remote Access Tutorial

Virtual private networks (VPN) are the most secure and reliable data communication connection but how easy is it to set up a VPN communication link to an industrial device, a control system network, or remote SCADA out station. By attending the 'To take a closer look-Remote Access Tutorial' you will leave with a better understanding, increased confidence and able to benefit from improved efficiencies and cost savings associated with reliable access to your remote assets for example:

- Preclude the cost and time associated with unnecessary site visits
- Return machinery to production potentially in minutes rather than days
- Monitor remote equipment and send alerts via text and email
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