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Eureka!



VIRTUAL WORKING

WHY WE NEED MORE COLLABORATION BETWEEN MAN AND MACHINE

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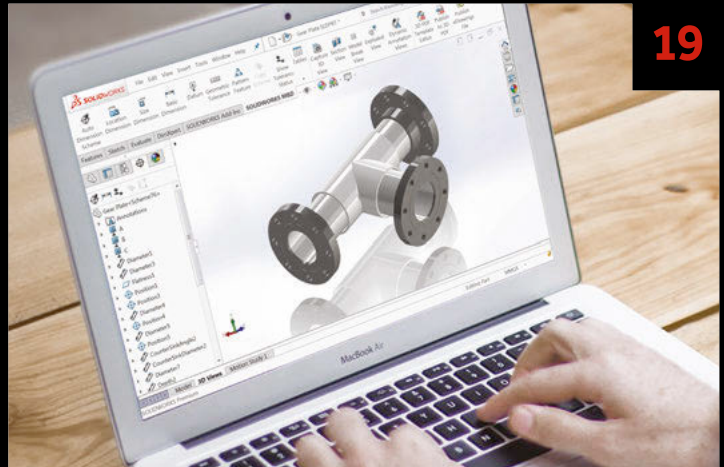
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A prototype polymer patch capable of performing the same role as actual heart tissue could be a gamechanger in the quest to combat diseases like Parkinson's.

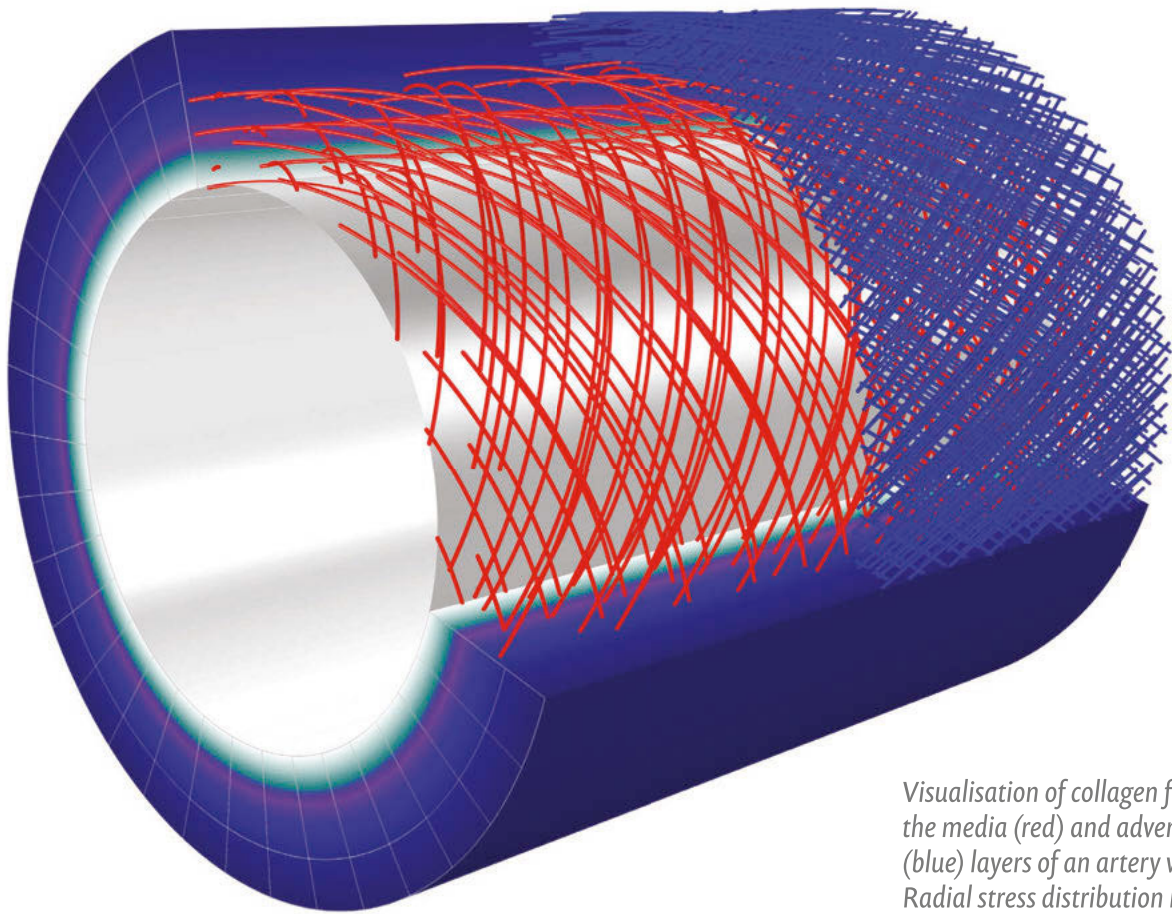
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Going beyond the HGO material model to study arterial walls.



Visualisation of collagen fibres in the media (red) and adventitia (blue) layers of an artery wall. Radial stress distribution is shown.

The Holzapfel-Gasser-Ogden (HGO) constitutive model is effective at describing the anisotropic mechanical response of artery walls. But to reliably model the behaviour of arterial walls after sudden changes in axial stress, you need to go beyond the HGO material model and use one that is hyperviscoelastic.

The COMSOL Multiphysics® software is used for simulating designs, devices and processes in all fields of engineering, manufacturing and scientific research. See how you can apply it to biomechanics modelling.

comsol.blog/viscoelasticity



Pic Credit: James Hellman, MD

NEEDS MUST

THE COVID-19 PANDEMIC has forced all of us to reassess priorities and has revealed weaknesses in structures and systems we have long taken for granted. One of the areas where the events of recent weeks has shone light is in the vulnerability of our global supply chains.

Nowhere has this situation been made more painfully apparent than in the potentially life-threatening shortage of ventilators available to hospitals in the UK. With global demand for these at record levels, the option of simply ordering them from abroad is no longer available, which means it has become necessary for the government to turn to UK industry to request help with their manufacture.

"We're calling on the manufacturing industry and all those with relevant expertise who might be able to help to come together to help the country tackle this national crisis" said a Downing street spokesperson. "We need to step up production of vital equipment such as ventilators so that we can all help the most vulnerable, and we need businesses to come to us and help in this national effort."

Already government has been talking to manufacturers on this subject and, while the only company officially mentioned by the government is Unipart group, but Rolls-Royce Plc and JCB have also been referenced in a number of reports.

One of the biggest challenges in this is mobilising the supply chain and ensuring



that all of the key components required can be readily sourced. In order to aid the Government in this critical effort, Eureka! has identified companies on its Supplier Directory that produce the relevant components and is making sure that they are made aware of this initiative.

If you think you can help, we strongly urge you to go to <https://ventilator.herokuapp.com/> to find out more.

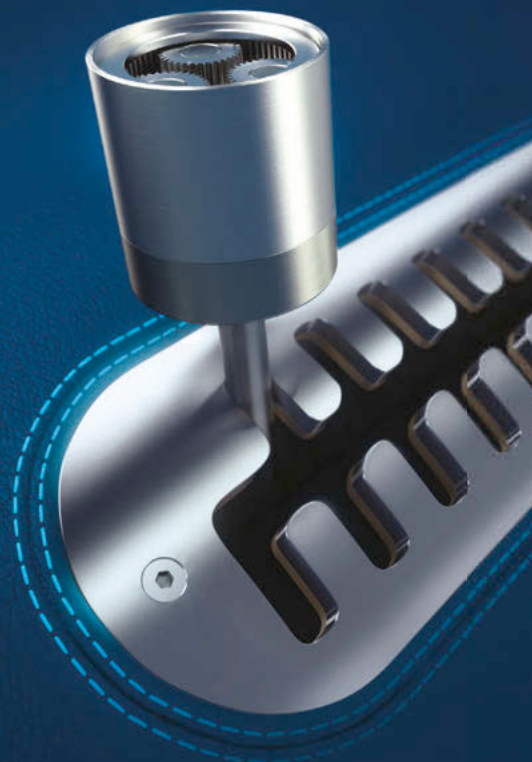
Manufacturing and engineering have always been of vital national importance. This is an opportunity to demonstrate that fact.

Paul Fanning, Editor

MISSION STATEMENT

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Eureka! connects design engineers with the UK's industrial heartbeat by providing in-depth coverage on the very latest technology developments and industry trends; keeping you inspired, informed and innovative.



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Editor **PAUL FANNING**
paul.fanning@markallengroup.com

Deputy Editor **TOM AUSTIN-MORGAN**
tom.austin-morgan@markallengroup.com

Art Editor **CHRIS CHARLES**
chris.charles@markallengroup.com

ADVERTISING SALES 01322 221144

Sales Director **JEZ WALTERS**
jez.walters@markallengroup.com

Sales Executive **RAY GREEN**
ray.green@markallengroup.com

Production **CHLOE JEAKINS**
chloe.jeakins@markallengroup.com

Circulation Manager **CHRIS JONES**
chris.jones@markallengroup.com

Publisher **LUKE WEBSTER**
luke.webster@markallengroup.com

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MOVING ON?

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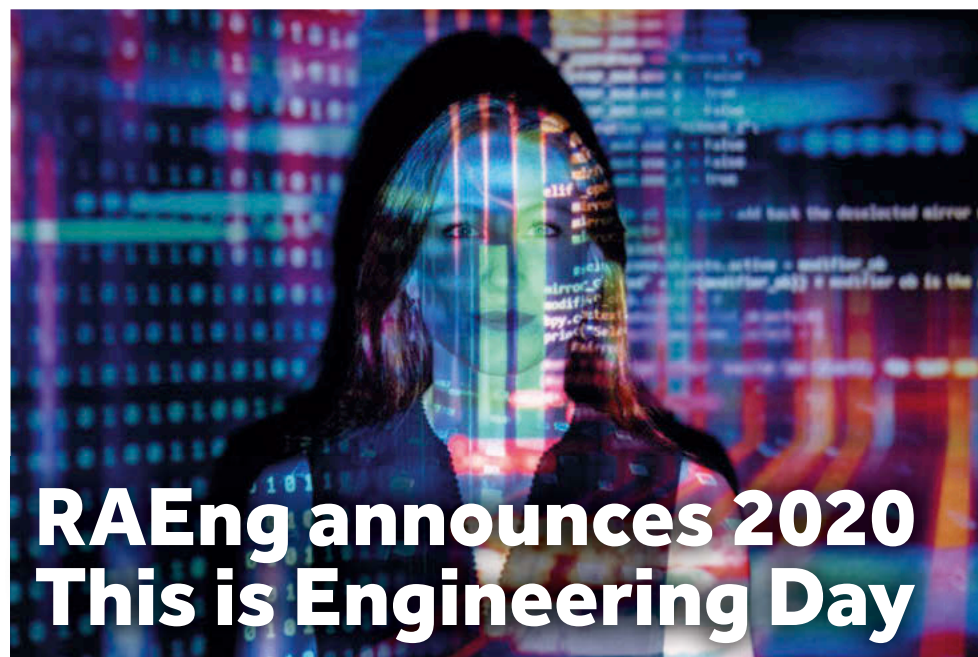
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RAEng announces 2020 This is Engineering Day

THE ROYAL ACADEMY of Engineering's 2020 This is Engineering Day will celebrate the engineers and engineering shaping our everyday lives and the world around us.

Working with EngineeringUK and partners across the profession, the initiative is central to the Academy's This is Engineering campaign to give more young people, from all backgrounds, the opportunity to

take up engineering careers.

Dr Hayaatun Sillem CBE, chief executive of the Royal Academy of Engineering, said: "More than 150 engineering companies and organisations across the UK have so far pledged to help the Academy to show a different, diverse and surprising image of the profession. We're calling for even more partners to join our This is Engineering campaign and celebrate This is Engineering

Day on 4 November 2020 as we continue our work to transform the image of engineering."

'Be the difference' is the theme of the Day and engineering companies, organisations and individual engineers are all invited to get involved and think of ways in which they can showcase how engineers make a difference – online, on social media or via events and engagement activities.

GRAPHENE PATCH MONITORS WOUNDS

GRAPHENE FLAGSHIP

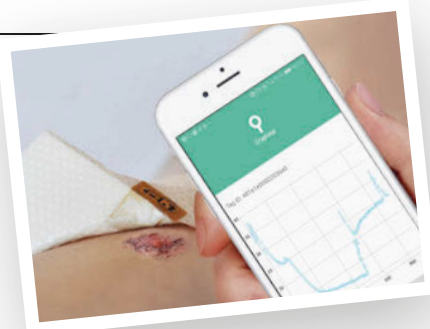
MEMBER Grapheal has developed a wearable patch for the remote monitoring of chronic wounds. The flexible and transparent graphene-based biosensor enables doctors and nurses to provide hyper-responsive treatment of chronic wounds.

Chronic wounds, mostly associated with diabetes in Europe, can take months or even years to heal. In 20% of the cases, the injury never heals and can lead to limb amputation. There was a 19.4% increase in limb amputations during 2014-2017

compared to 2010-2013.

Connected to a smartphone, Grapheal's wearable patch enables continuous monitoring of wounds. The patch measures and stores the bio parameters of the wound and communicates this data to the cloud via the app. This real-time connectivity ensures nurses and doctors can be alerted to early stages of infection and other complications.

"Our patented formula uses Graphene-on-polymer, in a non-invasive way, to actively react to any changes to the wound",



explained Vincent Bouchiat, Grapheal CEO. "As an atomically thin material, graphene's electrode conductivity will change according to any physicochemical change, enabling faster detection of problems for patients."

"The non-invasive nature of the patch actively stimulates wound healing — and we have led eight preclinical studies to prove its bio stimulation properties."

3D PRINTING IN SECONDS

RESEARCHERS FROM

SWITZERLAND'S Ecole polytechnique fédérale de Lausanne (EPFL) say they have developed a completely new way of creating small 3D "in a matter of seconds".

The EPFL's method draws on the principle of tomography, a method used mainly in medical imaging to build a model of an object based on surface scans.

Paul Delrot, CTO of Readily3D, the company that has been set up to develop and market the system,

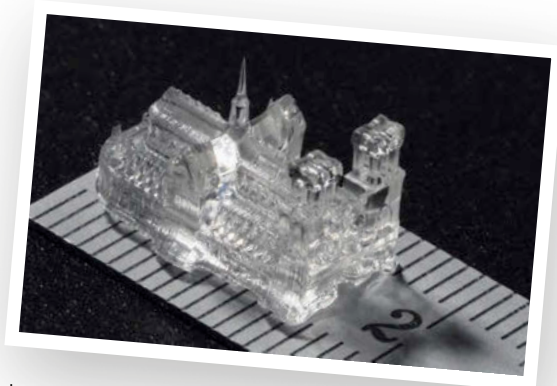
explained:

"The laser hardens the liquid through a process of polymerisation. We use algorithms to calculate exactly where we need to aim the beams, from what angles, and at what dose."

The technology could find use in a range of industries, but its advantages over existing methods suit it especially for medical. Researchers believe the process could be used, for instance, to make

soft objects such as tissue, organs, hearing aids and mouthguards. What's more, printing can take place inside sealed, sterile containers, preventing contamination.

According to the EPFL team, the system is currently capable of making 2cm structures with a precision of 80 micrometres. However, they believe that could be increased to 15cm in the future.



BUSINESS NEWS

HEXAGON ACQUIRES ROMAX

Sensor, software and autonomous solutions company, Hexagon AB has acquired Romax Technology Limited, a provider of CAE software for electromechanical drivetrain design and simulation, for an undisclosed sum to help with the shift towards electrification.

MULTI-MILLION MANAGEMENT BUYOUT

HMK Automation Group has undergone a multi-million-pound management buyout (MBO). The deal sees control of the business handed to the management team led by MD Gary Kitchin.

LIGHTWEIGHT OPPORTUNITIES

SDE Technology, a pressings and assemblies company (formerly Salop Design and Engineering), has become the first company in Europe to hold a production licence for Hot Form Quench (HFQ), a process for producing light weight, high strength aluminium parts for use in the automotive, aerospace and renewable sectors.

ROCKWELL BUYS ASEM

Rockwell Automation has acquired Italy-based ASEM, S.p.A., a provider of digital automation technologies, for an undisclosed sum. ASEM provides a complete range of Industrial PCs, Human-Machine Interface hardware and software, remote access capabilities, and secure Industrial IoT gateway solutions.

Coronavirus prompts calls for local sourcing

THE UK'S MANUFACTURING sector is being urged to re-think the long-term benefits of 'local sourcing' due to a sudden spike in demand driven by the Coronavirus outbreak.

"Coronavirus has heightened the need to 'think local' on a long-term basis, and reduce over reliance on overseas sourcing," said Roger Vance, MD of Ad-Vance Engineering.

"Many leading businesses are suddenly facing major supply

challenges. But with over 50% of UK tool manufacturing currently being sourced from China, the impact on our entire manufacturing sector, and wider economy, could be disastrous."

According to Vance, local businesses offer major manufacturers a more sustainable supply solution.

"Across the board we are better organised, more responsive and much more efficient. We also have the experience, processes and people in place to offer an experienced, no-risk,

high quality solution which is also very cost effective.

"It has taken a global threat to highlight the benefits of re-shoring, I would urge the sector to re-consider its supply base."



TECH BRIEF

LOW-COST CAM FOLLOWERS

UK bearings importer, McGill Bearings has introduced a budget-friendly range of imperial cam followers to combat the rising costs of big brand bearings.

Also known as cam bearings or track followers, these bearings are an essential component of many appliances including commercial and domestic dishwashers, and external sprinkler systems. They are also particularly suitable for conveying systems due to their unique and unusual design.

The budget-friendly range are full complement and sealed and feature a cylindrical outer ring and a black oxide finish. With three options available – the imperial yoke sealed cam follower, the CF-SB series imperial cam follower, and the CFH-SB heavy series cam follower – outer roller diameter choices measure between 0.5 and 3 inches.

"The market is dominated by one or two big US brands that really have the monopoly," said Midland Bearings managing



director, Phil Chesworth. "The US brands are widely available yet costly, which is why we've made it our mission to source more affordable, budget-friendly alternatives which save money without compromising on quality."



MOVERS & SHAKERS

42 TECHNOLOGY APPOINTS DIRECTOR

42 Technology has appointed Dr Chris Floyd, previously business development director at Rolls-Royce, as a non-executive director to its board. Floyd brings a wealth of experience in international business development and strategic management and will play an advisory role in the company's growth and development.

EXPERT RE-JOINS MATERIALS COUNCIL

The Materials Processing Institute has welcomed the return of steel industry expert Jon Bolton to its supreme governing council. Bolton has 40 years' experience in the industry, and has co-chaired the Steel Council, advising government and providing strategic leadership.

CPI CEO STEPS DOWN

Nigel Perry, the CPI's chief executive officer, has stepped down. His successor, Frank Millar, formerly CPI's chief operating officer has been appointed and will take on the role of CEO from April 2020.

NEW COO AT DASSAULT

Dassault Systèmes' chief financial officer Pascal Daloz has been appointed chief operating officer. In this newly created role, Daloz will lead the Operations Executive Committee, a new organisational structure that will support Dassault's ambition to drive innovation in the Life sciences and Healthcare, Manufacturing industries, and Infrastructure and Cities sectors. He retains his role as CFO.

ROYAL NAVY'S AUTONOMOUS SUB

PLYMOUTH-BASED MSUBS

LTD is to provide the Royal Navy with a £1million, 30-metre underwater test vehicle with a range of up to 3,000 nautical miles.

In use, Manta XLUV (Extra Large Unmanned Underwater Vehicle) could take part in surveillance, reconnaissance, and anti-submarine warfare operations.

"I am enormously excited about



Tony Radakin, First Sea Lord.

"These XLUVs

are at the forefront of underwater systems

technology; UK technological developments such as this will be key to the Royal Navy maintaining its battle-winning edge in the underwater environment."

The first phase of testing will see an existing crewed submersible refitted with autonomous control systems. If successful, up to a further £1.5m is available for further tests.

the potential for remotely piloted and autonomous systems to increase our reach and lethality, improve our efficiency and reduce the number of people we have to put in harm's way," said Admiral

SOLUTION TO LAST MONTH'S COFFEE TIME CHALLENGE



Last month we asked you to come up with a design for a method or device to make sheep shearing more efficient for the shearer and less stressful for the sheep.

Our solution comes from Oxfordshire-based torque measurement solution and wireless load sensor manufacturer Sensor Technology Ltd (ST). Based on SAW (surface acoustic wave) technology, ST's TorqSense transducers play an important role in product development as an aid to evaluating the performance of miniature electric motors at Gloucestershire-based Lister Shearing, the oldest supplier of animal shearing and clipping equipment in the world.

An issue commonly encountered with powered hand tools is sourcing motors that will combine high efficiency and high torque output with smooth operation and long life. This is complicated further by the high operating speed required from the motors.

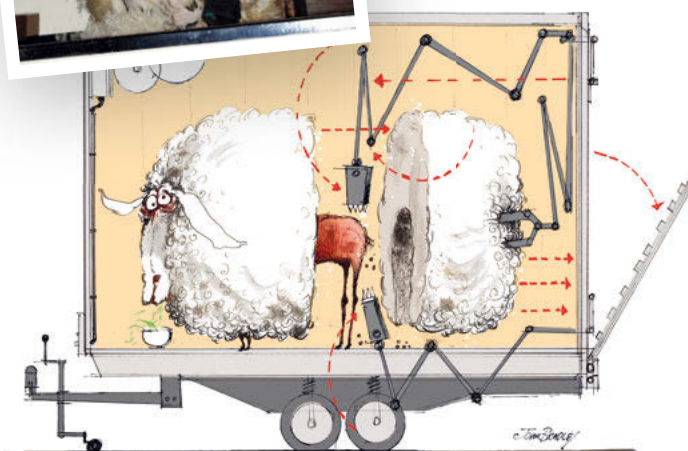
To address these issues, Lister Shearing set up a motor test rig that would allow the performance of motors from various suppliers to be compared quickly and easily.

TorqSense sensors are available in versions that can be used at shaft speeds well in excess of 20,000rpm, easily meeting Lister Shearing's requirements in this area. In addition, they have a high overload margin, operate

clockwise and anticlockwise, feature integral temperature monitoring, and provide accurate data about speed and power.

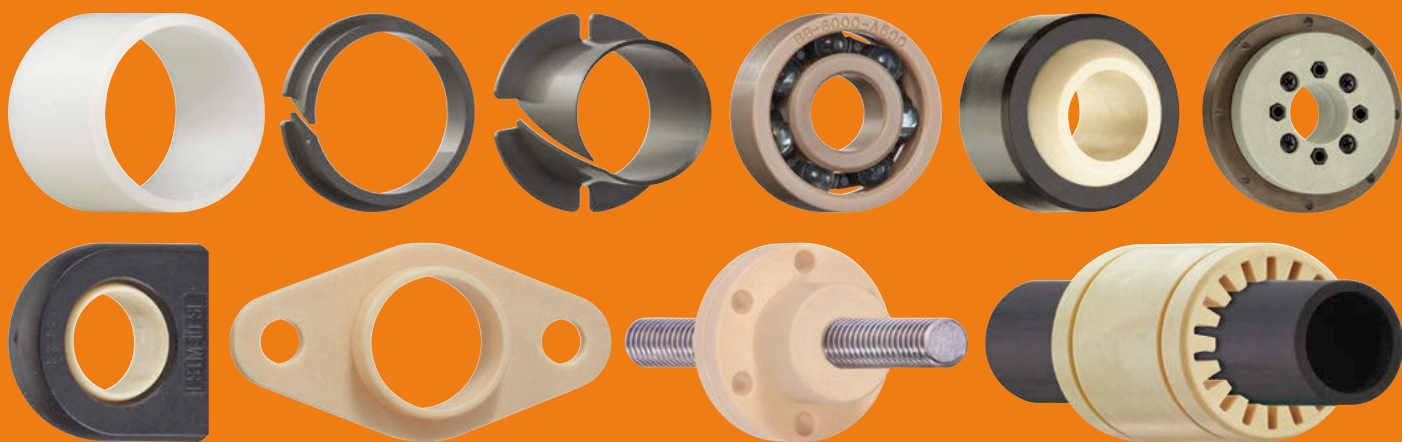
In this application, ST's TorqView software package was used to combine data acquisition with a real-time display of torque, motor shaft speed, power and temperature.

Robin Howell, chief development engineer at Lister Shearing, said: "After using the rig for some time, I have no doubt at all that it will help us to produce equipment that will set new standards for performance in sheep shearing."



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HUMAN MACHINE INTERACTION

Why do we need greater collaboration between man and machine? Tom Austin-Morgan investigates.

Over the past decade, technology — in particular, AI — has advanced at an unprecedented rate.

Rarely a month goes by that doesn't see a new innovation surpassing a benchmark previously thought to be insurmountable. For example, a few years ago Google Deepmind's AlphaGo program beat one of the world's best Go (a Chinese board game) players in such an impressive way that its tactics were described as "beautiful" by Fan Hui, a European Champion.

Although, these developments have engendered some concerns. Many worry that such rapid development of machines could spell the demise of humanity. Although for others, the chief concern is the prospect of unemployment. According to a report from Carl Frey and Michael Osborne at Oxford University, 47% of jobs will be partly automated over the coming years. Whilst interesting, such research does nothing to calm the nerves of the workforce.

However, there is countering evidence to suggest that the future might not be as negative as many have assumed. So, rather than machines rendering humans obsolete, we should instead be exploring the countless opportunities that will stem from a closer collaboration between man and machine.

THE BENEFITS OF COLLABORATION

"First and foremost, we must acknowledge the possibility that AI could ultimately improve the way humans work," states Nikolas Kairinos, CEO and founder of Fountech.

ai, a company specialising in the development and delivery of artificial intelligence solutions for businesses and organisations. "Indeed, the Harvard Business Review found that 1,500 firms achieved the most significant performance improvements when workers and technology worked closely together."

So, what improvements can we expect to see from such a collaboration?

According to Kairinos: "The first will likely be amplification — that is, machines augmenting the roles and tasks that humans already fulfil. AI for farmers, for example, highlights just how such amplification could work. Here, the latter can be provided with real-time recommendations as to where they should plant crops, which crops they should plant, what sort of fertiliser to use, etc. The role of the agriculturists is still as important as ever, yet the collaboration between man and machine means the crop yield could become far greater. The engineers of tomorrow will need to ensure that new machines dovetail with both the needs of workers and the capabilities of AI, as in this example."

Secondly, Kairinos continues, AI will certainly play a greater role when it comes to repetitive tasks: "Millions of people worldwide have jobs that are repetitive, laborious and at times, dangerous. In the engineering world, there are countless examples, but the operators who manage machinery spring most keenly to mind.

Thankfully, AI could be set to make the world of work more interesting. Tools such as X.ai are on the bleeding edge of this battle. This is an example of a program that automates »



» procedural, time-consuming office emails, acting essentially as a personal assistant and thereby allowing workers to spend more time on value-adding tasks.”

In these ways, collaboration between man and machine is needed because it makes the work humans do more fruitful and less monotonous.

WILL WE BE REPLACED?

While collaboration between people and technology appears both likely and highly beneficial, many continue to make gloomy predictions about unemployment and humanity being replaced. These are usually accompanied by questions over where future generations will find their purpose, if not in work.

However, Kairinos adds, those issues are at the bottom of a slippery slope, and the reality is likely to be more positive. He says: “History has shown that great technological advancements don’t necessarily push people out of work. Over the course of the 20th century, for example, we collectively progressed from the telegram to the personal computer, and unemployment in the West hovered roughly around the 5%-10% mark throughout.”

Indeed, huge progress in AI looks likely to drive job creation instead. Kairinos continues: “According to the World Economic Forum, there will be a net creation of 58 million jobs due to technological advancements over the medium term — despite millions of jobs becoming automated. Pedro Domingos, head of machine learning at the D.E. Shaw Group suggests that the proliferation of AI and new technology will create roles that are currently unintelligible — in the same way that the concept of a ‘graphic designer’ or ‘software developer’ would be unimaginable to a Victorian.”

Further, Kairinos says, there are many arguments suggesting that humans have some inherent characteristics that machines will never be able to replace. “William J. Littlefield II, a tech specialist and philosopher, offers the example that people are able to reason ‘abductively’. Whilst machines can

While collaboration between people and technology appears both likely and highly beneficial, many continue to make gloomy predictions about unemployment and humanity being replaced



NIKOLAS KAIRINOS

CEO and founder of Fountech.ai, a company specialising in the development and delivery of artificial intelligence solutions for businesses and organisations.



do so ‘inductively’ and ‘deductively’, this faculty is creative and allows us to think beyond the confines of pre-established parameters.

Some would argue that this ability to think outside the box sets us apart from machines.

“We also cannot do away with the need for human insight, particularly when it comes to sensitive matters.

The example of Google Translate offers a good example — researchers at the University of Princeton found that it had picked up sexist discrimination from language learning and had begun translating Turkish in an offensive manner. Without human oversight and input from engineers, developers and designers, these problematic mistakes could go unchecked.”

In sum, we need greater collaboration between man and machine because of the many benefits it will bring. Importantly, many of the concerns people have about the negative results of this collaboration appear unlikely to come to pass. I now look with interest to see how the engineering sector will respond to these trends and how individual firms maximise on the growing opportunities in AI.

HEALTH AND SAFETY

Automation doesn’t just mean certain jobs being taken away from workers or even the creation of new jobs, Steve

Brambley, CEO at Gambica — which represents the instrumentation, control, automation and laboratory technology industries in the UK — says it’s also about improving societal issues.

“We often forget that automation isn’t just about productivity or quality,” he says. “There’s masses of evidence out there that talks about the fact that technology is a creator of jobs and will make a great change to society.”

He claims that Greta Thunberg, the extinction rebellion movement and the proliferation of electric vehicles have raised the profile and our understanding of the climate crisis.

“Other drivers at the institutional level include the United Nations’ Sustainable Development Goals,” Brambley adds. “There’s a whole load of drivers about poverty, hunger, welfare, etc, but also things like decent work and economic growth. So, it’s not an entirely green agenda, it’s also about good society and sustainable development goals.”

These goals are being applied to product standards, for example, manufacturers want to demonstrate to their customers and staff that they’re trying to do the right thing.

“How does that translate into where automation and digitalisation go? Well, health, safety and wellbeing are probably some of the more familiar things driving automation. Particularly, regulation and safety have been very big drivers, and preventing accidents has long been one of the reasons »



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» why people automate – whether they're forced into it because something happened or because they're being proactive to make sure that accidents don't happen," Brambley continues. "And it's not just accidents and fatalities, it's injury and strain. Whether that's moving things around or just augmenting the people that do the job."

Equally, protection from toxic and hazardous materials, such as paint shops in car manufacturing plants or anywhere that's dusty or uses chemicals, automation is used to reduce exposure to those elements by continuous monitoring of the environment.

Brambley adds: "Finally, reducing stress and anxiety might not be always directly obvious, but the idea that if we provide information to people to help them do their jobs, it actually takes away some of their worries. For example, 'have I remembered all the things I have to do?'"

THE 'CONNECTED WORKER'

Industrial software and services company, PTC's president and CEO, Jim Heppelmann, also believes the use of AI and Augmented Reality (AR) can protect the knowledge and expertise of retiring workers by training next-gen and existing employees. He says the rise of the 'connected worker' could help end the UK's skills drain being accelerated by an ageing workforce.

The chief executive of the company, that has its UK offices in Farnborough, pointed to an increased uptake in the number of companies investing in AR as a way of protecting traditional skills and securing IP.

In its simplest sense, PTC's Vuforia Expert Capture lets experienced designers and engineers record a task as they carry it out using a wearable device, such as Microsoft's HoloLens. The content is then turned into a step-by-step video guide with instructions for other workers to follow through the wearable tech – locking valuable skills in place forever.

"The terms Artificial Intelligence and Augmented Reality automatically conjure up images of robots taking



According to the recent PwC 'Seeing is Believing' Report, wider adoption of VR and AR is going to add £1.5trillion to the world economy over the next ten years. It's not something businesses can ignore any longer

human jobs – well, the 'connected worker' paints a completely different picture," explains Heppelmann.

One of the biggest threats to UK industry is an ageing workforce, with recent data from a European Labour Force Survey revealing that 16% of the total EU workforce is aged 55 and over. There is a real danger that these experts will retire before the next generation has had the chance to learn from them.

Heppelmann continues: "This no longer needs to be the case. Adoption is growing thanks to the ability to combine AR and AI to offer cost-effective solutions to manufacturers, not to mention a change in mindset from industry, who have now realised the importance of investing in business-ready software and hardware.

"We have countless examples of small, medium and large firms that are embracing 'connected worker' technology to protect knowledge when workers retire, to reduce the costs of onboarding new employees and even the ability to quickly reskill and cross train existing staff.

"I can only see this trend continuing, especially as we see technology and platforms mature to meet the requirements of the modern-day manufacturer. These technologies can bring the superpower of computing into the arms and legs of

the workforce.

"According to the recent PwC 'Seeing is Believing' Report, wider adoption of VR and AR is going to add £1.5trillion to the world economy over the next ten years. It's not something businesses can ignore any longer."

AR is still a relatively new technology, with its use in industry only dating back five years or so. Previously, it has mainly been used to enrich static views by information being overlaid on to reality, but now new functionalities are being developed and rolled-out over the next twelve months.

This will overlay information dynamically and, using low-cost or high-quality glasses, enabling nearly every industrial application imaginable to benefit from Augmented Reality.

Heppelmann concluded: "Augmented Reality is one of the most effective user interfaces ever developed, but it isn't that useful if it never makes it out of R&D as a true off-the-shelf business tool.

"PTC is heavily investing and working hard to ensure that organisations can leverage the additional technologies related to the Internet of Things (IoT), Product Lifecycle Management (PLM) and Generative Design, ultimately leveraging the full spectrum of what Industry 4.0 has to offer whilst also ensuring people are at the centre of Digital Transformation." 



JIM HEPPELMANN

President and CEO of industrial software and services company PTC.



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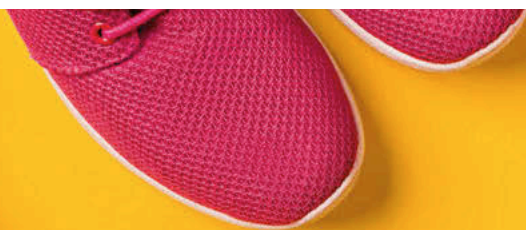
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CYBER RISKS IN 3D PRINTING

With the increasing use of 3D printing, Corey Nachreiner, CTO at WatchGuard Technologies, looks at the potential cyber risks and how to keep this fast-growing technology safe.

According to Dutch 3D printer manufacturer Ultimaker, 25% of businesses will take up 3D printing over the next two years, compared to 7% currently. This is because, across the globe, awareness of what this exciting new technology can deliver is growing at the same time as the cost is dropping, enabling wider industrial and commercial adoption.

So far, we haven't seen any real-world attacks on 3D printing systems, nor are we aware of any publicly known breaches due to the technology. Most of the discussion and research around their vulnerabilities and weaknesses comes from security researchers finding potential problems, but that statement shouldn't be misinterpreted; researchers have found proven and exploitable flaws. Criminals just don't appear to have 3D printing in their sights – at least for the time being.

Having said that, these 3D printers run software like any other computing device and that software can be vulnerable to programming flaws and backdoors that allow various types of attack, up to and including gaining complete control of the 3D printing device. Since we often connect these printers to a network, either directly or through a printing host, vulnerabilities in their network software could potentially give

attackers full remote control of a printer. This is not just theory, as researchers have found and released details on specific vulnerabilities in particular models of printer or accompanying network software, that have been proven exploitable.

Additionally, many security experts worry about the data security of 3D model files used to generate the actual prints. If not secured properly, they may give criminals access to valuable intellectual property if they include R&D prototypes or other internal designs. Furthermore, a sophisticated actor with access to these files could make very subtle changes that are not immediately viewable to the human eye but could result in compromising or weakening the finished product.

While these new threat surfaces could potentially result in attacks with significant impact, so far, we are not aware of any real-world criminal attacks.

THE MOST PROBABLE RISKS

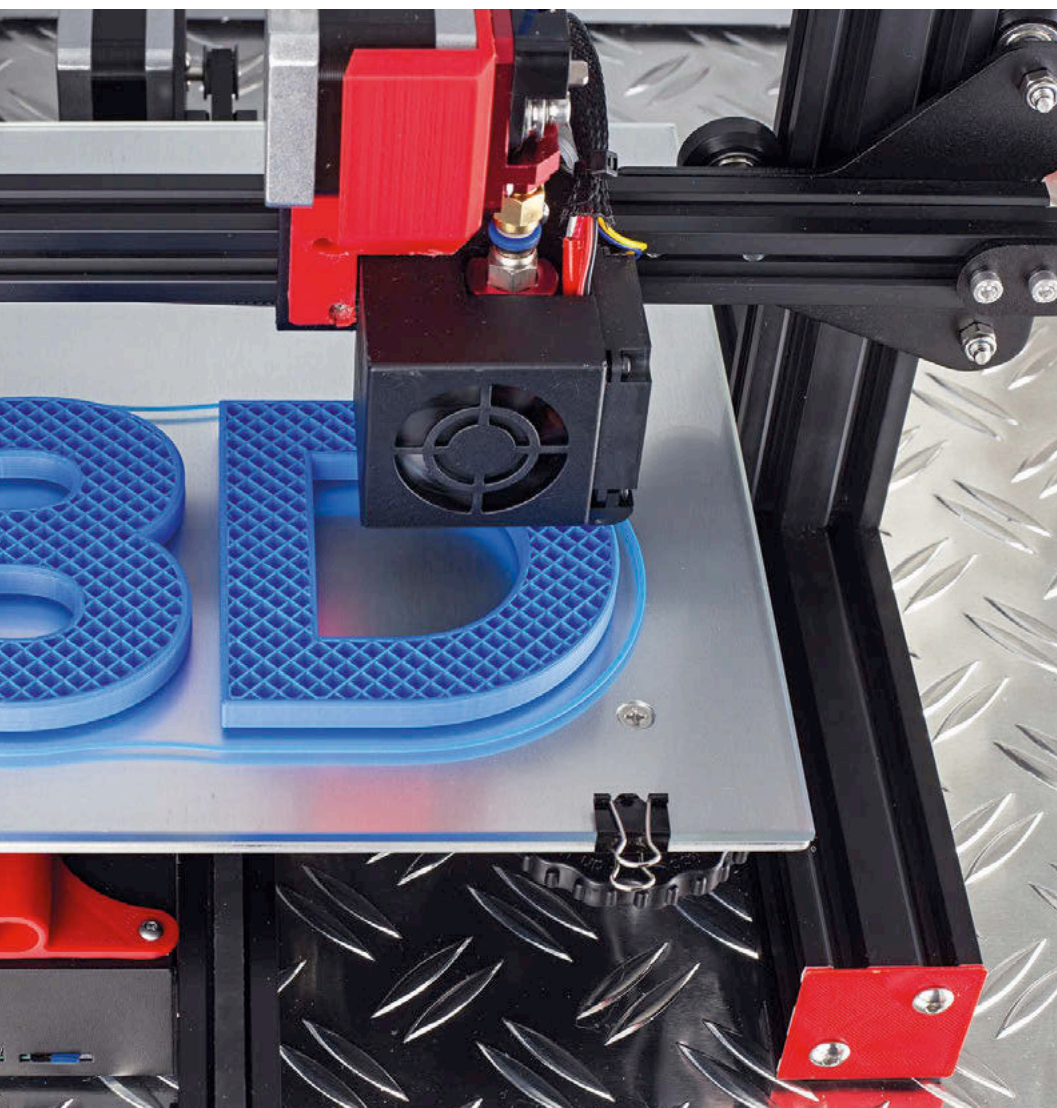
3D printers come in many levels, from hobbyist ones that print small, proof-of-concept plastic models, to very robust professional printers that can create useable mechanical or medical parts. In connected production environments, the most potentially damaging threats could be:



ABOUT THE AUTHOR

Corey Nachreiner,
CTO at
WatchGuard
Technologies

- A simple denial of service (DOS) attack. If you are using a printer professionally to output commercial parts, a simple DOS attack will cost you money. Prints can sometimes take a long time, so an attack simply forcing an error at the end of a print could result in many unusable parts costing you time and money.
- Intellectual property theft. These printers, by definition, are printing from 3D model files. If those 3D models are your intellectual property, the plans themselves need to be protected.
- A hidden trojan horse in your network. While all 3D printers can be different, some actually embed regular networked computers. A software flaw could give an attacker full control of



the computer. Even if they do not leverage that access to mess with your prints, they now control a hidden host on your network from where they can attack the rest of your internal network.

- Maliciously damaged or booby-trapped prints. One of the most nefarious potential attacks against 3D printing is maliciously modifying the model/printing file used to create the item you are printing. If you are creating parts that are being put under any force, the internals of that model are as important as the external shape. It is possible for malicious actors to modify print files in a way that they structurally weaken the internal design, even if its external shape looks perfectly as expected.
- Physical risks. Many 3D printers

use potentially dangerous processes, including very high heat. It is theoretically possible for an attacker to disable software safeguards and cause things like heating elements to overheat, maybe even causing damage and fires.

PROTECTION ACROSS THREE DIMENSIONS

To help prevent any of these breaches from happening, it's important to recognise that when connected to a network, either directly or via a printer host computer, these devices suffer many of the same types of attacks as traditional computers. Therefore, applying some of the same defences you do to your normal computer often helps.

If your 3D printers are networked,

firewall them from the Internet. This prevents remote attackers from accessing them or the printing hosts that run them. You should also internally segment your 3D printers from your most trusted computers internally (firewalls help here too). This adds an extra access control point that may prevent any successful attack on your printers from leaking to your more secure, trusted network. You should already be segmenting your Internet of Things (IoT) devices and putting your 3D printers in that segment is recommended.

Other network-based security solutions like Intrusion Protection Services (IPS) can be leveraged to potentially catch any exploits that do target printers. Updating printer firmware and other 3D printing software regularly is imperative. Like any IoT device, 3D printers actually run software internally, it is just called firmware when it's embedded into hardware. Many don't think about updating the software that comes with hardware, but it does get updates from vendors (though less regularly), so it should always be up to date. When researchers, or worse yet criminal hackers, do find software vulnerabilities in specific printer software, that update could fix it and prevent it being targeted.

Currently, known attacks on production 3D printers are so low and virtually unheard of, that this attack vector isn't particularly relevant yet, and shouldn't be a priority. However, not being aware of any real-world attacks doesn't mean they haven't happened. More importantly, researchers have found provable exploits that work and do pose risk to specific 3D printing devices and software. Over the last decades, the cyber security research community has had a great track record of predictively researching certain new vectors of attack long before they became a common vector among criminal hackers. It therefore wouldn't be surprising to see cyber criminals target 3D printing devices more regularly within the next five years.

If individuals and companies leverage 3D printing for critical business processes, attacks on them can cost them money, as well as their reputation – particularly if print parts fail when it comes to operations. **!**



New transparent
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of LSR possible

Demand for tailor-made polymer materials optimised for specific uses is steadily growing. On the downside, quantities of waste material to be disposed of has increased greatly due to the use of disposable articles. To counteract this, EMS-GRIVORY has developed this new transparent high-performance polymer which can be sterilised several hundred times and therefore, is reusable.

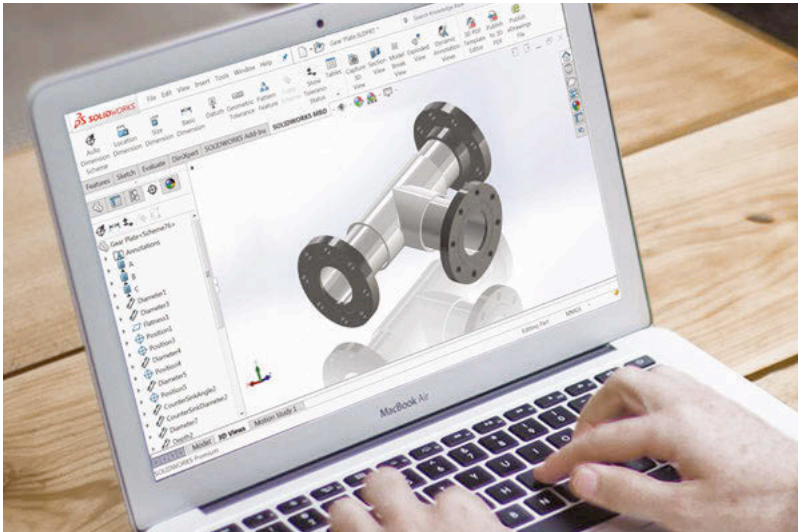
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ENHANCING DESIGN COMMUNICATION



To communicate design intent, the manufacturing sector has a legacy of using 2D drawings that move from design to shop floor. A solution to this time-consuming design finalisation process is Model-Based Definition.

According to independent research, *The 2014 State Of Model Based Enterprise Report* by Lifecycle Insights, approximately 98% of manufacturers communicate using 2D drawings, 42% of which use 2D exclusively while 56% use a mix of 2D and 3D. Only 2% communicate using only 3D annotated models.

Although the industry has found a comfort zone in 2D drawing techniques, it comes with its own set of limitations, some of which can have far reaching consequences on the efficiency of the project. A more comprehensive analysis of the shortfalls of 2D design brings up a pertinent question: How do we eliminate, or at least mitigate them?

A powerful technique known as 'Model-Based Definition' or MBD could be the answer. MBD helps companies eliminate some major

design communication hurdles and enable seamless manufacturing.

To fully understand what MBD is and how it will help tackle the challenges faced by designers who are currently using traditional communication methods, it's important that we first recognise some of its challenges.

INCREASED TURNAROUND TIME

In competitive markets, companies providing the quickest turnaround times win more projects. However, much of the time on a project is spent trying to create accurate production drawings prolonging project duration.

Moreover, there are a lot of do-overs involved. Minor design tweaks result in drawings having to be re-worked and re-distributed. It causes chaos in record keeping but luckily, it's avoidable. »

CASE STUDY 1

A global manufacturer of custom handling and packaging systems was looking to automate product development and manufacturing workflows to increase efficiency, improve communication, eliminate reliance on paper drawings, and improve quality.

The company adopted several products by SolidWorks for design data management and analysis to achieve a completely paper-less design ecosystem.

RESULTS

- 80% reduction in manufacturing release times.
- Digitised production drawings in form of 3D models
- Ended strenuous printing, paper, and administrative costs

CUSTOMISABLE OUTPUT TEMPLATES

The tool comes with numerous customisable 3D output templates that can be moulded by the designers as per the project requirements. Apart from actual models, these templates also come with other complementary functions such as layout, company or department logos; 3D viewport and thumbnails; descriptions; Meta-property links; and tables.

All of this information can be used to entertain specific requests such as quotation, audit reports as well as engineering drawings. Companies can also make use of these templates while formulating design and communication guidelines for various departments.

HIGH ADAPTABILITY

One of the major features of SolidWorks MBD is its high adaptability to existing file formats, outputting in widely accepted formats like 3D PDF and eDrawings. These 3D files come with strong encryption options and also support manoeuvring movements like Pan, Zoom, Rotate, etc.

CASE STUDY 2

A leading custom furniture and display systems manufacturer based in Brazil faced issues to speed development cycles of custom furniture and merchandising displays for stores, restaurants, and other businesses while keeping the product quality intact.

The manufacturer adopted MBD and integrated the SolidWorks API with its ERP, to effectively develop a seamless transfer of PMI from its 3D models to ERP systems.

This enabled it to automate production by auto extraction of BOMs, geometry and dimensioning, material information from SolidWorks eDrawings files, and complete disposal of time and efforts needed for creation of 2D drawings.

RESULTS

- Increase in the time-to-market by 50%
- Reduction in design cycles by 30%
- Decrease in scrap and rework by 50%
- Development costs reduced by 20%

COMPLETE COMPLIANCE

By employing MBD, companies can consistently manufacture products that comply with all the commonly prescribed industry standards like MIL-STD-31000A, ASME Y14.41, ISO 16792, DIN ISO 16792, and GB/T 24734. This not only helps them gain a significant edge over their competition, but also makes it possible to deliver within the stipulated time frames.

CONCLUSION

Although the industry has always been fiercely competitive, there has been a substantial increase in just how fierce it has become. Companies are arming themselves with newer, more advanced communication tools that enable them to take on their competition all guns blazing.

In a scenario like this, a technology like MBD that ticks all the boxes is a huge asset for any engineering design and manufacturing firm.



USHA TRIVEDI
Usha Trivedi is an engineer at Hitech CADD Services

PRODUCTION COSTS INCREASED

» Industry surveys show that up to a third of the total budget of a project is dedicated to creating and maintaining 2D drawings. Additionally, companies spend heavily on printing and plotting work as well as towards the logistics. All these factors contribute to inflating production costs.

INDUSTRY STANDARDS

As industry gears towards standardisation, more companies insist on having production data in 3D and are beginning to see design communication in 2D as a burden. This is a tectonic shift for companies who have relied on 2D for decades and now have to accept the novel technique of MBD.

QUALITY ISSUES

The conversion from 3D models to 2D drawings makes way for a significant loss/misinterpretation of data. Thus, production drawings are often incoherent, faulty and lead to manufacturing failures. According to studies, the likelihood of such a scenario is as much as 60%. This creates an enormous amount of quality issues and can result in rising costs.

On taking a closer look at these shortcomings, engineers at Dassault Systemes, identified conversion from 3D models to 2D drawings as the most

As industry gears towards standardisation, more companies insist on having production data in 3D and are beginning to see design communication in 2D as a burden

recurrent factor hampering the overall manufacturing project productivity. So, they developed MBD, a Drawing-less Communication Solution that eliminates the requirement of converting 3D to 2D and instead communicates all the product and manufacturing information (PMI) within the 3D model itself.

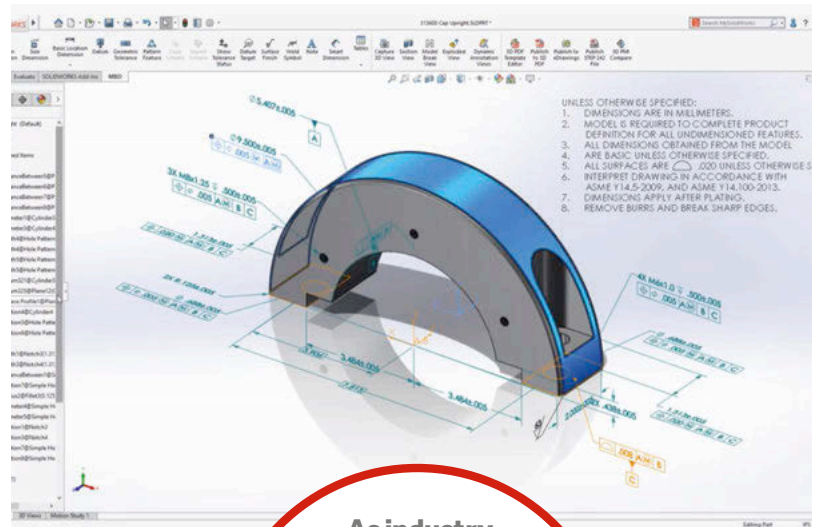
Drawing-less communication creates a single source of truth for all design and manufacturing related information in one 3D annotated model. It can, thus, establish an error-free communication channel thereby saving time, costs and resources.

Here are some of the ways SolidWorks MBD can help your organisation:

ACCURATELY DENOTE 3D DATA

In order to avoid any time delays, cost inflation, and eliminate any quality issues, SolidWorks MBD focuses on how the designers and manufacturers can accurately make sense of a vast mesh of 3D data available in the model.

For this, the tool has the capability to show and hide the annotations while rotating the model. This gives the viewer enhanced clarity about the product while also displaying all the critical-to-function annotations, like DimXpert, reference dimensions and GD&T values for the respective components. **!**



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We explore the technical questions often asked about data translation and data migration.

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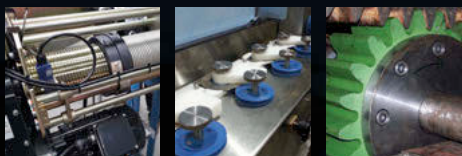
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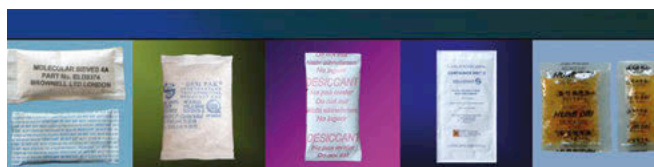
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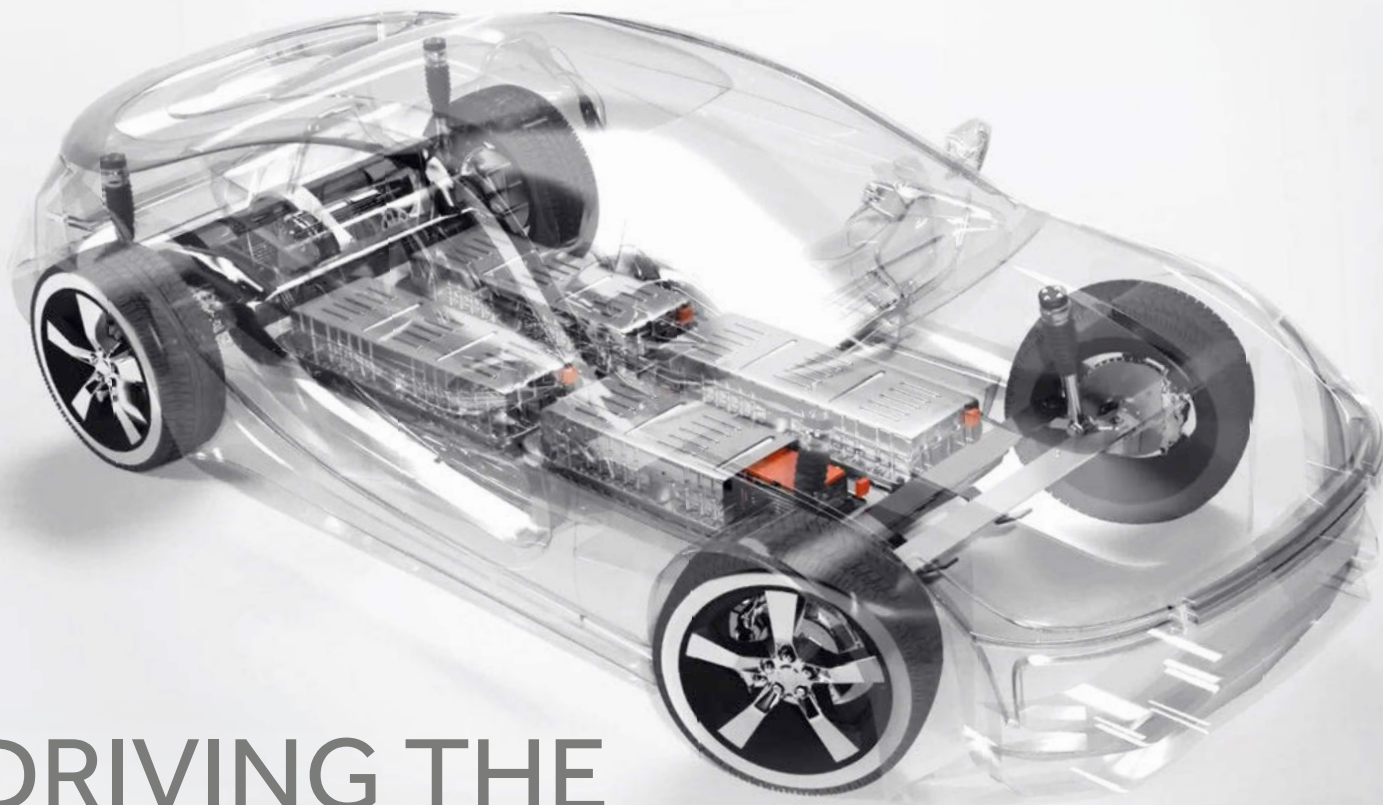


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DRIVING THE FUTURE OF MOBILITY

Game-changing new technologies are driving the biggest transformation that the automotive sector has seen in 100 years. The car of the future will be electrified, connected to its environment, autonomously driven, and even shared among several users.

But what does this step-shift mean for manufacturers? Which adaptations will they have to make to production processes—while still delivering high performance, safety and efficiency?

THE OPPORTUNITIES

For Dr Christian Kirsten, corporate senior VP of Automotive & Metals at Henkel, three changes will have profound opportunities for automotive material suppliers moving forward.

Lightweight construction: Lightweighting in the automotive industry has been a trend for many years. Manufacturers have been constantly looking for ways to take weight out of

Lightweighting and greater reliance on electrical systems are essential areas in the manufacture of electric vehicles. Henkel's adhesives and materials divisions are working on technologies to meet the requirements of e-mobility.

the car body and chassis. There are many methods to do so, including the increase of aluminium content.

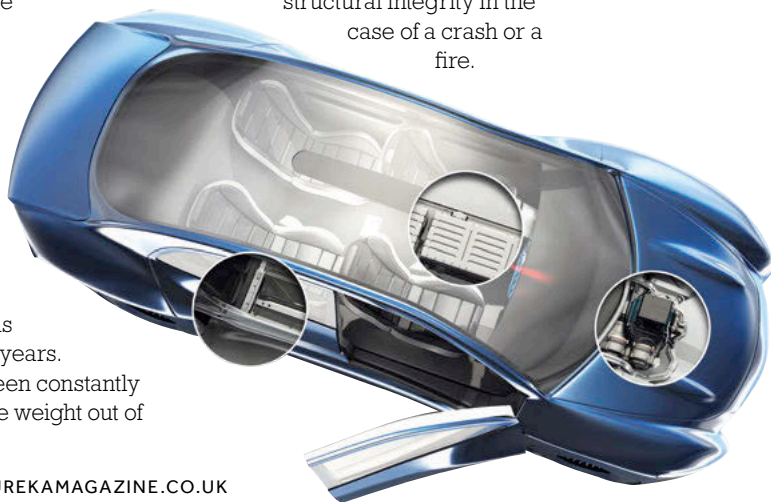
The emergence of electric vehicles: As well as for cost efficiency and safety challenges, electric vehicles need to be able to achieve sufficient range. Manufacturers need to ensure that the battery is completely protected, maintaining its structural integrity in the case of a crash or a fire.

The continuous trend towards autonomous driving: The road to totally autonomous vehicles is a long one. The first step will be electrification, with smarter cars to follow. But this shift presents its own challenges, especially in ensuring the reliability and safety of all vehicles on the road.

NEXT STEPS

Optimising the design of these future vehicles will require a combination of engineering and material science expertise.

Henkel Adhesive Technology solutions include thermal interface materials, like gap filler technology, which will help batteries run safely at a consistent temperature. Other technical examples from the portfolio include adhesive technologies for bonding battery cells together, and UV light purification solutions that reduce cycle times and lower processing costs. »



» “Our portfolio includes thermal interface materials, adhesives, sealants and functional coatings for battery packs, but also other specific components on the car,” says Frank Kerstan, director e-mobility & powertrain at Henkel. “We combine this material expertise together with engineering support to work with our customers on new designs in a very early phase, to ultimately allow them to achieve smarter and more cost-efficient designs for certain components.”

COIL PRE-TREATMENT

As part of its active global support for the metal coil industry, Henkel is partnering with major coil producers to implement dedicated process solutions for end applications in e-mobility. In addition, the company is also addressing demands for reducing the complexity of downstream manufacturing steps by enabling continuous upstream functional coating processes without compromising the technical properties of the coated material.

E-mobility is a megatrend that requires new approaches to enable the production of electrical applications in increasingly larger volumes, as required to meet the expected growth of hybrid and fully electrical vehicles. Metal coil producers play an essential role in this market, supplying steel and aluminium coils to the manufacturers of batteries, transformers, converters, wound cores, shunt reactors and other key components for e-drive and electrified powertrain systems.

Henkel is determined to help its customers in this dynamic market segment to steer the future of e-mobility and gain a competitive edge with a complete portfolio of products and services for metal pre-treatment and functional coating. Moreover, in underscoring its commitment to the metal industry beyond established downstream solutions, the company is also exploring advanced concepts together with major metal coil manufacturers, designed to bring the



value-added benefits of its functional coating products to upstream processes.

“So far, most functional coatings are applied in secondary process steps at the battery or component manufacturers’ sites, increasing the manufacturing complexity of end products, which is a considerable time and cost factor particularly with high-volume applications,” explains Aziz Mabrouki, business director metal coil Europe for Henkel. “In close collaboration with major customers, we have developed an integrated coil pre-treatment and functional coating technology that can be applied in a continuous upstream process and will not only maintain but even improve the performance

properties of the coated metal. In other words, adding value right on the coil.”

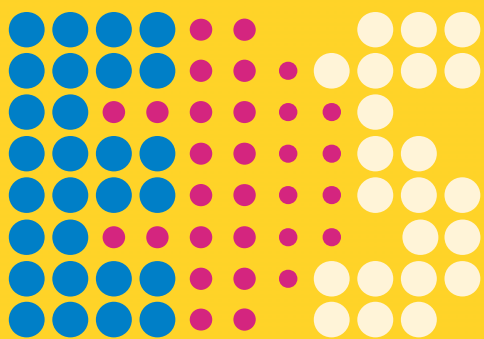
Henkel’s process know-how extends across the entire value chain from the rolling oil for electrical steel to specific pickling inhibitors and cleaners to specialised new functional and conductive thin coatings, such as for covering the aluminium foil used in EV battery systems. Besides providing reliable corrosion protection for painted or unpainted substrates, these products have been custom-tailored to improve the overall performance of e-mobility applications by enhancing insulation and bonding properties, magnetic permeability and electrical conductivity. At the same time, they also address important sustainability goals, such as minimised product consumption and waste and the phase-out of hexavalent chromium (CR VI) in metal treatment.

Latest product innovations targeted at both upstream and downstream metal pre-treatment and functional coating for end products in e-mobility include:

- Bonderite O-TO dedicated product range
- Bonderite M-CR 12 series

In addition to the company’s comprehensive product portfolio for the metal coil industry, Henkel also offers special equipment to ensure best manufacturing practices in many coil process steps. 





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PORTABLE SIMULATORS

Designed to meet demand from chassis and safety engineers, compact simulators are now offering opportunities across multiple departments of OEMs to successfully solve market challenges in a more immersive environment.

With advances in simulation technology moving on in leaps and bounds over the last ten years, there is an overriding theme emerging of the rise of autonomy and the capability to validate AI and machine learning and ensuring driving simulators are capable of testing multiple scenarios efficiently, repeatably, and perhaps most importantly, safely.

With more automotive engineering departments relying on simulation, Driver-in-the-Loop (DiL) technology will undoubtedly grow in stature, allowing even more access for more people and vehicle constructors. No longer are they the exclusive preserve of high dynamics and OEM engineering departments. User Experience, Driver Assistance, Human-Machine-Interface (HMI), and legal departments and more are now trusting results gleaned from the virtual world. Having achieved the core fidelity needed to provide

convincing human interaction experience and valid data, driving simulators have already come of age, backed by a long-life expectancy.

In fact, due to such megatrends in autonomy, electrification, connectivity, and driver assistance, portable driving simulators for vehicle development applications are providing the ideal solution to those who are restricted by space or cost, thanks to their compact footprint and sophisticated computational architecture.

As vehicle complexity continues to increase, more pressure is placed on development timescales and resources, creating a burgeoning need for companies and departments to now gain access to human-in-the-loop simulation technologies to validate hardware and software solutions. Where simple desktop solutions don't provide the fidelity necessary, compact simulators can offer a fundamental building block

for connecting real people with automotive simulations, anywhere in the world, through optimised complexity, quality, and time-to-deploy. It is just a matter of wheeling it in, plugging in and starting work, enabling it to be operated stand-alone, or it can be connected with external Software-in-the-Loop (SiL) and Hardware-in-the-Loop (HiL) systems.

With portable simulators incorporating features such as complex traffic and actor scripting, together with sensor integration, they are fast becoming ideal for validating scenarios for advanced driver assistance systems (ADAS), active safety and autonomy. Add to this integrated form and internal sound isolation, and it is easy to see why they are becoming used more and more in standard office spaces.

And with some of the latest solutions on the market including driver's seat, fully adjustable steering wheel, dashboard, »

» pedals, gear stick and screen, along with the ability to be placed directly in an office, it is giving OEMs, Tier 1s, research institutes and industry bodies a more immersive and car-like environment, whilst making the practical operation much easier.

Portable, compact simulation technology is a direct response to its creators' interactions with the various segments across the automotive industry, which are seeking dependable, rapid, and powerful validation tools. Acknowledging this steep rise in vehicle technological development and validation, Reportlinker analysts predict that the driving simulator market will reach \$2.4 billion by 2025.

Ansible Motion, a provider of driving simulator solutions for vehicle constructors and suppliers around the world, began production of Theta C, a compact, portable, self-contained cube simulator after favourable responses were received from its initial exhibit at the JSAE 2019 Congress in Yokohama, Japan, in May 2019. According to Ansible Motion, each element of its Theta C product line is scalable in terms of both hardware and software aspects in order to keep pace with the automotive industry's technology progression.

"What a compact, portable sim does is allow easy inclusion of the human experience into what would otherwise be an ordinary simulation, and this turns out to be a critical part of the process", explains Phil Morse, international manager of Ansible Motion's Commercial Group.



What a compact, portable sim does is allow easy inclusion of the human experience into what would otherwise be an ordinary simulation, and this turns out to be a critical part of the process

"Considering the ever-increasing complexity of today's vehicles and on-board systems, we believe that putting real people into early-and-often contact with virtual vehicle systems is a key part of successful and efficient vehicle developments."

Morse adds that portable DiL simulation allows everyone involved in the development process – not just traditional test drivers – the opportunity to offer relevant subjective feedback.

"A compact simulator like our Theta C also offers a cost-effective solution that is easy to install in an office," says Morse. "And although it may appear relatively straightforward to create something like this for those with simulation experience, its apparent simplicity belies its extremely well-thought-out form factor and its powerful computational backbone."

Theta C's architecture is said to be robust enough to handle sophisticated vehicle and environmental physics models and connectivity to external systems like test benches, therefore allowing validation of emerging automotive technologies.

"'Plug and Play' is actually not that easy to achieve in a real simulator," Morse continues. "But our customers don't need to be bothered. They can leave the heavy lifting to us and carry on with their real work."

This type of simulator is proving increasingly popular among the industry's manufacturers and influencers throughout departments

already invested in tech which have the existing simulation architecture in place, yet want to evaluate, experience and feel the technology from a human perspective. Simply put, a compact simulator connects real people with detailed simulation environments and is a solution that is addressing the increasing need for human-in-the-loop simulation.

This was seen recently when a leading tyre manufacturer installed a Theta C simulator at their North America R&D centre, in order to expand its research, development and simulation capabilities. The simulator was brought in to enable virtual test driving and evaluation of tyre-road-vehicle interactions in advance and in parallel with physical testing.

"Virtual vehicle models help manufacturers to gain efficiency, improve performance and reduce cost during the vehicle development process," Morse explains. "Investing in a compact, portable DiL simulator allows more OEMs and key suppliers easier access to the technology, to help satisfy the need for reliable virtual test driving."

Distilling the main engineering-grade componentry that's required for human immersion inside a small physical space is proving key to portable sims. They are fast becoming the fundamental building block for connecting real people with automotive simulation environments, aimed at delivering a practical balance between cost, complexity, and capability. 📌



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CHOOSING THE RIGHT VALVES

Modern process control valves offer a wide range of features and benefits for industries that require precise control over fluids, steam and other gases. Here, Damien Moran, field segment manager, Hygienic - Pharmaceutical at Bürkert, looks at some of the basic differentiators as well as some recent design developments.

Control valves are used to manage the flow rate of a liquid or a gas and in turn control the temperature, pressure or liquid level within a process. As such, control valves are defined by the way in which they operate to control flow and include globe valves, angle seat, diaphragm, quarter-turn, knife and needle valves, to name a few. In most cases the valve bodies are made from metal; either brass, forged steel or, in hygienic applications, 316 stainless steel.

With so many control valves on the market, it's important to establish the features that will deliver the most cost-effective design for a particular application.

ESTABLISHING THE PARAMETERS

Actuators use an on-board system that measures the position of the valve with varying degrees of accuracy, depending on the application. A contactless, digital encoder can place the valve in any of a thousand positions, making it very accurate, while more rudimentary measurements can be applied to less sensitive designs.

One of the main areas of debate when specifying control valves is determining the required valve size.

Quite often process engineers will know the pipe diameter that is used in an application and it is tempting to

take that as the defining characteristic for the control valve. Of greater importance are the flow conditions within the system as these will dictate the size of the orifice within the control valve. The pressure either side of the valve and the expected flow rate are essential pieces of information when deciding on the valve design.

IMPROVING EFFICIENCY

Inside the valve body, the actuator design is predominantly either a piston or a diaphragm design.

The piston design typically offers a smaller, more compact valve which is also lighter and easier to handle »

» than the diaphragm designs. Actuators are usually made from stainless steel or polyphenolsulphide (PPS), which is a chemically resistant plastic. The actuator is topped off by the control head or positioner.

Older, pneumatically operated positioners had a flapper/nozzle arrangement and operated on 3-15 psi, so no matter if the valve is open, closed or somewhere in between, the system was always expelling some compressed air into the atmosphere.

Compressed air requires considerable energy to generate and when a manufacturing line is equipped with multiple process control valves all venting into the atmosphere, this can equate to a large waste of energy. It is important to establish not only the most appropriate valve design, but also a cost-effective solution that takes account of annual running costs.

Modern, digital, electro-pneumatic valves that use micro solenoid valves to control the air in and out of the actuator have introduced significant improvements for operators. This design means that while the valve is fully open, fully closed or in a steady state, it is not consuming any air. This, and many other engineering improvements, have made substantial advances in both economy and precision.

FLEXIBLE DESIGNS

Valve seats can be interchangeable within a standard valve body, which allows the valve to fit existing pipework and the valve seat to be sized to the application more accurately. In some cases, this can be achieved after the valve has been installed, which would enable a process change to be accommodated without replacing the complete valve assembly.

Selecting the most appropriate seal materials is also an important step to ensure reliable operation; Steam processes would normally use metal-to-metal seals, whereas a process that included a sterilisation stage may require chemically resistant seals.

After installing a valve, set-up is now comparatively easy and less time-consuming. In-built calibration procedures, such as Bürkert's X-tune,



perform the initial setup procedures automatically, measuring the air required to open and close the valve, the resistance of the piston seals on the valve stem and the response time of the valve itself. Once complete, the valve is ready for normal operation.

IMPROVING SAFETY

Control valves should be specified so they operate in the 40-85% range so if the valve is commanded to a 10% setting, it can detect that something has potentially gone wrong with the control system and the best course of action is to close the valve completely. If the valve is commanded to a position of 10% or less this can cause very high fluid or gas velocities, which have damaging effects on the system and cause considerable noise and damage to the valve itself.

Modern control functionality can offer a solution that acts as a safety device to prevent damage to the process pipework and components. By building in a fail-safe mechanism, any valve position setting below a pre-set threshold will result in the valve closing completely, preventing damage to the surrounding system.

Control inputs can also include safety circuits to ensure safe operating conditions within the equipment. For example, if an access panel on a vessel containing steam is opened, an interlock switch will open and the

valve controlling the steam supply to the vessel can be closed automatically helping to mitigate any risks.

IMPROVING RELIABILITY

Many process control environments offer less than ideal conditions for long-term reliability. Moisture-laden atmospheres, corrosive chemicals and regular wash-downs can all shorten the service life of a process control valve. One of the potential weaknesses is the actuator's spring chamber where atmospheric air is drawn in each time the valve operates.

One solution is to use clean, instrument air to replenish the spring chamber. This offers a defence against the ingress of airborne contaminants by diverting a small amount of clean control air into the control head, maintaining a slight positive pressure, thus achieving a simple, innovative solution. This prevents corrosion of the internal elements and can make a significant improvement to reliability and longevity in certain operating conditions.

Ultimately, choosing the most appropriate process control valve can be a complex task that is often best achieved with the assistance of expert knowledge. Working directly with manufacturers or knowledgeable distributors enables process control systems to be optimised for long-term reliability as well as precision and efficiency. **!**

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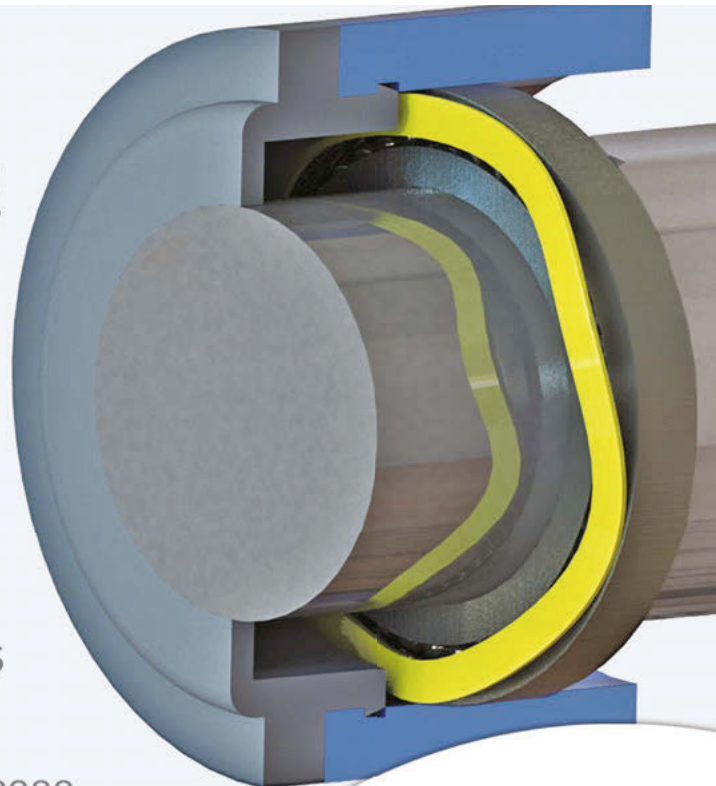
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DRUG DELIVERY IS KEY TO TREATMENT

Global engineering technologies company, Renishaw has announced that its award-winning

intraparenchymal drug delivery device, has played a critical role in a joint Phase 1-2 clinical study with Herantis Pharma plc, for the investigation of cerebral dopamine neurotrophic factor (CDNF) as a treatment for Parkinson's disease.

Parkinson's is a neurodegenerative disease, caused by the break-down of dopamine producing neurons in the brain. Symptoms include involuntary shaking, stiffness of muscles and slowing down of movement, which can be extremely debilitating. In addition, patients can suffer associated non-motor symptoms such as difficulty sleeping, memory loss, anxiety and depression. Whilst these symptoms can initially be managed with medication, there is currently no treatment available that effectively prevents disease progression, or that treats the motor and non-motor symptoms together.

The study's repeated delivery regime, which allows for a prolonged therapeutic window, is crucial to achieve the potential neuroprotective and neurorestorative actions of

A prototype polymer patch capable of performing the same role as actual heart tissue could be a gamechanger.

CDNF and has been made possible through the use of Renishaw's ground-breaking drug delivery system.

Initial results indicate predictable and accurate placement of the device as well as its positive performance and safety. The Company will continue to assess the results as the data is analysed and through the extension part of the study, as patients receive ongoing monthly infusions of CDNF using the Renishaw device.

PROMISING RESULTS

Rupert Jones, managing director of Renishaw Medical, says, "The results of this trial and the performance of Renishaw's drug delivery system are promising for the many people with Parkinson's disease and I would like to take this opportunity to thank the trial participants for making this possible."

He adds, "These results allow us to build towards CE marking of Renishaw's device so that further neurodegenerative and neuro-oncological conditions can benefit from our technology. We see our device as an enabling technology that

facilitates the reliable and repeated delivery of therapeutic agents direct to targets deep within the parenchyma, as part of a paradigm shift in the way treatments of neurological disorders and brain tumours are progressing."

Renishaw's intermittent drug delivery system comprises of up to four catheters, which can be implanted into target areas within the brain. The catheters are accessed via a 3D printed titanium transcutaneous port implanted behind the patient's ear. Drug-filled infusion lines are connected using an MRI compatible application set, which repeatably locates onto the port. Retractable needles extend through a septum in the port to enable therapeutics in the external infusion lines to be infused through the implanted catheters.

NEUROINFUSE

Renishaw's neuroinfuse chronic drug delivery system is composed of up to four catheters, which are implanted into a target area within the brain. The catheters can be accessed via a 3D printed titanium »

» transcutaneous port implanted behind the patient's ear. Drug-filled infusion lines are connected using an MRI compatible, 3D printed, titanium application set, which repeatably locates onto the port. Retractable needles extend through a septum in the port to enable therapeutics in the external infusion lines to be infused through the implanted catheters. The port features a roughened surface below the skin to encourage bone integration and device anchorage, whereas above the skin, it is polished to discourage bacterial settlement.

The device holds promise for the treatment of a range of neurological conditions and brain tumours. It is currently being used in a Phase I – II clinical study with Herantis Pharma Plc, investigating cerebral dopamine neurotrophic factor (CDNF), for the treatment of Parkinson's disease. It is also currently being used on humanitarian grounds to treat children suffering with diffuse intrinsic pontine glioma (DIPG), an aggressive form of brain tumour that occurs in a difficult to access area of the brain. DIPG most commonly affects five to ten year olds.

"There is currently no approved method for the chronic

The port allows repeated delivery of pharmaceuticals over long periods of time, without the need for further surgery — patients can be admitted as outpatients for the infusions

delivery of drugs for neurological disorders into the brain," explains Dr Max Woolley, technical fellow and head of Drug Delivery Device Research and Development, at Renishaw. "This device has the potential to completely change how neurological diseases are treated. The port allows repeated delivery of pharmaceuticals over long periods of time, without the need for further surgery — patients can be admitted as outpatients for the infusions."

"If we produced the device using traditional subtractive machining, we estimate it would have required up to ten parts," added Woolley. "By designing for metal additive manufacturing, it was possible to produce it as one component, reducing the time needed for manufacture and the potential for

error from unnecessary assembly operations."

CLINICAL TRIALS

Thanks to this innovative, patented design, patients are able to receive infusions in an out-patient setting, rather than requiring the reimplantation of new catheters for each infusion, which has been the only option for many trials to date.

The study was a first-in-human study whereby 17 patients were randomised to receive either one dose per month for six months, of a placebo, or six increasing doses of Herantis Pharma plc's novel drug candidate, CDFN, over the same period in a blinded manner. After this six month period, patients may enter into an additional six-month study where all participants receive CDFN. In total, patients will receive 12 infusions, all delivered in an out-patient setting.

The primary endpoints evaluate the safety, performance/tolerability of both the drug delivery system and CDFN as well as surgical accuracy. Secondary to this, the potential efficacy of the drug, rated against the Unified Parkinson's Disease Rating Scale (UPDRS) motor score evaluation, was also monitored.

The clinical study has received funding from the European Union's research and innovation programme Horizon 2020. 



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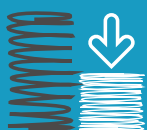
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CHARGE OF THE LIGHT BRIGADE

The use of miniature mechatronic drive motors is supporting the development of the next generation of lighting system and camera platform innovation.



Czech photographer Miroslav Tichy once said that photography is simply painting with light. Light Revolution, a lighting and camera system manufacturer for the film, photography and photogrammetry industry, with the support of mechatronic drive motor specialist Electro Mechanical Systems Ltd (EMS), has taken the concept of painting with light straight into the 21st century.

Developed by founder Patrick Llewelyn-Davies, Light Revolution provides creative lighting systems for the film, photography and photogrammetry industry that use long exposure techniques to manipulate lighting in product imagery.

The Light Revolution base system comprises 15 main components and takes just minutes to assemble, meaning that innovative and eye-catching images can be captured in moments.

"We've taken the concept of painting with light and brought it straight into the modern era," says Llewelyn-Davies. "The central hub of the base system rotates the arms and delivers power to the lights. The

The Light Revolution base system comprises 15 main components and takes just minutes to assemble, meaning that innovative and eye-catching images can be captured in moments

system also comprises of two arms with pylons to attach the lights and adjustable legs, which support the hub. There is a separate support assembly complete with a 1000mm diameter circular tabletop for the object in question to be placed ready for capturing.

"We have developed a precision engineered system that uses high-quality components to ensure a smooth and seamless experience for the user — and one that captures the most wonderful images possible," adds Llewelyn-Davies.

When developing the system, Llewelyn-Davies recognised the need for high-quality motors, which »

» would enable the rotating turntable to move smoothly and effortlessly.

"It was vital that the motors we used were reliable, accurate, easy to control and offered precise timing," continues Llewelyn-Davies. "The motors are used to turn the rotating arms in the system, which go through an internal gear in the main hub of the unit. Because of the level of quality and control we wanted to provide in our system, and in order to capture the detail of each image taken, we knew we needed a high specification motor."

While researching options, Llewelyn-Davies completed test simulations with various motor and gear box combinations but didn't find the fine control that was needed to match the quality system he had developed.

Further research led to Faulhaber motors, which are already extensively used in other photographic systems. As a result, Llewelyn-Davies contacted EMS Ltd, the sole supplier of Faulhaber motors in the UK.

Dave Walsha, commercial development officer at EMS Ltd worked closely with Llewelyn-Davies to source and deliver the best option for the Light Revolution system.

"When considering the options for Light Revolution, I immediately identified that the Faulhaber brushless motors would be the ideal solution," Walsha explains. "The controllability and overall longevity of the Faulhaber brushless motors give a level of performance that was perfect for this application."

"The biggest challenge for the system was the need for the central hub to spin smoothly, with extremely high levels of precision, while also maintaining the portability and light weight of the equipment as a whole."

"The Faulhaber brushless motors provide a high power, precision and are also a light-weight option, making them perfect for this use. The range of Faulhaber motors I initially suggested — the BX4 family — can control speed while providing extremely accurate levels of movement."

"By opting for a family of motors, it also meant that we were able to test the power of the motor without compromising the programming work that had already been put into developing the system," adds Walsha.



"The Faulhaber BX4 motors come in a range of sizes and power capabilities. This meant that if the first motor we suggested wasn't powerful enough, or if Light Revolution wanted to create larger or more intricate system designs we would have been able to scale up the power of the motor without the need for a change to the core programming of the equipment."

"When you're trying to introduce new technology into a well-established industry, like the photography and cinematography sector, you need to ensure that the equipment provided is up to scratch from the outset," explains Llewelyn-Davies. "The Faulhaber BX4 motors that EMS supplied have given us the accuracy and reliability we were looking for from a motor, all while being powerful enough to turn the system with ease."

"As the motors are used across critical industries such as aerospace and nuclear power, I knew they would supply the level of precision and reliability needed for our system."

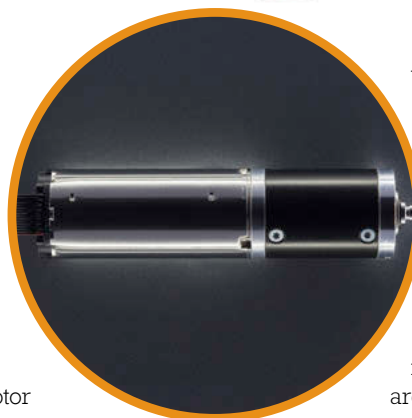
"The support that EMS provided was second to none. Being a small developer, having a direct point of contact with a member of the team

that was able to suggest exactly the right motor for our system was invaluable."

The Light Revolution system is now being tested by companies that specialise in 360-degree photography and beyond. A number of renowned museums across the UK are interested in using the system to photograph artefacts and items from their collections, while universities across the country are also enquiring about the possibilities.

"There is a huge amount of potential for the system, both across the UK and globally," Llewelyn-Davies says. "With its portable nature, it is possible to transport the system from one site to another relatively easily, meaning that there's no need to rent expensive equipment on location or on film sets. Our system gives image capturing experts the ability to paint with light at the touch of a button."

"The support from EMS provided has been critical for the success in developing the system, which is vital for the rapidly growing and innovative industry that we are working in. We see a lot of opportunities coming up that mean we'll continue to use Faulhaber motors from EMS for the foreseeable future." 📌



The Faulhaber BX4 motor

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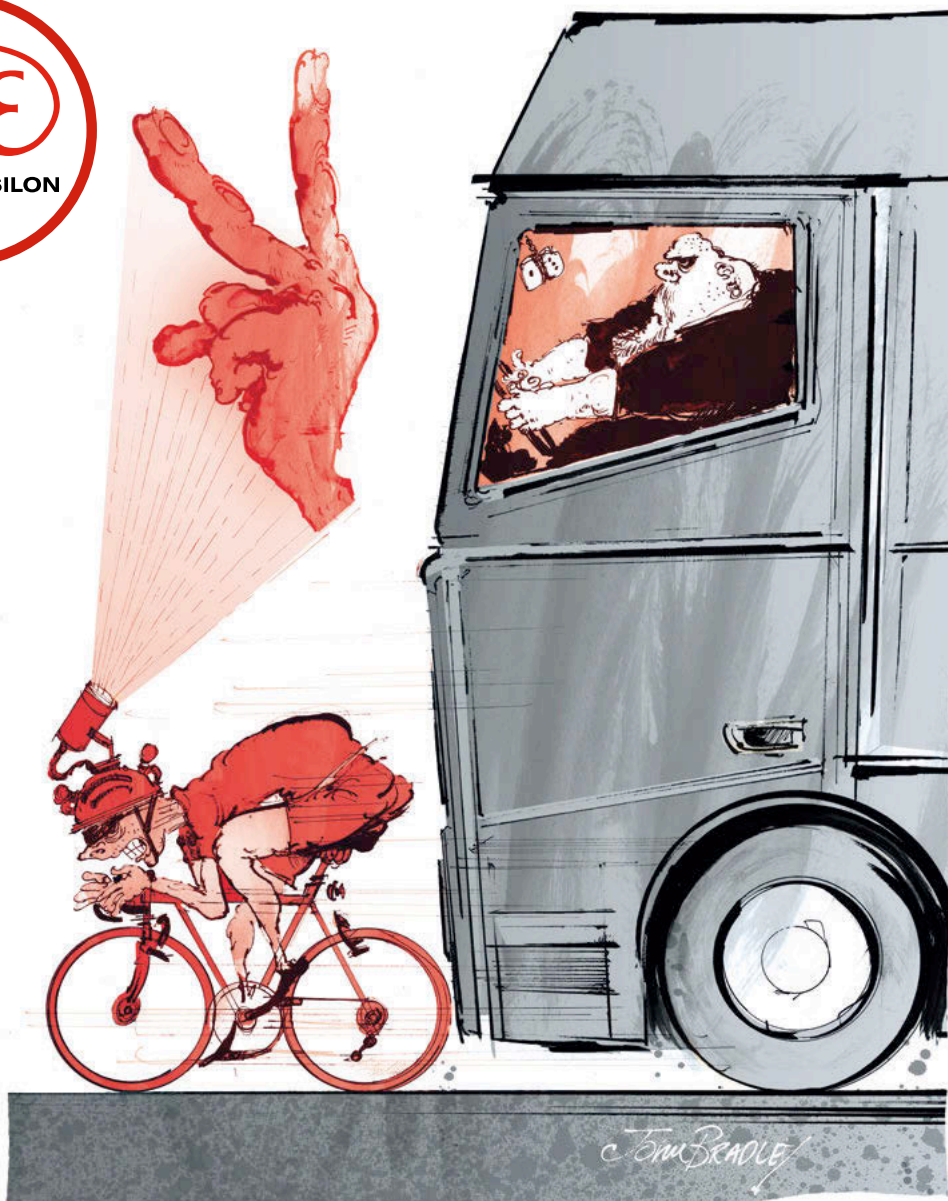
Our roads are busier than ever with drivers, motorcyclists, cyclists, and pedestrians all vying for space. It's no wonder that tempers are lost, and conflicts arise as our ability to communicate is locked behind windscreens and inside helmets – resulting in more than 2,000 cyclists being killed on roads in Europe each year.

But what if our roads don't have to be a communication vacuum, save for gestures and blaring horns? What if there was a way for cyclists to clearly and safely indicate how they feel, which way they intend to turn or highlight a danger ahead that a following road user may not be able to see.

THE CHALLENGE

This month's challenge then is to come up with just such a system. Whether your final design is high- or low-tech, it must be clear to understand in any language, all weather conditions – including at night, and must be able to be operated without the cyclist taking their hands off the handlebars. 

As ever we have an idea in mind that we will reveal in the **May** issue of Eureka! Until then, why not let us know how you would tackle the problem by leaving your thoughts in the comments section of the Eureka! website or by emailing the editor: paul.fanning@markallengroup.com



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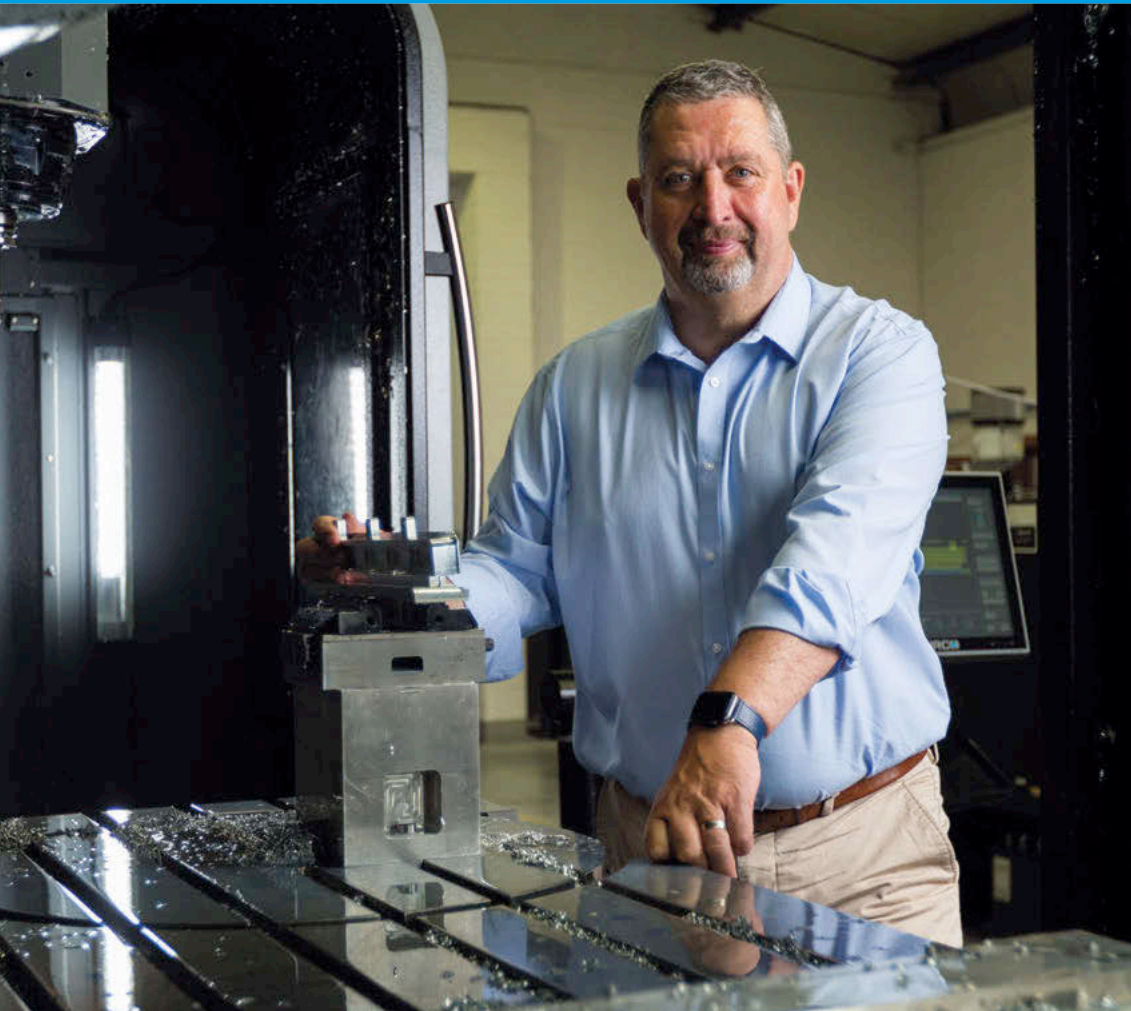


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