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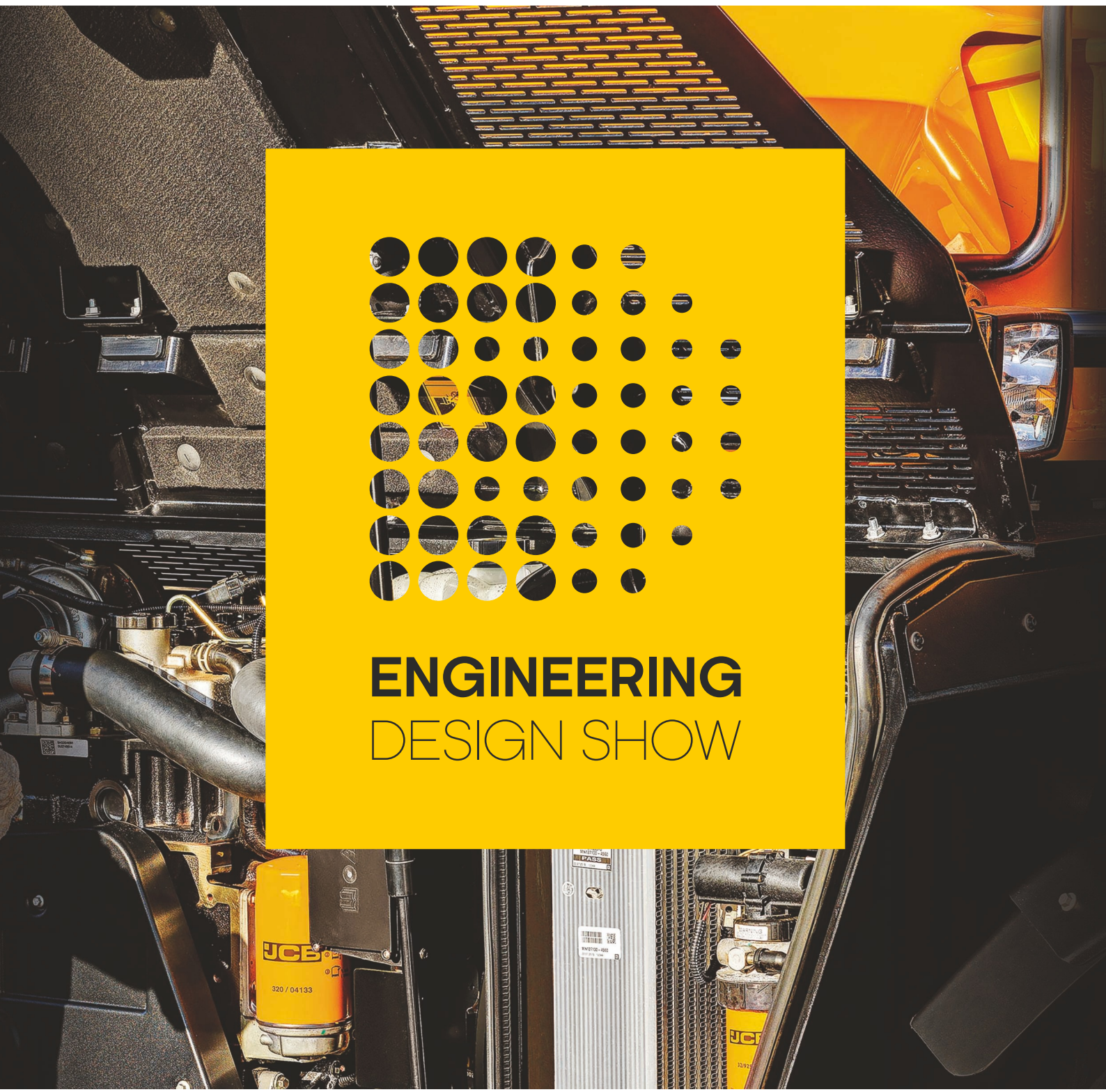

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INNOVATION | INSPIRATION | INTERACTION | INSIGHT

19 - 20 OCTOBER 2016 | RICOH ARENA | COVENTRY

KEYNOTE CONFIRMED AT THE EUREKA CONFERENCE

Eureka Conference, 09:15-10:00, Wednesday 19th October 2016 EDS, Ricoh Arena, Coventry

JCB – A STORY OF INNOVATION

JCB's success as a global construction and agricultural equipment manufacturer over the past 70 years is built on innovation. The Eureka Conference will be host to JCB Chief Innovation & Growth Officer Tim Burnhope as he shares with delegates exclusive insight into the JCB innovation process during the opening keynote.

Tim will also look at what makes a successful design strategy – focusing on the recently-launched JCB Hydradig as a prime example. The machine is set to revolutionise the way jobs are done in urban environments and on construction sites – and has innovation running through its veins.

KEYNOTE SPEAKER

Tim Burnhope, JCB Chief Innovation & Growth Officer

Responsible for research product development, engineering and strategic growth planning for the JCB Group.

WHAT WILL YOU LEARN AT JCB'S KEYNOTE?

- The design process behind the revolutionary JCB Hydradig
- The difference between evolutionary and revolutionary innovation
- In-depth understanding of the JCB Innovation process
- The importance of understanding customers' real challenges in your design strategy

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DIGGING THE NEW BREED

JCB's design strategy is yielding revolutionary new machines

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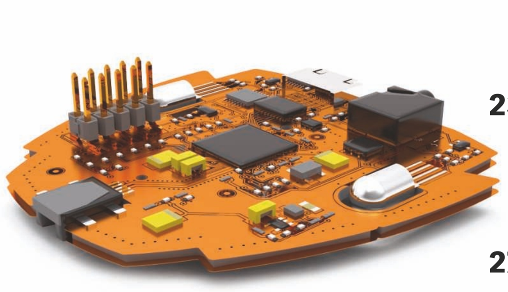

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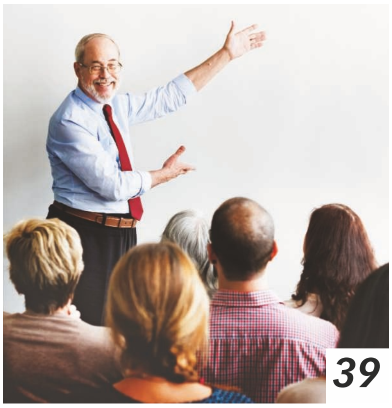

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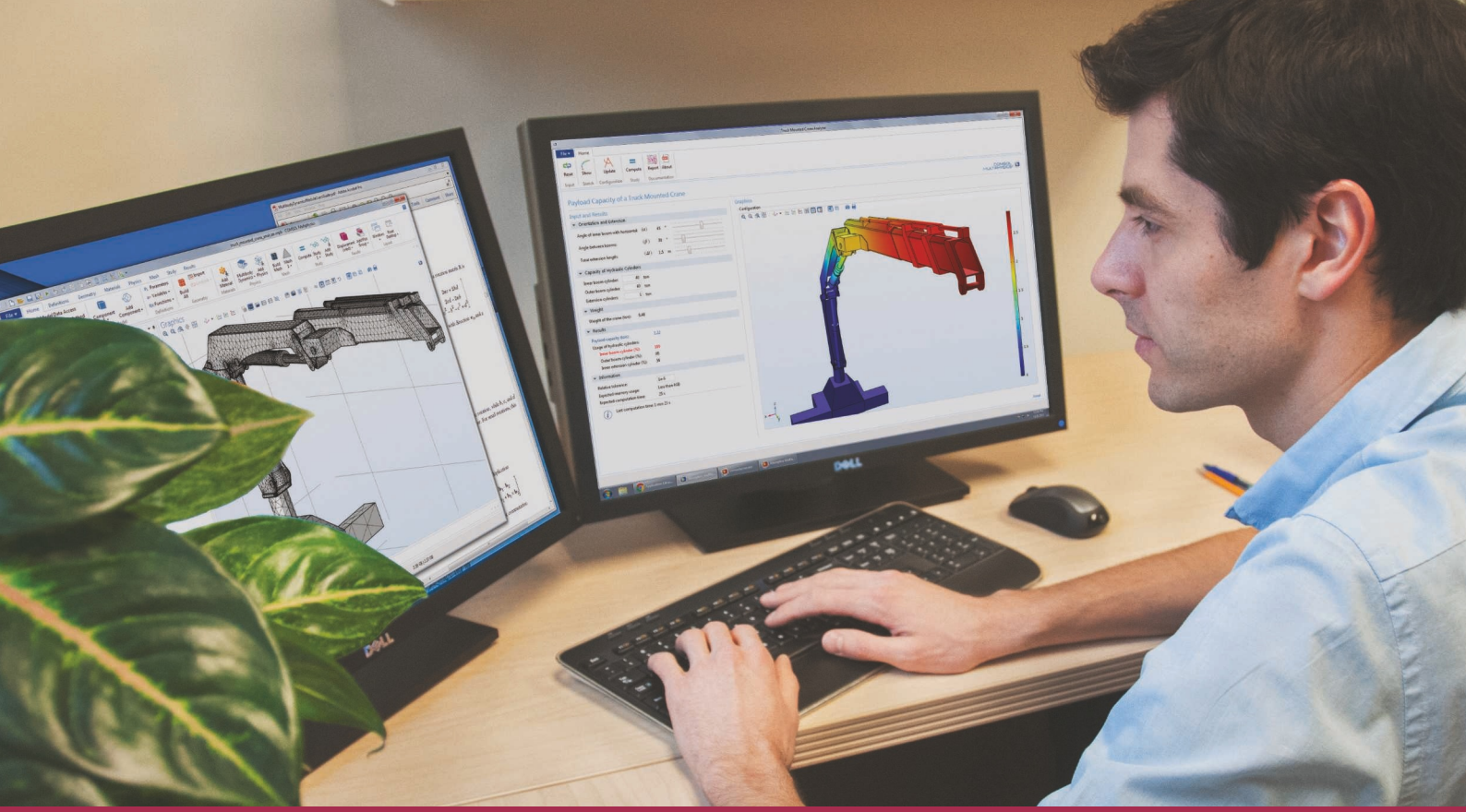

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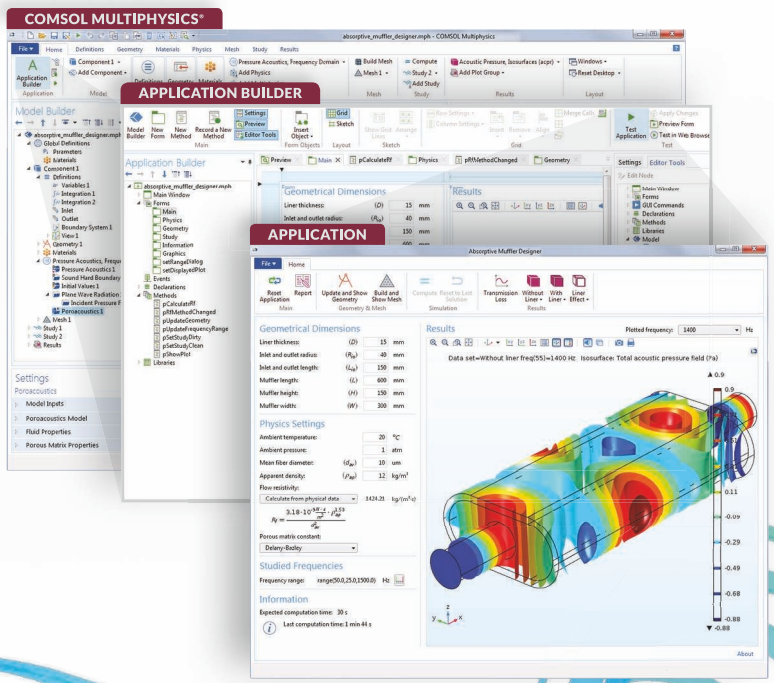

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Parting of the partnerships

Tim Fryer, Editor (tim.fryer@markallengroup.com)

Being honest I had hoped that the Brexit issue would have sloped off stage quietly and be in the past by now. It seems though, it and its consequences will be with us for many years.

A trip to the Farnborough Air International Show (FAI) highlighted why these consequences could hit the British technology and engineering sectors hard. Large scale British engineering excellence was in abundance and while the considerable defence capability on show might not have been to everyone's tastes, it was clear that the whole aerospace arena is one that we are particularly good at.

However, there was much talk of European collaborations, particularly those funded by Horizon 2020 (i.e. EU money), which forms part of the funding foundations for many of our academic institutions. The programmes also depend on the expertise and even the unique manufacturing capabilities of some of our leading companies – it is hard to see how some of the aerospace programmes could continue without partnerships with companies like Rolls Royce and GKN. Programmes are coming to an end and new ones are getting underway, but faced with uncertainty around British participation will they either not go ahead or proceed without considering UK involvement?

It is a critical time, and time that could be lost if no action is taken until our EU exit is finalised, presumably two years hence. This is not a situation that can be resolved simply by diverting monies saved by non-membership of the EU. It will require a strategy that will ensure UK involvement in science, technology and engineering programmes, and one that may involve direct payment into a central fund or perhaps government sponsorship of participating organisations.

Not addressing the situation at an early stage will have consequences for our academic institutions, technology companies as well as for our European partners – we do, after all, have a huge amount to offer such collaborations.

Manufacturers urged to export following Brexit

Midlands based MNB Precision is urging UK manufacturers to take a brave leap into the export market, after experiencing its own surge in exports following Brexit.

The precision engineering specialist is reportedly reaping the benefits of a weak pound following the uncertainty caused by Britain's decision to leave the EU.

"The sharp fall in value of the pound is making UK goods more attractive to overseas buyers and I only see this continuing," said managing director, Luke Benton. "It presents UK industry with a huge opportunity to grow exports, and it also de-risks export market entry for businesses that are yet to trade with the rest of the world.

"Now is the time for the manufacturing industry to market our quality all over the world to ensure that when the UK does enter talks about trade agreements, Europe and the rest of the world already know what we have to offer."

A number of manufacturing businesses are enjoying a short term export boost and the Government is keen to develop the UK's export markets, with a number of senior politicians saying it will be critical to the UK's success outside of the EU.

"Overseas trade is likely to offer the sector huge opportunities over the next few months and the worst thing we can do as an industry is let this pass us by," concluded Benton.

EVENTS

30 August
National Instruments Hands-on Taster
NI HQ, Newbury
Full day hands on seminar

7 & 14 September
Build your 'hands-on' expertise in the Testing of Materials
University of Sheffield
Full day hands on workshop

14 - 15 September
Low Carbon Vehicle Event 2016
Millbrook, near Bedford
Showcase and exhibition

21 - 23 September
Experience Composites - powered by JEC 2016
Augsburg, Germany
Exhibition

28 September
The Wiltshire Festival of Engineering
Olympiad Leisure Centre, Chippenham
Festival

28 - 29 September
TCT Show + Personalize
NEC, Birmingham
Exhibition

4 - 5 October
3D PRINT 2016
Lyon Eurexpo, France
Exhibition

beea british engineering excellence awards

6 October
British Engineering Excellence Awards
London
Award Ceremony

ENGINEERING DESIGN SHOW

19 - 20 October
Engineering Design Show 2016
Ricoh Arena, Coventry
Exhibition & conference

TECH BRIEF

3D PRINTED BIOHYBRID ROBOT

Researchers at Case Western Reserve University have combined live tissues from a sea slug with flexible 3D printed components to build 'biohybrid' robots. By combining materials from a California sea slug with three-dimensional printed parts, the researchers said, 'we're creating a robot that can manage different tasks than an animal or a purely manmade robot'.

A muscle from the slug's mouth provides the movement, which is currently controlled by an external electrical field.

Swarms of biohybrid robots could be released for such tasks as locating the source of a toxic leak underwater, or search the ocean floor for black box flight data recorders.

The researchers chose the sea slug because the animal is durable down to its cells, withstanding substantial changes in temperature, salinity and more.

"One of the problems with traditional robotics, especially on the small scale, is that actuators tend to be rigid," added a researcher.

To control movement, the scientists use either chemical or electrical stimuli to induce the nerves to contract the muscles.

NEWS

Chinese & UK graphene partnership to deliver lighter transport

The Beijing Institute of Aeronautical Materials (BIAM) and the National Graphene Institute (NGI) at The University of Manchester will carry out a five-year collaborative research project to deliver lighter, better performing aircraft and high-speed trains.

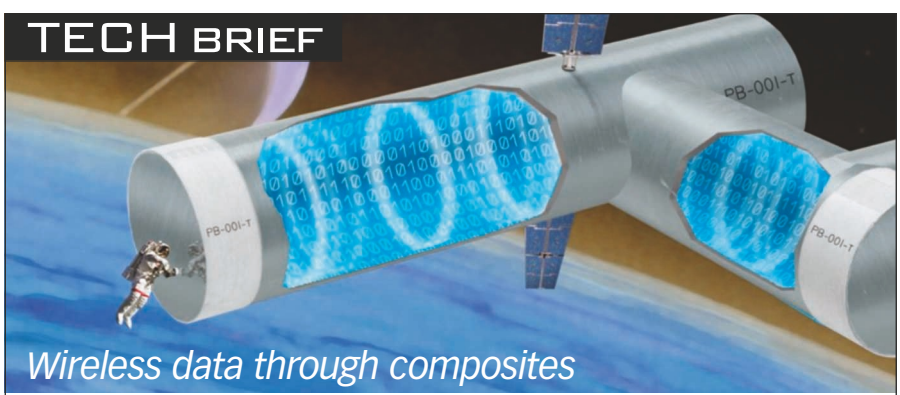
Research will focus on composites with enhanced performance in the field of mechanical, electric conductive and thermal conductive behaviour, as well as the compatibility of graphene in matrix materials.

The NGI says graphene can also be used to measure the strain in the wings to see if damage has occurred. Ultimately, replacing the carbon fibre structure of the wings themselves is the major goal of the collaboration, but the NGI says this is, '20 years away'.

As well as aircraft, the research could have an impact on high-speed trains and industrial equipment to replace traditional materials.

The partnership is an extension of a project started last year, which is looking at creating graphene composites with metals such as aluminium.

TECH BRIEF



Wireless data through composites

Research and innovation organisation, TWI has created a form of data transfer technology called SurFlow. It claims that SurFlow can be incorporated into composite materials to create a high-capacity, resilient data transfer network.

Through a patented process, SurFlow is said to transmit data in the form of electromagnetic waves that travel through composite parts. The system uses no wires or fibre optics and, unlike wireless data transfer, cannot be intercepted remotely.

By incorporating a substrate combining dielectric and conductive materials, these surface waves can be transmitted through composite structures. The waves are propagated and received using transducers which can be placed anywhere along the smart composite.

By turning a composite part into a 'smart' composite, the technology integrates a data network into a component's physical structure. TWI says the system is capable of transmitting data at up to 6Gbit/s and can continue to function even if the composite part suffers damage.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NEWS

Engineers embrace North East show

The North East's largest showcase of engineering suppliers closed its doors on 7th July on another successful year. Held at the Radio Metro Arena, Newcastle, MENE - Manufacturing & Engineering North East - provided a regional platform for the best of British design and manufacturing innovation. It brought together 90 machinery, supply chain and engineering exhibitors alongside a conference and workshop programme.

The conference programme played host to 13 thought-provoking presentations. Darren Cumner of Hitachi Rail in Newton Aycliffe opened proceedings discussing the progress of its £82m factory. Further highlights included Sora Group, Nissan, AMRC, UKTI, IMechE and Ford Aerospace. The two day conference was brought to a close by James Wharton MP, minister with responsibility for the Northern Powerhouse, who discussed his long term vision for the region post-Brexit.

MENE East 2017 is being held at the same venue on 5-6th July. For event updates visit: www.menortheast.co.uk.

Products

Here is a selection of the latest products featured on the Eureka website. Just enter the reference number in the search box for the full story.

143790
Infrared cameras for monitoring manufacturing operations

143738
Curved sections for modular belt conveyors

143710
Balluff I/O blocks enable quick network building

143702
Festo's reverse jet pulse valve

143656
Pipeline pressure monitoring

143655
Multi-functional CAN-to-Ethernet gateway

143550
Ensuring optimum coolant flow

Solution to last month's Coffee Time Challenge

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The solution to last month's Coffee Time Challenge, about how to stabilise a home camera, comes from Kickstarter project Snoppa. It has produced a handheld portable gimbal, which uses three motors on different axes with integrated controls to allow a camera to record smooth flowing videos even with arm shake, ground bumps or general movement.

The Snoppa Go uses three brushless motors and advanced sensors to keep the camera level and stable during frenetic activity. The advanced 3-axis stabilisation technology instantly compensates and auto-balances for vibrations, arm shake, and body movement. It allows users to follow a subject or capture an action scene, resulting in video footage that is stable across any plane of motion.

There are three modes. Lock Mode, when total stability is essential, holds the camera stable along the pan axis and tilt axis. There is also Pan Track Mode that locks the tilt axis while controlling the pan axis for perfectly level panning and tracking. And finally there is Omni Track and Underslung Mode that provides stabilisation by controlling both the tilt axis and pan axis.

www.snoppa.com

DIGGING THE NEW BREED

When you already have your place in history for a particular design, is it easier to evolve what you have rather than diversify and innovate? Tim Fryer went to visit JCB to see how it is keeping it fresh.

JCB's place in history is the backhoe loader, a truly disruptive technology when it was introduced in 1953. It retains leadership worldwide in this product category and backhoes remain responsible for half of JCB's business. However, a trip to the company's Visitor Centre in Staffordshire reveals that there are many other milestones in its history that have resulted in a diverse product range that tend to more than just the mainstream construction industry.

In fact, there are around 350 products in the range, manufactured at 22 sites around the world, and each of these products will typically last for around six years before being upgraded. As this is a rolling programme of evolution, it means there are around 55 to 60 product launches per year spawned from 150 – 170 programmes, which themselves each last one to three years. Such evolutions may be needed to meet new emissions legislation requirements, to introduce radical technology updates, or to roll out new features across the range like a new type of cab, transmission or axle.

Despite the diversity in JCB's products, operators want the same level of convenience and comfort across the breath of the range. So then, why not use the same cab design in a tractor, wheeled loader or excavator, for example?

ENGINEERING DESIGN SHOW

Tim Burnhope will be speaking about JCB's design strategy at this year's Engineering Design Show's Eureka Conference, held at Coventry's Ricoh Arena on 19-20 October. For information about the event turn to page 36 and to register go to: www.engineering-design-show.co.uk

Innovative designs can be introduced on premium products initially, and then the volume of the backhoe and Loadall (the telescopic handlers) units where, because of economies of scale, the same engineering quality can be introduced at lower costs.

Chief innovation and growth officer at JCB is Tim Burnhope, who said there is a formula for such development: "We use evolution to redesign and develop the product range, but also use an Innovation Checklist, which ensures all of our products right across the world carry the same JCB DNA."

The checklist includes, among other things, comfort, usability, productivity, cost of ownership, safety, security, and reliability – all must be considered with any product development. However, the main theme goes under the label of 'strength of purpose'. Does it look like it will do what customers want it to do? Does a tractor look strong and fast? Does a mini excavator look easy to use? Does a wheeled loader look robust and powerful?

From evolution to revolution

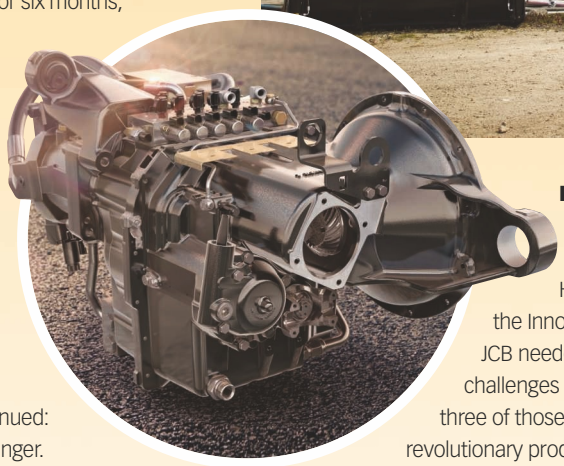
Every 10 years or so evolution must give way to revolution – a fundamental change to JCB's product range or to the vital systems within them, for example 10 years ago the 444 DIESELMAX engine.

To speed up the revolution cycle and give the process structure, JCB introduced its Innovation Centre three years ago.

"We say it houses the crazy ones, which is a bit unfair, but what we do is house the people for creative thought for the next projects," explained Burnhope. "What we realised is we needed an area where we can bring people from anywhere in the business and formulate teams to work on our next revolutionary product designs.

Within this centre we have a design studio and advanced engineering research for engineers who work on structures, hydraulics, electronics, electrics… and many of those are in combination, for example, we have an electrohydraulics lab."

The premise is that evolution happens within the design teams of individual business units, but that is unlikely to foster a fundamental shift in technology. "When you get the revolutions, quite often we need the people from, say, transmissions working with the Loadall people, working with the electronics people, working with the engine people," said Burnhope. "So what we'll do is bring a team of specialist experts from each area, hot desk them, put them together for six months, develop a concept, get it going and then they can go back and introduce it to [individual business units and product designs]."



There is a base staff of more than 100 at the Centre but up to 60 people can be brought in from various parts of the business based on their expertise. Burnhope continued: "It's been a real game changer. When you are in a business unit you've got to react to the day-to-day. You've got programmes to deliver. It's a very frantic world.

"Evolutionary innovation is relentless. So we pick people out of it and say, 'don't worry about the day-to-day. You've got to worry about tomorrow, you've got to think about revolution'. So the minute you walk through the door here, you leave behind everything else and move into a world that allows you to be fully creative."

This difference in thinking is illustrated by JCB's drive to improve fuel efficiency over the last five years, which has resulted in a 35% improvement across many of its machines. That's well beyond any mere evolutionary tweaks. Burnhope explained: "I said at the start I wanted it to be 50%. They thought I was completely mad and people thought it should be 10% or 20%. But it caused people to be much more radical in their thinking."

The Centre includes a 'rapid factory' where ideas can be made using 3D printing or more traditional modelling techniques alongside some advanced simulations.

The 3CX Compact for city repair and maintenance and (inset) Agripro's dual technology

Revolution 1: Backhoe for the city

Having launched the Innovation Centre, JCB needed industry challenges to work on, and three of those have resulted in revolutionary products that have come to market during 2016.

The challenges for the first product were manifold. The main driver was to make a machine that suited one of the busiest markets in Europe – London. Congested narrow streets and restricted work sites mean that the big machines required to do a job don't fit into the available space. The machine in question typically would be a 3CX backhoe loader, JCB's bestselling product for many years. The result has been the 3CX Compact - 35% smaller than its big brother. So how did the Innovation Centre achieve this while maintaining other key parameters like speed and power?

"We break [key parameters of the design] down and put people on different sub-teams," Burnhope said. "So we say, 'you go and tell us how to halve the turning circle, how we can shrink the height, or how to get a smaller footprint'. It's important to do it in different teams because if you just use one team they might continue with a compromise or say they can't possibly make it 35% smaller. So it causes the teams to go away and be very radical."

The resulting machine aims to be nimble and flexible but, as Burnhope points out, this can place more demands on the technology required.

"Its like the medical world going to keyhole surgery versus big operations, that's almost what our customers are looking for," he said. "We don't need to move as much material – what we need is to be smaller, and be in and out quicker."

Revolution 2: Flexible farming

The second challenge came from the agricultural sector. Farmers were looking for more productivity from their telescopic handlers, one of the standard agricultural workhorses. However, the modern farm is not the smallholding of bygone years. Consolidation has meant most farms are of considerable size and moving equipment around represents considerable time lost. How then do you get a machine that is quicker between sites and more productive when it gets there?

Productivity typically comes from the power of the engine supplied with hydrostatic transmission, with the downside that it is cumbersome between sites. Travelling speed, however, is improved by using a good power shift transmission, but on site productivity is then diminished as a trade off.

Enter JCB's Agripro, probably the most innovative of the 'three revolutions' on account of its DualTech VT (variable transmission). JCB has the luxury of designing its own transmission and without this ability, this particular development may not have been possible.

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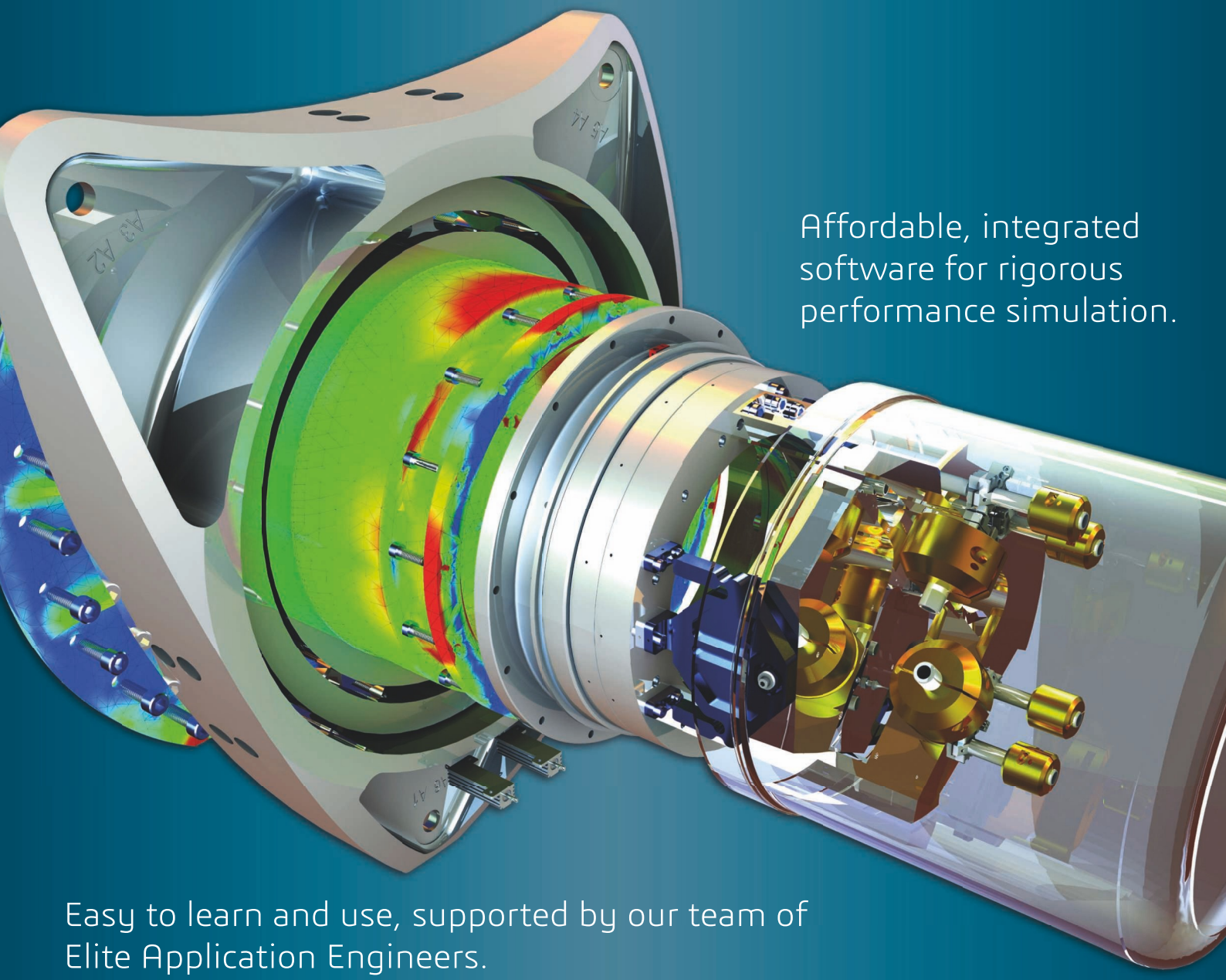

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The Agripro has developed a DualTech VT transmission to maximise productivity and speed, and (inset) the generic cab

DualTech VT brings two different types of gearbox into one. So when operating in a field, collecting hay bales for example, it will be in hydrostatic mode providing the most productive, fast response, quiet and smooth operation. As it leaves the field and exceeds 19kph it automatically trips to Powershift transmission up to a top speed of 40kph. It is the first time in the sector that two technologies have been squeezed into one gearbox, and it was not easy.

"It's actually 13% more productive than our current offering, and 25% more productive than any of our competitors' offerings," claimed Burnhope. "The big challenge is getting the speeds of the two transmissions to marry, especially on the downshift. If you are at 'Powershift speeds' and all of a sudden you brake to 10kph, you've got to get the hydrostatic transmission up from 0 to 10 to meet the shift coming down. All that software, and getting that to change seamlessly, with no real feel for the operator probably took us about a year and half to get those shift changes perfect."

Revolution 3: Light heavyweight

The third challenge was to address the construction and development markets instead of lighter-weight repair and maintenance applications catered for by 3CX Compact.

Burnhope said: "Our customers were saying, 'we want a much smaller machine for certain urban environments, but it's got to have the capabilities of some of the larger machines'. They told us the big issue was when you sit on these machines and look out, you can only see the horizon. That is a major issue when you work in a city, that you can't see somebody working in a trench next to you."

But matching the visibility associated with a mini excavator while reducing the footprint required for urban areas is not easy if you are still trying to maintain the lifting and digging capability of a much bigger machine.

The solution, Hydradig, is a true revolution in that it is a new machine category in its own right, claims Burnhope. Equivalent machines have the engine behind the cab and above the slew ring around which the top half of the machine rotates. There are reasons for this concerning tapping services off the engine through the rotating part, but the main reason is that the engine provides a counter balance for the main arm, whether it is being used for lifting, loading or digging. Visibility is therefore impaired at least in one direction.

To solve this, the design team came up with the solution of having a cab with perfect visibility in all directions to within 1m around the base of the machine. Obviously this means that the engine and fuel tanks had to go somewhere else.

Looking to its Loadall machines, the team adopted the idea of putting the engine much further down, effectively between the wheels. Although defying convention, reducing counterweight overhang was more than compensated for by lowering the centre of gravity of the machine. In fact, it now has over twice the lifting capacity. Further benefits are that there is no tail swing, maintenance is easier and by balancing the load across the base of the machine, it can travel at greater speeds without the 'nodding' that other machines experience.

Again, the design process was not conventional. "We simultaneously had our industrial designers, our main design team and some stability experts with us," said Burnhope. "Even though we were using the same principles of a Loadall, it was a completely different chassis design. We were starting to mock things up. We'd build other models, so some things we built up in wood, some we'd build in model form and CNC machine to get things to fit."

Having the 'services' on the lower side of the slew ring from where they would be, did present a problem, however. "I know it sounds daft, but you want to bring somebody creative in that's never worked on slew rings," said Burnhope. "You'll find they have got some crazy and completely different ideas, and that's really where it makes the difference."

Through these new products, the Innovation Centre has made a good start and enabled a more creative design process. Burnhope summed it up: "We are very lucky, we have an entrepreneurial leader in our Chairman Lord Bamford and he continually drives us to find 'firsts'.

"It's not about buying innovation - you don't have to spend millions. The important thing is that you've got the right environment, the right people, and the right tools to allow them to be creative. And some of our best innovations have been by far the simplest. It's having that motivation to find a solution and how you capture it."

Software tools

The design teams use Autodesk's Alias for industrial design and Siemens NX for the CAD work. For simulating how people would interact with their designs JCB use Siemens Jack software.

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CV: **Josh Claman**

Before joining Stratasys as chief business officer, Claman spent over 10 years at Dell, where he held a variety of senior positions including VP Large Enterprise Business Americas, VP Public Sector EMEA, VP Channel Sales EMEA and GM of Dell's UK/Ireland operation. Prior to that, Claman spent 15 years at NCR, a computer hardware, software and electronics company, where he was VP Services, Europe. Claman received a BA from the University of Illinois and an MBA from the University of South Carolina.

Behind the hype

Most engineers want to get their hands on a 3D printer, and the hype behind the sector is as strong as ever. But, how does the world's premier manufacture of machines view future prospects? Justin Cunningham finds out.

Things are changing according to those developing tech under the broad banner of Industry 4.0. Whether you belong to a start-up or multi-national, engineers are reportedly going about product development differently. From simulation to connecting products, there are a number of emerging trends creeping on to everyone's 'must look into that' list.

But there is one tech that is still on every design engineer's Christmas list, and that is the 3D printer. The hype is palpable. So, what does the chief business officer of Stratasys, a market leader in this space, think of it all?

"We are at the beginning of something that is going to shake up the world," claimed Josh Claman.

While this might sound like an over statement of someone keen to keep the hype machine going, Claman has a long reputation within the technology industry as a man that says what he means, and means what he says.

"If you look at what's happened in prototyping, we have already disrupted that process," he said. "When you put an additive technology in a [physical] prototyping environment, traditional technologies, like CNC or model making, get pushed out. They're just not as good."

Stratasys, in its current incarnation, has evolved from a merger between two 3D printing companies: Objet and Stratasys, each using a different technology. Objet's PolyJet technology offers fine features and product realism, while Stratasys' fused deposition modelling (FDM) is able to print real thermoplastics with corresponding mechanical properties, enabling genuine functional testing to happen much earlier.

"Companies have seen prototyping cycles go from weeks to, in many cases, one day," said Claman. "I might not produce them on a 3D printer but if the result is so realistic that I can get an order before I start production, the pressure and de-risking benefit is huge. It's not only changing the prototyping time frame, but how people take new products to market."

However, all 3D printers are not created equal, and the market has seen a number of lower end machines start to crowd the sector. While schools find them a great way of stimulating students by printing Yoda heads and Eiffel Towers, do these tools really have a place in a design office alongside the more industrial Stratasys machines?

"Small machines are not going to displace high performance machines, but they definitely have a place," said Claman. "What we are seeing is that they're going to be used at different points in the same workflow.

"For example, I'll do my drafts, just me, personally, as a design engineer, that I might not even show anyone on something like a MakerBot. When I'm happy with it and ready to escalate it I'll print it out on an industrial machine. I might use one machine to do a version that's a functional prototype, and maybe a different machine to do a fine finish realistic prototype. You look at our big customers like General Electric, it has big industrial printers but also a lot of MakerBots. It mimics that workflow that we see increasingly developing."

The key thing is that 3D printing, as an industry, is still developing and most – even the manufacturers – are still figuring out many of the emerging technology's nuances. "We are seeing the revitalisation of a profession called production engineering," said Claman, smiling. "This is printing jigs, fixtures, assembly guides… so 3D printing is being used to improve things on the manufacturing floor. You might have a worker with small hands on one shift, and big hands in the next shift. That, ergonomically doesn't work. Well, now you can print one for each user."

Jigs and fixtures are relatively low volume but can be expensive items. Tooling also serves to lock in a design, with major changes often requiring new tooling. By contrast, a relatively low cost 3D printed tool can be replaced quickly and easily, allowing more design evolution, flexibility and customisation in the production space.

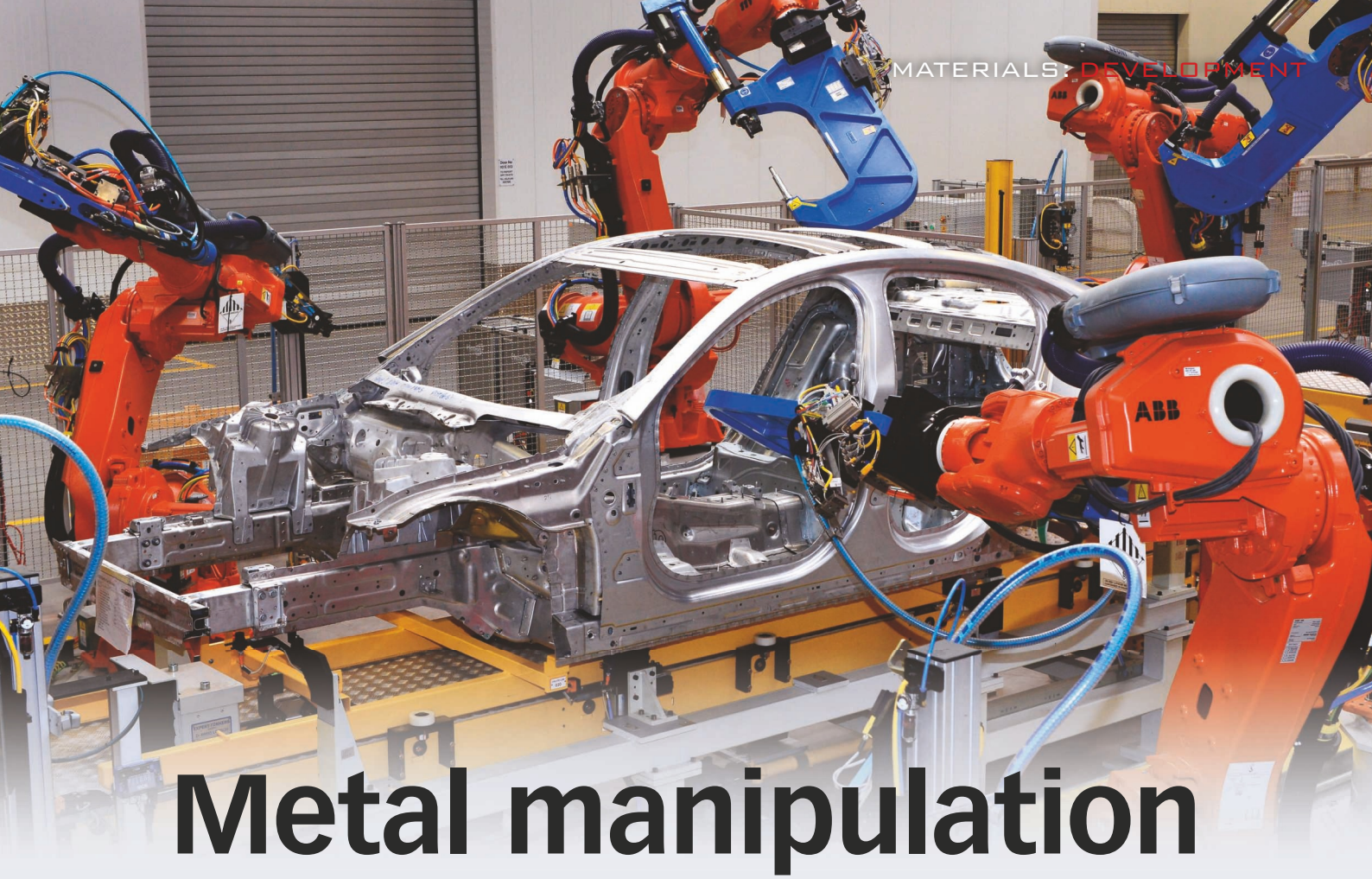
"Companies have seen prototyping cycles go from weeks to, in many cases, one day"

"This is capturing the imagination of plant managers across the world," said Claman. "We are in the very early adoption phase, but the opportunities are massive. The beauty of it is you can tweak it, redesign it, and constantly make it better. It is very iterative."

The ability to evolve designs quickly means that for low volume applications, 3D printing becomes a potential route to production. "At the moment this is a very small portion of revenue across the sector," admitted Claman. "But, we are already seeing some great examples of where this could work. Airbus, for example, uses 1000 inflight 3D printed parts on their new A350."

Aerospace's natural yearning for sweeping and complex geometries, as well as its low volume manufacturing nature, make it a natural fit with the technology, as do applications in medical and dental.

"At the moment we are in the application discovery phase," concluded Claman. "The adoption curve by vertical markets will change gradually, but right now we are now thinking, 'what are the next thousand parts going to be?'



Metal manipulation

As aluminium becomes the lightweight material of choice for many, we look at one project that aims to secure supply, reduce production emissions and keep value in scrap. Justin Cunningham finds out more about the REALCAR project.

Cars, aircraft and trains are increasingly demanding high quality aluminium to bring down in-use emissions. However, with China being the world's biggest primary aluminium producer, coal fired power plants have increasingly been used to provide the intensive energy required for smelting. It means aluminium's green credentials in the West come with a dirty Eastern twist, which is taking a larger slice of the lifecycle emissions pie chart.

Consumption of aluminium has spiked since the millennium from just under 40 million tonnes a year, to an expected 100 million tonnes or more annually by 2020.

While talk at the Jaguar Land Rover REALCAR event last month was almost exclusively about the circular economy (i.e one that produces less waste by design), it was really about making cleaner aluminium, and securing supply for the future. The project demonstrates how to turn high quality aluminium scrap back into high quality consolidated aluminium sheets. While it sounds simple enough, it hasn't been as straightforward as introducing separate bins and telling staff to be extra vigilant when sorting scrap.

The problem is that aluminium is extremely sensitive to cross contamination, meaning that when you mix different alloys, you end up with a metallic jambalaya, something in-between the lowest quality and highest quality material. And then there is steel and other metals, which change the material's composition considerably and makes end properties difficult to control. Once impurities get into the mix, some are very difficult to get out. It all devalues the waste stream and makes it hard to use recycled aluminium for high quality transport projects.

Control has been needed to turn high quality scrap back into predictable, homogeneous and again high quality aluminium ingots. JLR has done this by introducing a closed loop production system at its three press shops and eight partner shops. From here scrap is collected and re-melted into high quality aluminium ingots, but to do this metallurgists had to develop an entirely new alloy that's less sensitive to recycled contaminants.

"We've optimised an aluminium sheet to make it more tolerant to recycling," said Adrian Tautscher, a materials engineer at JLR. "The grade of alloy we have developed is RC5754, and it is a mix of processed scrap, prime metal and third party scrap that our partners source. It gives us the same performance as an alloy that relies on much higher prime content.

"It means we don't have to make a distinction about putting virgin or recycled materials in crash structures or other areas. It is about qualifying the material based on what it will be used for."

In collaboration with aluminium recycler Novelis and Innovate UK, the project brought together metallurgists, recyclers, rolling mills, and other key stake holders.

More than £7million has been invested across Jaguar Land Rover's Halewood, Castle Bromwich and Solihull press shops to install the intricate segregation systems needed to capture the aluminium scrap. The press shops process thousands of tonnes of material, employ hundreds of staff and create mountains of scrap –

it's the scale that's been the real technical issue.

"The target for cross contamination is zero but these are real processes and mixed metal lines so you will get some crossover," said Andy Doran, Novelis Europe sustainability and recycling development manager. "We are talking tiny proportions. That is part of the chemistry refinement we have done on the metallurgy side, to allow for any residual crossover – but it is all about minimising it."

To date around 50,000 tonnes of RC5754 has come back into vehicles, which is designed to contain up to 75% of recycled content, material already introduced to Jaguar's XE and XF lines.

REALCAR stands for REcycled ALuminium CAR, but end of life material recovery still remains a challenge for manufacturers

Design light

Like all automotive firms, weight has become the enemy. This is particularly the case for JLR, whose heavier luxury cars struggle more than most to reduce tailpipe emissions. It's move to aluminium has been industry leading, with Ford closely eyeing progress. The amount of CO_2 equivalent generated from a JLR vehicle is dramatically lower than a decade ago, but Tautscher told the audience that, "as we lightweight more intensely, the materials production phase has grown from 20% to 27%."

Lifecycle analysis (LCA) points to a dramatic CO_2 reduction as more secondary aluminium is used – the recycled material requires just 5% of the energy needed to smelt primary material. But, it also benefits JLR in other ways.

"This is being used for strategic engineering purposes," added Tautscher. "This is not just an LCA or CSR activity."

There are very real concerns across the industry about security of supply. JLR is the UK's largest automotive manufacturer and produces in excess of 500,000 vehicles a year. As volumes continue to rise and new models are introduced, forming a business strategy with aluminium at its heart must address these concerns, and to a large degree this is what the REALCAR project is about.

Rocketing demand coming from the building and construction sectors – particularly in Asia – as well as booming global demand for efficient transport means aluminium is the lightweight material of choice for many as it occupies the Goldilocks territory between steels' ease of manufacture and carbon fibre's lighter weight.

Conservative estimates predict that much of the global demand for aluminium is going to be met by primary sources. The worry, however, is that supply is going to come under increasing pressure and the markets renowned price volatility – already considered a headache by purchasing managers – will only get worse.

End of Life?

Despite the accolades from industry supporters, from a commentators point of view you might have expected more. Taking clean scrap, melting it down, and reforming it to be used again as principally the same material, should surely be something the company, and industry, is doing anyway. The question on everyone's lips was, 'what about end of life vehicles?' Surely, this is where the loop needs to be closed if we are really to achieve a circular economy?

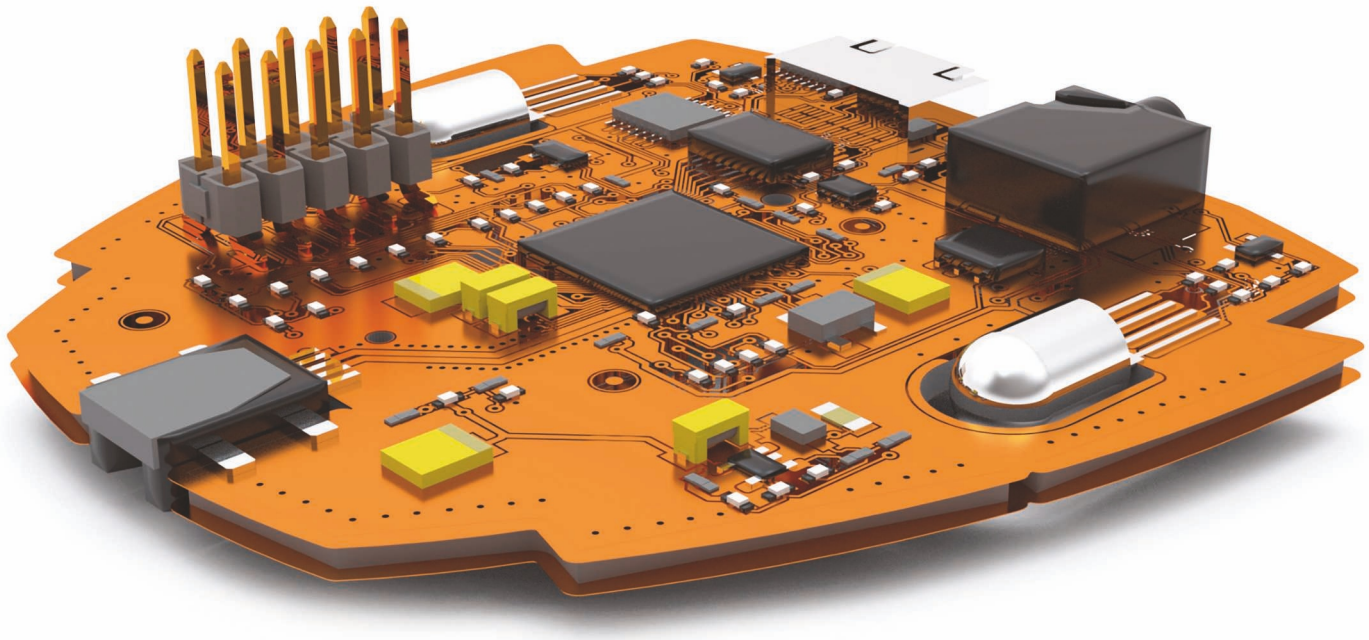
"It was challenging enough to do what we did," explained Tautscher. "The even bigger challenge now is to look at [End of Life] and longer term - that is where we want to get to. That's the only way we are going to achieve higher recycling rates, by looking at these post consumer sources."

For many though this is going to require a fundamental shift by the global aluminium industry. Instead of the thousands of different compositions that are currently available, a more limited selection of alloys is surely advantageous to avoid troublesome impurities seeping in, and devaluing the recycled materials.

REALCAR does set a promising foundation, however, and there are more projects to build upon this work with end of life remaining the ultimate destination. For now though, REALCAR is less of a breakthrough, and more of a milestone. 'Real develop' remains some way off.

Aluminium problems

Global recovery of the material is estimated to be 90%, only exceeded by glass at 94%. It's claimed three quarters of the aluminium ever produced is still in productive use. As long as the material is kept clean and segregated, it is in theory infinitely recyclable. The key thing is eliminating contaminants at source, so they don't reduce the recycled materials' quality and make it unusable for industries that require a high level of material quality. While poorer recycled materials can be diluted with more prime material to improve and hone properties, it defeats the point of trying to move away from prime material in the first place. And, for some contaminents like zinc, once they are in to a batch of aluminium, they are almost impossible to remove.



Seamless design for smart models

Increasingly designs have electronics at their core, but importing electronic CAD into mechanical models can be clunky at best. Tim Fryer reports on a package aiming to challenge that.

Most modern engineers are doing more than just designing a static part. Indeed, most parts are no longer static or designed by a single engineer. The majority of systems do things that require power, motion and electronics, and these are a collection of design skill sets that are not easy for an individual to master. More importantly, for an optimised design process, it helps to keep as many of these functions in the same design environment as possible.

However, getting all engineers working in the same environment, or even getting their disparate files working with the same master model, is not easy. That, at least, is the view of Louis Feinstein, product portfolio manager for Electrical and PCB at Solidworks, who commented: "IDF, IDX, Prostep, DXF, DWG inputs and all of those different industry standards for data exchange: none of them are any good. They are tortuous. None of them meet the total achievable goal that our customers want."

Electronic design engineering is becoming ever denser and mechanical engineers need to incorporate that in tighter packages. Students, says Feinstein, are now more commonly emerging with degrees in electromechanics, mechatronics and systems engineering.

"Electronics is everywhere and the future of design is in electromechanical systems," said Feinstein. "So we've come to the realisation that this is something we need to be part of, and that the world is changing. Solidworks needs to be the innovation platform of choice."

Altium Designer is popular amongst electronics engineers already, while Solidworks has traditionally been linked to mechanical engineers. Solidworks already has a package called Circuitworks, though this is more about ensuring compatibility with industry standards for the electrical connections rather than providing a ground up design environment for electronics. A new package, Solidworks PCB, is an integrated solution that is the offspring of a joint venture between Solidworks and Altium.

"One of the challenges that everybody has is integrating electronics into complex or small systems," observed Feinstein. "[Solidworks PCB] has the ability to integrate with Solidworks, there's a lot of emphasis on the electromechanical interfacing, but we did it in such a way that we call it 'stress-freeing', and that's really the point of it."

The other thing is to maintain existing workflows. Electronics engineers continue to design in the way they always have and the same for mechanical engineers. The difference to the norm is that these workflows concurrently run on the same model.

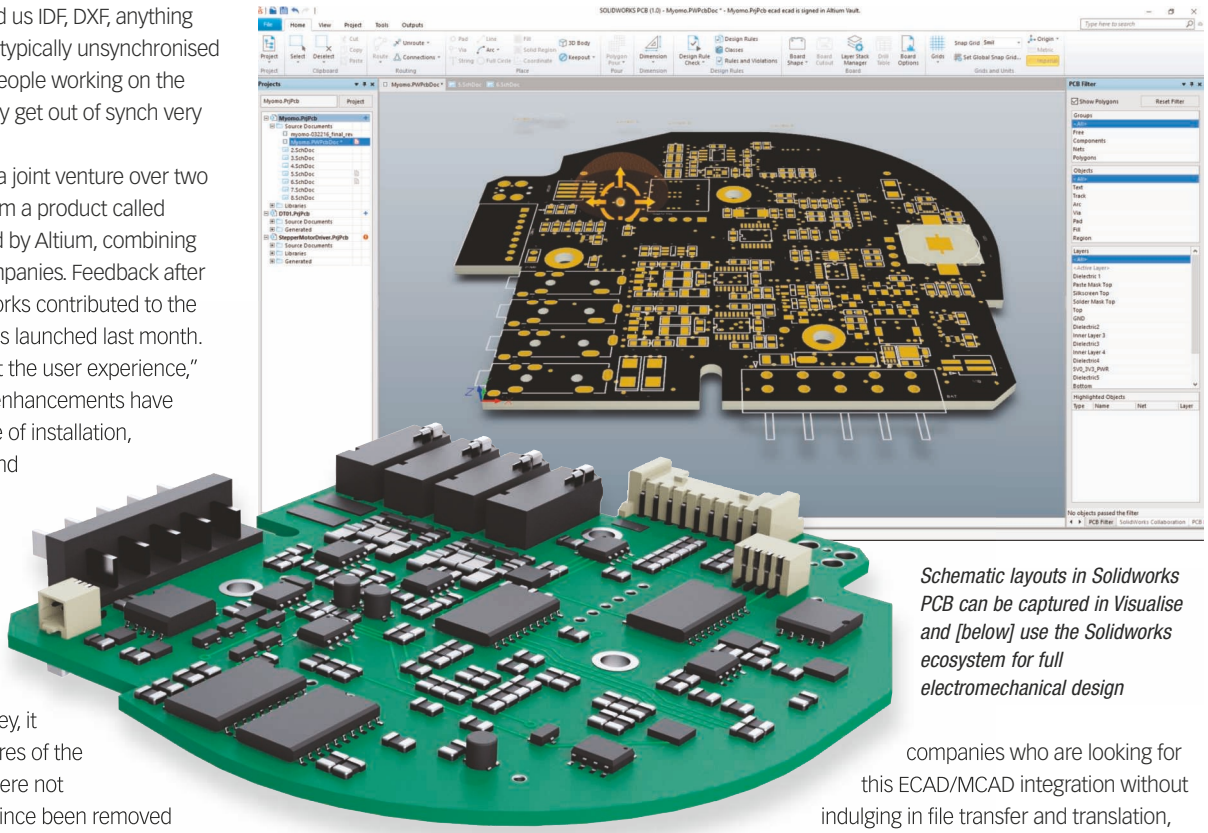
"When they want to synchronise, they can synchronise," Feinstein explained. "The really interesting part about it is we can show you what the other person's doing, you can accept or reject the change and the notification goes back directly. So, if an electronics engineer moves a mechanical feature he pushes it out to the mechanical engineer who can see the changes, and see how it's going to affect the mechanical design.

"It's an on-demand collaboration engine. When someone pushes it or pulls it, a little icon lights up because you have a new concept for you to take a look at when you approve it. The whole idea was to build the communication and make it really

stress-free. Customers told us IDF, DXF, anything that they use is laborious, typically unsynchronised and if you have multiple people working on the same project, they typically get out of synch very quickly."

The project started as a joint venture over two years ago and in the interim a product called PCBWorks was introduced by Altium, combining technology from both companies. Feedback after the introduction of PCBWorks contributed to the Solidworks PCB, which was launched last month.

"Solidworks is all about the user experience," Feinstein said. "So major enhancements have been in the licensing, ease of installation, how it actually operates and ease of use. We wanted it to have its own persona - ECAD software with the ancestry and DNA of Altium, but make it simpler to use."



Schematic layouts in Solidworks PCB can be captured in Visualise and [below] use the Solidworks ecosystem for full electromechanical design

Following a Solidworks customer survey, it was clear that some features of the original Altium Designer were not required and these have since been removed from the final Solidworks product. However, the big change is in collaboration capabilities. In the near future the Solidworks data management feature will be built in. When it is, Solidworks PCB will contain all the electrical design rules from Altium Designer and the equivalent mechanical design rules such as 3D collision.

Adding connectivity

However, companies already using Altium Designer are not being asked to switch to a new product if they don't want to. A second product has been launched, Solidworks PCB Connector, which brings Altium Designer files into the Solidworks environment.

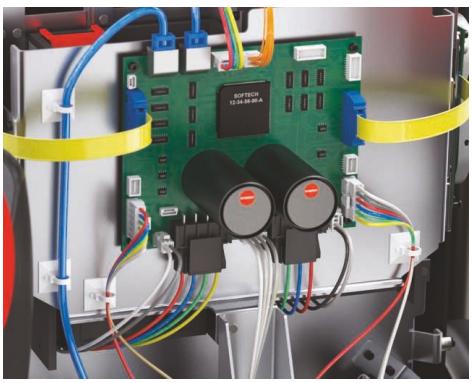
"The object here is not to compete [with Altium] – the object is to do what is right for the customer," said Feinstein.

Dedicated Altium users can therefore carry on in their existing design environment but use Connector to enable collaboration with mechanical models.

Beyond the design flow advantages that working on a single model brings, there are other benefits. "Once you have the product in the Solidworks ecosystem, it's incredible the amount of stuff we can do," Feinstein explained. "We can do thermal simulation, we can do vibration simulation, and also visualisation. Customers can't believe that we can build images of printed circuit boards that look better than if you'd take a picture of them.

"We're bringing out this ability to design a product, make it aesthetically pleasing and get marketing collateral prior to even cutting any steel. So once you bring it into the Solidworks ecosystem everything changes, from incoming inspection to documentation. So it becomes part of the ecosystem and seamlessly integrated."

While Solidworks PCB should appeal to companies who are looking for this ECAD/MCAD integration without indulging in file transfer and translation, Feinstein acknowledged that it taps into the modern connectivity phenomenon.



He commented: "There is this exploding market of the Internet of Things, and connected devices that go back into Industry 4.0. What we have here in Solidworks PCB is a backbone to do connected devices. Today people have all sorts of notions for connecting devices, but at the end of the day, its electronics that are doing the connections. The designs are becoming smarter and you need to have the software to do it. You're still going to do a schematic. But you need this type of tool to get the schematics done right. These are the tools of the future."

Solidworks PCB is aimed at the mainstream 'Solidworks market' but now addresses the requirement for those extra disciplines.

Feinstein concluded: "It will be those that get involved in electronic engineering that will really benefit from this. But, we also see it addressing the needs of start-up companies that are using freeware or maker software, and need to make the leap to becoming professionals. They need professional grade software if their products are becoming ready for market or if the existing tools that they're using just can't do what they need them to do."

Q&A

Why is SOLIDWORKS 2016 so great for electrical engineers?

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Where to find it: To add a PCB component select Components > New PCB

What's the biggest time saver in SOLIDWORKS Electrical 2016?

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Where to find it: Right-click>Paste Special or Ctrl+Shift+ V

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Where to find it: Side Panels can be accessed from 'Dockable Panels' rom within the 'View' tab.

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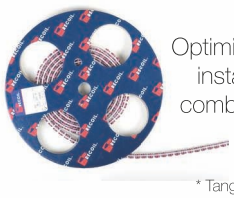

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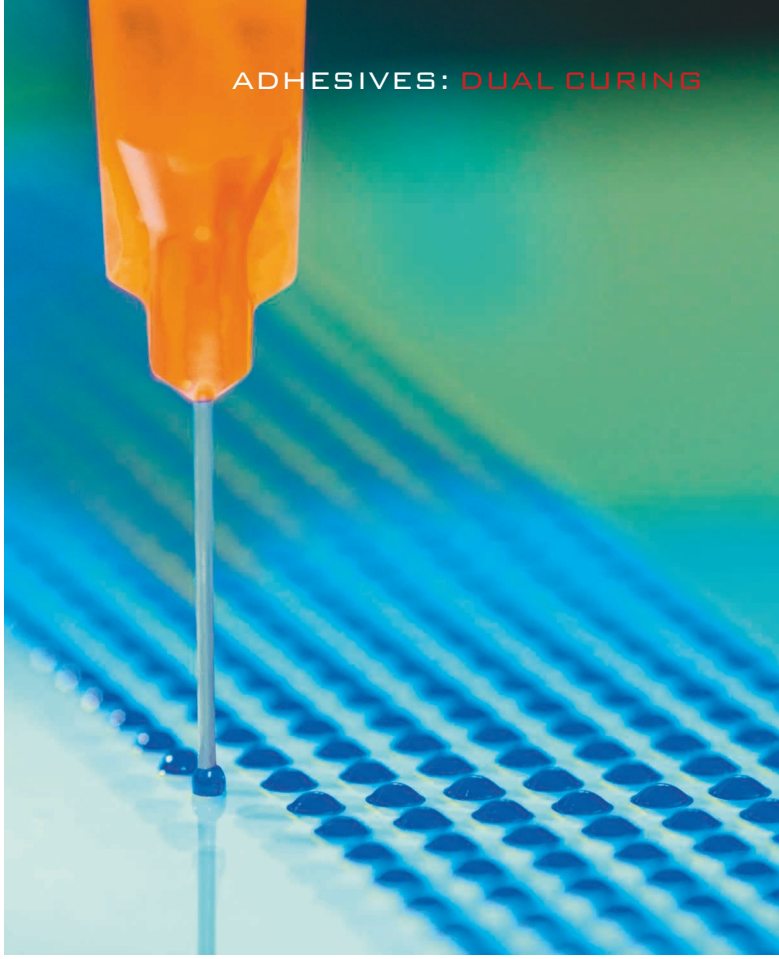
Sticking to multi-material assembly



As multi-material designs get increasingly passed over the preverbal wall for manufacture, the demand on adhesives with multiple curing mechanisms has increased. Here, *Eureka* reports on industry's latest developments.

Delo Industrial Adhesives has developed a portfolio of dual curing adhesives based on dissimilar chemistries, which, it claims, offers significant advantages over more 'traditional' adhesives, without sacrificing reliability, bond strength or ease of use. Uses include industrial displays, automotive camera modules, electric motors and even simple applications, such as thread-locking.

When bonding components together, it is essential that the whole volume of the adhesive is fully cured, as uncured adhesive in the finished assembly may cause corrosion or, in the case of optical products, interfere with the light path. For light curing adhesives (ultraviolet and visible light), achieving full cure can be a problem, due to shadow areas that the light can't reach. Heat cured adhesives do not suffer from this problem, but some components can be sensitive to temperatures even as low as 90-100°C.

Two-part cold cured adhesives, such as epoxies and polyurethanes, can overcome this issue, but the user then must suffer from the long curing times these adhesives require, thereby increasing cycle times and reducing throughput.

Diverse curing mechanisms

Dual curing adhesives overcome these issues in different ways, depending on the chemistry of the adhesive.

Currently, hybrid light and heat curing adhesives appear to be the preferred solution, but other chemistries, such as light and humidity or light and anaerobic adhesives, are gaining in popularity.

Light and heat cures

These are based on two diverse chemistries, epoxy and acrylate. Epoxies tend to be hard once cured, offering increased resistance to chemical and temperature stresses, on account of the tight cross-linking of the polymer that occurs during cure. Acrylates are usually softer adhesives, enabling quicker curing and greater flexibility of the cured adhesive.

Using a combination of heat and light to cure these adhesives offers the user a very fast fixation by snap-curing the photoinitiator in the adhesive. Subsequent heat curing ensures there is no uncured adhesive in any shadow zones that might exist in the assembly. This fast fixation also allows increased accuracy for the user – this is especially useful for companies that have invested heavily in high accuracy placement machines, only to see that investment wasted, due to movement of the parts being bonded during the heat cure stage.

According to Eamonn Redmond of Inseto, Delo's UK agent since 1998, customers' feedback has been incredibly positive when it comes to accuracy of bonded parts, with less than 1µm of movement during subsequent heat curing, as a direct result of light fixing the adhesive. "This is just not possible with adhesives that are only cured by heat," he said.

This heat cured stage generally involves heating the parts up to around 100°C after the light cure process. However, for temperature sensitive materials, such as some plastics, modified epoxy adhesives are available that will cure at 60°C, combining defined processes and short cycle times, despite the low curing temperature of the adhesive. These are especially useful in applications such as automotive camera modules or where the end product is subjected to chemical influences that would otherwise harm an acrylate adhesive. These dual curing epoxies also exhibit very low outgassing and low yellowing, making them ideal for applications with demanding optical requirements.

Dual curing acrylates offer similar advantages to dual curing epoxies, namely very fast fixing and full cure after subsequent heat curing, but these adhesives also exhibit excellent impact resistance and tension equalising properties, because of their flexible nature. These are ideally suitable for applications such as the assembly of rotary encoders, where optional

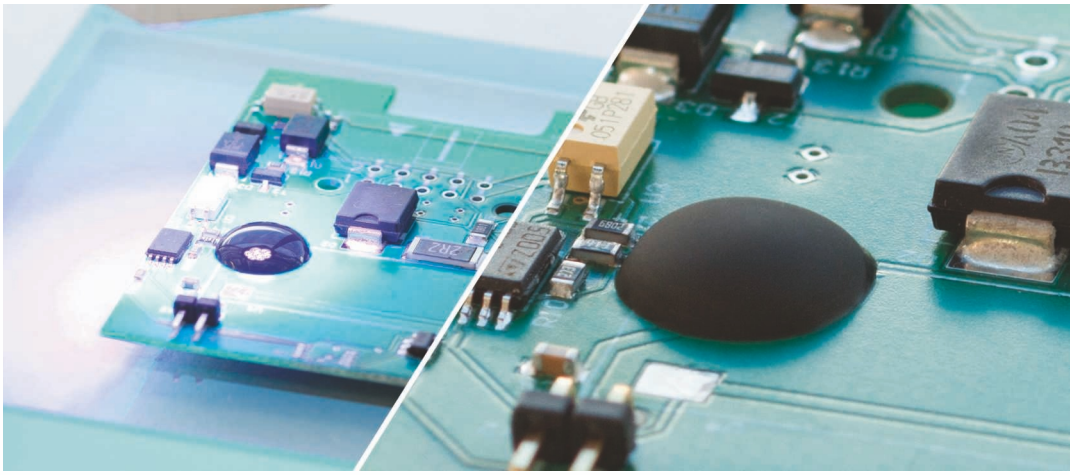
fluorescing and colouring can be added to aid visual inspection.

Light and heat cured adhesives also offer increased flexibility in the manufacturing process. While heat curing is mandatory for a small number of these adhesives, the majority offer independent curing mechanisms, allowing curing either by light, or by heat, or by a combination of the two.

Light and humidity cures

Light and humidity cured adhesives also enable a fast fixation by light, but the secondary curing mechanism in this instance is humidity, so there is no requirement for additional curing equipment. The majority of the assembly should be capable of being cured by light, to achieve optimum bond strength, but for applications such as mobile phone displays, where only the black border prevents light getting to the adhesive, then humidity curing at a rate of 2mm/day is the ideal secondary curing mechanism, enabling immediate handling after the initial light cure process.

These are also single part adhesives, and are free of isocyanates (no health and safety issues) and silicones (no impediment to subsequent adhesive bonding), unlike some acrylates. They are highly flexible, optically clear adhesives, offering climatic resistance, while also providing powerful bond strength on surfaces such as glass, PMMA, metal pins and most plastics.



Light fixable anhydrides used on a PCB

Light and anaerobic cures

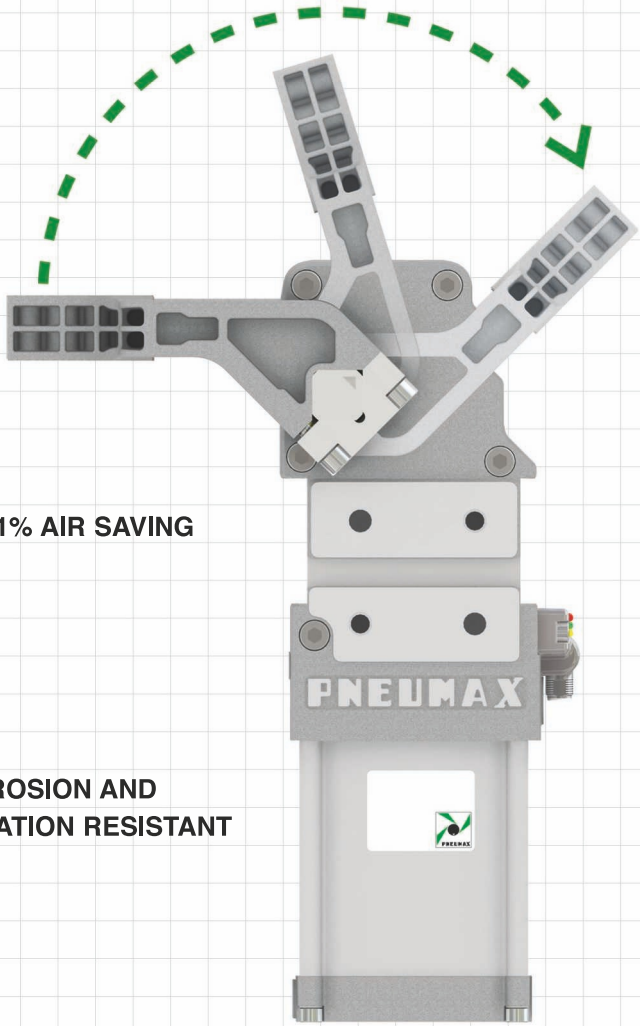
Anaerobic adhesives cure in the presence of metal and the absence of oxygen, but, in a lot of cases, the adhesive at the edge of the joint is exposed to air, which results in a small amount of uncured adhesive, possibly at either end of the bond. By using the photoinitiator in the adhesive to snap cure the edges of the joint, a 100% cure of the adhesive then becomes possible.

For example, Hall Effect sensors are used in automotive applications when position or speed needs to be monitored. These sensors are sometimes located directly on the wheel rim or even on the wheel hub. From there, they provide accurate information on how frequently the wheel is rotating. Using light and anaerobic dual curing adhesives for these applications is especially appropriate, because they assure a rapid fixation and a secure final curing, even in shadow zones. These adhesives are also highly resistant to media such as oil, gas and braking fluid, and they also meet JEDEC (Joint Electron Device Engineering Council) requirements for salt spray, reflow, vibration and drop tests.

These adhesives also offer an extended temperature resistance of -60°C to +180°C, making them suitable for applications such as e-motors where a lot of heat is generated. As they also exhibit excellent adhesion to most metals and plastics, with very high impact resistance, they are used for the assembly of slot magnets and temperature sensors.

Dual curing adhesives provide increased flexibility in the manufacturing process, giving end users more freedom when designing the manufacturing flow. They eliminate the unwanted possibility of uncured adhesive in the end product and offer maximum placement accuracy when building complex assemblies on expensive equipment.

Pneumax Assembly Line Clamp Technology



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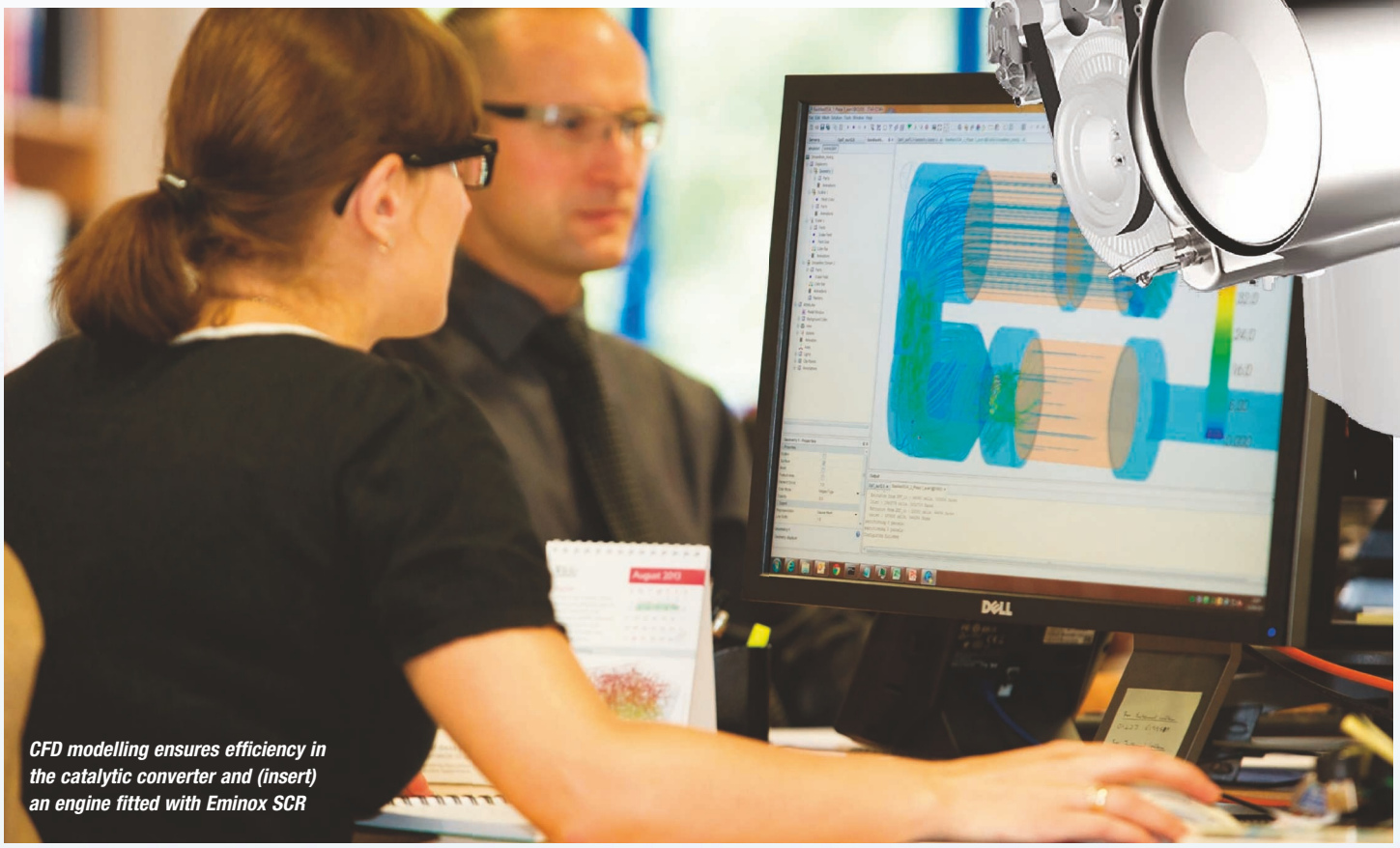
CLEAN IMAGE

Diesel engines have got a bad press in recent years, but there is a lot of work going on to make sure that strict environmental legislation is being met. Tim Fryer reports.



CFD modelling ensures efficiency in the catalytic converter and (insert) an engine fitted with Eminox SCR

Brexit voters, enraged by the amount of red tape and EU laws that we are subjected to, will find little relief when it comes to emissions legislation concerning diesel engines. As will be the case in many sectors, engineers will need to design to European or global standards if they intend selling their products in to those markets. Diesel engines, particularly for larger off-road vehicles, are typical of this as no OEM is going to want to design a vehicle just for a home market.

Not that the UK would necessarily want to ignore such legislation. The World Health Organisation has classified Particulate Matter (PM) as carcinogenic, and there is increasing evidence of the harmful effects of Nitrogen Oxides (NOx).

However, meeting the Stage 4 EU legislation has been demanding and the move to Stage 5, although three or four years away (depending on engine size), will demand air coming out of an exhaust being cleaner, at least in terms of PM and NOx, than it was when entering the engine. Stage 6 lurks a decade or more away, and presumably by that time the diesel engine will be regarded as an air purification device. It is a tough ask and unsurprisingly many OEMs are already making preparations.

Designing a vehicle that will be compliant is no easy task. It will be an evolutionary process but one that will be complicated by the route that was taken when meeting the demands of Stage 4. Going back a step further, Stage 3 emissions could be dealt with within the engine's cylinder, the last legislative tier where this was possible. Stage 4 signalled a change in technology requirements – after treatment has become a necessity.

Engines can be developed to reduce harmful emissions but there is a trade-off. Reducing NOx typically increases PM and vice versa, and this affects the nature of the after treatment. A low

FOR DIRTY DIESEL

NOx engine with high PM will typically be dealt with by a diesel oxidation catalyst (DOC) along with a diesel particulate filter (DPF). The alternative route is to go for a low PM engine with high NOx levels that then would require treatment using a DOC and selective catalytic reduction (SCR).

It should be pointed out that carbon monoxide and hydrocarbons are also included in the legislation, but they are removed by using the processes for NOx and PM. Another aspect of the Stage 5 is that it will distinguish between engine size. So engines down to 19kW (25 horsepower), that's lawnmower size, will have certain emission restrictions and these become more stringent after 56kW (75hp).

Implementing a strategy to tackle emissions compliance is not a straightforward task for most vehicle manufacturers. Simply adding more filters and treatment plants under the bonnet is not an option.

Bob Laing, product development manager at Eminox, explained: "Generally OEMs will do a facelift based on the emissions change as well. The reason being is it has such an impact is the considerable space it claims within the vehicle. Generally, there's not really that much space available. So when they've actually got to go round again, and to do the redesign and put all of this equipment in, they find that they've got to move major components. So therefore it's almost easier to start from scratch."

Laing says Eminox is already a considerable way along the path of developing solutions for its OEM customers. He said: "As we move to Stage 5, the emissions standards have become so tight that virtually no-one can get through the standard without bringing all of these elements together. So all engines larger than 56kW will go with the DOC, some type of particulate filter, an SCR, and then what we call a clean-up catalyst."

Companies who went down the DOC/SCR route add a second fluid to the catalytic converter. This fluid, AdBlue, is a urea in water solution, that converts NOx into environmentally acceptable bi-products, principally nitrogen and water.

This reaction is temperature dependent as are other catalytic options and the passive regeneration within the filters. Temperature management therefore becomes critical in assessing the capability of the converters, but the most important consideration is the amount of space the OEM allows.

"We understand the packaging space that they've got available, and the engine guys set emissions targets," said Laing. "The targets then drive an initial sizing of the bricks [the cordierite filters] which is the biggest constraint. Some of these can be a 13-inch diameter, by 18 or 20-inches, and that would be one can. And inside that we have an inlet, a DOC, a DPF and an outlet to potentially an SCR mixer section. You may have two cans like that."

The design process flow starts with Eminox taking collaborating with the OEM to create CAD files. Initial CFD will assess the ability of the design to achieve necessary gas flows and temperatures.

Fuel Injector durability test rig

Laing continued: "Once we've got a package locked down and we're quite happy that it fits, it meets the emissions tier, we've got the substrates in there, we'll then move to a much more in-depth study. We'll use CFD to then make sure that the gas, as it goes round the corner, actually hits the full front face of the catalyst. What you can't do is have a very tight bend and then have the gas only hit a portion of the catalyst, because then you're just wasting money. The efficiency of the system must be very high. We're actually looking at about 96% to 98% of the gas hitting the full front face of the catalyst."

Satisfied that the system works in principle the next stage is to move on to the bracket stacks, the mounted system, to make sure the system is sound. An NVH (noise, vibration and harshness) study ensures that there is no disruptive noise from the system.

The overall goal is to make systems that are lighter, cheaper and smaller. Improvements in catalysts should help along this road but there are immediate subtleties that can make a big difference.

"Alongside identifying the right type of catalyst for the right job, there are things like mixing technologies," commented Laing. "If you can do a good job of mixing, you can do that in a smaller space leading to systems that are more compact and lightweight. It is where we add a lot of value in what we call close proximity mixing, allowing the systems to still achieve high performance in terms of emissions reduction, but in a more compact space."

Good engineering can satisfy the demands of current legislation, but what happens when we move to Stage 6? "We're actually at a point where the particulate matter is so low and the NOx is being controlled to such a level, that the legislators have got to go after something else," said Laing.

But what are they going to go after and to what level? In or out of Europe, we will need to find the answers.

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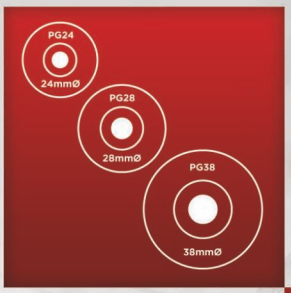

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Car batteries go the extra mile

One of the challenges of electric cars has always been to make the economics stack up. If worn out batteries still had a value, would that help and reinforce environmental credentials? *Eureka* reports.

2016 looks like it is the year of energy storage, as a growing number of suppliers commercialise battery technologies which are emerging as a critical part of the sustainable energy puzzle.

Tesla started the ball rolling, shipping deliveries of Powerwall, a home battery that charges using electricity generated from solar panels, or when utility rates are low, releasing its energy in the evening when demand and prices are higher. Other well-known companies such as Daimler have also launched products in this area.

At the same time, power management company Eaton has joined forces with carmaker Nissan to develop an innovative and scalable energy storage and control system, opening up multiple applications across industrial, commercial and residential settings.

The Eaton/Nissan development is particularly interesting because it finds a way of giving a second-life to old batteries from electric cars. Specifically, the solution re-uses lithium-ion battery packs from Nissan's Leaf electric vehicles, creating an energy storage technology with wide-ranging benefits including securing continuity of supply, integration of renewable energy sources, avoidance of peak energy tariffs, participation in demand response programs and a reduction in the reliance on expensive fuels such as diesel.

"Energy storage systems are becoming crucial components in the development of smarter grids," said Cyrille Brisson, vice president of marketing at Eaton Electrical. "These technologies facilitate the wider adoption and deployment of renewable generation, and they hold the potential to give people greater control over their energy supply and consumption.

"Each energy storage technology solution is different in its own way. But there are some common and wide-ranging benefits, which include continuity of supply, increased grid stability and efficiency, avoidance of peak energy tariffs and a reduction in the reliance on expensive fuels like diesel to compensate for no-grid or poor-grid situations. Energy storage clearly has a very bright future."

"Energy storage systems are becoming crucial components in the development of smarter grids."

Cyrille Brisson

From Nissan's perspective, the energy storage technology provides a cost-effective 'second life' for batteries that have degraded after several years' use in its Leaf vehicles. The Leaf has become one of the world's top-selling all-electric cars, gaining acceptance as a popular replacement for petrol- and diesel-powered superminis and family runarounds, particularly in urban settings. Second-life Leaf batteries maintain more than 70% of their initial capacity at the end of the ownership cycle, and with more than 200,000 Nissan EVs sold since launch, that represents multiple gigawatt hours of energy storage capacity.

The battery technology is combined with an uninterruptable power supply (UPS) into a single, packaged system with the capability to integrate any solar PV system. This will allow customers to manage energy consumption and supply while connected to, or independent of, the grid. The Eaton UPS acts as the

(Above) The Nissan battery stack and (right) the introduction of the technology was at the COP21 exhibition in Paris

brain of the system, with the second-life batteries providing the storage capacity. Importantly, the energy storage solution has been designed as an integrated package – unlike many other battery-based energy storage solutions currently available which comprise a collection of standalone technologies that are linked together. With the integration of the photovoltaics, for example, the connection is not just via an input on the UPS - it is connected inside the UPS on the DC bus which acts to minimise the losses on the system. This integrated approach provides uninterrupted high-quality power, energy storage and supply of energy off-grid. The UPS is programmed to select the optimum mix of power sources according to load, grid constraints and availability of renewables.

In terms of usage, if installed with solar photovoltaics, the technology could work in several ways, depending on various factors. During early mornings, when renewable energy is not available and the batteries are not fully charged, the energy control centre could use the grid to power the load. When the sun begins to shine and renewable energy becomes available, the control centre could then be used to power load or charge the batteries.

When the sun is shining and batteries are fully charged, the energy control centre could feed the load directly with renewable energy, thereby reducing costs. During peak periods, when solar produces more energy than needed by the load, the control centre could inject the available energy to the grid. If grid demand was very high, the energy stored in the batteries could also be released to further support peak shaving.

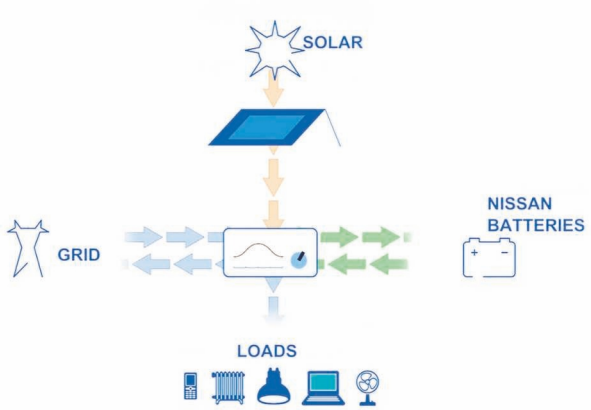
The first working demonstration of the system was installed at the Nissan pavilion during the United Nations conference on climate change COP21 at the end of 2015 in central Paris. The system integrated power electronics, control software and stationary storage with the possibility to combine up to four 17 kWh second life batteries in parallel providing an output of up to 50 kW at voltages of 230V/400V. The building's energy was switched from grid to batteries to power lighting and other electrical circuits. The technology is therefore tried and tested and ready for full market commercialisation.

In addition, Nissan's new regional office in France will house the largest second life battery storage unit ever installed in a building, anywhere in the world. The new building will feature a 1MWh energy storage system from Eaton, powered by 64 Nissan Leaf second life EV batteries combined with solar energy generation.

In terms of system lifecycle, car battery capacity would usually degrade by around 25% over several years of standard automotive operation, and it is at this point that they would be considered for second-life energy storage use. Nissan says that, depending on their usage, the batteries in the energy storage unit would then be expected to last between five and 10 years.

Ultimately, the development of the energy storage product could change the economics of electric car ownership, as the value of degraded batteries increases. While disposal of spent batteries has always been considered a cost, in future there would be real value for the car owner at end of life. That change in the economic landscape could go a long way to transforming the market for electric cars.

When the sun is shining and batteries are fully charged, the energy control centre could feed the load directly with renewable energy, thereby reducing costs.



Content still KING at Coventry

As the Engineering Design Show returns to Coventry, it aims this year to address the marked shifts being seen across the engineering industry, and allow visitors first hand opportunities to try out the latest technologies for themselves.

There are great shifts occurring within the engineering industry. Some are even calling it the 4th industrial revolution. But, whether you place that much emphasis on it or not, there is no doubt that things are changing. Intelligence and connectivity are increasingly seeping in to products, as are exotic materials, which no longer seem so exotic. Design cycles are being compressed, innovation expectations heightened, and better products are getting to market faster than ever before.

It can be a little overwhelming. So when productivity demands are greater than ever, is it really the time to start using virtual reality headsets to design your next product? Is 3D printing all it's cracked up to be? Sometime the best way, and only way, to make your mind up for sure is to get your hands on some equipment and ask questions to those in the know, and those that have made the endeavour.

Broadly speaking, this is the reason that MA Business set up the Engineering Design Show. It connects emerging technologies with those that can use them to produce products that are better, faster, stronger, cheaper, or whatever it is that your market demands.

Of course the show is a commercial venture, but it is one that has always strived to put content and the needs of its visitors, first. This year's *Eureka* conference will hold two extended keynote sessions on the changing face of engineering design tools and then how to adopt advanced materials on the following day.

Each of these sessions, scheduled for two hours, will have three speakers from major international industry players. This will be followed by an open panel discussion with the three speakers to take questions from the audience. The aim is to allow attendees to quiz specifics by asking direct questions relevant to their organisations, addressing concerns about implementing change, and how to overcome reservations from senior management.

Since last year, both the thought leadership conference and more practical workshop sessions have been approved to have Continuing Professional Development (CPD) points awarded for those in attendance. It means that all our sessions have to have third party approval to meet content standards, to help visitors work towards professional registration.

Innovation Zone

The Engineering Design Show has also reserved space to show off particularly innovative products. Visitors are encouraged to explore this area of the show floor to help stimulate ideas and see how others have gotten creative with the technology around them. These products have incorporated a number of emerging technologies and processes to create something that is market leading or game-changing.

Examples, this year, include the front end of a motorbike that has been produced using additive manufacturing processes developed at the Manufacturing Technology Centre. That's joined by the RP1 track day car from Elemental Cars that uses cutting edge design and engineering techniques in combination with advanced materials. There will also be a head up motorbike helmet display that's been developed by Renfrew Group.

Oxford Space System will also be

ENGINEERING
DESIGN SHOW

displaying it's out of this world antenna, which competes on the world stage despite the group's relatively humble design and manufacture facility. JCB will also lend the Coventry hall's its innovative Hydradig, the first true wheeled excavator designed for purpose, from the ground up, for the challenges of operating within inner city construction sites. Both companies will also give a conference session thought leadership piece about becoming a competitive UK engineering firm on the world stage.

Future Zone

New to this year's show is the Future Zone. This is an area reserved on the show floor to showcase and give visitors demos of emerging technology. This year we are going to feature two virtual reality headsets to allow passersby the opportunity to try the technology out for themselves.

The headsets provided by Virtalis are top of the range and track the motion of the user's head as well as allowing them to interact with computer models driven by CAD data.

Co-located shows

Alongside the Engineering Design Show will be the Electronics Design Show and fast growing Embedded Design Show.

The Electronics Design Show also runs a seven session a day workshop theatre as well as a corresponding *New Electronics* Conference programme. Both promise to pack practical as well as thought leadership speakers on the bill, covering everything from industry trends including evolving cellular networks and 5G, cost-effective board testing and programming, as well as the emerging wearables market.

The Embedded Design Show focuses its attention on the booming embedded electronics marketplace that is being driven by connected and smart products, often under the broad banner of the Internet of Things and Machine to Machine connectivity. Again a seven session a day workshop theatre will cover topics such as sensor selection for the emergence of smart products, keeping online devices secure, and optimising battery life.

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Pitch *Perfect*

Anyone who has ever watched Dragon's Den will know that when you are put on the spot it can all go horribly wrong, especially if you don't have all the answers ready in advance. Tom Austin-Morgan finds out what makes the perfect pitch.

Pitching a project or product design can be incredibly stressful, all those details and numbers; the pressure of competing against other teams with rival ideas; how will your audience react to your ideas? Should you imagine your audience naked? Never fear, there are some 'dos' and 'don'ts' that can help ease the anxiety.

The first thing you need to do, according to Cambridge Consultants' Max Middleton, is to understand the company you're pitching to: in which market(s) does it operate? What products does it produce? Who are its customers? What is it trying to achieve with the project/product?

"As soon as a project comes in we go to the end users and ask what they don't like about, or what they would like from, the existing product or project," explained Middleton, group leader in Cambridge Consultants' product design engineering group.

Knowing exactly what the client company does and what it needs from the project before you even enter into a discourse is paramount. Being able to demonstrate a wider knowledge of the market in which the client company operates instils trust in your ability to tackle the challenges of the project ahead.

"You have to give them the confidence that you're the best team for the job," Middleton added. Having the experts, i.e. the engineers and scientists, in your team make the presentation will increase trust, as they will be able to talk about the project in greater depth than business developers, for example.

In addition, having a wide range of skills in your organisation is another boon, as it means that you have the ability to pitch for a wider variety of projects. It also means that you can more easily overcome problems that arise during the course of a project.

Most companies however, don't have access to multiple teams with varying degrees of expertise and will have to collaborate with other design houses or consultancies. During the collaborative process disagreements can arise. Ensuring you keep good relationships with those around you is also essential to keeping projects on track.

When it comes to the presentation, should you use PowerPoint or is that old hat and boring in the world of more dynamic tools like Prezi, CustomShow, Projeqt and SlideDog?

"We typically present on PowerPoint, rather than other flashy software, as it's largely ubiquitous and the story you're telling should be told as simply as possible," explained Middleton. "A flashy presentation that scrolls around and zooms in and out doesn't make for a good, strong pitch. The flashiness is all the client will remember, not the product or the pitch itself. Being picked for

a project based on this kind of presentation can be a mistake for both parties."

Also, consider where the client is with a project. Do they want concepts to take forward or a production ready design? If the project is in the initial stages, perhaps various sketches may suffice. Alternatively, you could consider presenting physical design variations via 3D printed models, so the client can see and feel your ideas. How important are looks versus user experience. Concentrate on what matters.

"We've found 'experience design' is what a lot of our clients are more interested in when it comes to connected devices," said Middleton.

Using slides containing a single image with as little written information as possible is good practice for slide based presentations. A lot of text is distracting; people start reading the slide rather than listening to what you're saying. A video is also a good option that allows you to get a lot of information across, while giving you the opportunity to provide a voiceover.

"In your presentation, keep the introduction of your company, its history and similar projects you've worked on in the past to a minimum," added Middleton.

A well-timed pitch should be between 20 and 30 minutes. However, expect the real fun to start during Q&A sessions which can last in excess of an hour. This is where clients will really quiz your knowledge and drill down in to the detail of your pitch. So make sure you anticipate questions, and be as prepared as possible. This is also an opportunity to demonstrate your experience and knowledge by knowing about regulation or safety constraints, who will make the product and exactly what resources the client has put towards it.

And be brave. If you really struggle with nerves there are some great sites on the internet that offer all sorts of advice. But most important are: take deep breaths; have a glass of water handy; speak slowly and clearly; smile; and, most of all stop thinking about yourself. Remember that the audience is there to gain information and your only job is to put it across to them clearly.

HAVE YOUR SAY

Have you had experience with in-house pitches? Do you have any best practice tips that we haven't covered here? Let us know by emailing: editor@eurekamagazine.co.uk

"Keep the introduction of your company, its history and similar projects you've worked on in the past to a minimum."

Max Middleton, Cambridge Consultants

Checklist

- ✓ *Know your audience and their market needs*
- ✓ *Be enthusiastic about your pitch*
- ✓ *Have as wide a skill-set as possible*
- ✓ *Be confident!*
- ✓ *Practice makes perfects – don't expect to be a master pitcher without gaining experience of being under the spotlight*
- ✓ *Use experienced people – having an experienced hand to accompany you can help drive the right positive message and keep the team calm under pressure*
- ✓ *Consider the in-house vs external partner question*
- ✓ *Keep it simple: flashy presentations can be distracting*
- ✓ *Use videos*
- ✓ *Pitch at the right level: is it for conceptual ideas or production ready designs?*
- ✓ *Minimise the text on a slide*
- ✓ *Keep it concise – 20-30mins maximum!*
- ✓ *Be prepared to be grilled. Q&A sessions are where decisions are made – so have all the answers ready and figures to hand*
- ✓ *Show your expertise and creativity*
- ✓ *Be bold – this is an opportunity to show what you can do. Don't be shy and undersell yourself!*

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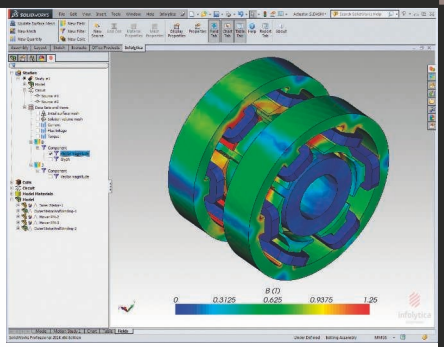

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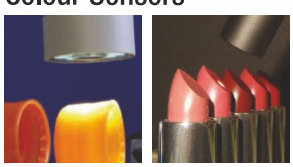

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Quieten down, please!

Perhaps it is a sign of impending middle age, but sometimes many of us wish the world would just quieten down. Colleagues' talking, spouses' snoring, kids' screaming… has someone just turned up the radio?! Too much noise makes it hard to concentrate, sleep or relax.

And, for those that have to work in a noisy environment, wearing ear defenders or earplugs cuts out high frequencies, but leaves a bass ridden drone that seems virtually unattenuated. Many complain that this imbalance adds stress and fatigue as the brain compensates for the mismatch.

This is also a problem for music lovers that attend gigs, giving rise to the question of whether to wear earplugs or not. Wearing them muffles the music, unbalances frequencies, and distorts the listening experience… but they do prevent hearing loss, so it is not all bad.

Then there are the musicians themselves, of course, that mostly opt to avoid ear protection for exactly that reason – it muffles and unbalances the music they create.

The challenge

The challenge this month is therefore to come up with a better way of reducing or alleviating loud volumes. An ideal solution would be to attenuate all frequencies evenly, essentially turning down the volume of the outside environment, for example at a music concert. Alternatively, any solution should also offer the option to, as close as possible, completely block out sound altogether. For example, if you need to concentrate at work, relax on an aeroplane or get some sleep with a 'snorer'.

Material choice is bound to be important here. Many ear protection products rely on foam materials that work by absorbing sound waves. However, these tend to only block certain higher frequencies and might reduce potential damage but fail elsewhere.

Sound needs a medium to pass through, so perhaps forming a vacuum in the ear canal might prove the ultimate sound barrier? Keep in mind, however, any solution should be practical to wear and be preferably passive, though this is not a prerequisite.

The solution we have in mind will be revealed in the September issue of *Eureka*. In the meantime, have a think of how you might tackle this problem, and let us know your ideas by emailing tim.fryer@markallengroup.com or leave a comment on the Coffee Time Challenge section of the website.

Last month's Coffee Time Challenge was to come up with a method of removing camera shake. You will find our solution on page 9.

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Where:
The Honourable Artillery Company (HAC), London

When:
6th October 2016, 11.30am

What:
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Host:
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