

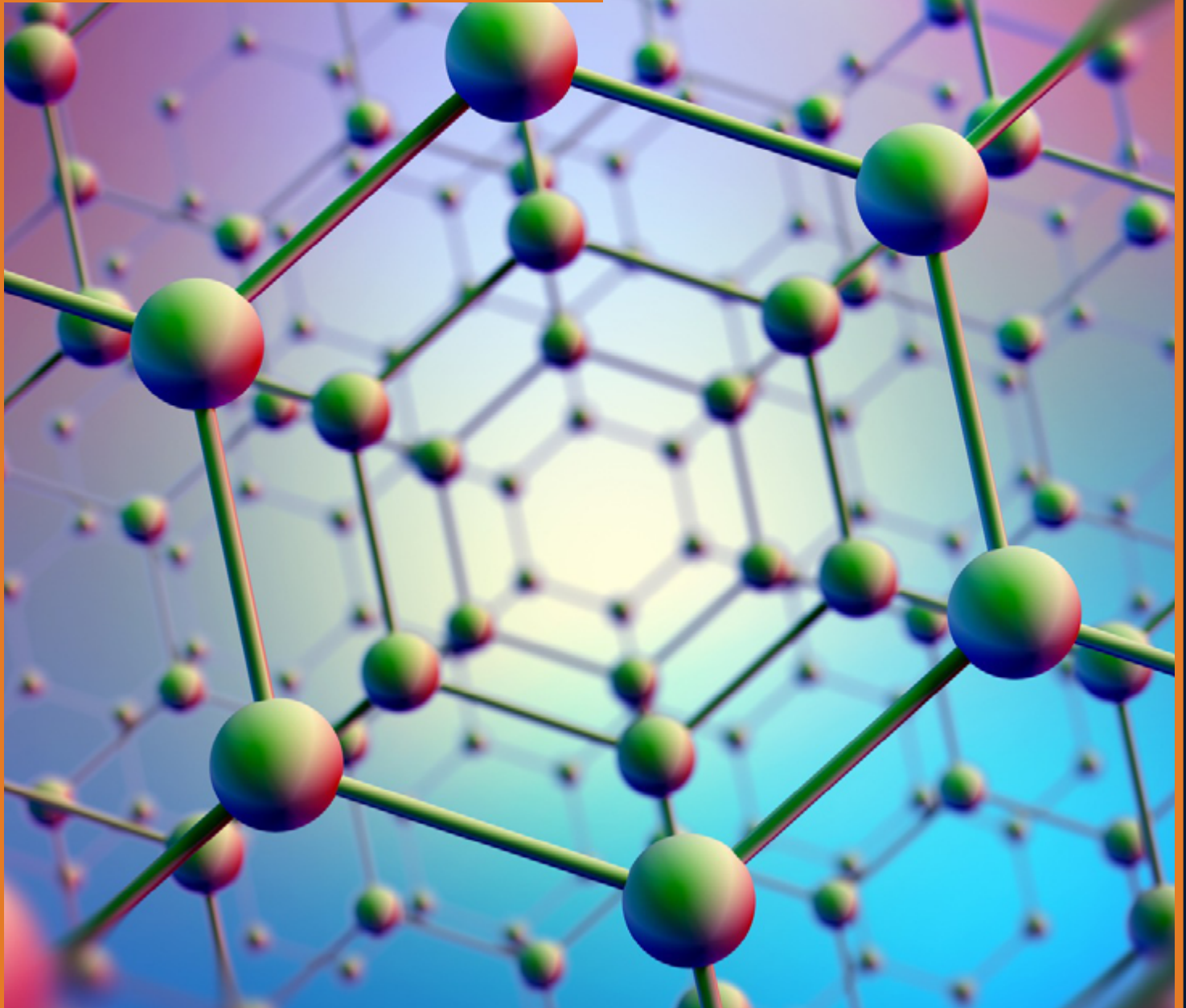
Jan/Feb 2021

# INDUSTRIAL NEWS

The premier source of industry news



## INNOVATION



**EXPLORING THE INNOVATION AND RESEARCH  
SHAPING THE YEARS AHEAD**

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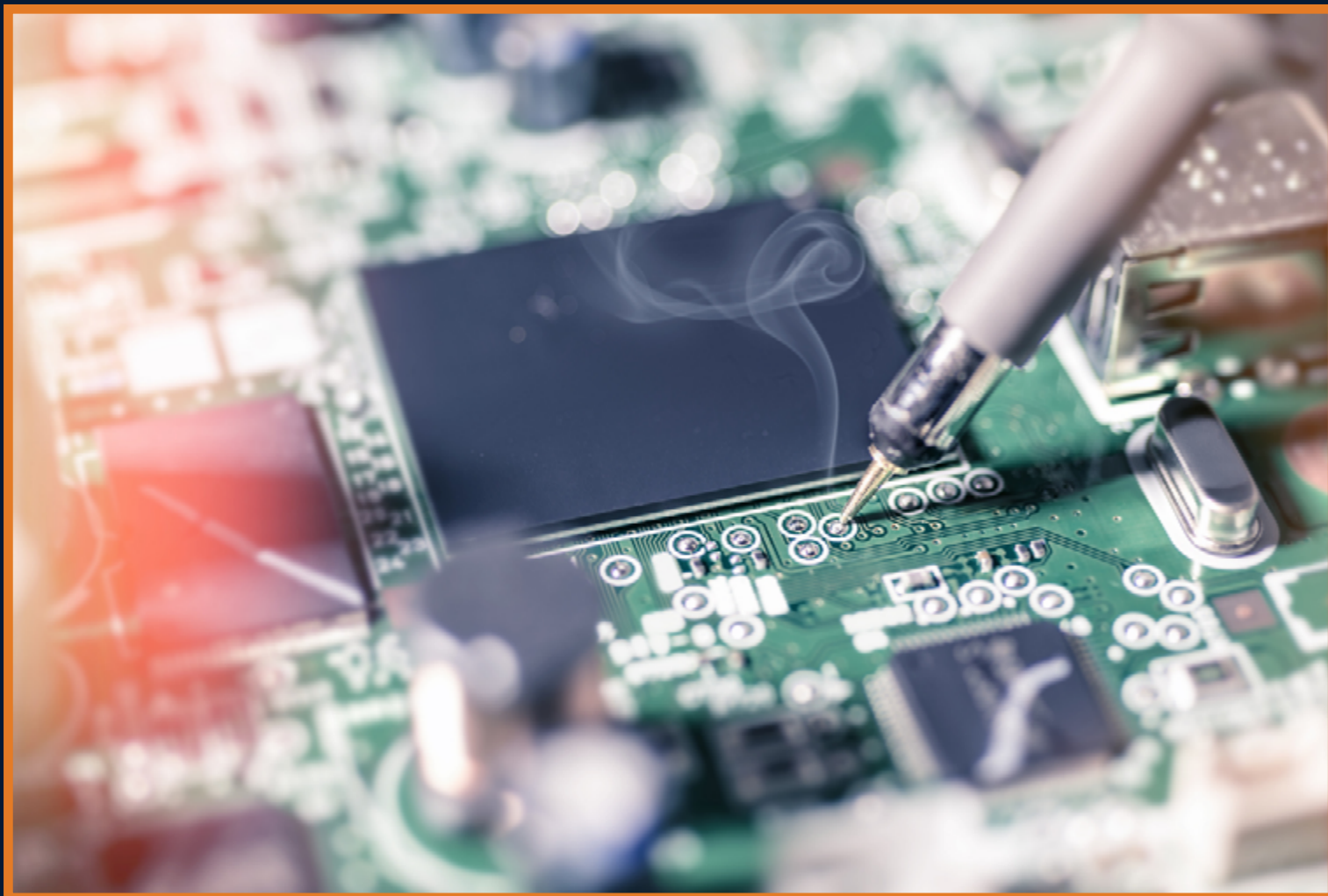
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EDITOR'S NOTE

2020 forced the hands of most industrial businesses to accelerate adoption of new technologies and work practices. This is one of the few bittersweet 'wins' of the coronavirus pandemic for industry.

Although the pandemic highlighted deficiencies in areas of industry, we must not forget that the industrial space is one that is rife with innovation and cutting-edge research. It is this that brings us to the latest issue of Industrial News, where we turn our attention to some of the new technologies, ideas and research that demonstrates the innovation that has long underpinned industry.

At a time when, in the UK and ROI at the very least, progress feels slower than usual and it is far easier to reflect on the past than dare interest in the future, we invite you to cast an eye over the articles in this issue. From augmented reality applications and hydroponic farming to elastomer research and rechargeable salt batteries, there are plenty of scientific and technical advances afoot. These may be the breakthroughs that shape our future, post-pandemic world.

**David Webb**  
 Editor



# Steri-Wipes protect touchscreens from coronaviruses for seven days

A British company has teamed up with German microbiologists to develop hygiene wipes that can protect touchscreens from coronavirus for seven days. The surface cleansers - launched by LiquidNano as 'Steri-Wipes' - leave behind a microscopic coating that releases a disinfectant slowly over a period of days.

The antimicrobial wipes are designed to close a 'hygiene gap' that experts warn can enable pathogens to survive on mobile phones and other surfaces for up to 28 days.

Andy Middleton, co-founder of LiquidNano, said: "Mobile phones and touchscreens are among the dirtiest things that we come into contact with. This creates a hygiene gap because even if you clean them, they can easily become re-contaminated the moment you touch them again. However, our Steri-wipes were developed using nano-technology in order to create an antimicrobial coating that stays effective for a whole week."

Steri-Wipes contain a gel to create an



invisible film of liquid glass that is 500 times thinner than a human hair, which then kills bacteria and viruses, including envelope viruses such as SARS-CoV-2 (which causes Covid-19).

The innovative product has previously been donated to a number of NHS staff and also to

the Life Lines charity to help them keep their mobile phones clean. LiquidNano is also in talks with companies in the retail and hospitality sectors, as well as with parenting groups who wish to use the wipes for children's toys and household objects.

<http://liquidnano.com/>

# Elastomers develop stronger bonds of attachment

Elastomers are the soft, elastic materials, like gels and rubbers, that are found in automobile and airplane parts, in sports equipment, and are used to protect precision machinery and buildings against vibrations. Scientists now want to make them thinner and tougher, without losing elasticity.

Nagoya University materials engineer Yukikazu Takeoka and colleagues reviewed the most recent efforts towards improving elastomers for the journal Science and Technology of Advanced

Materials.

"Our review gives hints about the kind of molecular thinking that needs to go into making elastomers tougher," says Takeoka.

Takeoka and his team from Nagoya University's department of molecular and macromolecular chemistry explain that elastomers can be made tougher by introducing

strong hydrogen or ionic bonds that can reversibly link elastomer chains together. These reversible bonds attach and detach from the elastomer chains as the material deforms. Scientists have used hydrogen bonds to fabricate strong hydrogels that can deform up to 600% and return to their original state within three minutes at 37 degrees Celsius or a few seconds at 50 degrees Celsius.

[shorturl.at/cgsvL](http://shorturl.at/cgsvL)

# Salt battery helps EVs go extra mile

Using salt as a key ingredient, Chinese and British researchers have designed a new type of rechargeable battery that could accelerate the shift to greener, electric transport on our roads.

Many electric vehicles (EV) are powered by rechargeable lithium-ion batteries, but they can lose energy and power over time. Under certain conditions, such batteries can also overheat while working or charging, which can also degrade battery life and reduce miles per charge.

To solve these issues, the University of Nottingham is collaborating with six scientific research institutes across China to develop an innovative and affordable energy store with the combined performance merits of a solid-oxide fuel cell and a metal-air battery.

The new battery could significantly extend the range of electric vehicles, while being fully recyclable, environmentally-friendly, low-cost and safe.

A solid-oxide fuel cell converts hydrogen and oxygen into electricity as a result of a chemical reaction. While they are highly-efficient at extracting energy from a fuel, durable, low-cost and greener to produce, they are not rechargeable. Meanwhile, metal-air batteries are electrochemical cells that use a cheap metal such as iron and the oxygen present in air to generate electricity. During charging, they emit only oxygen into the atmosphere. Although not very durable, these high-energy dense batteries are rechargeable and can store and discharge as much electricity as lithium-ion batteries, but much more safely and cheaply.

The researchers have successfully improved the technology by turning the molten salt into soft-solid salt, using solid oxide nano-powders. Professor Jianqiang Wang, who is leading this collaboration project has predicted that this quasi-solid-state (QSS) electrolyte is suitable for metal-air batteries which operate at 800 °C; as it suppresses the evaporation and fluidity of the molten salts that can occur at such high operating temperatures.

Professor Chen, who is leading a molten salt electrolysis laboratory in Nottingham, hopes the team's "encouraging results" will help to establish a simpler and more efficient approach to designing low-cost and high-performance molten salt metal-air batteries with high stability and safety.

[shorturl.at/ruOUS](http://shorturl.at/ruOUS)

# New edge AI computing platform in UK

Embedded systems specialist Recab UK is now supporting engineers to develop more sophisticated embedded computing projects with the availability of Diamond Systems' Floyd GPGPU products. The new product range, which includes the NVIDIA Jetson compatible Floyd carrier boards and the Jetbox-Floyd complete embedded computing platform, feature extended operating temperatures and are ideally suited to complex computing or imaging applications in harsh sectors such as defence, security and transport.

The Floyd carrier board features interface circuitry, input/output (I/O) connectors for all module features, camera interfaces, power supply and additional I/O that allow engineers to make full use

of the computing power of the NVIDIA Jetson Nano or NVIDIA Jetson Xavier MX modules. The board includes two PoE Gigabit Ethernet ports, three MIPI/CSI 2/4-lane connectors and one USB 3.0 port for camera inputs, as well as miniCard, M.2, and Micro SD sockets for I/O expansion and storage.

The Floyd is available in two versions — a lower cost version that is compatible with NVIDIA Jetson Nano, and another for more complex applications that uses the NVIDIA Jetson Xavier MX module. The full feature MX models incorporate dual Ethernet ports with Power over Ethernet (PoE) support using an external power injector, two multi-protocol serial ports, dual HDMI displays and a PCIe / USB minicard socket.

The lower-cost Nano models do not feature the PCIe switch needed for the higher cost model's additional I/O, which allows a full PCIe x4 link to the M.2 socket for potentially higher flash memory read/write speeds.

Alongside the availability of the carrier board, Recab UK can also provide Diamond Systems' Jetbox-Floyd GPGPU system for UK projects. The Jetbox-Floyd is a complete GPGPU system based on the Floyd carrier board and features an NVIDIA Jetson Nano or NX module, with a Linux operating system pre-configured to support the extensive I/O of the Floyd board.

[shorturl.at/aIGW4](http://shorturl.at/aIGW4)



# How Can IoT Make Manufacturing Smarter?

Rob Moore, sales director, EMS

In 2015, there were just 3.8 billion active Internet of Things (IoT) devices globally. By 2025, this number is expected to jump to over 21 billion connected IoT devices around the world.

The IoT revolution has been gaining traction steadily over the past decade thanks to an amalgamation of hardware, software and the internet. Already, the implementation of IoT has created a more technically driven environment in sectors such as healthcare — connecting patients to healthcare providers and allowing them to enjoy a wider support network.

But what about manufacturing? IoT is highly valuable in the fields where both faster development and the quality of products are critical factors. One such field is the electronics manufacturing industry.

Just as the invention of the steam engine accompanied massive changes in the early 17th century and the advent of the digital age rocked the world in the second half of the 20th century, today's technological breakthroughs are reimagining how products are designed and produced.

Now, powered by IoT, the Fourth Industrial Revolution is reshaping the manufacturing sector and transforming factories.

## Full visibility

IoT has a multitude of applications in smart manufacturing facilities, helping to improve automation, monitoring and production flow. In fiercely competitive global markets, IoT-enabled smart manufacturing provides full

visibility of assets, processes, resources and products.

Data from sensors and machines are communicated to the cloud by IoT connectivity solutions deployed at the factory level. By automatically collecting and analysing this data, smart manufacturing enables factory managers to monitor and manage both processes and resources remotely — allowing them to make better-informed decisions to optimise production and change plans quickly when needed.

IoT-enabled factories support streamlined business operations and dramatically improve manufacturing outcomes; for example, by reducing waste and time to market. Connectivity solutions can also help to improve yield and the quality of products produced and, ultimately, give manufacturers a competitive edge when it comes to cost.

Many manufacturers are already using IoT in areas such as production, machine maintenance and quality control.



## Production

The production floor is one of the most important areas of any manufacturing company. By installing IoT devices into equipment, operation managers can view all actions as they occur — essential for planning and project management.

IoT devices can also track and trace the inventory system on a global scale, giving manufacturers meaningful estimates of the available resources and allowing them to monitor their supply chain more closely. What's more, by introducing Enterprise Resource Planning (ERP), these devices also eliminate the need for the manual documentation of operations.

## Machine utilisation and maintenance

IoT is being used to observe the rate at which equipment is being used, too. Production issues and equipment failures are inevitable in a manufacturing environment, and operational and maintenance costs often make up companies' most

most significant overheads. So, it's vital to maintain equipment to avoid breakdowns mid-production.

With the aid of IoT devices like temperature and vibration sensors, manufacturers can easily detect and predict failure before it occurs, helping to improve predictive repairing and maintenance capabilities drastically.

IoT and machine learning can even enable machines to identify issues and fix them on their own, using automated 'self-healing' systems that intelligently regain control when downtime occurs.

## Quality control

IoT can also be applied in the quality control stage, where data is analysed and used to tweak product designs — eliminating waste and additional costs due to shortcomings and faults in the final product.

For example, an IoT approach known as 'digital twins' can replicate digital copies of the developing product to streamline

operations and improve product quality. With this IoT technology, manufacturers can experiment with prototypes and foresee their functionality, as well as pinpoint potential bottlenecks in their product. This helps to create a better final product.

## What's next?

Clearly, IoT technologies are already starting to transform the way industries such as manufacturing work. But this is just the beginning.

The latest advances in 5G have been designed to match industrial IoT requirements and will act as the catalyst for further transformation — allowing for even greater flexibility, cost control and quality.

As such, manufacturers will need to align themselves with the IoT revolution and these advancing technologies if they want to stay at the top of their game.

Rob Moore is sales director at EMS.

EMS is well-established in the UK as a global supplier of electronic manufacturing services, including PCB assembly services.

Keen to find out more? Get in touch with the EMS team today to discuss your next project.

<https://emsolutions.uk.com/>





# Carbon-dust cement composite experimented

*Neil Ballinger, head of EMEA sales at automation parts supplier EU Automation, explores the implications of an experiment into carbon dust as a new cement composite material.*

A new paper has experimentally investigated the effect of using carbon dust, generated as an industrial waste-product from aluminium factories, in creating a cement composite material. The paper was published in the journal materials by researchers from Qatar University's Center for Advanced Materials and the Jordan University of Science and Technology in July, 2020.

In the experiment, the team collected the carbon dust by-product from aluminium production, characterised the dust and used it to partially replace cement particles in cement mortar production.

Their results showed that the, "incorporation of carbon dust in cement mortar production not only reduces its environmental side effects but also enhances the strength of cementitious composites. Up to 10 per cent carbon dust by weight of cement can be added to the mixture without adversely affecting the strength of the mortar. Any further addition of carbon dust would decrease the strength. [The] best enhancement in compressive strength (27 per cent) is achieved in the case of using [a] five per cent replacement ratio."

The team used a scanning electron microscopy (SEM) equipment to generate images that showed that incorporating a small amount of carbon dust, less than ten per cent, produced a denser and more compact-structure cement mortar.

If further, large-scale research can support this initial experiment, the

implications of this research could be potentially significant. Managing industrial waste is an ongoing problem in industry. Solving this problem is part of a wider move towards sustainability and the re-use of materials, that has garnered traction in recent years with the movement of the circular economy and numerous sustainability initiatives.

Carbon dust in particular is a widespread problem. It's a super fine black powder that's generated on a large scale by aluminium companies during the aluminium production process, when anode butts are crushed and when bath material is cleaned during the shot blasting process.

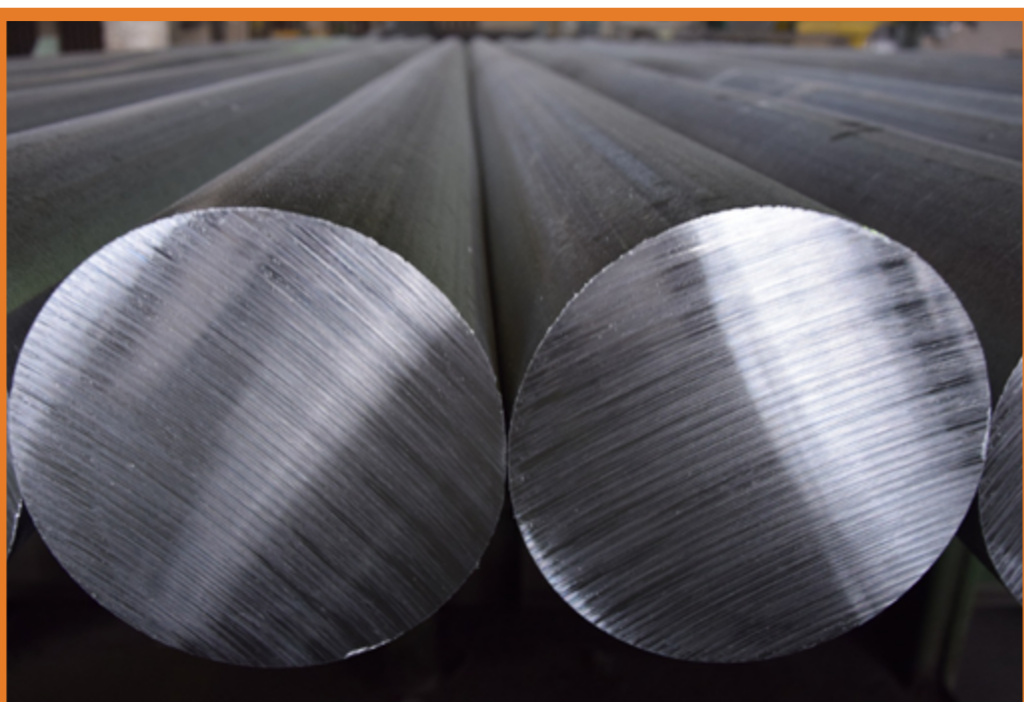
A large part of this industrial waste material usually finds its way into landfill and also creates issues during handling and transport due to how fine it is. As a result, it can cause air pollution and has the potential to leach into groundwater.

For businesses and factories across industry this highlights the need for two things. Firstly, businesses should continually consider new and innovative materials, especially ones that can contribute to sustainability. Second, they should ensure that their industrial plant machinery and equipment is adaptable to meet the increasingly complex handling needs of modern materials.

This process should involve a thorough lifecycle risk analysis of existing and planned equipment, and a scheduled repair and replacement strategy. In doing so, businesses can work to be more sustainable while ensuring they remain productive.

To find out more about automation technologies, visit the EU Automation website.

[www.euautomation.com/](http://www.euautomation.com/)



# The challenge of decarbonisation

*Simon Hyde, CEO of FAUN Zoeller, explores the need to share challenges and innovation in decarbonisation.*

It appears there's a whole new economy in decarbonisation and it's key for businesses to come together to share their ideas or more importantly, share challenges. Alongside this, experiences and views on waste minimisation, hydrogen, solar panels and other renewable energies.

No one says it's going to be easy but the more businesses can align, the better and these points should be high on the agenda at every opportunity. This isn't just down to the business owners or management, employees are advocates and their ideas regarding decarbonisation are welcomed and should be well-considered, as we have introduced in programmes at FZUK, which has for example definitely helped us in securing ISO 14000 accreditation.

We are very focused when it comes to a 'green agenda' in our own company at a regional and group level but it's clear that infrastructure and skills are a challenge that must be met for such technologies not only to deliver the carbon footprint, but ensure that it's commercially and economically viable.

You will no doubt be aware of the Government's ten point plan for a Green Industrial Revolution. It's key that these initiatives carry on and deliver to the government's targets and expectations but is the 'elephant in the room'. Different technologies don't come cheap but at the same time businesses and enterprises must acknowledge that productivity and technology



must reduce the cost, making it more commercially accessible.

The support or changes needed at organisation level will be different depending on each sector, there are a number of ways businesses can be more sustainable and they can be steps as part of a long-term journey.

Our core client base are UK Local Authorities and we are already in discussions with a number of them on how hydrogen and battery powered public sector fleet can make a big difference to tackling climate change and improving local air quality. FZUK is interested in developing long term strategic partnerships with Local Authorities that share our ethos and want to 'hit the reset button' when it comes to the environment, local transport, the waste strategy and the funding constraints for the public sector.

At a recent BEIS roundtable review, I suggested that local energy production, whether it be solar or wind, could help provide charging facilities for the local authority

fleets and help produce electricity for the production of green hydrogen through an electrolyser system for example. Waiting for significant investment in the National Grid and a hydrogen infrastructure maybe too far away to help the kick-start.

I am also proud to be working on a number of projects with BEIS, OLEV and a 'Clean Air' committee in Westminster. These opportunities have great potential not only to address climate change and local air quality but also in helping to create a new economy, jobs and skills for the next generation. As Chairman of the North Worcestershire Skills and Employment Board, I believe this is crucial for our future positive economic development. I urge other businesses and leaders or advocates for change to find their own networks and groups where peers can share or learn best practices, as well as discover the wealth of information available to help them achieve corporate climate goals.

<https://faun-zoeller.co.uk/>



# Sustainable solutions: A cleaner alternative to Red Diesel

Alexander Baal, Director Sales Operations, Jungheinrich UK Ltd., explains how Lithium-Ion battery technology in the material handling industry will be an instrumental solution in supporting the government's aggressive environmental targets, while also delivering valuable productivity gains.



In June 2019, the UK became the first major economy in the world to pass laws guaranteeing an end to its contribution to global warming by 2050, requiring the UK to bring all greenhouse gas emissions to net zero by this date. This will inevitably have an impact across industries and companies as they start to research and deploy new solutions to fall in line with government targets.

To meet its ambitious goals, the government will introduce several initiatives over the coming years, so organisations must prepare now – not just to support global warming reduction efforts, but also reduce their costs and reap the resulting productivity benefits.

## Reducing red diesel

Part of the government's initiative to tackle climate change and improve the UK's air quality involves changing laws around the use of red diesel. From April 2022, the government plans to remove business entitlement to use this type of fuel, except for agriculture, rail and non-commercial heating. At present, businesses gain a significant benefit from using red diesel, paying a duty of just over 11p per litre, compared to almost 58p

per litre for using white diesel. At Budget 2020, the Chancellor, Rishi Sunak brought attention to the fact that the sectors using red diesel are some of the biggest contributors to polluting air quality and the red diesel scheme was essentially "a tax relief on nearly 14 million tons of carbon dioxide every year."

Despite calls by a coalition of construction trade bodies for an extension on the abolishment of red diesel to at least 2023 to allow for time for economic recovery after the pandemic, the fact remains that red diesel has a detrimental impact on the environment.

In order to achieve the UK's climate change goals, businesses will inevitably need to adapt to using cleaner sources of energy. Many will therefore need to overhaul their diesel equipment and consider more energy efficient power alternatives, such as Lithium-Ion. Addressing these issues now will increase efficiency and sustainability in the long

term, preventing any damage to business operations and ensure continuity.

## A cleaner alternative for MHE

Separate to the plans around red diesel, research by Calor found that 38% of forklift users are facing pressures to reduce their carbon emissions, and although 54% of those surveyed recognised that carbon reduction was a very important consideration, there were other priorities ahead of this. Above carbon concerns were cost, fuel efficiency, machinery downtime, security of supply and level of customer service from the fuel provider.

Lithium-ion batteries offer many operational and commercial benefits compared to diesel or gas-powered trucks or even lead-acid batteries. Increased efficiency and reliability is achieved as Lithium-ion delivers energy for multiple shift applications without the need for battery changes, due to its rapid charging times and the possibility



of opportunity charging during short breaks. Additionally there is a very small drop in remaining capacity experienced over the entire lifecycle of the battery. Savings are made as no maintenance is required and no period of battery resting is needed after each charge. During the recharge process, less energy is wasted as heat, thus saving money, and during the truck's operational shift, energy is harvested through direction changes and braking – resulting in lower energy costs.

An electric forklift may have a higher initial cost than its diesel or gas counterpart, however, it also benefits from lower maintenance costs as fewer service items are involved. This means the total cost of ownership can be significantly lower, especially when considering the stability of the price for electricity compared to red diesel.

Not only does Lithium-ion prove cost effective with the added benefit of having rapid return on investment (ROI), but it has the ability to support most 24x7 logistics operations with its fast charging capabilities, meaning operators won't need to be concerned about machinery downtime.

## Conscious compliance

Sustainability is key to the future of the industry and protecting the planet. The government will continue to introduce schemes, such as the impending red diesel initiative, to reduce carbon emissions to meet its targets and protect the environment – but the compliance of industry is essential to achieving this.

Organisations have the opportunity to proactively prepare

for a sustainable future and not be caught off-guard. While it may seem like a significant undertaking to upgrade materials handling equipment, there are solutions available now that can support this shift in addition to delivering significant cost, efficiency and productivity benefits. Not only does the changing legislation around red diesel provide companies with the perfect opportunity to act, employing Lithium-Ion as an energy-efficient solution will also protect organisations against future legislative changes and work towards a more sustainable future, while ensuring business productivity and success.

<https://www.jungheinrich.co.uk/>



# Automation industry outlook for 2021

A Q&A with Rochdi Ziyat, CEO of VINCI Energies UK & RoI



2020 was a tough year but will the automation industry fare better in 2021? Rochdi Ziyat, CEO of VINCI Energies UK & RoI, discusses some of the ongoing challenges as well as the bright spots on the horizon.

## What impact has COVID-19 had on the UK automation sector?

"Manufacturing has been impacted more than some segments by the need to maintain social distancing. Where there would normally be a lot of people working on the factory floor, some production lines have had to slow down, shut down or readapt. The distribution and warehousing segment, however, has never been busier due to the massive rise in e-commerce. Businesses that have already invested in intelligent warehousing are at an advantage because they are able to distribute products faster with fewer people on the shop floor."

## How did VINCI Energies UK & RoI rise to the challenge?

"We have coped with the pandemic well and I am extremely proud of the agility, resilience and entrepreneurial spirit among our people. We adapted quickly to

support our customers and have even developed some new offers, such as the Cougar Automation anti-COVID alarm system. This uses IoT-connected security passes to remotely monitor the number and location of people in a building to maintain safe social distancing and trigger cleaning alerts. It can even work with body temperature sensors and scanners to determine proper use of PPE, as well as contact tracing systems."

## How do you see the outlook for 2021?

"Social distancing and the boom in online retail will most likely continue until everyone is vaccinated, which makes the need for smart technologies even more pressing. Some factories are trying to work out solutions but we may need the world economy to pick up a bit before we see the real level of investment required to make a difference. The digital transformation of warehouses,

however, is accelerating because businesses are already seeing a large return on that investment. It's exciting because we are still at the beginning of this revolution and there will be many projects to implement smart technologies coming this year and beyond."

## What does that mean for VINCI Energies UK & RoI?

"We are in good shape for 2021. The benefits of digital transformation are increasingly understood in the industry and we are uniquely skilled to support businesses thanks to our 'Power of Three' strategic plan. As well as the automation expertise from our Actemium business units, we also have the ICT knowhow from our Axians teams and high-voltage electrical engineering from Omexom. This means we have everything we need to programme and connect the different machines, robots and PLCs to make industrial automated operations smart and more efficient in terms of production and energy consumption."

## What impact might Brexit have on the industry?

"In our globalised economy, there is a lot of to and from in manufacturing. Some components are produced in one country and then sent to another for assembly. If transporting materials and goods across borders slows down or becomes problematic, then manufacturers may need to reorganise their operations so that products can be completed locally. Smart technologies can also help overcome this challenge as they transform the flexibility, efficiency and personnel requirements of production lines. However, investment will likely depend on the economy."

## How are you approaching the engineering skills shortage?

"Sadly, there is still a huge gap between the demand for skills among UK companies and the numbers of young people studying STEM subjects in schools, colleges and universities. We are working with organisations, such as the Royal Academy of Engineering and the Women's Engineering Society, to promote our field and whenever we have a chance we meet with youngsters at school or university to explain what we do. Mostly, they are very intrigued because you get to work in a team, solve problems and there is a lot of variety. Sometimes you are behind a desk but then you meet regularly with clients to discuss projects and spend time with the team on site. The work is also rewarding because you get to genuinely help customers and see the results a few months down the line, not years and years ahead."

## What makes VINCI Energies UK & RoI such a great place to work?

"In our business model, the company is divided into 27 business units in the UK and ROI, which are empowered to be flexible, agile and act with an entrepreneurial mindset. They are all human sized communities, which means our people feel well within their business units. Everyone has a say and the chance to shine as they share the responsibility to drive the business forward together with their management team. When you excel, you can progress to become a manager, then a director or CEO."

"We have many examples of apprentices who have become business unit managers and graduates who have become project managers within two years. There are also lots of opportunities to move sideways between different parts of the business to develop new expertise. But the

most exciting thing is the importance of our work, delivering the promises of the digital and energy revolutions to create a better connected and greener future for us all."

## And finally, what are you doing to limit your environmental impact in 2021?

"The purpose of our work is to increase our customers' efficiency, reduce their energy consumption and facilitate the use of renewable energy but we are also taking some concrete actions to reduce our own carbon footprint in 2021."

"By the end of this year, we plan to have reduced our carbon footprint by almost 10% by changing our energy contracts to require renewable sources only and a further 5% by switching our car fleet to EVs. Eventually, we plan to have reduced carbon emissions 25% by 2025, 40% by 2030 and become carbon neutral by 2050."

"The VINCI Group has also changed its Innovation Prize to an Environmental Prize, rewarding projects from within VINCI businesses that support decarbonisation. This will only encourage environmental thinking throughout the organisation and demonstrates the extreme importance we place on caring for our planet. With all this said, I feel 2021 is going to be an exciting year for us."

[www.vinci-energies.co.uk/en/](http://www.vinci-energies.co.uk/en/)





# Electric component crash testing

**Virtual reality means much more than video games, as when purchasing an electrical device you're invariably presented with a table featuring the part's working parameters and operational limits. Discovering these limits takes a lot of testing, so can simulations simplify this process? Here, Steve Hughes, managing director of power quality specialist REO UK, discusses the details that go into simulating, stress-testing and prototyping electrical components.**

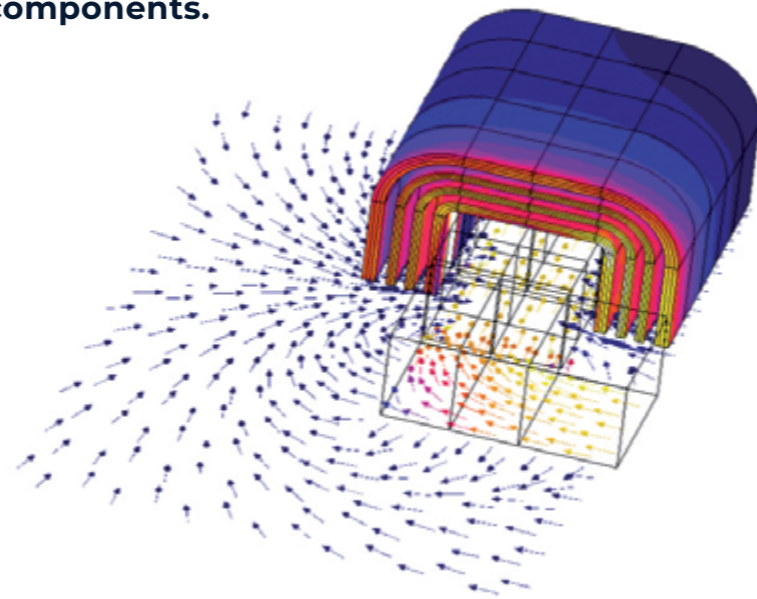
If you buy a car in Europe today, you'll find a European New Car Assessment Programme (NCAP) score featured prominently. This lets the customer know that the vehicle has been through an array of destructive physical tests and fulfils crash safety requirements. REO equipment facilitates similar tests, only on its electrical equipment.

For the physical aspect of testing and simulation, let's follow a component as it traverses REO's electronic proving ground.

## Dividing wheat from chaff

The first step is the simplest to describe, but possibly the most important — safety and validity testing. Here, test voltages are applied to individual components of the device, such as any field windings, enclosure or bearing components, to ensure that the device has been manufactured correctly. These range from isolation tests that discover short circuits to running tests that ensure that any insulation is complete and of good quality, and quickly uncover devices that may be defective for any reason.

The next step is to ascertain the device's operating limits and measure how those parameters change over time. This is achieved by physically loading the device to approximate the device's use case.



For instance, a motor might be tested at high torques for heavy vehicles or robotics, or lower torques for ventilation fans.

It's important to simulate the environment the device is expected to work in. This can include extreme high or low temperatures, submersion and even altitude. Any ingress, cold lubricant gelation or excess heat can quickly ruin performance and destroy components.

## Running the electrical gauntlet

Now the electrical tests can begin in earnest. The REOLAB range of testing supplies make this process simple.

Using REOLAB equipment, any electrical device can be thoroughly tested. The REOLAB 310, for

instance, provides programmable output voltages up to 520 volts, and is perfect for smaller testing laboratories that handle low to medium voltage devices. The range then steps up incrementally through higher and higher voltages up until the REOLAB 420, which is specially designed for the kilovoltage ranges required for testing the high-energy equipment found in electric rail, renewable generators and industrial power supplies.

The REOLAB supplies provide reliable current, frequency and voltage modes that provide the foundation for a plethora of investigative tests. Low-power modes and sudden shutdowns, for instance, can be easily and repeatably simulated to test component's performance in exceptional circumstances. Any

other real-world supply scenario can be simulated, such as voltage transients and electromagnetic interference.

By providing repeatable, cyclable and reliable test supplies, every aspect of a component is laid bare. For a motor these will include power factor, phase current, winding temperature gradients and the input to output power ratio. Other components might be tested for impedance, capacitance, reflected wave transients and electromagnetic compatibility, among many others.

This data then acts as a starting point for design engineers when designing equipment featuring these components. A part may fit the remit on paper, but when tested under its actual working conditions any number of external factors may affect the expected lifespan. It's impossible to know for sure without actionable data drawn from repeatable tests, which the REOLAB range provides.

## A view to the virtual

While REOLAB equipment is top of the class for simulating electrical conditions for testing and

verification purposes, it often comes after an equally important first step — virtual simulation.

Virtual simulation of electrical devices is performed using cutting-edge finite-element simulation. Every component within a device is programmed into the simulation, combining data from material scientists including material hardness, conductivity, heat expansion and more to create an accurate computational facsimile of the device.

When an accurate facsimile is produced, they can then be put through thousands of virtual tests. These might include running the device for thousands of virtual hours to discover how constant running affects the device, while other tests like over-voltages and power failures can be repeatably performed to provide actionable statistics that are crucial in developing planned and predictive maintenance schemes.

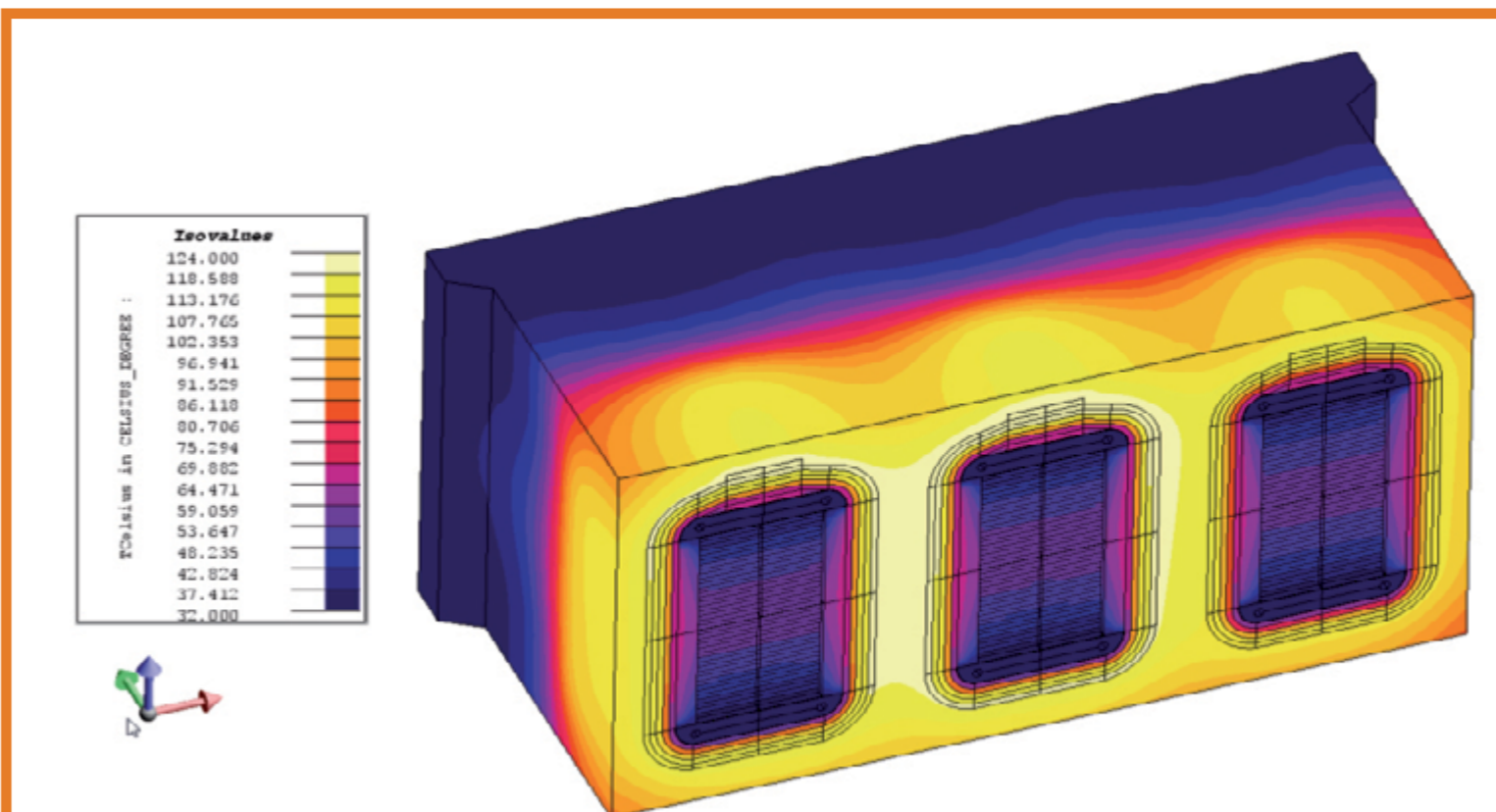
The benefits of virtual simulation are considerable. Foremost is a significant reduction in the work, waste and time taken when prototyping parts. Running new designs through virtual proving grounds quickly uncovers any errors

in design, while also highlighting areas where optimisations are possible.

REO operates a comprehensive virtual simulation system for its parts, which brings some fantastic advantages for REO and customers alike. Due to REO equipment finding itself all around the world, from frigid high-altitude mountains to scorching deserts, simulations work to ensure that the equipment is fully equipped to withstand these conditions. This drastically streamlines and simplifies design while also reducing prototyping costs, meaning equipment can be even more competitively priced.

These savings are then be passed to the customer, meaning everyone can get top-quality, fully tested equipment that has been through hundreds of hours of simulation, at a reasonable price.

[www.reo.co.uk/](http://www.reo.co.uk/)





# Farming innovation continues to advance at a rapid pace

With access to quality food a major concern throughout the world, from developing countries through to post-Brexit Britain, GrowPura's innovative technology is pushing farming into a more efficient, more productive and more secure future.

And now the company has secured planning permission to build a £22.5m National Hydroponics Demonstrator and Skill Centre as well as a commercial scale growing facility which will help showcase its technology to a global audience as well as training the next generation of industry leaders.

GrowPura specialises in indoor, vertical and urban farming using its specialist moving hydroponics equipment and techniques. In short, the company is allowing food to be grown throughout the year, in any location, using fewer resources and less capital input than ever before.

Vertical farming has grown in prominence recently. Its stacked growing systems allow more crops to be cultivated in smaller spaces. Not only does this reduce the amount of land which needs to be acquired, but it also allows growers more freedom over their location. This can mean growing crops where not previously possible, or the option to grow closer to retailers and end users, resulting in fewer emissions and significant financial savings throughout the supply chain.

The technology may have been more widely adopted more quickly but for the investment costs of launching such an operation. But GrowPura's technology is considerably more cost-effective and will enable farmers around the world to harness the opportunities for the first time.

GrowPura's system features low-energy LED lighting and recycles both air and water, allowing farmers and retailers to significantly reduce the size of their initial investment as well as ongoing energy and maintenance costs.

The company's set-ups are also combined with cleanroom technology, meaning that there is no requirement of pesticides or herbicides, or to wash food once grown, which further removes costly steps of the growing process.

The new commercial scale facility will grow plants in a high care controlled environment. The facility will showcase their vertical conveyor system technology that continually moves plants past sources of light, as well as their sophisticated irrigation and monitoring technology; all of which is housed within the clean room environment to ensure the highest quality and yield.



Nick Bateman, CEO of GrowPura, said: "Our industrial scale systems for large production numbers ensure our plants are constantly moving. The conveyor allows us to move the product around, providing phenomenal flexibility and reducing the demand on our irrigation and lighting infrastructure, to ensure we make the most efficient use of all the assets which in turn ensures a low cost, high reliability crop."

In a 2014 speech by the EU's Commissioner for Agriculture and Rural Development, food security was presented as one of the greatest challenges of our time. This is now even more pressing with the challenges of Brexit looming large for agriculture but surprisingly there has been little or no advances that respond to these challenges; that is until GrowPura pledged its commitment to the industry with its innovative vertical farming hydroponic solutions and intuitive technology.



Nick Bateman, CEO, Growpura

Nick Bateman, CEO of GrowPura, said: "Food security is a major global concern, not just in the countries you might expect but also right here in Britain. Following the second world war, we grew around 80 per cent of our own food and could rely on our own supplies.

"Today, we grow less than half of what we eat. With our exit from the European Union and the logistical weaknesses exposed by the current global pandemic, it's clear that our food supply chain is built on shaky ground. With our systems, any country can take back control of their own food supply."

Nick added: "Not only does this ensure a plentiful supply of food for all regions of the world, but it means an end to shipping food across continents, which is one of the leading causes of emissions, pollution and man-made climate change."

It's not merely reducing the miles travelled that makes hydroponics such an environmentally-friendly option for growers. By automatically rotating the growing systems, plants can pass by a single set of key components as required, rather than each plant

requiring its own dedicated lighting and irrigation process, as well as employing bio-mimicry, which involves harnessing natural sunlight wherever possible and providing natural stimulation for plants.

The technology is advancing at such a pace that GrowPura has secured backing to build its National Hydroponics Demonstrator and Skill Centre at an innovative science park in Bedford. The plans recently received the go-ahead from the local council and a £4.5m injection of funding from the South East Midlands Local Enterprise Partnership (SEMLEP), which is optimistic about both the opportunity to create high-skilled jobs as well as the region becoming home to an advancing, world-leading technology.

GrowPura will partner with academics from colleges and higher education establishments to develop training courses which deliver skilled individuals who will be able to continue advancing the technology and keep the UK at the forefront field of vertical and urban farming.

Nick concludes: "With approval for our plans we're on the cusp of creating something very special

which will have long-lasting ramifications for agriculture around the world, giving farmers more affordable, more flexible and more environmentally-friendly methods of growing their own food.

"Not only that but fresh food buyers in retail can also reap the reward of consistent, annual yield of crops of the utmost quality. A commitment and pledge that only GrowPura can offer with its innovative moving technology that guarantees end results with less operating costs and less capital injection required. Of course, the more the big players grow comes with it its own unique set of savings and ROI making such a source of food supply a key player going forwards.

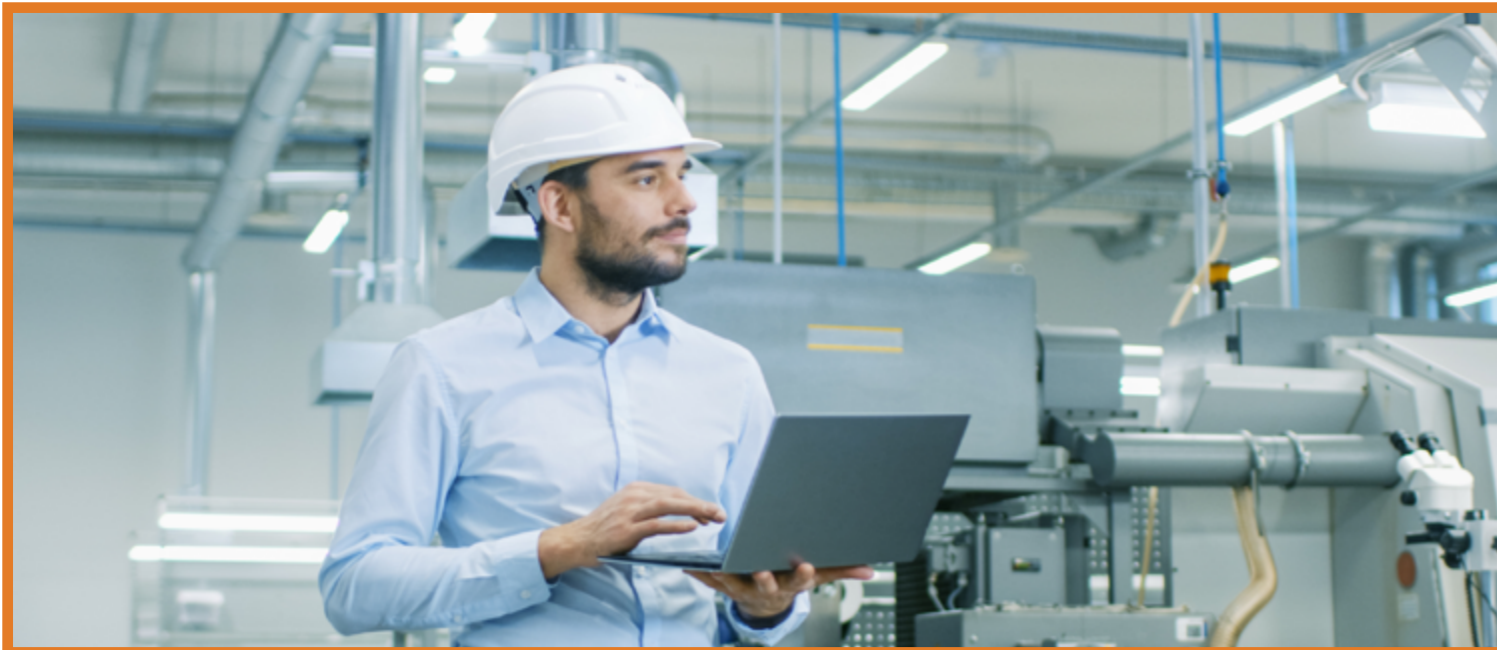
"We are thrilled to have received permission to build our National Hydroponics Demonstrator and Skill Centre and to have received backing from the local business community. Things are moving quickly and we're excited to share more about what is yet to come."

[www.growpura.com](http://www.growpura.com)



# Is SCADA the right tech for the future?

The truism “Jack of all trades, master of none” applies across many disciplines, and industrial software is no exception. The industrial Internet of Things (IIoT) has expanded the function of many pieces of software. But are SCADA systems biting off more than they can chew? Here, Sean Robinson, UK service leader at industrial software specialist Novotek UK and Ireland, discusses the issues that come with both approaches and suggests where a balance should be struck.



Data-driven industrial sites have settled into three distinct groups regarding data manipulation and handling. The first have fully embraced wireless interconnectivity and cloud-computing, and therefore handle all their data with analytics and other web-based databasing tools.

The second have adhered to the ‘if it isn’t broken, don’t fix it’ adage, and have taken their SCADA system and expanded its functions. Their SCADA systems handle it all, from process logic to web reporting and even historian functions.

The third group fit somewhere in between. These businesses have retained the SCADA systems they have relied on for decades, but

they have also applied piecemeal upgrades, such as cloud-computing, where possible and applicable.

Of these three approaches, each has its own distinct advantages and disadvantages.

## Internet problems equal manufacturing problems

The first approach seems very attractive at first glance. Exporting data wirelessly to data-farms curtails many of the restrictions associated with industrial data collection.

Adding new equipment, or even entire sites, into these flexible cloud-based systems is as easy as hooking up a WiFi signal and

aiming the data at the correct server with no extra equipment or wiring required. These setups also make remote monitoring possible for engineers anywhere around the world, vastly streamlining troubleshooting and support. However, it’s when exceptions occur that problems rear their heads.

By funnelling every bit and byte through the internet, you’re entirely at the mercy of your service provider. In the entirely likely event that internet connection is lost then any data-driven process must stop.

If dropped connections are planned for in advance, then process equipment can be made to return to safe configurations

with local backup logic, but for particularly data-intensive processes, such as CAD laser cutting controls or machine-vision systems, even a half-second blip can wreak havoc.

So, while this approach may be cost-effective, highly flexible and offer unmatched access, you’re effectively taking your process control and handing it off to anonymous middlemen, who may have zero knowledge or understanding of your specific process needs.

SCADA as a one-man band? At the other end of the scale, other industries have kept their SCADA systems online, and have built on and enhanced them to expand their remit far beyond typical SCADA features.

This patchwork approach is again quite attractive and leans into the strengths of software/firmware ecosystems in that they can easily be patched and updated. Seeing as all the data moves through the SCADA anyway, appending historian, web-monitoring, genealogy tracking and other data-driven features seems perfectly logical.

It’s not all plain sailing, however. Over years of incremental upgrades, SCADA systems can easily turn into the software equivalent of Frankenstein’s monster, with a tacked-on historian section here, a SQL log function co-opted from elsewhere there, and so on.

When SCADA systems are built up in this way, they become almost impossible to troubleshoot or source support for as every company operating this way will naturally develop its own unique setup. This puts a lot of responsibility on individual software engineers who understand the subtleties of a certain system, meaning in the event those engineers are



unavailable, if they’re ill or have retired for instance, nobody else knows where to start when troubleshooting a problem.

In the worst instances, modern software may have to work alongside completely obsolete, decades-old systems. A chain is only as strong as its weakest link, so this approach severely limits operational efficiency while software old enough to drink catches up.

Lastly, with so many interlinked and interdependent systems all working and communicating back and forth under the same hood, an exception in one area can quickly turn into a complete system failure. An error in one area of the software can quickly be distributed around, causing exceptions to fly, variables to overflow and data to be garbled.

## If it looks like a SCADA...

As you may be able to guess, the third approach described above is the one to take. Namely maintaining an up to date SCADA system and bringing in discretised additional software when required.

The key to making this work is making data interoperable between systems. This is achieved with GE’s model-based development (MBD),

of which Novotek is the sole supplier across the UK and Ireland. Here, common data formats are standardised across sites and systems. Doing so completely dodges the problems of the methods described above while retaining the advantages.

When the SCADA system, historian and other functions operate using the same signed variables, each function can be kept in its own environment and simply called through software when needed.

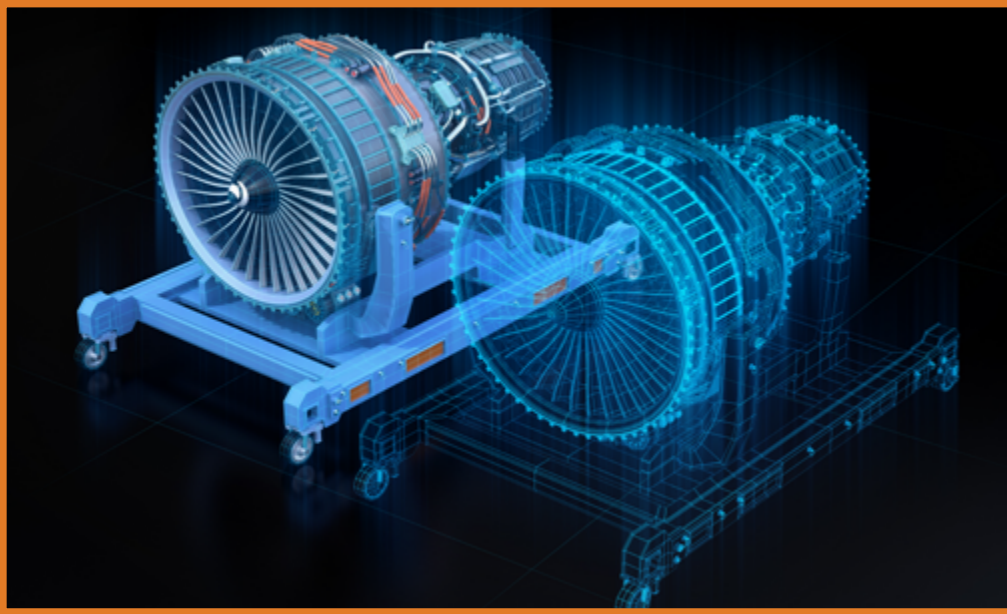
This keeps the software as lean and efficient as possible, but with none of the compromises to operational flexibility normally associated with discretised software because any additional functions can be easily added thanks to the shared data formats. It also means that if one area encounters a problem, the other software is unaffected.

MBD standardised variables mean that software operates where it is specifically designed for. By keeping SCADA functions within the SCADA, historian functions within the historian, and so on, and ensuring that data can be passed freely between systems, you can achieve the best of both worlds.

<https://www.novotek.com/uk/>



# Digital twins come of age



**Ali Nicholl from Iotics looks at the evolution of digital twin technology and its ability to disrupt.**

The term Digital Twin has been around for many years and has meant different things to different people. But in recent years we have seen the maturing of Digital Twins, with implementations expanding beyond simple visualisations to through-life real-time versions of entire processes, assets and environments. The Advanced Manufacturing Research Centre (AMRC) in its recent Digital Twin report, *Untangling the Requirements of a Digital Twin*, defined this new understanding of Digital Twins as, “A live digital coupling of the state of a physical asset or process to a virtual representation with a functional output”.

The next generation of Digital Twins model entire data estates and interact across corporate boundaries. Modelling of these

ecosystems is done through the interrelation Digital Twins.

Interoperable Digital Twins as virtual versions of assets, systems and processes can be seen in a similar light as Russian Nesting Dolls. For example, Twins of individual components (fan blades), form complex assets (turbines), nested inside large assets (engines), inside asset platforms (planes), which then form part of a service (airline route), as part of a digital ecosystem (transportation). Each of these Twins is equally valid, capable of interacting across corporate boundaries, interoperating to form digital ecosystems of Twins.

These ecosystems can be formed in a domain, such as a smart city; or an enterprise where barriers between silos can be broken down; or in a consortium of collaborating enterprises where relevant data can be shared securely between the participants.

A Twin-based digital ecosystem removes the complexity of heterogeneous systems, APIs and data formats to create a homogenous view, with brokered interaction between the Twins, applications and sources of data. Digital Twins operating in a mesh of relationships mirrors the goals and objectives of the FAIR data principles – digital assets that are Findable, Accessible, Interoperable and Reusable.

However, the Nesting Doll analogy is incomplete. Digital Twins don't have strictly hierarchical or linear relationships. A carriage may be considered part of a train, but carriages can be reconfigured into different trains and services. Component parts may be interchanged. Manufacturers make trains and operators run trains, but manufacturers lease trains to more than one operator and operators run trains from more than one manufacturer. It's clear that to accurately mirror our real-world systems with Digital Twins we need to move from linear composite views of Digital Twins to a multi-faceted relational way of interrelating Twins. Semantically describing Digital Twin meta data (the data about data) may provide the solution.

## The need for semantics

Twins are designed for a machine-readable world, opening up the possibility of autonomous interoperability, meaningful interactions between systems and processes, leveraging the power of event analytics, AI and



machine learning. This type of machine-readable interoperability is important for Twins in a digital ecosystem as twins need to understand what the other twins are saying about themselves in an unambiguous way. The semantics that describe a twin allow them to interact in complex ways.

Twins and semantic technology enable us to deliver on the promise of digital ecosystems, avoiding the limitations we saw in hierarchical databases with their focus on the logic of the databases themselves; not the business logic which drives value. Twins on their own provide information, but not insight and without accurate relationships, they restrict our understanding of the real-world complexity they purport to model.

Implementing the semantic web and Digital Twin-enabled digital ecosystem allows virtual twins to live and interact in the same way as their physical counterparts, creating the all-important mirror of life.

## Digital twins at Rolls Royce Power Systems

Digital twins don't replace existing technology, legacy investment or planned OT/IT activity, rather they extend capabilities, increase flexibility and mitigate the risk of obsolescence.

Rolls-Royce Power Systems have placed an emergent Twin-based interoperable ecosystem

at the heart of its vision to deliver the next generation in customer service. Sean Gigremosa, Technical Product Manager at RRPS explains, “the issue was that we didn't see our products the way our customers do. We saw the world based on our technology and process, infrastructure and delivery methodology. RRPS harnessed Digital Twin technology, to provide a virtual composite of the entirety of an asset's data and controls, one that could meaningfully interact with other twins, to provide a single source of truth that helps suppliers become service providers and customers to become partners.”

The use cases for Digital Twins are as varied as the twins themselves. The Digital Twin age is the next evolution of disruption provided by the web. The mirrorverse enabled by Digital Twins is helping turn silos of data into a web of sources. Liberating us from siloed thinking and enabling us to focus on what matters to our company, customers, and communities.

[www.iotics.com](http://www.iotics.com)



*Ali Nicholl is Head of Communications and Engagement at Iotics.*



# The next generation of big data analytics

By Frances Sneddon, CTO at simulation expert Simul8

The use of big data analytics has been gathering momentum for some time now as Industry 4.0 approaches become increasingly commonplace in industrial settings. More recently, process mining has emerged as an essential tool to bring disparate data sets together in a way that will transform organisational management. And now, the possibilities have been opened up even further with the next step of this journey, which is to combine process mining technology with the predictive power of simulation.

To jump back, first of all, process mining is the method of taking the vast amounts of separate operational data generated by things such as ERP, CRM, Service Management, BPM and other workflow systems, and applying algorithms that will combine all of the data into a single map or visualisation of a process. This full picture can then be broken down easily for analysis and optimisation.

The addition of sophisticated simulation software means that the analysis can be developed not just for current processes, but to also test and verify the impact of any alterations and future processes by leveraging the most accurate data available.

The software will use the mined data to create instant replica models of a process. This becomes a virtual environment in which to run test scenarios and identify which alterations offer the best ways to streamline and optimise the process before introducing any changes in the real world.

For example, a manufacturer may wish to review the potential impacts of introducing a new piece of machinery to a production line.

These could incorporate the rollout of additional throughput capacity, testing all possible reconfigurations of the production line, phasing out older machinery, staffing requirements or potential bottlenecks at later stages of a production process.

Or perhaps they want to use the technology to find out how best to optimise a full factory maintenance schedule in a way that will cause the least possible disruption.

Adopting this combination of process mining and simulation allows the manufacturer to run all their tests and checks virtually in order to gather the evidence needed to confidently make decisions.

This ability to experiment with



actual processes using accurate and readily available data without the fear of real-world consequences is invaluable. It's an opportunity to make operational changes on a scale that hasn't been seen before, making it a real game changer for organisational management.

[www.simul8.com/](http://www.simul8.com/)



# Finding a Silver Lining in the Pandemic

By Ted Fetterman, Bally Ribbon Mills

Like manufacturing operations around the country, Bally Ribbon Mills struggled with how to meet its contractual obligations while still maintaining a safe working environment for employees during the recent pandemic. Tasked with quickly developing a structural polyester tie-down for temporary medical and first responder structures, the company had to develop new operational methods that took us out of the comfort zone of a typical bricks and mortar manufacturing facility. Here's a look at our journey.

Design process for new product serves as test case for new system. The original inquiry for a structural polyester tie-down for temporary medical and first responder structures came after BRM had ceased normal operations and the entire sales, customer service, and R&D team was working from home. This created serious challenges for BRM's standard project planning, control and feasibility (PPCF) process, a rigorous review that allows experts to engineer products specific to customer requirements or specifications.

An integral part of the company's design review and ISO9001/AS9100 quality control system, the PPCF design process is focused on identifying and controlling risk. The sequential process includes review and sign-off by stakeholders with responsibility within the departments in BRM's organizational structure.

Before COVID, the entire PPCF design review process relied on a paper form that passes sequentially from one stakeholder to the next. In short, the paper-based system inadvertently created silos that meant only those that won projects would gain the knowledge from working on the project.

Others not intimately involved would not know about the project or learn from its successes and mistakes.

COVID forces the company to initiate efficient remote ways to work together. Enter COVID, which forced the company to initiate ways to work together efficiently but remotely.

The company adopted a new software program that provides sequential review by stakeholders. The program, integrated into Microsoft Outlook and combined with Adobe Acrobat Reader-DC, allows stakeholders to "fill & sign" the PPCF form in PDF file form. Once a stakeholder inputs all the information, he or she signs the document and forwards it electronically to the next stakeholder.

At any time in the process, the initiator can recover the process or skip any stakeholder to ensure that the document flows through the process efficiently. Furthermore, the initiator can change the routing to accommodate staff availability changes that previously delayed the process, for example, vacations, sickness, or other reasons for lack of stakeholder availability.

The electronic records of the process allow for a thorough review of all projects by relevant parties within the organization such as business development, R&D, and the executive team staff. Transfer of knowledge within the organization is now ensured and complete. Availability of the electronic record in the future is ensured. Using this new procedure, the time to complete the process was reduced by as much as 80 percent!

The new system was used to great

success for the structural polyester tie-down for temporary medical and first responder structures. The team reviewed the requirements and quickly got a quote to the customer. Producing a sample right away was a challenge given the existing production schedule and the need to clean and maintain proper social distancing while running the machines – but within just over a week, they produced a sample, got it approved, and the company placed orders.

The new procedures are the new normal, with social distancing and remote working to be permanently integrated into regular company procedures. We have also benefited from the changes. Our employees responded well by taking advantage of new software and new processes adopted during remote working to improve teamwork, taking our systems and transforming them into something even better.

Yes, we still miss the personal touch, face to face interactions, and impromptu problem solving that makes working in close proximity with colleagues so enriching. However, we also celebrate how the new systems adopted have greatly increased communication levels across the board and improved office staff productivity. In addition, we are reaping some great benefits from looking at all our operations and taking additional steps to ensure knowledge transfer and improve quality control. We have left behind some older ways of working – and we won't be going back.

<https://www.ballyribbon.com/>



# Industry 5.0: How far off are we?

By Robert Miles, Manager R&D Tax Incentives, and Adeola Adebowale, Manager R&D Tax Incentives, Ayming

The last 50 years has seen relentless progress in the manufacturing sector as automation and new technologies provide infinite possibility for growth. But it's in more recent years that we have seen progress really begin to accelerate in the convergence of automation, new technologies and big data analysis across manufacturing and the supply chain. The 'smart factories' this is creating have begun to dominate most industrial sectors.

Manufacturers recognise that to remain competitive, they must invest in new products, processes, and services that generate real returns on investment. Companies must be capable of responding quickly to changing demand with new product designs, enabled by flexible manufacturing processes.

This is perhaps why technology is moving so quickly, it was only a few years ago that Industry 4.0 – the so-called fourth industrial revolution – was hailed as the golden standard. But Industry 5.0 is rapidly becoming the aspiration.

Industry 4.0 saw a huge drive to automate processes putting machines at the heart of manufacturing. While this led to an increase in output, it also highlighted a lack of flexibility in operations. That is to say, without the ability to think critically and analyse data, the need for even a slight variation created a massive



problem. This conclusion was perhaps best articulated by Elon Musk following production delays on the Model 3 Tesla who admitted that excessive automation at the factory had been a mistake and that "humans are underrated".

The same realisation has been felt across manufacturing and now a drive has begun towards interconnectivity between humans and robots. Industry 5.0 sees a drive towards personalisation where humans are put back into industrial production to collaborate with robots. While robots are still used to assist with the heavy lifting, human collaboration provides a level of real-time analysis which means that systems can be adjusted in real-time and potential problems are anticipated.

A change is also being driven externally as customers demand more personalised products as standard. In order to meet this demand, manufacturers are continuing to invest in new

technologies and areas of innovation in order to get ahead. Here, we explore some of the key trends:

## 3D Printing

2020 saw some of the most effective use of 3D printing to date as manufacturers used the technology to meet the demand for medical devices and PPE caused by the pandemic.

Elsewhere 3D printing looks set to become a key stage in the manufacturing process, made highly valuable due to its ability to accept a wide range of product design. It's also critical for the industry's drive towards personalisation because of its flexible nature, allowing a single variation of a product, which eliminates the need for high volume manufacture. This is particularly valuable for producing replacement products, reducing possible component obsolescence, and negating the requirement for big warehouses as components can be produced with limited lead times.

## Big data

Data continues to play a huge part in innovation, with manufacturers continuing to invest in building smart factories which provide a constant flow of information about speed, quality and efficiency.

A weakness exposed by the pandemic is that a lot of data is held on the factory floor, rather than being updated to the cloud, requiring a physical human presence. However, the introduction of 5G is making the exchange of data quicker than ever before and smart devices allow information to be sent automatically rather than having to be manually processed.

## New materials

A drive towards sustainability is playing a huge part in the introduction of new materials and manufacturers are making a concerted effort to limit the use of substances which might be harmful to the environment, as well as improving product performance and properties. The search for new, sustainable materials has led manufacturers to invest in R&D and explore the practical use of new materials previously seen at research level, such as graphene.

## Virtual reality

Virtual reality is also proving a game changer for manufacturers, allowing them to test designs without the need for a physical prototype in the initial stages. This means that by the time

you get to the first prototype it's nearly as good as the finished product which limits waste hugely.

Having so much flexibility around the design process is also critical for manufacturers meeting the demand for personalised products as virtual reality means that altering or creating bespoke designs is easier than ever before. The manufacturing sector is undergoing a silent but radical transformation as new innovations continue to pave a way to Industry 5.0. Valuable lessons have been learned from increased automation but now those who are able to balance new technologies with a higher level of human intervention will find themselves several steps ahead.

[www.ayming.co.uk](http://www.ayming.co.uk)

## Virtual conference to help manufacturers fast-track recovery, growth & resilience

Made Smarter is to deliver a virtual conference to show manufacturers how to leverage and fast-track digital technology and tools for a year of recovery, growth and resilience.

The free-to-access online summit, Made Smarter: The journey to digital manufacturing, will take place on Wednesday, March 10, from 9.00am-5.00pm.

Curated by manufacturers for manufacturers, the conference features an impressive line-up of industry heavyweights who will showcase the 'why?', 'what?' and 'how?' of digital manufacturing,

including:

- **Juergen Maier**, Chair of the Digital Catapult and co-Chair of the Made Smarter Commission;
- **Stephen Phipson**, Chief Executive of Make UK, the manufacturers' organisation;
- **Andrea Hough**, Managing Director of ATEC Engineering Solutions; and
- **Glyn Jones**, Service Delivery Director at BAE Systems and Chair of the Made Smarter Pilot Steering Group.

The packed one-day programme, which will be hosted virtually using an interactive online platform, will include insightful panel discussions and roundtable debates, interactive workshops; demonstrations of the latest digital manufacturing technologies; and one-to-one advice sessions, giving businesses the vital intelligence needed to start their digital journey or take the next step.

<https://www.madesmarter.uk/conference>



# Reducing electrical complexity with modern automation

*For all the uncertainties and instabilities that the industrial sector has faced in recent years, one thing has remained constant: automation, and investment in it, has grown steadily. These systems provide a wealth of benefits for industrial businesses, but they can present a series of challenges for electrical engineers in terms of wiring and control cabinet functionality. However, things may be set to change, as Stephen Hayes, managing director of control system expert Beckhoff Automation UK, explains.*

Automation has been a consistent priority for industrial business leaders for much of the past decade. Findings from BDO's 2019 New Economy: Investing in Automation report highlighted that 87 per cent of surveyed UK businesses had invested in automating a key process in the previous 12 months. In addition, 21 per cent of chief financial officers identified automation as their most important investment for the coming years.

Then there is the 2020 annual manufacturing report, which reported that 63 per cent of businesses have already actively adopted automation and robotics. Together, these surveys paint a clear picture of an industry already reasonably automated, with further automation investments on the horizon.

It is not difficult to see why this is the case. Automation allows for efficient completion of repetitive, monotonous tasks such as handling of materials or packing of products, and similarly can manage processes with a lower rate of error than human workers, such as quality inspection. It supports human workers to complete other tasks while the automated systems operate, which allows for greater throughput, output and overall productivity. As more systems can interconnect and share data, these gains become even more substantial.

However, adopting increased levels of automation is not

without its challenges. There are, first and foremost, the practical issues of adding a new automated machine to an existing production line. A plant requires ample space to support the machine, and plant managers will also need to account for the planned downtime on a production line while the system is integrated and set up.

Of course, automated systems can quickly recuperate productivity losses if set up properly, but then there is the matter of how much downtime is required per installation. As electrical engineers will know well, much of this downtime

comes from connecting automated machines safely into control cabinets.

## Electrical issues

Unfortunately, as automation systems become more advanced, they require more space in control cabinets to house power and communication cabling. This contributes to control cabinets starting to occupy large footprints, which reduces the space available for plant managers. These densely populated plants also present issues for electrical engineers.

The typical control cabinet

contains a combination of higher voltage — often around 480 V — power supply cables, 24–120 V control wiring and, increasingly, communications cabling. The conductor for each cable and wire needs to be sufficiently separated to prevent signal disruption and the proliferation of electromagnetic interference (EMI).

Generally, magnetic fields are generated as current passes through the conductor. This field will periodically change direction as the alternating current (AC) flow changes, which can induce an erroneous voltage in other control wiring in close proximity. This EMI induced voltage can produce a false signal for connected equipment or distort supplied voltage, leading to erratic equipment behaviour, compromised performance and accelerated component failure.

Part of the management of this issue involves ensuring that cables are sufficiently shielded and separated, which inadvertently increases the required footprint of the control cabinet.

Then there is the fact that with an ever-increasing amount of wiring comes more opportunity for wiring errors. These errors elongate the installation downtime of adopting a new automation system, while also making future manoeuvring of the machine more complex.

Modern automated systems possess a great deal of components that require wiring through a cabinet, with each cable and wire introducing another instance of EMI risk. This presents a possibility of more complex automation systems producing a greater deal of problems for electrical engineers.

In Beckhoff's view, this is not a sustainable approach to automation. When we consider the limitations presented by control cabinets in terms of footprint, electrical reliability and installation complexity, it's clear that an



alternative is needed. Fortunately, new automation technologies are moving away from the conventional control cabinets, with the support of a new approach to cabling.

## Shrinking cabinets

For automation components and systems, there are two key cabling requirements: power and control. A distributed servo drive, for example, needs power to operate but also must be able to communicate data to allow for motion control. The obvious solution is to find a way of integrating power and communications into a single cable to immediately halve the number of trailing cables and wiring errors. However, finding an effective way of doing this has been far from obvious.

Hybrid cabling is not a new concept, but it is one that has faced difficulties of execution, especially in terms of compatibility with multiple systems. This is why we have seen the development of a new type of cable in the form of EtherCAT P, which combines the 24 V DC power supply required by many systems in a single 4-wire standard Ethernet cable. The system and sensor supply voltage and the peripheral voltage for actuators are electrically isolated from each other and can supply up to 3 A of current to connected components.

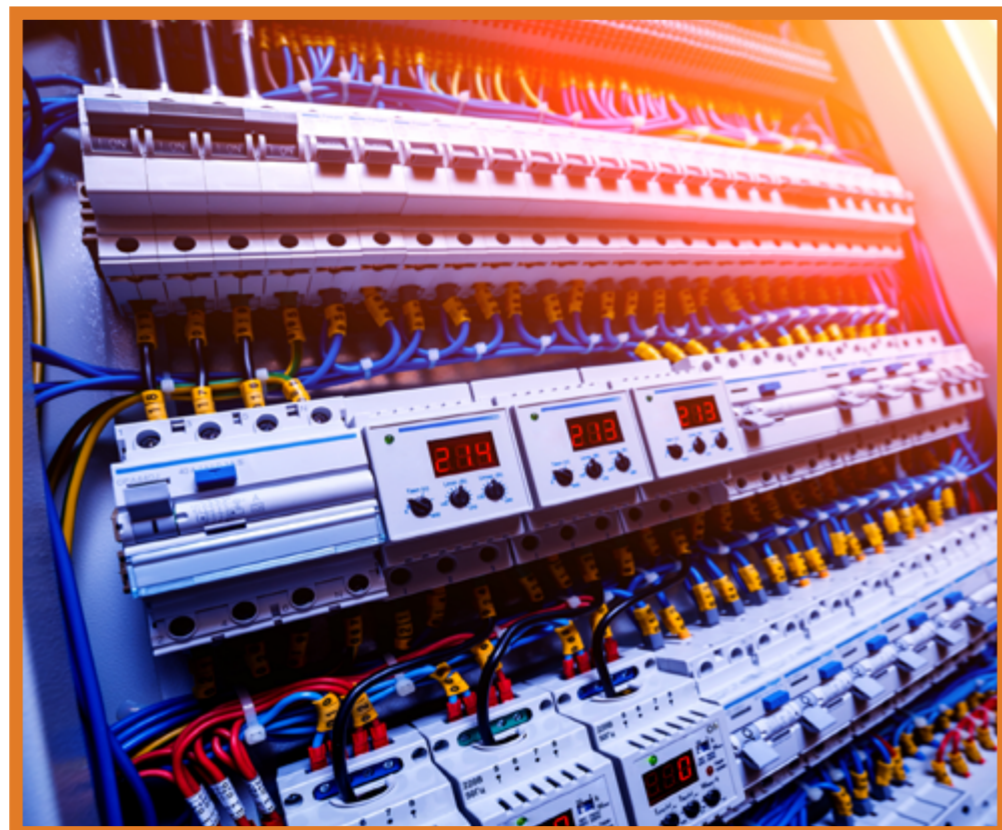
This innovation alone streamlines the number of cables, which immediately theoretically halves the size of control cabinets. However, it's when we couple it

with distribution and power supply modules for machine components that we start to see the scale of the impact. Using a power distribution module compatible with EtherCAT P in a machine with multiple servo drives, for example, allows up to five servo systems to operate from a single module with only the module requiring control cabinet connection.

What this means is a plant could invest in an automation system with five servo systems to control various motion processes, with only a single wire needing to run to the control cabinet. Immediately, the risk of wiring errors is substantially reduced and the installation complexity faced by electrical engineers is mostly eliminated. This allows electrical engineers to complete automation integration and wiring tasks much more efficiently.

It then also means the control cabinet can be much smaller, occupying less space on a factory floor and leaving more room for productive investments.

This is all made possible by new automation technologies, which have supported a move away from the bulky control cabinets that have long been a staple of factories and production lines. As more automation systems are adopted into industrial environments and investment continues to grow, we can avoid creating more difficulties for electrical engineers. Instead, we can all reap the benefits of automation, without cabinets.



[shorturl.at/nsyRV](https://shorturl.at/nsyRV)



# Using AR to solve challenges in post-COVID manufacturing

By James Mann, Enterprise Business Development Manager at Getac UK

The term 'Augmented Reality' was first coined around the turn of the millennium by computer scientist, Ronald Azuma, who recognised the huge potential that such technology had in a wide range of business areas and applications. It's taken a further twenty years for hardware and software to reach a point where that potential can start becoming a reality, but it's growing commercial adoption couldn't be more timely. With the COVID-19 pandemic imposing unprecedented restrictions on the movement of people, AR could hold the key to many of the operational challenges currently being encountered by manufacturers around the world.

## What is Augmented Reality?

Augmented Reality (AR) combines elements from the real world with digital representations. Unlike virtual reality, it does not fully immerse the user in a digitalised world, but rather integrates digital information in the perception of the user, enriching the real-world representation with virtual elements and providing context relevant data.

Doing so combines the advantages of both concepts (digital and real-world) allowing for hands-free operation by removing the need for an additional device for entry or display purposes. Azuma himself defined Augmented Reality as 'the possibility of integrating virtual objects in the real world and interacting with them in real-time'.

## Demand for AR is accelerating

IDC recently predicted that worldwide spending on AR and Virtual Reality (VR) is forecast to accelerate out of the pandemic,

growing from just over \$12.0 billion in 2020 to \$72.8 billion in 2024. Furthermore, commercial applications make up by far the largest share of this growth, with industrial maintenance (\$4.1 billion) predicted to be the largest area of investment, alongside training (also \$4.1 billion).

## What practical applications does it have for manufacturers?

One of the applications with enormous potential in the manufacturing industry is the maintenance and repair of industrial machinery over large distances. This application takes advantage of the increasing availability of networked product development and manufacturing data created by the Industrial Internet of Things (IIoT). Machine data is, after all, provided not only for operation purposes, but also for more transparent, speedier and higher quality maintenance and repair. Increased data transmission speeds - especially through mobile networks such as 4G/5G - and shorter latency times allow for support repair and maintenance

work from almost anywhere, even from different countries.

In the current situation, this kind of application is even more valuable than ever. With the manufacturing industry suffering from a growing skills shortage, many organisations have a relatively small pool of skilled experts that they rely on to lead repair operations all over the world. However, ongoing restrictions mean they are currently unable to physically travel, which leaves virtual consultation the only option available. Adoption of AR technology can significantly enhance the quality and capability of long distance repair work, enabling experts to remotely connect with less skilled technicians from anywhere and walk them through complex tasks step by step.

Such an approach also offers a number of side benefits. Not only does it enable better knowledge sharing between skilled and lesser skilled employees, helping to reduce skill gaps, it also helps manufacturers cut their carbon



footprints (and expenses) by eliminating unnecessary employee travel. Furthermore, for repair operations in hazardous areas, it reduces the number of employees that need to enter the environment, minimising the health and safety risks involved.

## What equipment do manufacturers need?

Scalable software platforms, such as the Augmented Reality Service Platform by Inosoft, the Reflekt Remote application by Re'flekt GmbH or Device Insight by the Munich-based IIoT pioneer of the same name, provide a variety of hardware solutions, which equally access existing data and can present their function in a customised manner. In this application, users do not necessarily need to revert to head mounted displays, as robust tablet PCs or notebooks suitable for industrial use do the job well in daily operations and especially in harsh factory conditions.

A typical AR-assisted repair process could look like this - a worker at the machine wears a head mounted display and contacts an expert remotely



through the network. Through the camera integrated in the display, the expert receives images or video of the situation on-site. Using a notebook or tablet PC, the expert can then add visual notes and thus inform the technician which lever on the machine needs to be actuated or which cable needs to be run to solve the pending issue, all while the technician works hands free.

At a time when the combination of growing skill gaps and global travel restrictions is putting increasing pressure on manufacturers everywhere, AR technology offers a timely, technology based solution to many of the key issues faced. As adoption continues to grow and price points come down, it will soon be hard to ignore as a way for manufacturers to share expert knowledge around the world in a cost efficient and environmentally conscious way.

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# Pondering the mystery of nanomaterials

By Samir Jaber, content writer at materials database Matmatch

“Great things are not done by impulse,” wrote George Eliot, “but by a series of small things brought together.” While this certainly applies to advancements in nanomaterials, similar deliberation is needed to assess the technology’s unknown risks.

For materials scientists and design engineers, the principal qualities of nanomaterials relate to their shape, size, surface characteristics and inner structure. To give an idea of their size, nanomaterials are frequently compared to a single strand of human hair, which typically ranges in diameter from between 50 and 100 µm. A nanomaterial is hundreds and thousands of times smaller than this, with spatial dimensions of below 100 nm.

The minute size of nanomaterials is key to their existence in a variety of forms and their use in various applications. These include as solids and liquids in air, in aerosols, liquids-in-liquids as found in emulsion paints or as solids-in-liquids commonly used in sedimentary fluids. Their end-uses are just as varied as they are impressive, from next-generation computer chips and phosphors for HD televisions to insulation materials and hardened cutting tools.

## Better chemistry

Besides their shape, other key features of nanomaterials include their chemical composition, physiochemical stability, crystal structure, surface area, surface energy and surface roughness. These latter properties are of particular interest as we see increasingly high requirements

of the surface and interface properties in many mechanical systems.

These demands, in turn, require new designs and improvements in surface modifications and manufacturing technologies. This is where the unique mechanical properties of nanoparticles have shown real potential over the last couple of years.

Increased interest in nanoparticles has likewise seen an evolution, and many different compositions and physiochemical properties are now available.

These unique properties affect, firstly, their usability — in biomedical applications, for example — and also their toxicity. Nano-research has delved increasingly into the latter in recent times to predict the toxicity of nanomaterials. However, it is far from straightforward to find specific correlations between this data, which is often incomplete and unrelated. That also goes for matching different critical physiochemical characteristics to the materials’ potential toxicity.

Materials scientists are still studying and balancing these known and unknown qualities. These efforts have evolved significantly in recent years, in both Europe and the United States, particularly in relation to the toxicologically relevant properties of engineered nanoparticles.

This isn’t the only way that nanoparticles remain unpredictable — especially in relation to their risks.

## Under the skin

The principal risks of nanomaterials relate to human health. Nano-sized particles can enter the human body via the lungs and the intestines, while penetration of the skin — though possible — is less likely. Chances of penetration depend on the particle’s size or surface properties, as well as the point of contact in the lung, intestines or skin. Their size also affects distribution within the body.

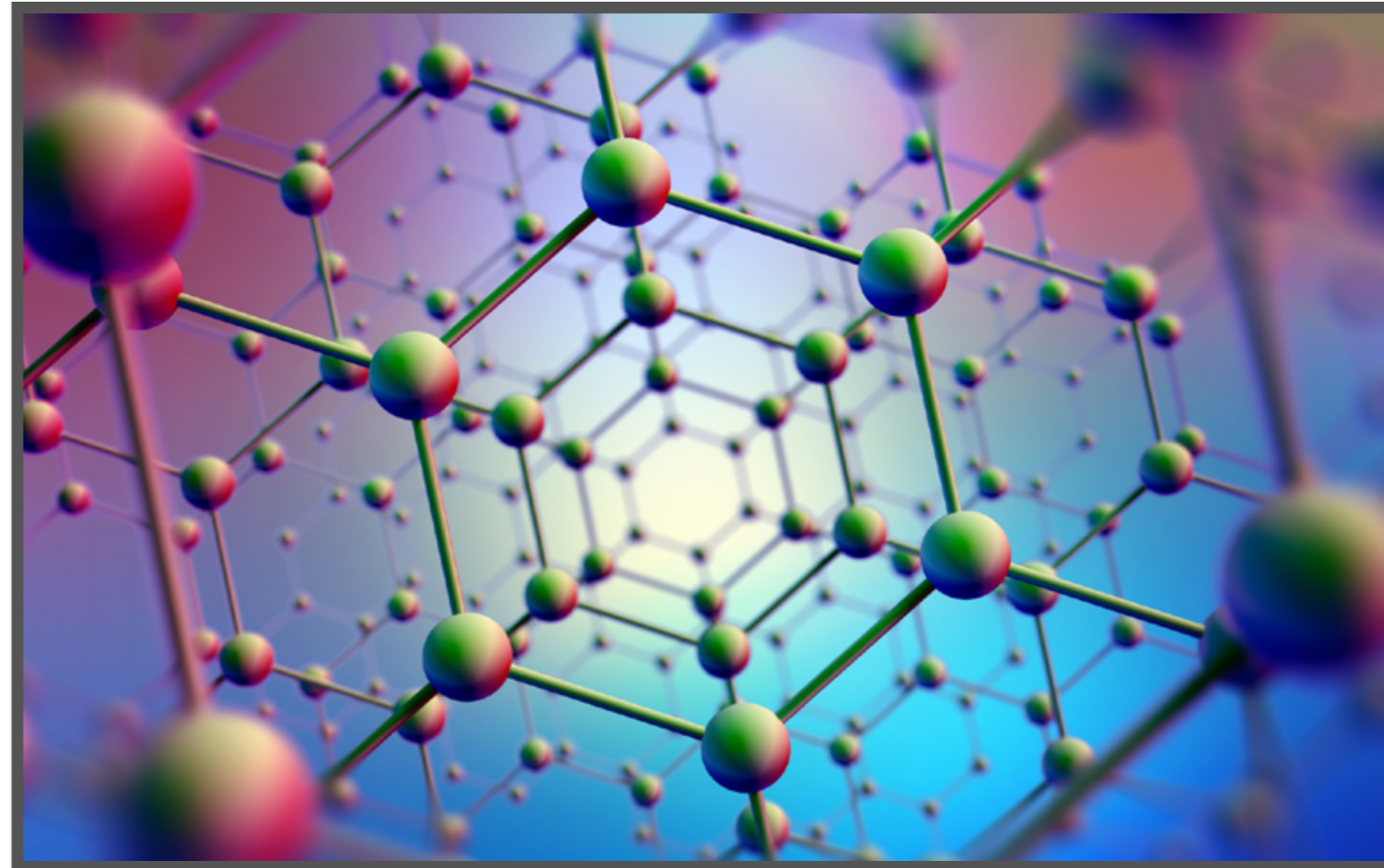
The health effects of nanomaterials still require detailed research and development, especially given the variety that is in existence today. Each nanomaterial should be treated individually in terms of their potential health risks.

Current tests to assess the safety of materials should also be applied to identifying hazardous nanoparticles — instances can include identifying increased risks of heart or lung diseases. Given the complexity of the technology, specific measures should be taken for every newly produced nanoparticle.

The onus, here, falls to the industry, legislators and risk assessors to devise low-cost tests without reducing the efficiency of these assessments.

## A question of scale

In 2007, the production of nanomaterials increased in scale to thousands of tons. Aside from being an impressive engineering feat, this milestone also increased the likelihood of the materials potentially entering the environment.



There remains an almost complete lack of data on the effects of nanomaterials on the environment, whether it’s through production, manufacture or disposal. The latter evokes issues of bioaccumulation, bio-toxicity and biodegradation.

While concerns have been raised about transport and transformation of nanoparticles released into the environment, a lack of significant findings means that no definite conclusions about the toxicity of biomaterial can be drawn, at present.

To allay these concerns, it is worth noting efforts to develop the environmental friendliness of nanomaterials. This includes their use in increasing the efficiency of fuel cells and solar cells, thereby decreasing our reliance on fossil fuels in these technologies. Further to this, photoactivity demonstrated by nanomaterials indicates potential uses in bioremediation to remove contaminants and pollutants in the environment.

Despite the clear advantages of nanoparticles, further studies are being conducted into their mechanical properties; particularly with advances of characterisation techniques and new nanoparticle production methods. These studies pertain mainly to their size-dependent and material effects, and to gaining a clearer understanding of their use in specific applications.

One way to achieve this is through direct visualisations of nanoparticle behaviour on the micro, nano or even atomic scales. Another way to keep up to speed with the latest developments in nanomaterials is with a comprehensive materials database like Matmatch.

To repurpose the words of George Eliot, this diminutive-yet-powerful technology must be underpinned with engineering and scientific rigour, rather than impulse.

**Samir Jaber is content writer at Matmatch, an online materials database designed to support design engineers and material scientists through the specification process and connect them with material suppliers globally.**

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