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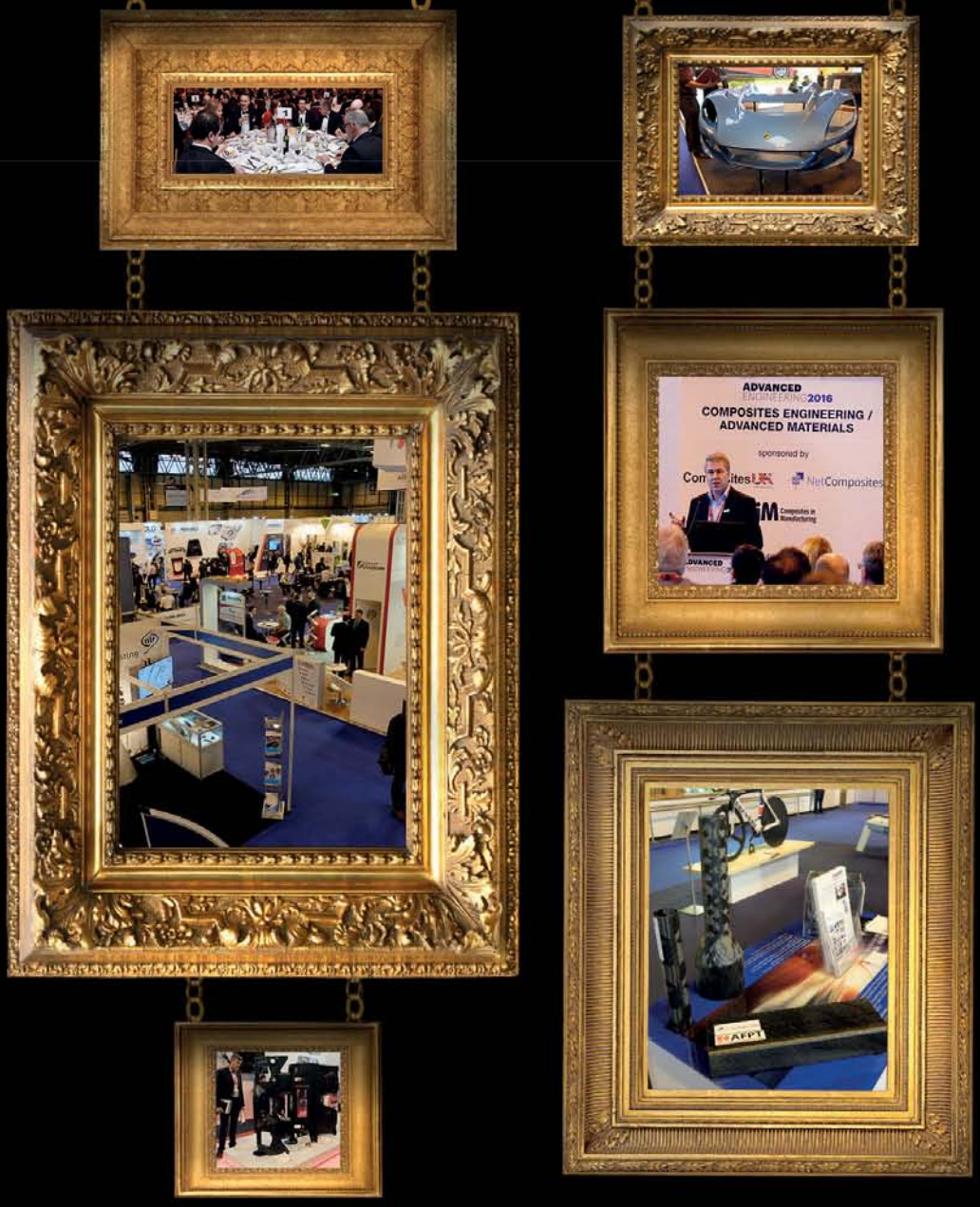

COMPOSITES ENGINEERING2017
1 & 2 November, NEC, Birmingham

A GALLERY OF COMPOSITE INNOVATIONS p36

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When shove comes to push

For some footballing nations, the dream of the 2018 FIFA World Cup finals is over. Failure to progress beyond the European group qualification stages sees them cancelling their flights to next year's tournament in Russia and staying at home.

Many excuses will be trotted out, ranging from poor management and poor team selection to injuries and player indiscipline. I could go on. So, I will.

Whilst England just squeaked through, there's the suggestion that the team is too nice compared to the nastiness displayed by other footballing nations. It hints at a collective human trait in that the English are generally, too polite and too posh to push when it comes getting any credit - assuming we deserve it of course.

The UK's withdrawal from the EU means its influence on a shifting world stage requires new methods of exercising power by replacing the use of force (hard power) with 'soft power', which is defined as getting what we want by influencing other countries we do business with to want the same thing through the forces of attraction, persuasion and co-option.

Increasing digitalisation, via Industry 4.0 means the nature of the UK's relationship with the EU, the US and new rising powers needs to evolve. The dynamic will need long-term strategic analysis to ensure we make full benefit of the advantages of these soft power methods, within the new international milieu that is developing in this digital age.

In the same way that the goalkeeper protects their goal, the effects of an increasingly digitalised industry mean that we must work harder to protect our manufacturing assets by doing a better job of helping our OEMs, primes and SMEs tell their success stories to the world. Previewed in this issue, where better to start than at Advanced Engineering 2017, NEC Birmingham next month?

Mike Richardson, *Editor*

CiM Composites in Manufacturing

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recycle

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Belotti seals NAVY 5-axis CNC machine installation

Operating from a dedicated 4,800m² production facility in Galgorm, Northern Ireland, Wright Composites is a specialist company working on one of Europe's emerging automotive brands.

Today, it employs in excess of 180 staff and is the main GRP supplier to its sister company Wrightbus, manufacturing 100,000+ GRP units per annum. Due to the scale of its automotive operations, resources and experience in GRP technology, Wright Composites has the platform to further develop its expertise and operation in a number of equally demanding market sectors, such as marine, energy and construction.

Able to undertake the development of new FRP components utilising both open and closed mould processes, the company has recently invested in a new Belotti 5-axis CNC machining centre through UK agent, Cannon Shelley to provide complete control of tooling design and manufacture in-house.

"It was a real pleasure working with Wright Composites, and I would especially like to thank their development engineer, Stephen Hewitt in helping make the installation and operation of the Belotti NAVY 6062 go seamlessly," stated Cannon Shelley's sales & service administrator, Phil Rudd.

The Belotti NAVY 6062 machining centre is one of the largest 5-axis machining centres in Northern Ireland dedicated to pattern making and boasts a machining volume of 5.5m² x 2m in Z axis. Integrating advanced CAD/CAM software, it will allow Wright Composites to continue to innovate and offer customers an end-to-end service to meet their requirements and specification.

WWW.CANNONSHELLEY.COM

New website, new era in composite covers

Created to showcase its evolving product portfolio and reflect its design-to-delivery capabilities, fibrelite.com, Fibrelite's new website, claims to showcase the widest range of GRP access covers and underground enclosures available.

Accommodating the increasing variety of internet usage, the new site delivers a consistent user experience on desktop, mobile and tablet – allowing users everywhere to intuitively navigate by product, select specifications, download technical information and request quotes.

Customers can also access over three decades of expertise, including instructional brochures, installation guides, manuals and test reports. A vast library of case studies demonstrates Fibrelite's ability to provide local support globally, develop covering solutions for different industries and manufacture bespoke products to suit every application.

WWW.FIBRELITE.COM

AERO SERVICES GLOBAL ACQUIRE EPM GROUP

Epm: technology has been acquired by Aero Services Global Limited (AS.G) as part of a multimillion pound buy and build strategy to service high performance high growth engineering sectors in aerospace, defence and automotive industries.

epm becomes a strategically important part of the AS.G Group, and the Group itself will provide capital and a robust management infrastructure to support the anticipated growth of epm technology. Graham Mulholland, CEO and founder of epm will continue to spearhead the development of epm.

"We have reached a point where epm requires the necessary funds and the executive ability to provide a world class service to our larger OE aerospace and automotive customers," stated Mulholland (pictured below). "This strategic acquisition will enable the business to now break the SME glass ceiling. This will also provide a boost for our ongoing commitments to staff development, R&D and process innovations which will continue to see epm pioneering and leading our industry and adding value to our customers."

Amin Amiri, the founder and CEO of a2e Industries, and the CEO of AS.G Group added: "AS.G is building a dynamic engineering group of companies to service and develop opportunities in the aerospace, defence and automotive markets. The acquisition of epm clearly demonstrates our appetite and ability to move and grow quickly. Part of this is activated by having the vision to support fantastic innovative companies like epm technology group to grow and add value to its customers."

Amiri is a successful investor with a fifteen-year track record of investing in or acquiring industrial companies and significantly enhancing their fortunes.

"Epm: technology will also continue to grow its bespoke services and proudly maintain all of its motorsport and F1 activities," explained Mulholland. "The business is best known as a F1 supplier and again having the correct financial resources to support all these activities is critical. This is a great result for epm, all its customers and my team moving forward."

WWW.EPMTECHNOLOGY.COM

Norco wins workboat contract success

Norco Holdings has been selected by Atlas Elektronik UK (AEUK) to build the fleet of replacement workboats ordered recently by the UK MoD and due to be delivered over the next six years.

The contract is for 30+ boats in total, ranging in size from 11 to 15 metres. As the primary composites supplier for the project, Norco will be producing the major components for the new vessels including hull, deck, superstructure and associated multipurpose modules.

The boats will be manufactured at Norco using modern and proven boatbuilding techniques. The company's knowledge and experience in such production techniques enables it to maintain the highest standards of quality and repeatability across the range of new boats.

Norco will work closely with AEUK and the design team throughout the life of the contract providing support in areas such as design for manufacture and production solutions, including the design and manufacture of high quality CNC tooling for the production of composite parts.

Mark Northey, managing director of Norco Holdings, commented on the contract award: "We are delighted to have secured this prestigious contract from Atlas Elektronik UK and look forward to starting work on the boats immediately. This project is a reflection of the capability Norco has developed in the manufacture of composite work boats, and we welcome further opportunities with AEUK and other defence marine companies."

WWW.NORCO.CO.UK

Porcher acquires Interglas Technologies

Technical textiles and thermoplastic composite solutions specialists, Porcher Industries has acquired Interglas Technologies' operation, including all business operations, workforce resources, assets, infrastructure and brand rights from the Preiss Daimler Group.

Interglas Technologies is a German producer of technical fabrics for aerospace, industrial, electrical and building applications.

"We are immensely proud to have completed this acquisition," stated Andre Genton, CEO, Porcher Industries. "As a respected competitor for over 40 years, we hold the company's experience, technology and reputation in high regard. Porcher Industries will be even better positioned to serve and innovate and we look forward to continuing Interglas' tradition of delivering excellence."

WWW.PORCHER-IND.COM

TUFNOL PRODUCTS BRIDGE THE GAP

Tufnol Composites says it has supplied specialist products to the new bridge across Scotland's Firth of Forth, the Queensferry Crossing.

Isolation washers manufactured from Tufnol's high performance glass laminate are forming preloaded connections with the bolts that attach critical components to the bridge construction and have been specially designed to cope with the forces that will be placed upon them every day. The washers are being supplied to the Forth Crossing Bridge Constructors who were responsible for the design and construction of the new bridge for Scottish Government's transport agency, Transport Scotland.

Gerard Kiely, Head of Section for Forth Crossing Bridge Constructors, said: "We have found the Tufnol isolation washer to be highly suitable for use with preloaded stainless-steel connections. These products are quite niche and initially we did not know if we would be able to source a product that would isolate different metals for corrosion purposes, while also withstanding significant preload. It was therefore good to work with Tufnol who were able to meet our requirements. The washers are exactly what we were looking for, both from a structural integrity and performance standpoint."

Roy Thomason, managing director for Tufnol Composites, said: "We are pleased to have supplied these products to the highly prestigious Queensferry Crossing project which has just opened.

"We've provided products and solutions to a wide range of projects such as this over the years including Birmingham's New Street Station and London Underground and it is great to be part of yet another high-profile infrastructure project."

The new 1.7mile bridge is the longest three-tower, cable stayed bridge in the world. The project is part of a major upgrade of the cross-Forth transport corridor in the East of Scotland, representing an investment of up to £1.35 billion from the Scottish Government.

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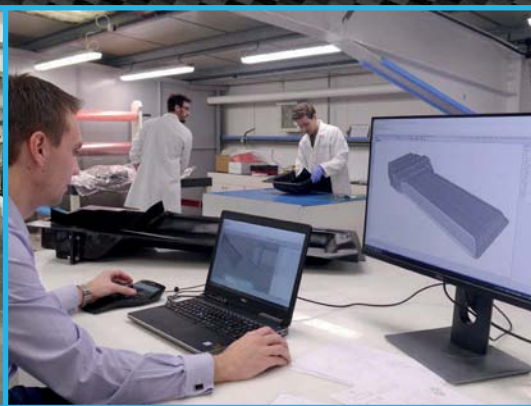

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Sigmatex scoops Composites UK award

Composites UK has announced Sigmatex as the winners of an award for its extensive work to reduce the amount of carbon fibre waste generated in-house during its production processes, and successfully developing a recycled product which utilises the existing waste stream.

During its in-house manufacturing processes, Sigmatex generates significant quantities of carbon fibre waste across its four manufacturing sites each year. Historically, this waste has been sent to landfill at an ever-rising cost to the business and the environment. Sigmatex has developed a means to capture the waste in a form suitable for conversion, whilst maintaining the primary benefits of carbon fibre.

The product, sigmaRF, is suitable for many applications which currently use virgin carbon fibre-thermoplastic materials and is especially applicable to the automotive, sports and leisure, medical and energy sectors.

Global commercial manager, Paul McMullan commented: "We are proud to have been recognised in this category, and the award further acknowledges our commitment to addressing an industry-wide issue and supports our innovative nature to provide cutting edge textiles to our customers."

The award will be officially presented at the annual Composites UK awards dinner on 1st November at the National Conference Centre, Birmingham. Sigmatex's Tom Rockwood has also been shortlisted for Apprentice of the Year award.

WWW.SIGMATEX.COM

Hexcel completes Structil acquisition

Hexcel says it has acquired all of the shares of Structil, a French producer and supplier of composites to the aerospace, defence and industrial markets.

The company employs approximately 70 people at its production plant in Vert-le-Petit, France. Structil's 2016 sales were approximately $21 million. The company's product lines include prepregs, structural adhesives and pultruded profiles used in engine nacelles, aerospace interiors, military jets and more.

Hexcel's Chairman, CEO and president, Nick Stanage, said: "We are pleased to complete the transaction and to welcome the Structil team to Hexcel. Together, we will strengthen our development capability and technologies for next-generation aerospace and industrial applications."

WWW.HEXCEL.COM

Chem-Trend launches new release agent

Chem-Trend has launched its Zyvax 1070W for the advancement of moulding processes for aerospace composites components.

The new product is designed to reduce application and tool clean-up time and improve moulded part quality. These attributes also provide significant environmental advantages, which aerospace moulders can leverage to impact a wide range of sustainability touchpoints.

Zyvax 1070W is a water-based, silicone-free release agent that is formulated for easy and quick application through a spray-on or wipe-on method and let-dry process. There is no need for curing time, which significantly reduces tool prep time. The product provides easy tool clean up, eliminating the need for sandpaper or other highly aggressive cleaning processes. Zyvax 1070W also has a slight tack characteristic, providing an advantage in lay-up procedures.

"The benefits of this product are significant for both aerospace applications and other types of advanced composite carbon fibre moulding processes," stated Amanda Pugh, Chem-Trend's business development director – Composites. "The highly effective nature of the technology developed for this product leads to more efficient composite moulding processes and allows it to deliver results that are optimised to meet the increasing demands of the lightweighting movement."

WWW.CHEMTREND.COM

SURFACE GENERATION OPENS NEW RUTLAND R&D FACILITY

Surface Generation has opened its PtFS Innovation and Application Centre, a new R&D facility for advanced composites manufacturing at its headquarters in Rutland.

The facility was opened by Sir Alan Duncan MP, Minister of State for Europe and the Americas and Member of Parliament for Rutland and Melton.

The facility is home to a workshop and research laboratory that will be used to develop advanced composite processing technologies and automated production techniques for Surface Generation's clients.

The facility will also be used to experiment with new technologies including graphene, 3D printing and nanocomposites, which have the potential to significantly improve the cost, quality and throughput of high volume composite component manufacturing.

Seven engineers and technicians will work at the facility initially, and Surface Generation plans to recruit 12 more people to its research and development team as part of its expansion plans over the next two years.

Ben Halford, chief executive at Surface Generation, commented: "The opening of this facility is a major milestone for Surface Generation. We already help major blue-chip organisations find new ways to manufacture composites so that they can be stronger, lighter and more efficient. This new facility provides the environment we need to expand that work and apply our processes and approach to larger and more complex components."

Sir Alan Duncan MP added: "Surface Generation is a small business exporting globally and making a big impact around the world. It is turning a small corner of Rutland into a centre of excellence for advanced manufacturing and composites research, creating high value jobs and revolutionising how cars, aeroplanes and electronic devices are built."

WWW.SURFACE-GENERATION.COM

ShapeTex unveils lattice reinforcements

Shape has developed a carbon fibre lattice structure for reinforcing flat panel laminates. Using ShapeTex fibre laying technology, even simple flat panel structures can be reinforced significantly.

"This carbon fibre lattice structure adds significant stiffness, for very little additional cost, to what is otherwise a fairly flexible flat panel." said Peter McCool, managing director of Shape.

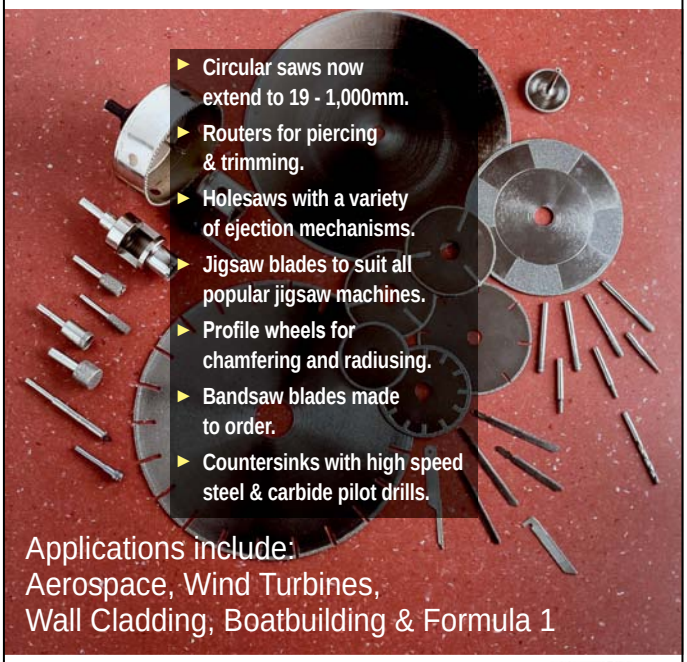
In this example of ShapeTex technology, powerful ribs of carbon fibre are laid down to create a lattice structure on a simple woven glass fabric panel. The lattice structure can have an infinite number of variations to provide a combination of structural and decorative patterns to suit a range of applications.

"Designers now have much greater freedom to create composite parts that are not only structurally efficient but that also have a unique decorative appearance," McCool added.

Shape plans to roll out a range of structural and decorative lattice patterns across a number of industry sectors.

WWW.SHAPETEX.CO.UK

Diamond Tools for Cutting Composites



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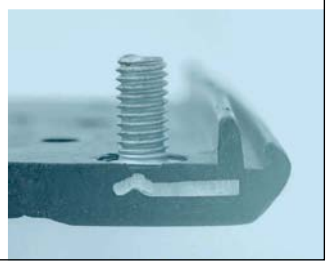

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NETCOMPOSITES' UNVEILS COVENTIVE BUSINESS ARM

Coventive Composites will be making its debut at Advanced Engineering 2017, highlighting several of its recent material developments, as well as its consultancy and training services.

The company was launched on the 1st October when NetComposites separated its technical services from its media business. NetComposites' conferencing, news and information services will continue to operate under the NetComposites brand, whilst its consultancy, training and innovation activities will now be marketed as Coventive Composites. Reorganising the business this way makes it easier for customers and collaborators to locate the support they require.

On stand M120, Coventive Composites will feature a number of its recently-developed materials including long natural fibre-reinforced thermoplastic pellets for lightweight injection mouldings, carbon fibre-reinforced thermoplastic tapes for the selective localised reinforcement of structures, and lightweight ballistic protection materials for personal and vehicle body armour.

Coventive Composites is an independent provider of expert services relating to composite materials. Through its in-house innovation centre, the company works in partnership with leading organisations to develop and commercialise the next generation of composite materials using its extensive facilities for pilot-scale manufacturing and materials testing.

HTTPS://COVENTIVECOMPOSITES.COM

Dura products on track with Network Rail

Dura Composites has announced that its GRP Modular Access Platforms and GRP Walkways now form part of Maidenhead's new railway sidings.

The sidings are a key part of Network Rail's electrification of the Great Western Main Line in preparation for Crossrail. The £4.5 million sidings have been installed as part of Network Rail's Railway Upgrade Plan and will ease congestion on the railway, allowing Great Western Railway to increase its capacity at peak times by introducing a further three new eight-carriage Electrostar trains.

The precision engineered glass-reinforced plastic solutions were installed by Balfour Beatty Rail, and are said to be the perfect fit for the Overhead Line Equipment environment, thanks to their non-conductive properties. Dura Composites GRP profiles can be designed to comply with bespoke site specifications and offer significant improvements over traditional alternatives, including increased buildability and a dramatic reduction in possession times.

Commenting on the installation of the Dura Slab Walkways and Modular Access Platforms, Rafal Konstanty, BBR Civil CRE at Balfour Beatty said: "Dura's GRP solutions were ideal for this project as the driver walkway access platforms are situated under OHLE wires with currents of 25,000kV. The resulting installations are non-conductive, lightweight and require virtually no maintenance which means that they offer excellent lifecycle benefits for our end client, Network Rail. The team at Dura Composites were great to work with, both in terms of their ideas and the technical support they were able to offer during the design stage, and I would happily recommend them to other colleagues in the Rail industry."

The sidings have been opened 18 months ahead of schedule and feature a number of Dura Composites GRP Modular Access Platforms and GRP Walkways.

WWW.DURACOMPOSITES.COM

Construction goes with the flow

*In a Q&A session, **Richard Brine**, manager of Lionweld Kennedy's GRP business unit examines the increasing adoption of glass reinforced plastic within the construction industry.*

As a leading manufacturer of industrial GRP grating, handrails and stair treads, Lionweld Kennedy's products - which include its Flowgrip flooring, and Flowgrate and Flowtread gratings - enables the supply of complete access solutions to businesses around the world.

Right
A GRP access platform at Doncaster Carr

What types of construction-related trends/demands are placed on your company by customers?

The necessity to provide highly technical engineering responses that satisfies the customer has always been the case. Nowadays, this expectation appears even greater, partly due to the change in style of the engineering client. Other than price, quality and delivery demands, expectations include knowing what is asked for in the design, build strategy, site methodology, evidence of compatible build in 3D model prior to commencement, significant supporting paperwork demonstrating product suitability, operation and maintenance requirements and ultimately trust built up in being a market leading reputable supplier for your specialist subcontract. Along with relationships, flexibility, case studies, improved marketing of what you actually do - not what is perceived (and there is always a wider gap than you think) - and constant product development, allows some ability to manage your market position. However, competitors are doing exactly the same.

What are today's customers looking for in terms of performance solutions?

It's a given that customers are looking for more support in technical and engineering solutions than ever, but ultimately, they're looking to satisfy their clients in the most effective way possible. With GRP being a relatively immature product for construction applications, that lacks a large amount of market knowledge, this means there are even more phases of design, review, redesign and barriers to acceptance as it's not a 'traditional' product used in the industry. Therefore, even more time is necessary to provide the trust of product suitability and subcontractor capability in fulfilling the project requirement. 'Lunch and learn' (or CPD) sessions with main design houses and contractors goes down very well in bridging the additional support gap inevitably for a product still to be fully-embedded in supply chain norms.

From what areas of the construction industry are you seeing the most interest in GRP solutions?

The majority of interest comes from Risers in tall multi-story buildings, which have replaced traditional steel gratings, increasing use in the rail and infrastructure sectors, especially where non-conductivity and lightweighting provide a USP or are becoming the norm for the task in hand. In addition, renewables and the oil & gas sector

have a proportion of GRP business due to lightweighting, low corrosion and low maintenance. Where the product is known by designers and consulting engineers, it has been supplied into floodlights, high-rise access walkways and sports stadia disabled access add-ons, as well as perimeter fencing where barriers to the pitch are required among others.

What kinds of technology barriers do you need to overcome in order to get your product to market?

The technological barriers to mainstream adoption are about the whole supply chain being aware of the product, its abilities and constraints. It has many benefits with some disadvantages and these need to be educated into the supply chain as another option to consider over more traditional methods. This is why 'lunch and learn' sessions are important to understand where GRP has been used successfully and how it might benefit a project in complementing steel or other materials. The drivers for use are easily understood and with awareness can grow the opportunities of supply in the future.

How much does aesthetics come into providing product solutions?

Traditionally, galvanised steel work is either grey or painted to suit the end use requirement. GRP generally comes in yellow, green or grey, or can be manufactured in any RAL colour to suit specific projects on longer manufacturing lead-times. Finishes, such as gritted or concave (meniscus) non-slip, appeals in areas of heavy traffic, such as transport hubs. Branding has minimal effect at the commodity level, though this tends to change significantly as the GRP structures become more engineering solutions based on the confidence of engineering supply.

What types of fasteners are required to assemble an access gantry for example, or is everything glued together?

Various GRP suppliers have different methodologies for supplying their GRP structures. Wherever possible, we tend to use fixtures and fittings that would traditionally be used in similar steel applications. More often for GRP, standard stainless steel and/or galvanised fixings can be accommodated and most suppliers of GRP will supply the range of fixings required for their range. These would be what most clients would already be working with. Regarding gluing or bonding, we don't tend to be involved at all, as riveting is our preferred method. Some suppliers may be much more heavily involved in bonding, and this is down to each supplier to satisfy their client expectations with the variability of products available.

What length of lifespan do GRP constructions have and what are the end-of-life plans in terms of recycling, if any?

GRP constructions can provide lifespans and warranties at least equal to most substitute materials if not longer, and are especially competitive when taking whole-life costs, such as regular maintenance, site visits and asset management requirements into account. Lifespans of up to 60 years aren't uncommon requests for GRP solutions. For recycling, the industry is looking at energy from waste solutions, such as a plant built in Germany, whereby the product would be recycled. In addition, Best use of automated nesting reduces waste and the remaining product can be often used for treads, sand ladders and 4x4 track support methods kept in the boot of a car due to its lightweight handling ability. Rather than skip our offcuts, we sell a sizeable proportion on for a nominal value to others who use them for a variety of uses.

What differentiates your company from the competition?

Lionweld Kennedy is the only UK manufacturer of open steel gratings and holds one of the largest GRP flooring and handrail stocks in the UK. People contact us because not only are we a leading, trusted company - especially on more complex projects - but our service to customers provides a best practice technical and engineering offering, supported by BIM level 2 compliance including the use of 3D design modelling software, the ability to provide calculation sheets and other supporting technical documentation for GRP as we would be expected to for steel projects. We supply GRP, just as we would steel, to the same governance, compliance and regulatory frameworks necessary and as demanded of a subsidiary business of a FTSE250 company.

Above
GRP open mesh flooring and handrails at Doncaster Carr IEP rail depot 3

Below
GRP constructions can provide lifespans at least equal to most substitute materials

Bottom
East West Rail's bridge handrail

What developments will we be seeing in the construction sector in the future?

Developments are likely to provide both risks and opportunities to companies such as ours. Recent events have provided the need to ensure everything is supplied fully-compliant to all engineering and technical requirements, and any doubts must be removed prior to project or phase commencement. We see a more rigorous and robust supply chain perhaps linked to more onerous legislation as a positive in removing poor product, practice and performance, and assisting companies like ours that always work towards meeting or exceeding current legislation, design codes and other minimum standards as a given. That said, smarter working methods, flexible working, lightweighting, CSR and sustainability impacts along with speed of response, methodology and value for money will all play an increasing factor in future decision-making in the medium-term.

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Waking up to automation!

*Güdel UK's **Will Bourn** looks at the UK's past record of investment in robotics and automation, and the positive impact that future investment in these systems can have on UK competitiveness.*

The UK is currently in the midst of some of the most significant political and economic changes seen in a generation. As we move towards what could be an uncertain future, there is, however, little doubt that manufacturing industry will play an increasingly important part in our economy and future prosperity.

Against this background, it is clear that a dramatic increase in investment in robotics and automation will be essential if we are to remain competitive and achieve the productivity levels required to attain the growth needed to sustain our economy.

For a country with an impressive manufacturing heritage, the UK's record when it comes to investment in manufacturing industry is quite depressing. There are regular articles in the news regarding our productivity compared to the rest of the world, and they don't make comfortable reading.

According to figures from the office of national statistics, among the G7 countries only Canada and Japan are less productive than the UK. Germany is at the top of the pile, being 26.7% more productive per man-hour worked than the UK. Even Italy with all of its current economic problems is 10.5% more productive than us. And why is this? In my view, the principal reason is lack of investment. This can be illustrated very simply by looking at robot numbers per head of the working population.

The International Federation of Robotics (IFR) recently published figures which show the UK near the foot of the table with just 71 robots per 10,000 employees in manufacturing industry. Our European cousins rate much higher, with France at 127, Spain at 150, Italy at 160 and Germany, which has more than four times that of the UK, boasting an impressive 301 robots per 10,000 employees in manufacturing industry.

> *"When you automate you bring down the overall cost of the goods you make and you improve their quality."*

Below
Güdel brings flow to industrial automation by delivering intelligent motion solutions

The overall robot density in the large Western European economies is still currently ahead of China, who have 49 robots per 10,000 employees, but the robot population there continues to grow fast, boosted by their governments aim to become one of the top technological nations. Their stated aim is to hit 150 robots per 10,000 employees by 2020! This is against the background that China's economy has been built up on the basis of low wages.

China's approach is mirrored by Poland and the Czech Republic, also traditional low-cost economies, which are the two highest climbers in Europe in terms of robot installations. The Czech Republic's robot density climbed 40% between 2010 and 2015!

The really interesting part of this though is the correlation between robots and jobs. In the US between 2010 and 2015 80,000 new robots were installed, and in parallel with this the number of jobs in their automotive sector grew by 230,000. This same effect is seen in Germany where over the same time period their robot stock grew by 3% and their automotive workforce grew by 2.5%. The reasons for this linkage are quite straightforward. When you automate you bring down the overall cost of the goods you make and you improve their quality. You are therefore more competitive, so you sell more and you gain market share.

Of course, looking at robot statistics is only one indicator of the reason why we have relatively low productivity in the UK. Other reasons are more structural, such as education and training, transport

infrastructure and the tax regime. It is very difficult for individual companies to do anything about these factors, but what they can do is invest in automation.

Money for investment is at a historically low cost, and with the links demonstrated above, that investing in automation brings about a corresponding improvement in productivity and hence market share, then the question becomes – why on earth is the UK not doing this? The UK has a historical reluctance to invest in manufacturing, with a government which seems to believe that the service economy is the key to all prosperity, but with Brexit on the horizon many of these jobs are threatened – we are already seeing several of the major international financial institutions setting up offices outside London in preparation for Brexit, so we need to replace these good quality jobs with others – why not in manufacturing?

This is something which is widely recognised across the whole of the UK robot and automation sector. As an industry, all of the recognised robot suppliers, machine builders, and system integrators, together with associations such as BARA and PPMA for example, continually campaign to raise the awareness of both the need for investment in automation and robotics, and the benefits that can be obtained by UK manufacturing industry.

Pledges from Government in the latter part of 2016, to invest an extra £2 billion in science and technology R&D are obviously welcome, but these strategies are generally mid- to long-term. We already have the robot and automation technologies available today that can make a positive impact on productivity, performance and profitability in our manufacturing plants. What's needed in the short-term is a change in the way investments and payback periods are calculated in the UK to encourage these vital automation projects.

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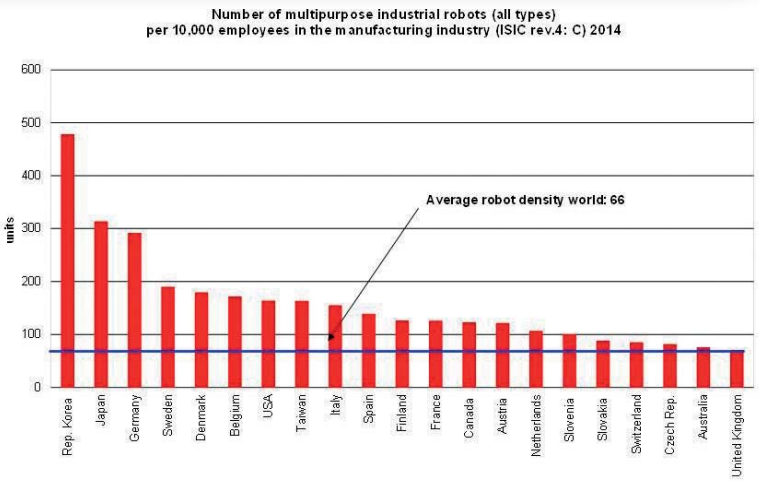

Right
Statistics from the IFR in September 2016 show the UK continues to perform poorly in the uptake of robots

The pursuit of material advancement

Solvay held a press conference during this year's Paris Airshow to announce a strategy for increasing its aerospace presence in order to help industrialise the composite materials production process. ***Mike Richardson*** *reports.*

Announcements of products specified on the Lockheed Martin F-35, COMAC C919 and the Irkut MS-21 to name a few, along with its recent MoU with GKN Aerospace's Fokker division to industrialise thermoplastic materials, plus the doubling of its Toulouse kitting capabilities to meet the increasing production rate of large composite parts sees Solvay making bold strides in reinforcing its position as a key partner to the aerospace industry.

During a press conference held at this year's Paris Airshow, Roger Kearns, Solvay's executive committee member, advanced materials and Carmelo Lo Faro, president of Solvay's Composite Materials Global Business Unit (GBU), quickly dealt with the proverbial elephant in the room, i.e. why Solvay acquired Cytec. The explanation is a simple one: it's the best thing that could have happened to Cytec because Solvay brings its considerable business size, technological capabilities, an established industrial ethos and its proven competence to take the aerospace industry to new heights.

"Solvay has a strong speciality polymer business that for many years has touched on a number of markets whilst working towards building an advanced materials cluster," Kearns begins. "Two years ago, we decided to acquire Cytec for its composite materials aerospace expertise. Part of our aim was to build a bridge between Solvay's experience in thermoplastics and Cytec's vast knowledge of composite materials. Over the last 18 months we've moved quickly to integrate the Cytec team into Solvay and we have now co-located the headquarters of the composite materials business and our speciality polymers centre in Atlanta, US.

"As of today, we are focused on sustainability: lightweight materials form a huge part of this equation, but what is equally important is the ability to create

Above
Nine prepreg specifications and seven adhesive specifications were qualified with Solvay products for the C919 programme

the application and the use of materials to make this all work. The entire industry is pushing hard to lower cost, so we need to satisfy this demand, create solutions that meet customer needs and drive the industrialisation of the production process."

In 2012, Solvay - at the time Cytec - was awarded a long-term agreement to supply high-performance, structural composite and adhesive materials for the COMAC C919 commercial aircraft via the Shanghai Aircraft Manufacturing Company, who is responsible for the C919 aircraft's manufacture.

In total, nine prepreg specifications and seven adhesive specifications were qualified with Solvay products for the C919 programme and were used across the aircraft's structure. Solvay's CYCOM 977-2 and CYCOM X850 prepregs, toughened epoxy materials were utilised on the horizontal stabiliser, rear pressure bulkhead, aileron and flaps. CYCOM 970 and CYCOM 7701, two epoxy prepregs producing void-free honeycomb sandwich and monolithic structures were respectively used on the rudder, elevator, winglets, spoiler, wing-to-body fairings and on the radome. Various adhesives for metal and composite bonding were also selected.

"As well as the COMAC C919, the Irkut MS-21 made by Russia's United Aircraft Corporation (UAC) also recently completed its first test flight," states Lo Faro. "Solvay has a significant presence on both these programmes with a majority share, and we've provided some really interesting technologies - particularly on the MS-21. Both aircraft programmes are undergoing production ramp up rates over the coming years.

"So, the name of the game today for the aerospace industry is industrialisation. Think about the next new aircraft programme and it will be all about industrialised production. The aerospace sector isn't at the same industrialisation stage as the automotive industry. Our strategy is to use this technology capability to really help a young technology in a young industry get to the next stage."

And getting to this next stage has seen Solvay and GKN Aerospace's Fokker business team accelerate the adoption of thermoplastic composite materials on aircraft. Under the agreement, Solvay and Fokker will combine their expertise to advance technological developments in thermoplastic composite materials as well as improve processes and cost competitiveness. Both businesses have complementary materials expertise in thermoplastic polymers and fibre-reinforced composites. Fokker also brings leadership in component design and manufacturing, to translate the technology into innovative solutions for aerospace customers.

Top
Carmelo Lo Faro, president of Solvay's Composite Materials Global Business Unit

Above
Roger Kearns, Solvay's executive committee member

Below
Solvay has a significant presence on the Irkut MS-21 made by Russia's United Aircraft Corporation

"The GKN Fokker MOU is an example of how we're putting our strategy into practice," continues Lo Faro. "Thermoplastics is a new technology but isn't dominant by any means. Today's new aircraft programmes contain many composite parts, but very few thermoplastic ones. And yet, thermoplastics technology has the potential to get these programmes to high production rates.

"When combined with fibre, a thermoplastic material has the ability to produce a form very quickly - it doesn't need to 'cook' in an autoclave like traditional CFRP materials. Many flying parts on today's aircraft are cured in huge autoclaves, whereas the MS-21's wing - which performed its first flight last May - is constructed using our unique technology that allows customers like Irkut to manufacture flying parts outside of a traditional pressure cooker environment. This saves lots of money and offers a more efficient way of producing the parts."

According to Lo Faro, the beauty of composite materials is that customers can make any shape they want. There are many more degrees of freedom when using composite materials – shapes that are impossible to achieve using traditional metals.

"Composite materials have only been in existence in the last forty years, so it's still a fairly young technology. However, it's been adopted extremely quickly and offers huge potential and opportunities. Whilst airframers use composite materials primarily to save weight, they also use them because some aircraft components cannot be made efficiently using metal.

"The advantage is that designers can change the fibrous properties of a composite part. We are in the digital age with the ability to use a huge amount of computational power. Combine this with a material offering so many degrees of design freedom, and you have a clear reason why there is so much potential for composites."

Lo Faro ends by suggesting that composites technology has still got a lot of room for improvement, and that Solvay's strategy is to ensure it can provide every single type of composites technology.

"We provide very different material chemistries and product forms which enable our customers to use them to manufacture parts," he concludes. "We have the design competence that allows our people to bring the materials to the next stage.

"With composites, you create the material as you make the part. This requires competence and understanding in tying together the design and manufacturing and this is something that Solvay excels in."

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Where knowledge means power

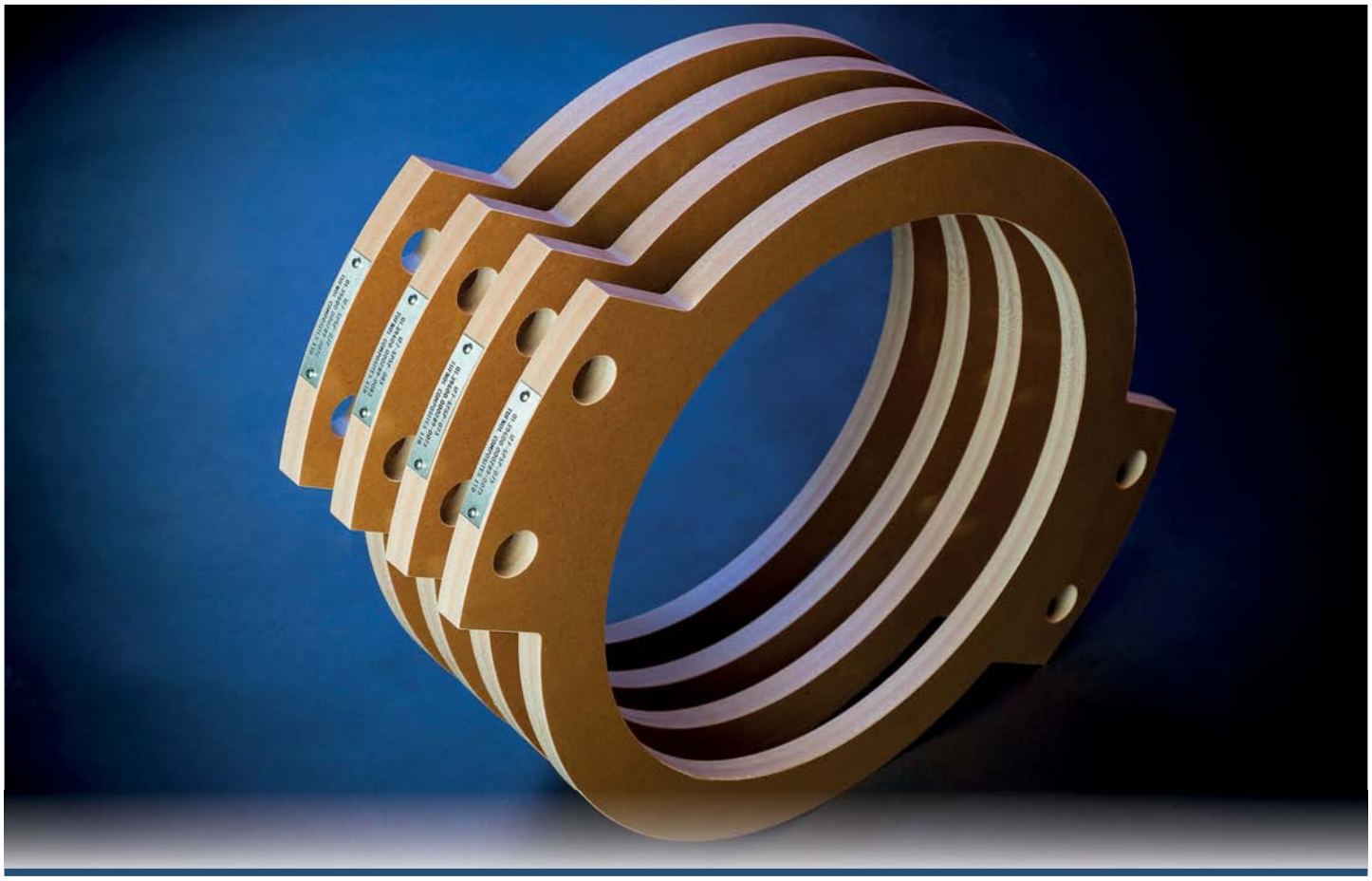
Is your industrial laminate as reliable as you think it is? ***Roy Thomason,*** *managing director of Tufnol Composites describes what to look out for when sourcing laminate products.*

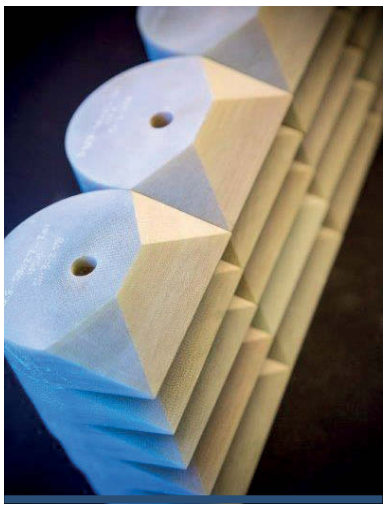
It is no accident that industrial laminates have been around for as long as they have – which is now almost 100 years.

Laminate comes in a wide range of sizes, thicknesses and grades and enjoys a solid track record of being supplied to, and used by, varied manufacturers around the globe. Those who are responsible for selecting laminates for use in a myriad of different applications have much to consider. Such elements include maximum working temperatures, the mechanical strength, its toughness and impact strength and its machinability to name but a few. Combined together these are all vital to ensuring the overall reliability of the product and the avoidance of any kind of failure.

Below
Critical components for use in the oil & gas industry

There are many types and grades of industrial laminates and each manufacturer will have its own recipe for its own individual products. When a product has been found that works well in the particular application while delivering a good result, it is important that the very same product manufactured to the same formula is purchased each time. This way it is possible to ensure consistency and ultimately, reliability for the process and end result.





Left
Products are developed and continuously tested at Tufnol's in-house laboratory

Right
An example of structural aerospace components

Below
Roy Thomason, managing director of Tufnol Composites

It is widely recognised in manufacturing that during the last 10 years since the financial crisis and the subsequent recession, procurement departments have inevitably been under pressure to source materials that will do the same job and deliver the same result, but at less cost. In reality, this is something that is virtually impossible to deliver because as the old saying goes - 'you get what you pay for in life'. With any mechanical component or material, if something is cheaper then it is for a reason. We have all purchased products in the past that look the same as the more expensive version that we were previously pleased with, only to find it that doesn't perform as expected and then feel let down.

Quality and reliability

In any manufacturing situation, reliability is key. Aside from the actual process, it is important to use materials that are of the right quality to meet the requirements and expectations of the job.

As with most products, 'me toos' are something that can be found in laminates and composite materials and anyone searching for these items online will be faced with an array of products which claim to be 'equivalent'. The main worry here is that, while it may be possible to take a reasonable 'stab' at the recipe, make-up or processes used to create a similar product, it cannot possibly be exactly the same nor deliver the same end result. These factors should be taken into account when sourcing any type of materials, be they laminates or otherwise.

Reliability will inevitably be the price paid for using inferior or 'copy-cat' products. Failure during a process which will in turn result in downtime for the equipment and costly loss of production. This underlines the argument that it is wise to turn to the OEM each time in order to ensure consistency and reliability.

Some of the problems which can arise from cheaper products include the level of mechanical strength, the electrical strength and in-service temperature. Because of this, proper and in-depth product testing is key to guaranteeing reliability and creating confidence for the customer.

In the case of Tufnol, we have our own in-house laboratory where products are developed and continuously tested. Working with a manufacturer-supplier with such facilities is always advisable.

Mechanical strength is one area where an inferior material will often fail. This is due to delamination of the layers which can have a catastrophic impact resulting in manufacturing shut downs, leading to expensive loss of production and necessity for repair. Another area where failure can occur is with resistance to surface tracking. In such cases, electrical current will always seek the shortest path and the ability to resist surface tracking is measured and referred to as its Comparative Tracking Index (CTI).

Top performing resins

An example of this is provided by one of Tufnol Composites' high-performance resin systems which has been modified to give the superior epoxy cotton Grade 6F/45 a CTI of 800. Inferior materials which claim to be an equivalent can only achieve, at best, a figure that is only 75% of this value. Here, it is possible to see that the consequential difference in performance is vast.

> *"Reliability will inevitably be the price paid for using inferior or 'copy-cat' products."*

It is also important to note that while a product may be manufactured to meet the British Standard, this does not mean that it is necessarily equivalent to the OEM product. This is because products may very well fall within the standard, but it does not make them the same or guarantee the same reliability.

When looking to purchase a reliable product, it is advisable to go to a manufacturer that has experience and enjoys a good reputation. Have a look at the other customers they work with and check out their track record, including which quality assurances they have in place. If they enjoy good relationships with their existing customers, then there is a good chance they will be able to do the same with new customers too.

Close examination of the material specification of the laminate, and consideration of how it will perform to meet expectations, is vitally important.

Leading manufacturers will always try to exceed, rather than simply meet, the British or ISO standard. Those with true technical creativity will be able to achieve this in the same ways that designers of equipment do. Customers can be confident in the service and product they receive and be assured of excellent in-service performance and total material reliability.

When sourcing a new component or material for a specific application, look for an OEM with the right level of knowledge and experience that is willing to give advice on the best solution. This will help to ensure the best and most reliable result in the long run.

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Composites under the microscope

*Microscopy plays a vital role in the investigation of composite materials. Here, we talk to **Dr Geraint Harvard** of R-TECH Materials who reveals how microscopy is helping composite manufacturers with material characterisation, failure analysis and even reverse engineering!*

When it comes to investigating the characteristics of composite materials and how they fail, microscopes are an essential piece of kit for materials scientists.

"If a picture paints a thousand words, then a good quality microscopy image can tell you chapter and verse about a composite material," begins Dr Geraint Havard, composites manager at R-TECH Materials.

Widely regarded as one of the fastest growing test laboratories for composite materials in the UK, R-TECH Materials is used by manufacturers in the aerospace, marine and automotive industries worldwide.

According to Dr Havard, microscopy helps to understand a number of features of a composite material, which ultimately determine a composite component's quality. This might include inspection of resin rich areas, fibre alignment, ply layup, ply thickness, void content, fibre volume fraction and how the fibre and matrix interact with each other.

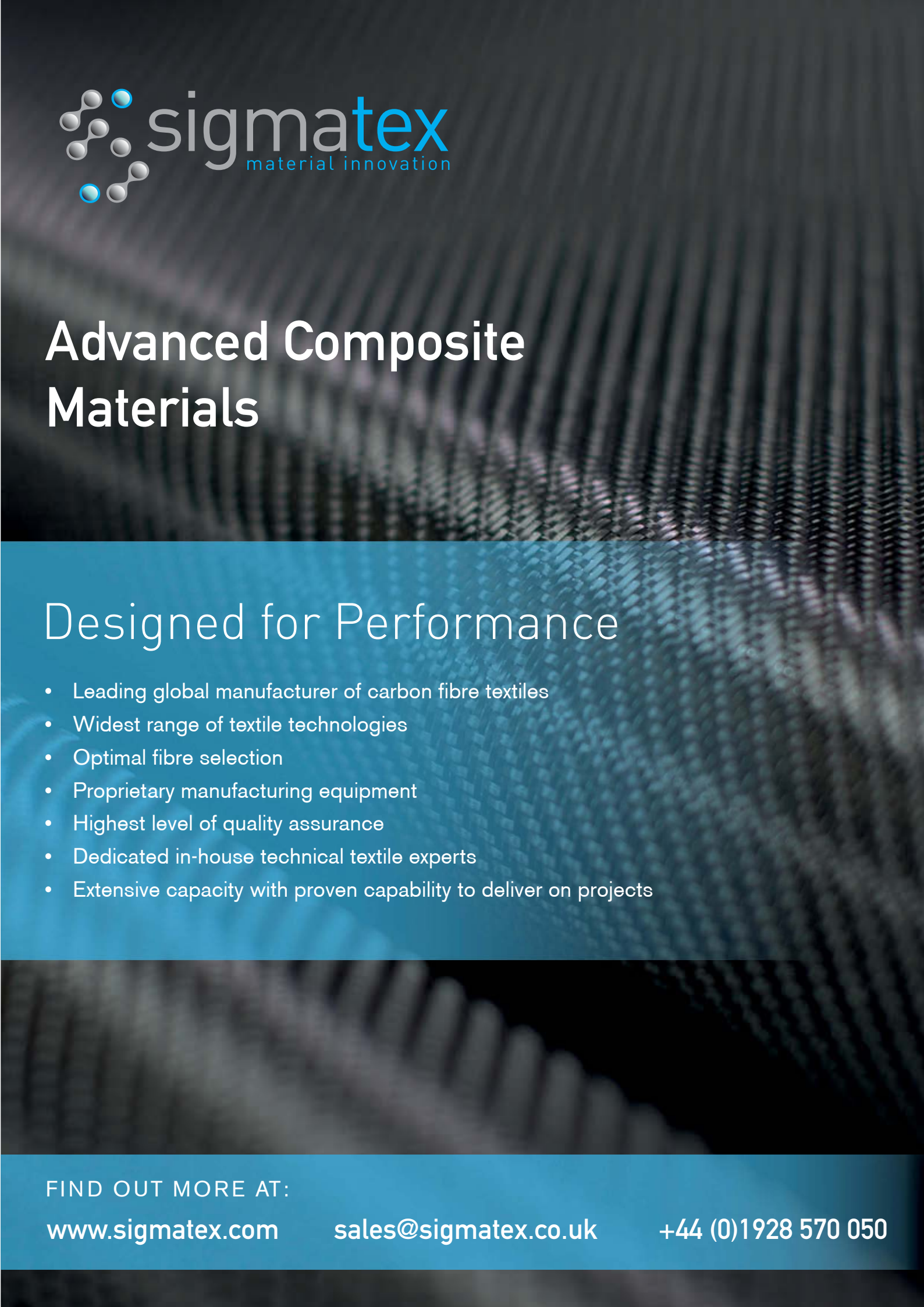
Characterising the material in this way can be especially valuable for first part qualification testing in the aerospace industry, where there is a need to fully understand the quality of the composite laminate before production.

Getting up close

Based in South Wales, R-TECH Materials has developed a wealth of microscopy expertise over 10 years as part of its materials consultancy business. It's now applying this same expertise to composites. Unlike isotropic materials such as metals, which have uniform properties in all directions, composites are anisotropic in nature, which means their properties are different when measured in different directions. This can have a critical impact on performance and microscopy, along with mechanical testing, can help to establish an understanding of a material's behaviour in any given orientation.

R-TECH's facilities include a top-of-the-range Hirox digital microscope. This produces high quality optical images, which can be captured and analysed by software, to not just visualise features, but measure them accurately as well. The Hirox is used on plane samples, and can work at magnifications up to X5,000. Beyond this, R-Tech's Zeiss EVP 6 Scanning Electron Microscope takes over, with EDX microanalysis, and

Above
Dr Geraint Havard, composites manager at R-TECH Materials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magnifications up to X20,000. The SEM images in 3D, so that features such as fibre pull-out and matrix delamination can be clearly identified.

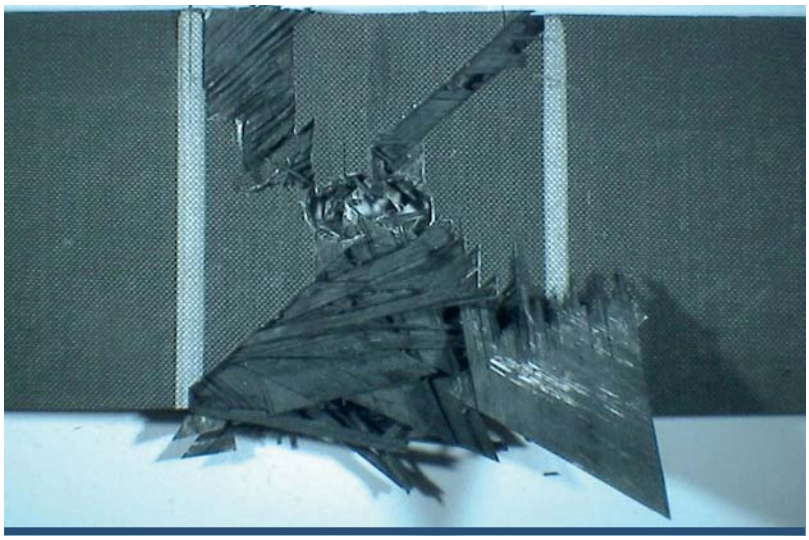
"All of our microscopes can be linked to image analysis software for the measurement of image features, such as dimensional measurement or area fraction of different phases," explains Dr Havard. "And we also have equipment to prepare material samples for microscopic examination, including precision cutting, mounting, grinding, polishing and etching. Indeed, we've recently invested in an automatic polisher which means we are able to polish a composite material down to a superior finish, which provides excellent microscopy images."

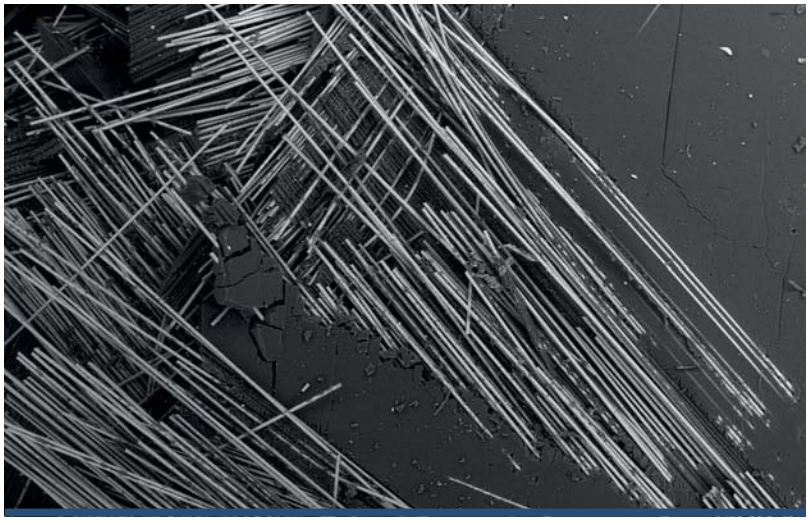
The SEM's magnification and depth of field make it the ideal tool for the examination of features relating to material failures, such as fracture surfaces, internal damage and surface condition. R-TECH's experts can use this information to determine the causes of material failure, which manufacturers can use for improving component design, manufacturing processes, and product safety.

R-TECH has a wide range of experience in failure analysis of polymers and composites. From stress corrosion cracking of polycarbonate plate covers used on a cruise ship to CFRP overwrap for an oil refinery pipeline and carbon fibre vanes on an aluminium rotor. There's not much the company hasn't seen under the lens of a microscope! It's even used its microscopy skills to characterise the resin interface with capacitors in electrical components.

R-TECH Materials' microscopy and characterisation expertise complements its established polymer and composite test laboratories. Accredited to perform testing in tension, compression, flexure, shear and hardness to ISO and ASTM standards under controlled temperature and humidity conditions, R-TECH's reputation for the accuracy and quality of its mechanical testing has been recognised by UKAS, which has awarded it accreditations for 24 test standards. The company is also preparing to secure Nadcap approval later this year – for which excellence in microscopy is a prerequisite.

Dr Havard is quick to extol the virtues of why mechanical testing and microscopy are ideal bed fellows.





Left
Failure mechanisms exhibited during open hole compression testing for different ply thickness carbon fibre

Below left
A failed in plane shear CFRP specimen under the Scanning Electron Microscope

"We've always believed that as a test house, we should carry out more than just the mechanical testing and chemical analysis of composites. That's why we've spent significant time developing our microscopy skills and investing in state-of-the-art kit."

Back to the future

Apart from using microscopy to characterise materials or investigate failures, manufacturers are increasingly turning to test laboratories like R-TECH for reverse- or so-called back-engineering.

Dr Havard, who recently reverse-engineered an aircraft interiors panel for a leading Japanese chemical company, explains the process: "Using a combination of microscopy, fourier transform infrared spectroscopy and resin burn off/acid digestion techniques, we were able to determine the number of layers that the panel was made up of, the resin type used, the weave of each different layer of reinforcement and the composition of the core material used."

Managing director, Dr Tony Franks concludes: "The properties of composite materials are controlled at the microscopic level. Our task as materials scientists in putting composites under the microscope is to connect what we see to the performance of the materials in service."

Clearly, there's nothing small about the role microscopes play in material characterisation, failure analysis and even reverse engineering. When it comes to composites, microscopy is definitely a big player complementing both mechanical testing and chemical analysis.

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A cut above the rest

***Mike Richardson** catches up with Alex White, managing director of flatbed cutting machine specialists, Blackman & White to hear how the company is staying at the cutting edge of an increasingly competitive industry.*

Using a process that is traditionally done by hand, the composites industry cuts shapes from rolls of material which are then laid up in moulds. Cutting prepreg materials on a flatbed cutting machine is much faster, more accurate and the material can be utilised much better. Additionally, companies can save money on installing material into moulds because they get a more accurate fit due to highly precise cutting, making layup far quicker and easier for operators to handle.

Founded in 1964 by engineers Les White and Jack Blackman, Blackman & White has a proud heritage which has seen it create a range of high quality machinery with longevity. The company first developed its machines for the sail making industry in the 1980s, and has gone on to pioneer multi-tool laser cutters within the textile world and launched specialist cutting tools for the filtration and graphics industries.

To satisfy the types of demands placed on the company by its customers, Alex White, managing director of flatbed cutting machine specialists, Blackman & White says that in today's competitive market, customers are looking firstly for a machine that will give the required return on investment.

"It's just not sensible to invest in a machine from a distant overseas supplier if you are uncertain that the support and backup will be there when you need it," he begins. "Cost is often the most important factor in making a decision but this clearly should not be the only consideration. The development of Blackman & White cutting solutions has shown that as a company we listen to our customers' requirements and implement new features in order to meet production requirements."

Automate to innovate

In terms of the latest demands driving flatbed cutting machine technology, White points to a clear trend in the industry toward automation.

"Blackman & White is working with several customers in supplying machines to work within a production cell. With the use of high-speed robotics, it's possible to fully-automate a cell from material supplied from a roll to finished part

Above
The composites industry is looking to slash costs and increase the speed of production

without any manual intervention. This level of integration will drive the market for our machines in the future as high production demands from automotive and aerospace push forward.

"Feeder solutions are available for both dry and prepreg material that are supplied with the machine. Customers often require edge sensing and powered un-roll for the large sized rolls of material. Blackman & White can supply feeders for applications across the range of fabrics and sizes."

Blackman & White produces machines designed for the composite industry, however just cutting dry prepreg is often not the only type of material to be processed.

"The machines we produce now are able to cut 2-inch core material with both oscillating blade and high-speed milling spindle. We're now fitting our machines with the choice of a 5kw spindle that is IP 55 rated specifically for processing composite materials. Dry carbon and glass fibre are also commonly cut on the system, and for them we recommend the high-powered driven wheel. The fully-automated knife depth station makes it quick and easy to change between cutting tools."

A system of systems

White adds that most customers already have well-developed CAD systems. Catia is often used, but lower-cost alternatives exist, such as SolidWorks and Rhino. Indeed, some customers still only require 2D software and are content to use traditional manual patterning techniques for developing the shape profiles.

"The nesting software that we recommend is the CutFab solution. This has been developed to interface projection with the cutting process, so that part identification is enabled. Inkjet systems are also available to mark at high-speed complex text strings onto the material.

"The cutting systems are available with a range of sizes with high speed and also economic entry level solutions for the market. Blackman & White has the most comprehensive range, including the options of laser cutting on the same platform. Automation within cutting cells even supports 24-hour production that is leading the way for the future of composite manufacture. Training on software is quick and painless and often completed, either on-site or at a training day at Blackman & White. The safe use of the machine is important and this is achieved by both on-site supervision and also a two-day training course at the Blackman & White factory.

Above
Alex White, managing director of Blackman & White

Below
Blackman & White's Genesis flatbed cutter

"The range of machines is suitable for most composite manufacturing plants. It's still often the case that companies are cutting material by hand. With nesting software and high-speed cutting all our customers see a rapid return on investment and regret not making the investment sooner."

Blackman & White has supplied many machines to customers that produce fabrics across the range of composite manufacture and vacuum bagging films.

"We are proud to have supplied machines to leading companies, such as TenCate and Toray, along with manufacturers such as Hope Technology and Surrey Satellite Technology Limited," he adds.

Driven by experience

White believes that it is the experience of Blackman & White that really sets it apart from the competition. For him, the development of the company's machines and integration with complex production workflow is unrivalled.

"The company remains family-owned and at its heart is driven by management to ensure customer satisfaction. Whilst we are not the largest manufacturer of cutting solutions, it is a proud fact that not only do we produce machines that integrate into challenging applications, we also ensure our customers recommend us to other companies. It's no surprise that close to 50% of our customers own more than one of our machines."

I'm interested to know how White sees the future of the UK's composites manufacturing industry - and particularly subcontract kit cutting - evolving in the future?

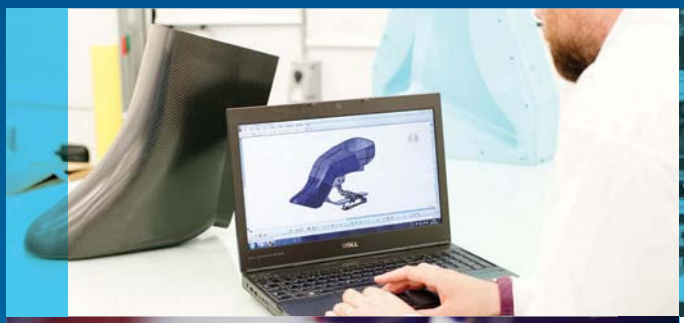
"It is certainly true that we are increasingly supplying machines for companies that then supply kit cutting services to composite manufacturers. It is impossible for some customers to work this way as the cure time and requirement for cut panels just prohibits the outsourcing of the cutting. However, it certainly makes sense for customers that are already outsourcing the vacuum bagging to also have delivered cut components."

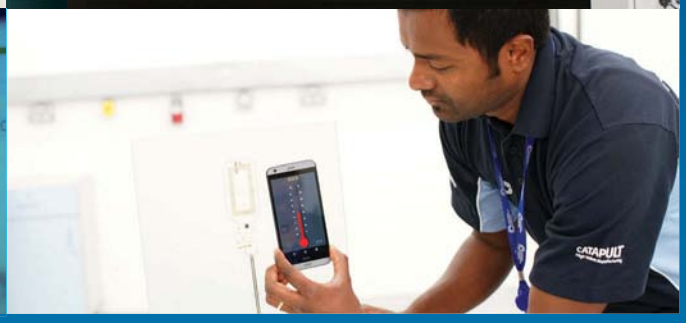
White concludes: "As the future of composites develop, it is likely that manufacturing techniques will change and it will make the cutting of fabric unnecessary. In fact, for the composite industry to reach its full potential and penetrate markets, such as automotive electric cars, there will have to be lower costs and higher speed composite production solutions. Perhaps this will come from improved 3D printing techniques that will enable raw material to be processed directly into finished parts."

HTTP://BLACKMANANDWHITE.COM

NATIONAL COMPOSITES CENTRE

Powering Composites Opportunities



Accelerating UK Industrial Growth at the NCC

Our Mission is to accelerate the growth of industrial output by enabling design and manufacturing enterprises to deliver winning solutions in the application of composites.

Working together with industry:

- Creating new Composites Capabilities
- Developing new Technologies and Processes
- Exploiting Digital Possibilities
- Translating World Renowned Research into Manufacturing Excellence

By bringing together; our 200 plus highly-skilled engineers, academic researchers, end users and the supply chain in industrial-scale facilities the NCC translates radical composites manufacturing innovations into commercially viable products.

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Set up for success!

*In a Q&A session, **Composites in Manufacturing** hears the thoughts of Eastman Machine Company's marketing manager, **Elizabeth McGruder** and how the company's sophisticated, tailored, automated flatbed cutting systems can help streamline its customers' operations.*

As a fifth-generation family-owned and operated business, flatbed cutting machine specialist, The Eastman Machine Company has many customer relationships that have been maintained for generations because of its personalised service, support and attention to client concerns that it takes the time to review and respond to with care.

What are the types of demands placed on your company by today's customers?

Listening to our customers' production issues or headaches and presenting the best equipment configuration specific to their application is where Eastman excels rather than supplying an 'off-the-shelf' size or configuration. Adapting or engineering special tools, creating new capacity material handling systems or customising software to meet the needs for new and high-tech materials, as well as traditional textiles is a way to stand out from the competition. In today's marketplace, we need to be available 24 hours a day to respond to customer inquiries and we manage it personally and digitally to be fast and resolute.

What is driving flatbed cutting machine technology and why and what are today's customers looking for in terms of performance solutions?

Above
Elizabeth McGruder, marketing manager of Eastman Machine Company

Below
Eastman's Eagle C125

The demands are for the accuracy of cut pieces; a reduction of expensive material waste due to operator errors in cutting or lack of nesting; speed and throughput of cut parts; flexibility to cut many types of materials, thicknesses and properties on one system; the ability to mark/label parts or identification to reduce post-process operations; fully-automated facility communications from system to system, and robotics for piece collection.

What kinds of composite-related materials and thicknesses can your flatbed products handle?

Eastman systems are suitable for cutting composites in both dry and prepreg form - with or without peel ply; unidirectional continuous strand roving; bidirectional (woven roving, woven fabrics, continuous strand reinforcement); multidirectional (chopped strands, continuous, chopped strand mat, tri-axial, multiaxial); nonwoven core materials; blocker materials and more. Depending on the material type and system – anywhere from 1mm thick to over 3cm for flexible goods.

What CAD and material utilisation nesting software do your products use?

Eastman systems can accept most CAD file formats with .dxf being a typical industry standard. We optionally supply

Above
A three-roll roll stand designated CRA-318

patternPRO for pattern design, marker making, import, and nesting.

How do your flatbeds perform in comparison to the competition?

Ask anyone who has experience with an Eastman system and another single-ply cutter and the first response you will always get is that the Eastman outperforms in speed, repeatability and ease of operation and training. Take it from one of our customers, Adam Butler, operations manager, Certikin North, based in Leeds: "When it was time to replace our 20-year-old Eastman EC3 cutting conveyor, we knew we needn't look elsewhere. The help and service received to keep production going made Eastman the only choice. The new C125 gives us increased functionality and the ability to optimise all areas of our cutting processes along with the confidence that we can cut what we want when we need it."

Tell me about your levels of after-sales support and machine training provision?

In addition to phone and localised support through our global network, all of the Eastman systems feature remote access, so that our team is able to log in with customer approval to provide assistance from our technical support headquarters.

Do you get involved in supplying/ specifying automated roll feeding of dry fabric/prepreg material equipment to the machine's bed?

Eastman has been manufacturing material handling equipment since the early 1970s - traditionally used with textiles for spreading and lay-up purposes. As new and high-tech materials entered the market, as well the requirement to feed directly to automatic cutting systems, Eastman's product line evolved in tandem with these needs. Concerns over fibre orientation, tension-control, rewinding and feeding multiple layers simultaneously became common language in Eastman's daily manufacturing. Eastman responded to industry demands and now manufactures over 30 models of roll stands, power feed systems and a complete line of spreading equipment for materials ±4m wide and ±1,100kg.

Can you say anything about any customer success stories and the sectors in which these customers operate?

An area of speciality for Eastman is our large network of customers cutting dry fibreglass in multiple layers on the single-ply conveyor cutting systems primarily for wind energy, ground pipe and marine applications. The cut pieces are long, the material rolls are heavy and the demand for fast and repeated throughput is intense. We have client sites cutting nearly 2 tons of fibreglass per hour on the systems at facilities in China, Brazil, Turkey, Mexico, USA, India and other countries. The same facilities can also cut small, intricate parts from prepregs or other materials and the customer knows that the system will hit precise tolerance levels.

How do you see the future of the UK's composites manufacturing industry and particularly subcontract kit cutting evolving in the future?

The composites manufacturing industry is growing worldwide. Large-scale international projects with short lead-times will push every part of the supply chain to move fast and accurately to meet the demands. Outsourcing or subcontracting cutting requirements to a kitting facility has several benefits, including but not limited to: reduced cycle times and material waste; streamlining of additional manufacturing operations; and experienced specialists to manage job flow, ply orientation and nesting.

What differentiates your company from the competition and why should customers use you over your nearest rival?

If you're looking for an industrial 'workhorse' which can continuously be adapted with new tools and accessories as your cutting requirements grow, Eastman is your best choice. If you're looking to start a business relationship that can last for decades, Eastman is your best choice.

WWW.EASTMANCUTS.COM

A gallery of composite innovations

Ed Hill hears the latest news about the annual industry showcase Composites Engineering 2017 from its organisers Easyfairs.

ADVANCED ENGINEERING2017
1 & 2 November, NEC, Birmingham

COMPOSITES ENGINEERING2017
1 & 2 November, NEC, Birmingham

The Composites Engineering zone staged at the NEC, Birmingham has established itself as the UK composites industry's biggest gettogether in recent years.

Part of the Advanced Engineering Show, held this year on November 1-2, which also includes the co-located Aero Engineering, Automotive Engineering, Performance Metals, and a new addition this year, Connected Manufacturing zones, visitors can see the latest composite manufacturing developments in the show aisles. The Composites Engineering event has grown as these new materials have found an increasing number of applications in industry.

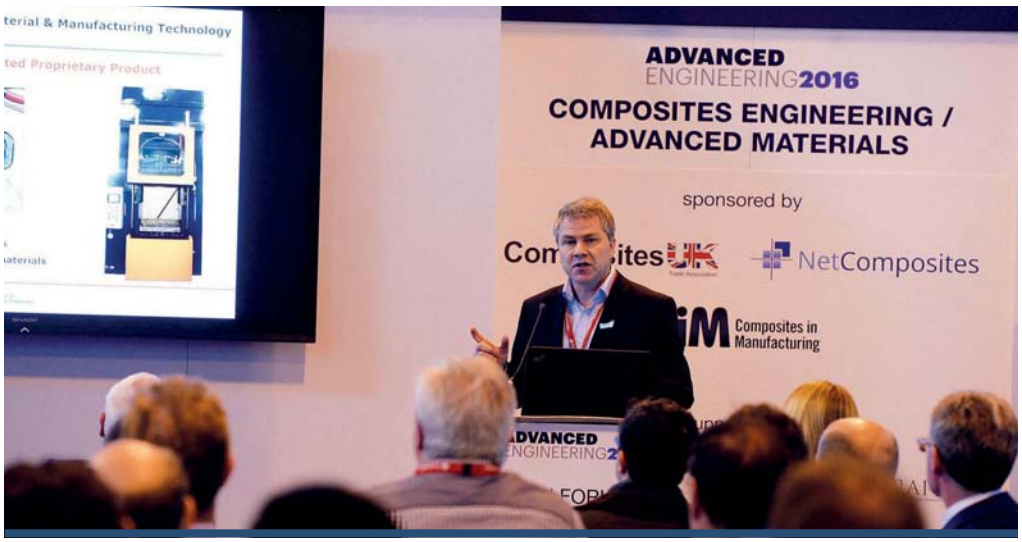
"The composites industry is growing at a fantastic rate, and the Composites Engineering zone is the place to be to see the latest technological developments," begins Alison Willis, industrial divisional director at Easyfairs which organises the show. "These are revolutionising a raft of markets, from planes, trains and automobiles, through to oil & gas; benefiting millions of people worldwide who consume these products. That means practically everyone on the planet! The industry shows no sign of slowing down. This year, as in previous years, we will welcome thousands of visitors and exhibitors whose businesses are in composites."

Jeremy, Whittingham, head of marketing at Advanced Engineering adds: "We originally launched the zone because of the huge overlap with the aerospace sector but in recent years there is increasing interest as these material's growth is seen in other markets and there is a requirement for more affordable composites, products and processes that can be used in higher volume sectors such as automotive."

The Composites Engineering Show works in partnership with associations and industry bodies such as Composites UK – which holds its annual industry awards during the event – Catapult high manufacturing centres such as the National Composites Centre (NCC), Innovate UK and the Knowledge Transfer Network.

One of the biggest features of the show is its Open Conference programme. These are held at open forums located in each industry zone. Presentations concerning composite manufacturing this year include themes such as delivering the UK composites strategy and the use of composites in construction, rail, automotive, and the issues around automation, artificial intelligence, Industry 4.0. and sustainability.

Above
Composites Engineering has established itself as the UK composite industry's annual showcase



Talks will include Faye Smith from Composites UK discussing growth and demand in the industry; Ben Morgan from the AMRC discussing automation and Industry 4.0 for SMEs and Clive Chitiz from Plataine discussing artificial intelligence and the Industrial Internet of Things (IIoT).

This year the conference programme is Continuing Professional Development (CPD) accredited, meaning it is content complements the policies of professional institutes and academic bodies and is recognised by employers as giving helpful professional development for visitors.

"We can confidently say that it's the UK's largest engineering conference programme at a trade event," says Willis. "One of the features that most appeals to visitors is the flexibility of the talks and seminars. People can pick and choose which presentations they want to attend located in each show zone. They are not stuck in a single conference room. We also keep the presentations intentionally short so there is plenty of time to see the rest of the show."

One of the great pluses of Advanced Engineering is the crossover between the various show zones. Exhibitors involved in composite manufacturing and applications are also likely to be found in the Aero Engineering or Automotive Engineering zones. There is also a broad cross section of exhibitors from global tier 1 companies down to the smallest specialist subcontractor.

More than 700 exhibitors will be attending the show at the NEC, as well as thousands of engineers, procurement managers and senior decision makers from large and small companies; all looking to source, specify and invest in the most up-to-date products and explore industry innovations.

Innovation is very much a driving force at the event. This year the Enabling Innovation hub sponsored by Magna International and supported by Innovate UK partner, the Knowledge Transfer Network, has expanded and will feature 50 start-ups and researchers presenting the next generation of new technologies across all engineering sectors. The zone will be an opportunity for those selected to attract investment in their ideas.

Easyfairs says Advanced Engineering's continued success is due to its ability to keep abreast of the very latest manufacturing advances accommodated in dedicated show zones.

"How we evolve the show and develop new sectors and zones ensures we remain relevant and offer the visitor the right exhibitor experience," says Willis. "This is largely thanks to our advisory board made up of industry stakeholders who are the leaders in their field from all the various sectors and industries we feature. It means we can look to the future to see what is happening in engineering and reflect that back to our visitors. We also partner with the right industry organisations and associations to ensure that the show not only has credibility, but includes the right content."

Joined-up manufacturing

The biggest development at Advanced Engineering this year is the introduction of the Connected Manufacturing zone, dedicated to the latest manufacturing buzzwords Industry 4.0 and the Internet of Things. Visitors will see cutting edge technology and service providers, focused on connected manufacturing advances.

Key exhibitors here will include Siemens, Rockwell Automation, ABB Robotics, Dassault Systèmes, and associations such as GAMBICA and the British Automation and Robot Association (BARA).

"Demand for this zone has come from many of our exhibitors," says Willis. "There is a need to enlighten some in manufacturing about the benefits of Industry 4.0, from large companies down to SMEs. Small companies may feel that these advances don't really benefit them but it could just come down to the introduction of a simple new process that can increase their efficiency significantly."

R&D and academic institutions are also well represented at Advanced Engineering, which this year is also being staged at the same time as its sister show Lab Innovation. The Show has already attracted leading names from the industry including Mercedes AMG F1, Formaplex and TenCate Advanced Composites who will be looking to meet and do business with other industry individuals.

Above
The show's Open Conference programme offers key insights from industry experts

Below
Alison Willis, industrial divisional director at Easyfairs

Back again and again

So, what is the feedback from those that both attend and exhibit at the show?

Mark Crouchen, managing director of Rockwood Composites, affirms: "This will be our seventh year exhibiting at the Composites Engineering Show. We wouldn't miss it. It is the place to be to experience at first hand the latest the industry has to offer. Come and see for yourself the wide range of composites engineering innovations the UK has to offer."

Willis concludes: "We have built on our success by remaining close to the industry, ensuring that we have the support from the advanced engineering and manufacturing community so we create a must attend event both for exhibitors and visitors.

"At Easyfairs, our role is not just providing a stand for the two days, but also providing all the additional support that we offer our exhibitors throughout the year, so that they get the ROI for being at the event. We want to ensure they get maximum exposure and generate as many leads as possible."

WWW.ADVANCEDENGINEERINGUK.COM

Stand by for action!

*The latest products, processes and services can all be found at the Composites Engineering 2017, held at the Birmingham NEC on 1-2 November. **Composites in Manufacturing** previews some of this year's exhibitors.*

We begin our show round-up with CMS Industries (stand 0124). The CNC equipment specialist will be showcasing its many new developments, including new additions to the already extensive machine range and enhancements to the existing machines. New machines include the Ikon and the Ethos K.

Compact in design, the Ikon has been designed by CMS for trimming/machining precision composite parts and helps minimise the floorspace required for such a large capacity machine. It features two vertically-mounted tables, each 3,100mm x 1,800mm with rotational movement - into and out of the machining envelope - which facilitate ergonomic and efficient loading/unloading of components during the machining cycle. Furthermore, it is fitted with either one or two 5-axis spindles, each with independent movement to maximise performance and permit multiple machining modes, including simultaneous cutting of identical components, masked tool change time and simultaneous machining of symmetrical components.

The Ethos is a gantry milling machine with monolithic frame, which delivers high levels of stiffness and achievable accuracy across its large working capacity. Designed for high material removal rates, the Ethos can be supplied with or without a flood coolant system. The newly-designed FX5 double yoke rotary axis assembly is fitted with twin direct drive motors. The CMS 32kW spindle produces high torque and rpm capability.

Enhancements to the existing range include a larger version of the Antares, which is now available with a deeper Y axis travel of 2,800mm, cast iron table and the new HX5 compact rotary axis assembly with double yoke (second structural support arm) which increases brake torque on the rotating axes. The HX5 is fitted with the proven CMS high torque 20kW spindle with a maximum speed of 24,000rpm and HSK 63 A connection.

Options include through-spindle air and liquid passage, as well as an efficient high velocity extraction hood. This version also has additional tool change capability and can be fitted with 3 x 20 rotary magazines as well as 2 x 8 racks for a total of 76 tools.

Above
Attwater specialises in laminates and machining

Below
CMS' Ethos gantry milling machine

Nearby, Attwater Group (**stand N100**) and its subsidiary Custom Composites will unveil a range of industry-leading innovations, including carbon fibre tiller extensions and a carbon fibre laminate for ballistic applications during the show.

The Lancashire-based company, which specialises in industrial laminates and machining will be exhibiting items selected from a range of more than 1,000 products that includes an extensive range of standard laminate sheets, a wide range of composite tubes and rods and a selection of epoxy glass, polyimide glass, phenolic fabric and carbon fibre products.

Attwater's products are popular in a wide variety of sectors, including aerospace, power generation, marine and general engineering, typically for electrical distribution and industrial applications. Custom Composites has specialist products for use in sectors, such as military, sport and industrial.

Sales director, Rachael Kennedy says: "The Composites Engineering Show is the perfect opportunity for us to showcase our products to the industry, and it's a fantastic way to catch up with familiar faces and to meet many more new contacts.

"It has been an exciting year for Attwater and Custom Composites with many more developments planned for the future, and our presence at the show will reflect that."

Elsewhere, advanced composites manufacturer Pentaxia (**stand K110**) will reveal plans for a £1 million investment in a new six-acre site at this year's event. The company is inviting business leaders to find out more about the installation of cutting edge equipment and upgraded facilities that will double its existing production capability.

Visitors will also get the opportunity to meet Pentaxia's team of engineers and take advantage of one to one meetings with managing director, Stephen Ollier where they can learn more about the future of composites and its capabilities across multiple industries.

Ollier comments: "As a company we're entering an exciting period of expansion and we are looking forward to sharing our growth news with our colleagues and contacts in the sector. Advanced Manufacturing 2017 is a fantastic platform to showcase our recent work as well as demonstrate our role in helping to shape the British supply chain, and invest in growth to meet the anticipated demand in the composites market."

In the new year Pentaxia will move from its current site in Longbridge Lane to a 70,000ft^2 manufacturing space in Derby. A six-month programme to refurbish and upgrade the site will start immediately and position the company to meet the rapid increase in demand for lightweight, high performance components from its blue-chip customers in the aerospace, motorsport and luxury automotive markets.

The write stuff

In the next aisle, OB2B Industrial Marketing & PR (**stand L170**) will exhibit once again at the show. The company specialises in providing marketing and PR writing services to manufacturers of polymer-based materials, composites, engineering plastics and adhesives.

Right
Pentaxia's managing director, Stephen Ollier

Below
OB2B founder & director, Nigel O'Dea

Below right
Aro director, Billy McKenna

Technical and commercial expertise is combined to provide cost effective marketing and PR support to a global client base of multinationals and SMEs. Specialist outsourced help needed by busy sales and marketing teams is typically provided to create new sales tools, review and update the website, and to regularly write and send out press releases to target media.

During the show, visitors can see examples of news and application story press releases written for client companies which have gained successful national and global media coverage in magazines and online.

Founder & director, Nigel O'Dea comments: "Gaining editorial in a reputable magazine or website is extremely valuable as readers see it as impartial coverage, which has helped to open doors and secure new business for clients."

Along the same lines, Aro PR and Marketing (**stand J122**) a specialist agency for composites, engineering and scientific companies, will launch its new awards applications and SEO services at the show.

Aro's awards service came about after several clients asked for support in applying for a range of industry awards, including EEF Future Manufacturing Awards and the Queen's Award for Enterprise - the UK's highest accolade of business success.

Using its PR and journalism skills, Aro successfully wrote the applications and managed the whole process – resulting in a number of Aro clients' becoming official award winners. As part of its awards service, Aro identifies the most relevant industry awards for its clients, and manages the whole application process, including writing the application form which can often be lengthy and time-consuming.

Aro's second new service is for Search Engine Optimisation service (SEO). Focusing on key elements that contribute to website ranking, this new service helped one of Aro's clients move from page four on Google searches to page one.

These services complement Aro's existing offering which includes: PR, marketing, media relations, profile boosting, digital marketing, social media, graphic design, web design and build, and copywriting.

Returning to Advanced Engineering for the fourth consecutive year, Aro will showcase how these services support business development, fund raising and staff recruitment and motivation.

"Awards are a fantastic way to achieve recognition within the industry and beyond, and enhance engineering and composites companies' marketing," states Aro director Billy McKenna. "They are also a great way to boost staff morale. However, the application process is often complicated and time-consuming, and that's where Aro comes in.

"We are also pleased to add SEO to our range of services. If your company is on the second page for a Google search, the chances are you won't be found. Our SEO service will address this and could catapult you onto the first page.

Left
Von Roll: Customised systems for ships

Below
Mirka's new Direct Electric Orbital Sander

This could make a real impact in finding new customers, and reassuring existing customers."

Lightweight and shipshape

Owing to many years of experience in the manufacture of lightweight composite materials, Von Roll (**stand L100**) has developed a GRP flight deck safety net system and guardrail stanchion system that is said to provide a cost-effective alternative to conventional metal-based systems. Currently supplied to the Royal Navy and other marine defence organisations, Von Roll is able to design custom-made systems that suit a wide variety of ships.

Properties such as corrosion resistance, lighter operating weight, fatigue resistance and an ability to tailor structural and mechanical properties to suit the application and operating environment make composite materials ideal for marine use.

Using its specially developed Delglas composite materials Von Roll manufacture's lightweight, easily installed and operated GRP flight and gun safety net equipment for Naval vessels. Systems come fully-assembled, rigged with safety net and lanyard and equipped with appropriate deck fittings ready to install.

Von Roll also manufactures lightweight GRP guardrail stanchions using its Delglas composite material that offers a lightweight, virtually maintenance-free, corrosion resistant alternative to metal based stanchions.

Meanwhile, Mirka UK (**stand K130**) will showcase a wide range of tools and abrasives, designed and developed to offer increased productivity, efficiency and a reliable high-quality finish, whilst also allowing businesses to control costs and look after the health of their workforce.

Mirka's new Direct Electric Orbital Sander (DEOS) machines will debut at the exhibition. The new DEOS will be launched by Mirka to get closer to the surface, easily accessing hard to reach areas and delivering a smooth finish.

The DEOS is available in two sizes, DEOS 383 CV 70 x198 and DEOS 353 CV 81x 133, making it suitable for use across multiple applications, including sanding composites.

There will be demonstrations of the new myMirka app which is available to download free of charge through both the Apple Store and Google Play. It gives guidance on vibration levels on a colour graded scale, and advises on how to lower the vibration if required. Additionally, the speed can be visualised in a separate graph. An in-app purchase will enable users to track the daily vibration in relation to European standards.

The exhibition will also showcase Mirka's brushless battery driven spot repair sanders, the Mirka AOS-B 130NV and Mirka AROS-B 150NV. The new sanders are suitable for multiple operations including various composite substrates as well as E-coat and primer sanding applications, and will produce a quality and consistently smooth finish while also maximising productivity. Their ergonomic design makes them easy to move from job to job and allows users to operate the products for a long period of time, while delivering good control over the sanding process. They also provide economical and consistent performance for the duration of the sander's battery life, which can last up to 16 hours when used on spot repair applications.

A comprehensive range of Mirka's Non-Corrosive (NC) abrasive solutions will also be on display. These abrasives have been designed specifically to meet the increasing demand from users for products that enable the compliant surface preparation of corrosion sensitive materials without the risk of cross-contamination. The range is suitable for the sanding of aluminium and painted aluminium parts, made possible due to significantly lower heavy metal content than the corresponding traditional abrasives that contain iron, chromium and copper.

Jim Fulton, OEM sales manager for Mirka UK, said: "Innovation is key for our customers to enable them to address specific challenges. At Advanced Engineering, we will demonstrate how our continuous investment in abrasive and tool development is enabling us to anticipate their demands and meet their requirements now and in the future."

Still on the theme of surface finishing, Vapormatt (**stand N43**) will demonstrate its wet blasting technology for the surface preparation and finishing of composites used in aerospace.

Visitors to this year's exhibition will experience first-hand, Vapormatt's extensive range of high performance wet blasting systems. Developed to meet the needs of the aerospace sector, these popular systems enable high quality surface preparation and finishing of engine components and composite materials.

Vapormatt's aerospace specialists will demonstrate the wet blasting process on its manually operated wet blasting system, the Puma. Visitors will see for themselves how to effortlessly achieve controlled, reproducible and superior results, using advanced solutions that are easy to use and maintain.

Vapormatt's popular Leopard and Sabre wet blasting systems are widely used across the aerospace sector already. These fully-automated machines ensure unrivalled surface preparation and finishing of large components, such as wing spars and turbine blades. The Leopard is available in three variants: a horizontal version; vertical version; and a remarkably compact, yet high capacity version known as the Cub.

Show visitors can discuss their process requirements with one of Vapormatt's wet blasting experts, while also learning how Vapormatt's versatile systems can meet their needs, whether that's for cleaning or peening.

Above
Vapormatt: wet blasting technology

Below
Boneham and Turner: Refinement of alignment

Below right
Farécla: Abrasives on the beat

Knowing the drill

Drill Bushes have been a core focus of the Boneham Group for 100 years. The aim has always been quality and efficiency. Boneham bushes are used throughout the globe, with vast inventories in the UK and USA, under BS ISO, DIN and ANSI standards. Continuing UK production investment, Boneham recognises OEM and supply chain requirements for speed. Aerospace standard bushes are inventoried or delivered on a fast track service under one of the group's key account solution programmes.

Boneham's solutions focus on identifying, manufacturing and delivering to the exact requirements laid down by the customer - backed up by extensive knowledge and understanding of core markets. Boneham and Turner (**stand N75**) can support customers in delivering their solution to target, whatever the core demand laid down by the supply chain.

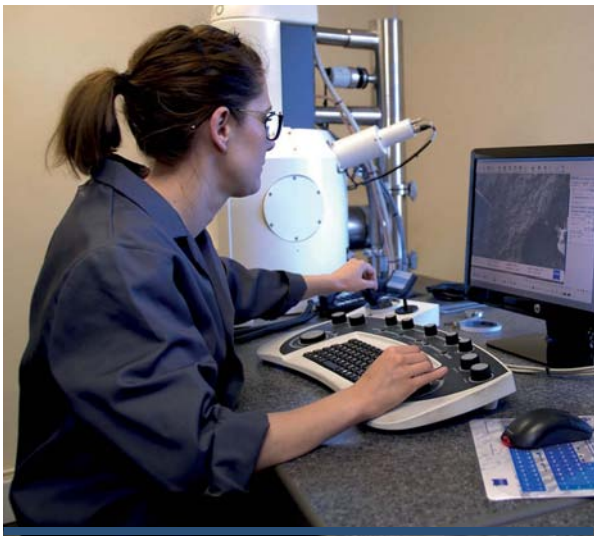
During 2017 Boneham and Turner launched a new customer-centric website allowing account customers the ability to access their contracted prices, use stock indicators, track orders, download invoices, pay on account, repeat order and process using customer part codes. For a demonstration on the website and to discuss any CAD requirements for designing Boneham components into fixtures and assemblies, please visit its stand during the show.

At the show, Boneham will reveal a number of products designed specifically for the composite and aerospace markets. Maintaining emphasis on alignment, location and drill jigs. Boneham continues to develop new solutions as well as delivering overseas standards to domestic markets.

The company represents other market leading solution providers. The stand will feature the Koenig Expander, a global leader in sealing drilled holes in low and high-pressure applications. The Expander is a zero defect 100% inspected solution. Also highlighting DADCO, a leading innovator in Gas Spring technology, with SMS-i sectional mounting system, a solution free from pipes.

Marching to a different drum, Farécla Products (**stand 0182**) will attend the event for the first time to showcase its PROFILE Specialist Applications compound range.

In the run-up to the show, Farécla has been collaborating with end user,



Cambridge Drum Company, a British company that produces individually tailored drum kits out of lacquered and painted wood for many notable musicians, including Jools Holland Rhythm and Blues Orchestra's drummer, Gilson Lavis.

Farécla's stand will feature a bespoke bass drum - as well as other exhibits from collaborating partners, including Davida Helmets, makers of luxury, open-face motorcycle helmets from GRP shells.

Farécla's stand will showcase the benefits delivered by the PROFILE range and allow visitors to see the quality of finish achievable when using the right products across a wide variety of surfaces: from tooling and production gelcoats, to acrylic and polyester, painted surfaces and lacquered wood.

Farécla invites visitors to meet the team and discover how its abrasive technology can help save time and lower production costs. From 2018 onwards, Farécla hopes to showcase its many unique surfaces and end results to the world, and wants to hear from end users interested in collaborating for future shows.

As UK agent, VAC Innovation (**stand N170**) will showcase the Italmatic range of autoclaves, ovens and presses for composite component processing.

Established in Italy in 1966, Italmatic's core business is the design and manufacture of autoclaves, ovens and presses for thermoset and thermoplastic materials.

Italmatic's autoclave manufacturing capabilities are not limited by diameter, height or length, and provide for electric, gas, oil or steam heating options. Additionally, optional cooling via air, water or oil is available, along with options for the vessel pressure medium (air or nitrogen). In all cases, taking into consideration different tooling geometries as well as dis-homogenous loads requirements, Computational Fluid Dynamics (CFD) is utilised to ensure cycle temperature uniformity.

Italmatic autoclaves, ovens and presses are managed by major brand PLCs, and are supplied with the latest version of the Italmatic in-house, user-friendly SCADA control software. The software allows for the creation and storage of bespoke cure cycles with immediate recalling of load configurations (to associate each bag to the part thermocouple and vacuum line); trends; alarms; loops and system settings; maintenance pages; calibration; management by different users; generation of part reports; printing of data and graphics trends.

This year, Instron (**stand J53**) will offer attendees the opportunity to see the ElectroPuls, an All-Electric Dynamic and Fatigue Test System and its new, intuitive, and touch-friendly Bluehill Universal software.

Instron offers one of the world's most comprehensive range of solutions for testing composite materials and components, including tension, compression, shear, torsion, planar biaxial, impact, and rheological properties to name a few. In addition to quality hardware, Instron also offers a wide range of services for verification and alignment.

The company's stand will feature a variety of application demonstrations on the ElectroPuls system and the Electromechanical load frame.

R-TECH Materials (**stand M122**) one of the UK's leading testing, analysis and consultancy businesses will showcase its capabilities during the show. Its UKAS accredited laboratories run tests on all types of engineering materials from composites and polymers to metals and ceramics.

The company recently invested in a range of equipment including a chemical analyser for carbon sulphur and nitrogen; a laboratory bend machine for rebar; a deflectometer for flexural testing; and automatic polishing equipment for preparing micro sections and macro

Left
Italmatic's range of autoclaves, ovens and presses

Above
R-TECH: UKAS accredited laboratories

Below
Instron's range of composite testing solutions

Left
Netcomposites' communications director, Gemma Smith

sections of welds. It's also on track to secure aerospace approval from Nadcap later in 2017 and has teamed up with Zwick Roell to run training courses on mechanical testing of composites.

It's time to listen up

Moving on, NetComposites (**stand M120**) will run its composites forums at this year's show. Working alongside various industry partners, themes have been chosen to reflect current industry hot topics. Each day will end with a panel session: day 1 will look at 'Challenges Faced by the Composites Industry', whilst day 2 will focus on 'Opportunities for the Composites Industry'.

The company will also host two sessions in the Aero Engineering forum, one each day with an 'Introduction to Composites for Aerospace' and the same in the Automotive forum with an 'Introduction to Composites for Automotive'. Finally, in the Performance Metals forum, it will have one session each day looking at Hybrid Composites.

The audience will be able to get a glimpse at what is happening across the composites industry, an update on strategy, new materials and innovations and hear about the latest industry case studies. Companies wishing to enter the market will be able to hear from some great contacts. The panel sessions will form a great place to get involved as well as an opportunity to meet relevant people.

Each of the forum sessions have been designed to end on a group Q&A session, bringing together all speakers and the interested audience. Coventive Composites - the new name for NetComposites' consultancy, training and innovation services Coventive, will be on hand from the stand to answer any questions people may have.

And the industry association, Composites UK (**stand J140**) says it is proud to be a headline strategic partner of this year's Composites Engineering Show. The show will see over 70 Composites UK member companies taking an exhibition stand with many more visiting over the course of the two days, proving the show to be a key event in the composites industry calendar.

At the show, Composites UK will deliver forum sessions such as 'Delivering the UK Composites Strategy'; 'Composites in Construction' – in conjunction with CompIC; 'Performance in Extreme Environments'; 'Sustainability'; as well as an overview of the six entries shortlisted for this year's Composites UK Innovation Awards.

The awards themselves will be presented in front of 250 people at

Above
Composites UK: An awards dinner to remember

Composites UK's black-tie dinner, hosted at the National Motorcycle Museum on 1st November.

Finally, the association is offering companies two extra month's membership when signing up at the show. Representatives from Composites UK will be available over the two days to discuss any queries from the stand.

A meeting of minds

Connecting brilliant minds, Axillium Research, a specialist innovation and research consultancy based in the Midlands, will be presenting at the event to support its consortia Partners as they showcase their latest technology developments and progress so far. During the show, the company will be offering innovation advice and support to potential future consortia members. Axillium is also available to meet those wishing to build new collaborations.

Axillium says it can help accelerate a company's technology innovation and enable them to grow. Whether they need access to funding, help mapping the innovation opportunities available, or need a fully-managed programme. Axillium will take clients right through the process and ensure their innovations deliver.

It's onwards and upwards for Norco Holdings (**stand M160**), a leading developer of innovative GRP mouldings and lightweight composite structures that offer composite solutions for end-users around the world.

Its complete manufacturing capability includes CAD design, 5-axis CNC patterns and moulds, component production using state-of-the-art composite materials and processes from wet/hand lay up through to prepreg lamination and final assembly. The company is accredited to ISO9001 and 14001, and has five production facilities.

The company's Composites division is active within the aerospace, automotive, defence, communications and renewables market sectors, supplying lightweight composite structures. The success of Norco Composites lies in its skilled workforce, its experience gained from completing many small and large-scale projects and its ability to offer the right technical solution.

Many industry sectors have seen a transformation in requirements, with an emphasis on weight, strength and cost. Norco's commitment to the aerospace, defence and communication sectors involves a balance of design, engineering, specification, technology and costing. Its extensive knowledge and understanding of these industries enables it to look at new composite manufacturing processes that are stronger and lighter yet remain cost-effective.

Norco will shortly add an extra 10,000ft² to its production facilities and recruit staff to cater for the increased demand from its customers for lightweight composite structures.

At the show, Norco will focus on its capability to engineer and manufacture both large and smaller composite structures, by providing a complete service from CAD design to final assembly.

Composite to the core

Meanwhile, MSA Manufacturing (**stand L163**) will demonstrate its capability to provide accurate and complex core and reinforcement material kits, with examples of products it has manufactured from of different materials.

The company specialises in offering machining, cutting and kitting services to high-tech composite manufacturers operating within the defence, aerospace, renewable, automotive and transport industries.

By supplying a complete kit of core and reinforcement materials, MSA says it can guarantee to reduce material waste and save build time. The company is completely independent of any material supplier, so it will always ensure the right mix of materials for projects.

Services include core machining and kitting, reinforcement cutting and kitting of both prepreg and dry material, digital engineering including 3D scanning and reverse engineering, ancillary services including reinforcement slitting and preforming and ancillary machining including e-plate, c-plate and ballistics plate.

Based in Dorset, MSA is ISO9001 and 14001 certified and prides itself on its flexible, resourceful and skilful approach to solving customer's complex material needs.

Elsewhere, PRF Composite Materials (**stand N122**) will showcase its new RP800 50°C epoxy tooling prepreg system.

The company's RP802 Overnight cure tooling system has a 12-hour cure at 50°C and an out life in excess of five days at 20°C. PRF's range of competitively priced tooling systems continues to receive outstanding customer feedback - particularly in terms of the quality of surface finish in the tool, even after repeated mouldings. This new product has been developed to provide an additional option for customers requiring improved dimensional accuracy of the finished tool.

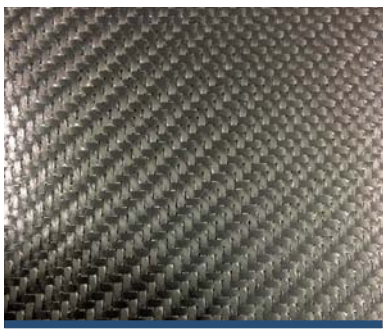
Fast becoming market leaders in quality and innovation, PRF will be

Top
Brilliant minds: Axillium Research

Above
Norco: GRP mouldings and structures

Below
MSA: machining, cutting and kitting services

Below right
PRF's RP800 50°C epoxy tooling prepreg system



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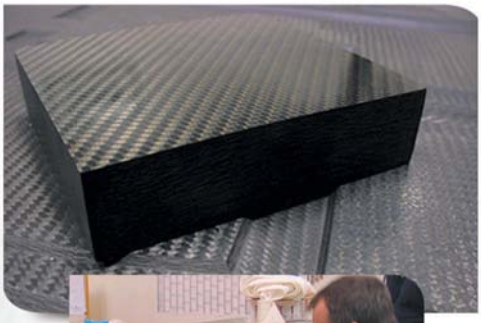

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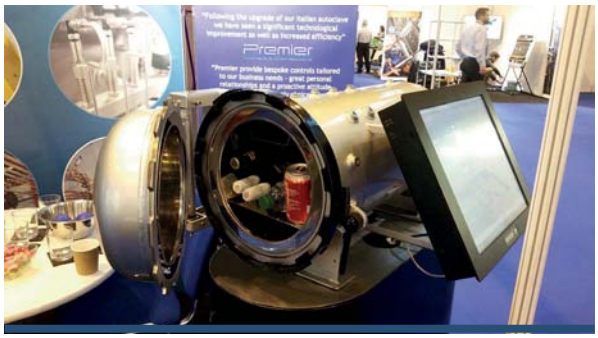

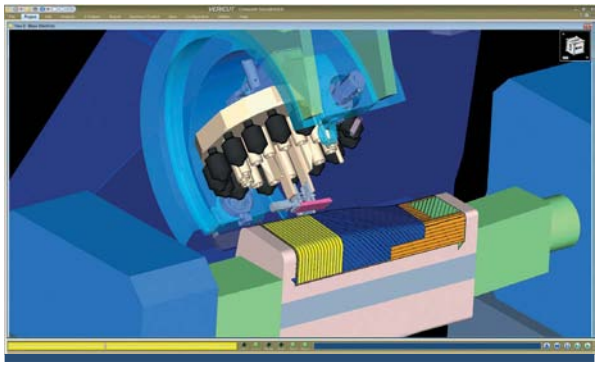

Top
Premier Autoclaves' mini-autoclave drinks fridge!

Above
CGTech: software for composite manufacturing

exhibiting other systems from its prepreg range, including RP542-1 – which provides consistent visual quality results in high-end aesthetic components – and RP549 highly toughened system – which has a Tg of 195°C (DMA), visual quality finish, and excellent mechanical properties in tensile, ILS and flexural strength.

Celebrating 35 years at the forefront of advanced composites, the PRF team will also be discussing its wide range of innovative materials: high performance reinforcements, epoxy resin systems, Qiicote mould release and kitting services.

In the next aisle, software specialist, CGTech (**stand 062**) will demonstrate the new version of its Vericut CNC machine simulation and optimisation software.

The company will showcase its Composites Applications software for programming and simulation of Automated Fibre Placement (AFP) and Automated Tape Laying (ATL). Visitors will have the opportunity to receive a thorough overview of the steps needed to get from a CAD designed composite part to CNC programs that drive an AFP or ATL machine. There will be information on new projects that highlight the implementation and use of machine independent off-line NC programming software for AFP and ATL machines.

Finally, Premier Autoclaves (**stand K122**) reckons it will have one of the most exciting stand features to showcase at this year's show: its already famous, ridiculously over-engineered, mini-autoclave drinks fridge!

The company welcomes customers old and new to its stand where it will demonstrate why Premier Autoclaves been rated as 'best supplier' by so many of its customers.

"We'd also like to discuss why we have just received our biggest ever aerospace OEM upgrade order and why more customers than ever are looking to improve autoclave efficiency, support and performance with Premier Autoclaves," states company sales manager, Scott Dyson.

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Composites get social!

*Aro PR and Marketing's director, **Billy McKenna** explains how social media is changing the way we engage, communicate, and how we find out information that influences our opinions.*

Baffled by social media? Some engineers find social media confusing and pointless. A few years ago, when we first researched the importance of these channels to the composites industry, we found social media was not as popular as in other industries. This meant engineering companies were missing out on a huge opportunity to position themselves and connect with both existing and potential customers.

Thankfully, the tide has turned. Evidence shows that today, social media engagement within composites is increasing at a rate of knots which means the industry is now taking advantage of the opportunity offered by these communication channels.

For engineering companies, LinkedIn, Twitter, YouTube and Facebook are generally the most important social media channels. They are popular with different audiences for different reasons.

Twitter is more widely used by manufacturers in general, though still with a role in the personal, not just the business context. LinkedIn is the most business focused of the social media channels, where 'profiles' act as online CVs, detailing experiences - both through work and education - and individuals connect and follow each other's profile based on business relationships.

As a video sharing platform, YouTube operates differently to the others and works often as a simple search engine. Many people will use it to find information instead of more traditional search engines such as Google or Bing and it can

Above
Like it or not, social media is here to stay

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Above
Billy McKenna, director of Aro PR and Marketing

increase brand awareness dramatically.

Facebook is more orientated to personal communications with family and friends, though it does have a strong role in business to consumer marketing, less so in composites or engineering. However, it is slowly on the rise, though Twitter and LinkedIn are more effective in spreading messages wider and to more targeted engineering audiences.

Let's look at each of the main channels in a little more detail – first LinkedIn. If you enter the word 'composites' into the search bar, it will offer: 235,605 people who mention composites within their profile; 4,466 companies; 178 groups (areas for special interests) and 173 job opportunities. 'Groups' on LinkedIn are leading the way with, for example, the Composites Industry Forum having nearly 20,000 members - a 40% increase since 2014 – while the group COMPOSITES has over 26,000 members, an increase of almost 50% in the last three years.

The groups include employees from OEMs, suppliers, tradeshows, trade bodies and composites focused media publications, who are all looking to interact and keep up to date with the latest industry news and innovations. It is also a great way to source new employees.

Moving onto Twitter. hashtags (#), which are a means of categorising communications into topics, make it easier to search for other relevant tweets. #ukmfg (UK Manufacturing), #composites and #IIOT (Industrial Internet of Things) are consistently making an appearance in posts from industry media, tradeshows, OEMs and even smaller players within the supply chain. In 2014, 55 tweets were found using #composites within a period of one month, now we reach that number within a few days!

In 2015, YouTube was hailed as the second largest search engine on the web with people preferring to watch videos to find information rather than read it. When searching 'engineering', over 20 million results appeared; and with 'composites' there were over 1½ million results, from polished corporate videos to product demonstration footage taken on mobile phones.

Still not convinced?

Graham Mulholland, managing director of epm: technology, comments: "Social media is a big part of any organisation's marketing strategy, using social media to showcase to the external market daily activities, recent project achievements, up and coming news, etc.

"In a world where social media is part of most people's daily lives, this new form of contact is required in the composite market as it gives an insight into an at times confidential industry and reaches out to a multitude of people and potential new customers.

"We also use these channels to inspire the next generation to become involved in engineering and the composite industry to help narrow the skills gap."

> *"We live in a world where product and brand promotion on social media is growing across all markets"*

Indeed, young engineers and composites professionals prefer to consume their information through social media. That's how they like to communicate and it is incumbent on the industry to meet these needs.

As well as reaching out to younger audiences, social media has other benefits. It can be more cost-effective than paid advertising, it can be engaging, done within a matter of seconds and can drive traffic straight to your website. Latest figures show that around a third of all website visitors are from social media.

The benefits are: you can decide what information is shared, not a third party; social media channels such as Instagram and Pinterest are photo sharing platforms, which can promote your products and other achievements, like an online catalogue or brochure; results on search engines can be improved. For example, Google and Bing pay attention to social signals, so the more posts that are liked and link back to your website, the higher your website will appear on search results; you can enhance relationships with all those important to your business such as suppliers and staff, not just customers.

A way of reaching out

Though social media channels are gaining in importance in the composites industry, we're not at the levels we need to be. Ken Doig of Formaplex takes this up: "I don't believe the supply chain fully utilises the opportunities available for brand/product promotion through social media.

"We live in a world where product and brand promotion on social media is growing across all markets; composites shouldn't be left behind. You have to keep track of what your customers and potential customers are looking at and aim for the right areas.

"Not all business users will look at Facebook, Snapchat or Instagram, however, LinkedIn and Twitter can be useful to promote a company and gain brand/product visibility in a wider market."

So, don't get left behind. Join the social media gang today and start showing off your composite capabilities!

To explore this further, visit Aro (**stand J122**) at the Advanced Engineering Show.

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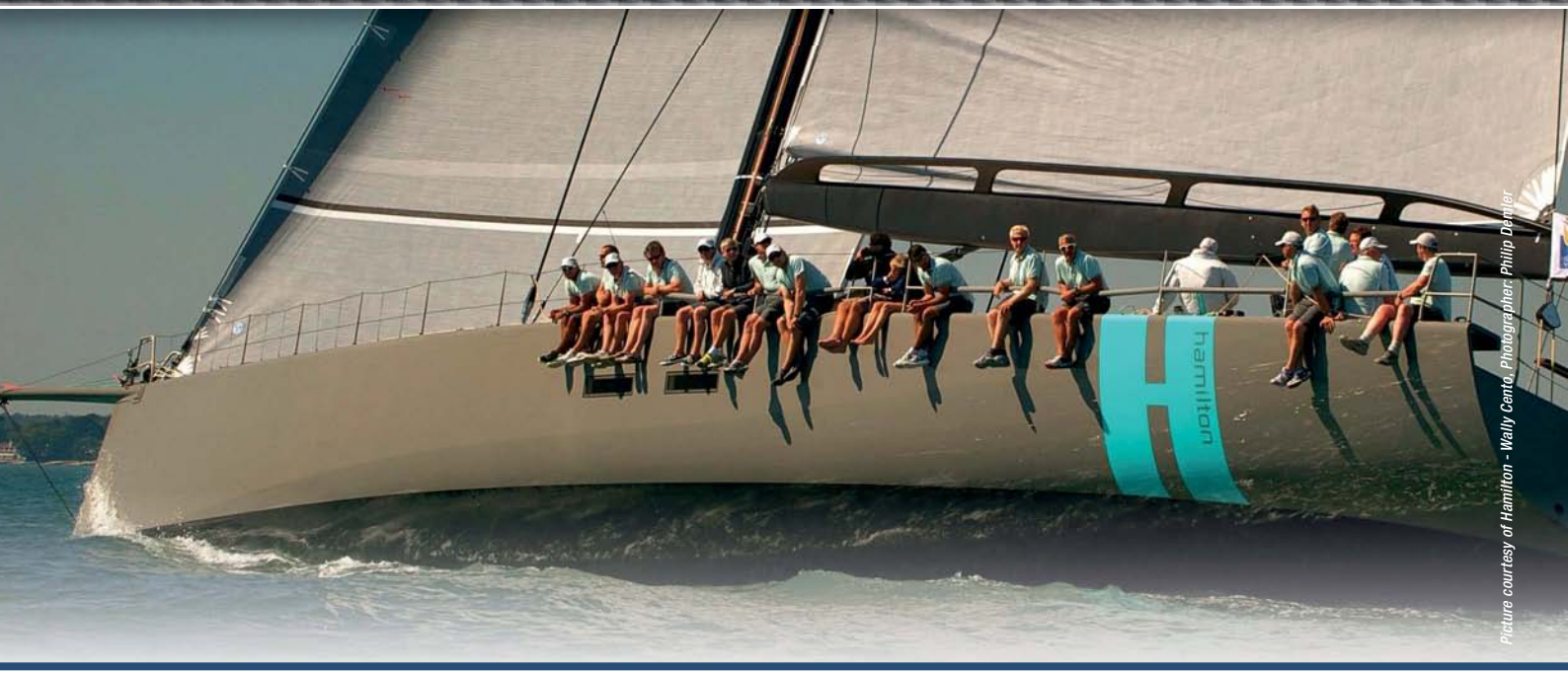


Picture courtesy of Hamilton - Wally Cento. Photographer: Philip Dennler

Cloud revolutionises composite design

When it comes to composite design, the ability to accurately predict the structural performance of a material and the costs involved is imperative. Here we look at how an online cloud-based IT solution is revolutionising composite design, helping manufacturers deliver up to 40% efficiency gains by reducing development time and costs.

Until recently, manufacturers looking for software to help them in the early stages of designing a composite yacht, bridge or wind turbine blade had little choice. There wasn't a dedicated composite design solution on the market.

As a result, engineers often found themselves cobbling together their own composites IT solution using a mishmash of manual linkages from existing off-the-shelf CAD and analysis software and homemade spreadsheets. Clearly, this do-it-yourself approach to composite design had drawbacks.

Firstly, it resulted in complex and inefficient workflows that required multiple inputs - which often meant cutting and pasting the same data. Second, vital information would often get lost when transferring from one system to the next resulting in inconsistent quality and an increased risk of errors. And lastly, but by no means least, users spent as much time developing these random IT tools as they did on actually developing their composites solutions.

But all this changed in 2010 when STRUCTeam – a composites business and technology consultancy, based in the Isle of Wight – created CompoSIDE.

Julien Sellier, managing director of STRUCTeam and CompoSIDE, explains: "We needed a suitable composites IT solution for STRUCTeam so we researched the market. We had two choices: to link software together using spreadsheets or to use our practical design knowledge and experience to build a purpose-made long-term IT solution to address our needs. Given the gap in the market, we also felt there was also huge mileage in marketing this tool to the wider composite community."

Above
CompoSIDE is used by world-class yacht designers and boat yards

Dedicated to structures

In January 2015, CompoSIDE was launched as an integrated suite of web-based design engineering modules and

data management tools dedicated to the development of composite structures.

Whilst CompoSIDE is said to be the number one composite software for the marine industry - used by world-class yacht designers and boat yards, such as judel/vrolijk & co - it's also proving popular in the renewable energy and industrial sectors, helping engineers to develop composite parts, structural elements and even complete applications. So how has CompoSIDE revolutionised composite design software?

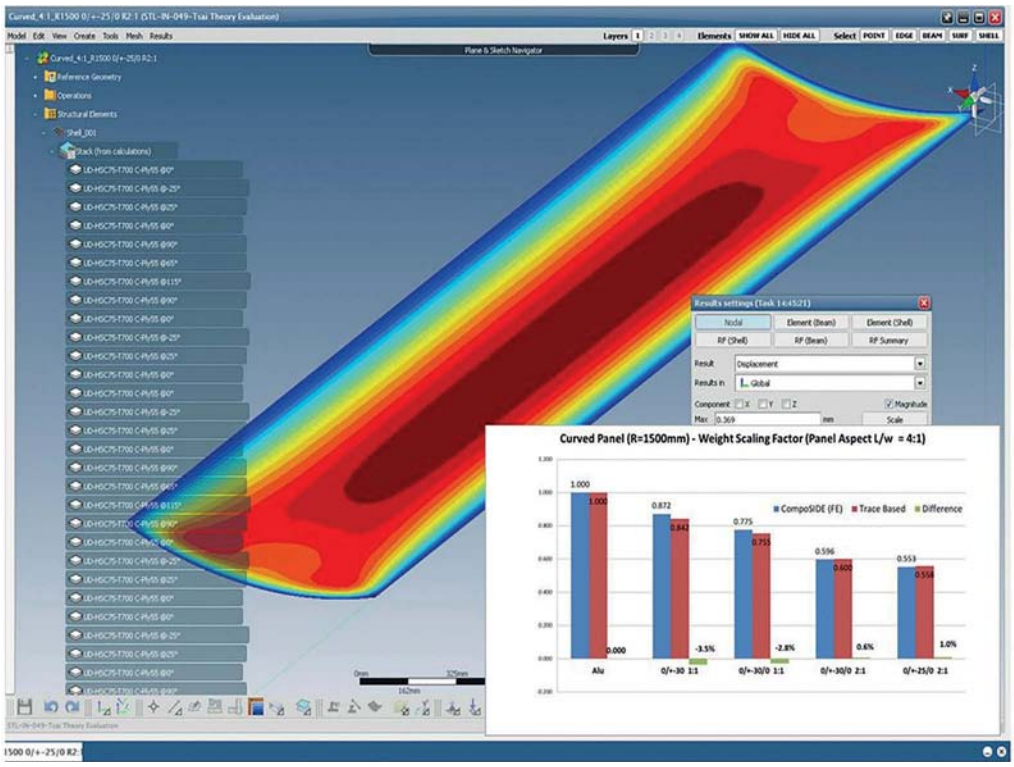
"Put simply, CompoSIDE is the first online cloud based IT solution of its kind," enthuses Sellier. "It's easy to use and reduces the development time and cost for composites applications. It's got everything an engineer requires for the development of a composite structure – design, project management, materials database, reporting and documentation. The integrated nature of CompoSIDE's web-based solution means engineers can test multiple design options collaboratively in a very short space of time at the early stage of a project, which ultimately improves the final design solution. A significant amount of time is gained by CompoSIDE combining several analysis types together in its platform."

Based on STRUCTeam's project logs, CompoSIDE's agile design workflow increases process efficiencies by up to 40% by reducing the time and cost it takes to develop composite solutions compared with more conventional methods.

CompoSIDE's software allows for greater innovation and creativity by letting the user experiment with different designs so during the development of your design, changes can be implemented quickly and the system automatically updates saving significant time and effort compared to using several software/spreadsheets one after the other.

Users can also complete more design iterations for the same time, resources and budget resulting in sharper and more refined component and product designs. And last but by no means least, quality is improved thanks to consistent workflows, standardised processes, an integrated system and a shared knowledgebase.

Another bonus is CompoSIDE's subscription model, which is based on a flat monthly fee. The baseline package is based upon two concurrent users: an attractive entry point for smaller, but also larger engineering departments. Engineers tempted to try out this new software, can register for a free trial on CompoSIDE's website which includes help from its support team to get familiar with the interface and share design workflow.



Above
CompoSIDE boasts a graphical user interface with straightforward navigation, designed specifically for engineers, designers, architects and project managers

Below
Julien Sellier, managing director of STRUCTeam and CompoSIDE

New realms of analysis

So, what do CompoSIDE's clients think of its software? Chris Matthews, from structural engineering company, Atelier One, says: "CompoSIDE allows us to explore new realms of structural analysis. Being able to accurately and quickly model cross sections of varying material properties helps us explore composite sections in unprecedented detail and easily compare the performance and cost to more conventional solutions."

How exactly, does CompoSIDE work? To begin with, it's got an intuitive graphical user interface with straightforward navigation that has been designed specifically for engineers, designers, architects and project managers.

CompoSIDE's core module provides toolsets for composites materials management, laminate calculation, beam section design and 3D finite element analysis (FEA) modelling with integrated reporting. CompoSIDE also dynamically links design modules and Bill of Materials, which means users are able to update and review the effects of design decisions on BOMs and costs.

The CompoSIDE Materials Database (CMDB) add-on contains 1,200 entries and supports material types like adhesives, cores, fibres, matrix and plies as well as non-composite materials such as metals, woods and plastics, plus you can also add your own materials.

It also features tools for managing materials data, physical properties and mechanical properties, as well as ply generation and micro-mechanics. The CMDB add-on allows export of material and laminates for leading third party FEA packages. Whilst its YACHTScant - a dedicated marine design workflow module - allows the user to develop its design with marine design guidelines, such as the ISO12215.

Lastly, project document generation, reporting tools and wizards allow you to create, manage and export your engineering data using customised templates which makes it easy to collaborate with project teams in different locations.

So, if you're struggling to find an integrated IT solution for your composite design, may be its time to look to the clouds. As they say, every cloud has a silver lining!

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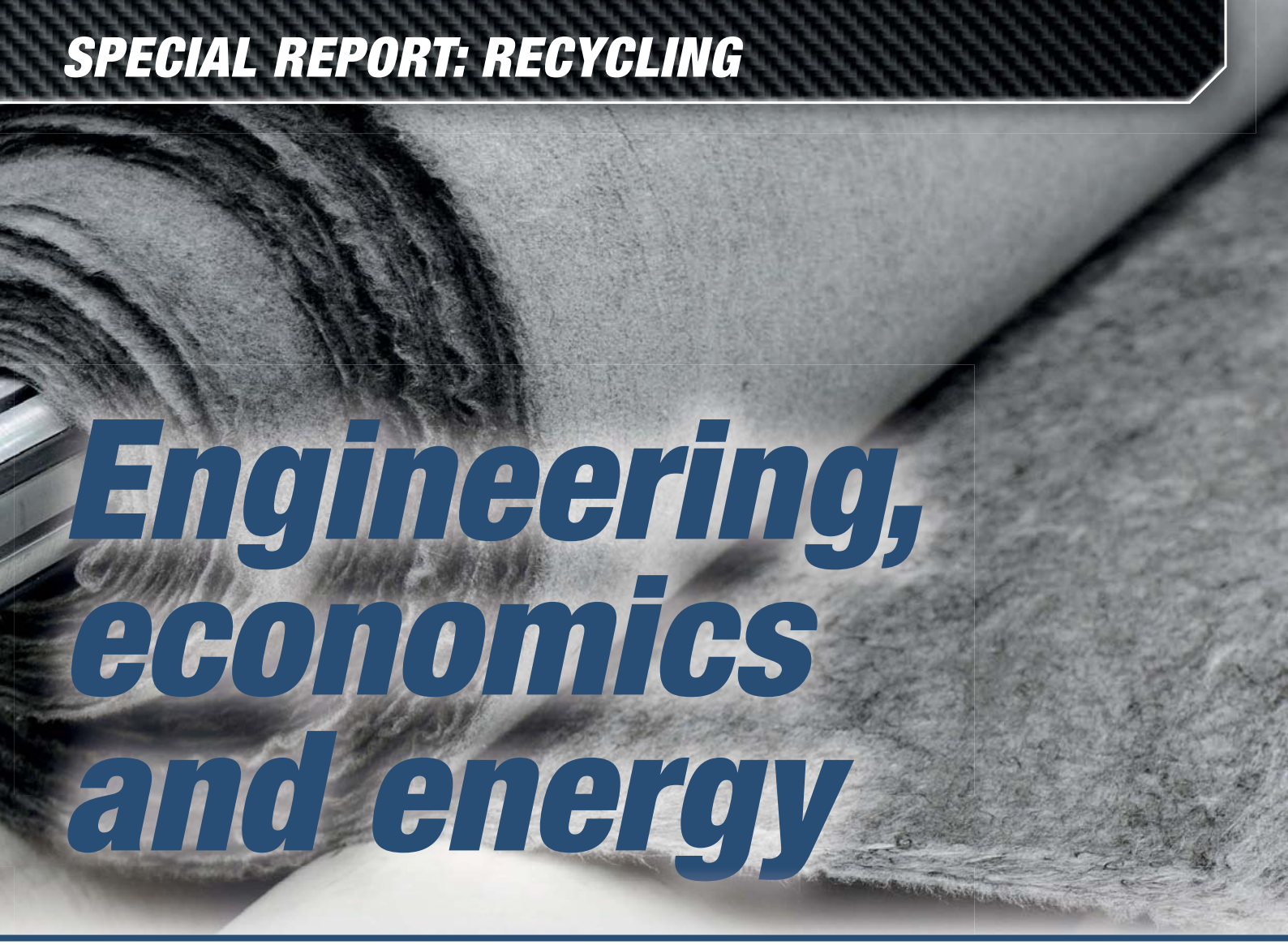

Engineering, economics and energy

*ELG Carbon Fibre opens its doors to **Composites in Manufacturing** and gives **Dr Neil Calder** the chance to talk to the company's managing director, Frazer Barnes.*

What is now ELG Carbon Fibre started life in 2003 as R&D company Recycled Carbon Fibre, with an entrepreneur who was sold on the idea of recovering carbon fibre waste. The business model they had then was that if you recover carbon fibre, customers would just buy the carbon fibre from you.

"In reality, even though they have good mechanical properties, recovered carbon fibres are a very difficult material to use," begins ELG Carbon Fibre's managing director, Frazer Barnes. "Composite manufacturers or engineers want to buy a woven fabric or a non-crimp-fabric (NCF). If I've just got a mass of black fluffy fibre, I can't do anything with it and that's the problem. You have to have a supply chain process that can do something with that material before you have a viable business."

The parent company, ELG Haniel Group, has more than 50-year's history in recycling high-value materials and is now the largest stainless steel recycler in the world. In the 1990s it moved into superalloys and titanium, and again the company is a leader in this area. The ELG method is to understand the importance of quality control to the whole process and having in place quality control procedures to return the material to its highest possible value through production hygiene and traceability, testing and understanding the variabilities.

The result is knowing the material properties going in, and consequently coming out through testing every batch of material on receipt and after processing. The importance of data throughout this process flow is absolutely critical, capturing this at the earliest stage in the conversion cycle. On the supply side as recently as 2014, it had 154 waste feedstock suppliers. Today, in terms of regular supply of material the company has three long-term supply contracts, running to 2022 with material converters.

Radiate to innovate

The new addition to ELG's production line is an NDT function using beta radiation sensing to determine the areal weight of the nonwoven carbon veil. This measures the amount of carbon fibre material between the emitter and detector heads on a continuous scanning basis. ELG says it could have gone into production with the nonwovens two years ago using a very standard line, but it took the time

Above
ELG's finished carbon fibre nonwoven veil

Below
ELG's managing director, Frazer Barnes

to understand carbon fibre processes and develop a piece of equipment that produces a very consistent product and which is exactly what the customers need.

The performance parameters from the recovered nonwoven actually stack up pretty well. There are very clear strength and modulus targets from the six automotive OEMs that ELG is working with currently. Then it comes down to the cost target. And cost of course is bound up with the consistency and quality variability. So, the material has to meet the mechanical property targets, with the right level of consistency, so the process can hit the cost targets which opens the way for the use of these materials.

Gordon Murray Design has integrated the ELG recycled nonwoven material into its iStream composite structural concept, just launched by TVR in its re-born Griffith sports car. The other key market within the transportation sector is rail, and ELG is grant-funded by the Rail Safety and Standards Board (RSSB) to develop composite structures with Alstom. This project is developing a lighter weight carbon fibre bogie frame, which incorporates secondary functionality, such as suspension and steering within the structure, providing a novel approach to the issue of weight reduction and track wear reduction on the UK's railways.

For ELG to create a product from incoming waste, which in most cases is from either the US or Asia, to ship material here, to recover the fibre, to convert it into the form in which it is to be used, takes less than 10% of the energy required to make primary carbon fibre tow. If you accept that the virgin carbon fibre has been made anyway and the eco-footprint of that has already been expended, then this is purely creating value from a waste stream.

The partnership puzzle

Barnes admits that one of the main tasks that sits on his desk is relationship management because ELG is one part in a larger jigsaw. The company needs to have very good relationships with all the other elements involved, from the feedstock side and materials use. Sometimes it is a supplier and sometimes it is a customer: it's quite a complex supply chain.

The virgin carbon fibre manufacturers think of ELG as competition, but actually it's really a critical and complementary part of the industry, because without a recycling solution, the potential for virgin carbon fibre manufacture is limited and equally, like the rail and automotive projects it is working on, the structural manufactured solution uses a combination of virgin and recycled fibres. You can't make the whole structure from recycled materials because of the mechanical properties limit, and you can't make the whole structure from virgin carbon fibre because of the cost limit.

There are more companies moving into this area, and ELG sees this as good for the sector - and good for the technical competitiveness of this part of it. ELG has a planned five-year global footprint, producing around 6,000 tonnes a year of recycled carbon fibre products at a point when it believes there will be 32,000 tonnes of carbon fibre waste available in the market. One of Barnes' concerns is that the projections for carbon fibre demand over that period exceed the capacity of the market to produce this. The reuse of current waste streams therefore becomes a necessity.

Much of ELG's current R&D effort is in processing of cured laminates rather than tow offcuts. This is reprocessing composite tooling and part trim waste, which is fairly consistent, although it has conducted end-of-life studies on four vehicles for a number of car manufacturers. A production solution for the initial size reduction process has to be automated before it goes to the shredder. Technical feasibility has been demonstrated, but this production solution isn't quite there yet. In 5-10 years, this is when the volume automotive markets start to kick in.

The company is in a massive growth phase. It has been trying to straighten out the whole of the supply chain for recycling of carbon fibres, within the eternal triangular relationship between material, process, and product, which really means that ELG has to understand not just what its immediate customers are wanting, but what its customers' customers need. It is mechanical properties and the cost at the end of the day: engineering, economics and energy – and ELG now ticks all these boxes.

WWW.ELGCF.COM

Below
Pre-sized cured laminate ready for shredding

> *"In reality, even though they have good mechanical properties, recovered carbon fibres are a very difficult material to use"*

COMPOSITES SUPPLIER GUIDE

CiM Composites in Manufacturing

ANTI VIBRATION MOUNTS

AUTOCLAVE SUPPLIES

COMPOSITE CUTTERS

LASER PROJECTION

MACHINING CENTRES

MATERIAL/ENGINEERNG COMPONENTS/TOOLING

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SPINDLE REPAIR

TOOLING

VACUUM BAGGING MATERIALS

Composites UK
Trade Association
Supporting the UK industry supply chain

Composites UK sets H&S standards for the industry

Composites UK is the trade association for the UK composites industry, an industry largely made up of small companies. As a trade body we have collected accident statistics for a number of years, and whilst these figures have always shown that the UK Composites sector is in relatively good shape in terms of Lost Time Accidents compared to the manufacturing sector average, we have recognised that there is no room for complacency and we should strive for continual improvement.

As a result, we have worked with the Health and Safety Executive (HSE) and other trade bodies through the SiMPLC initiative (Safety in Manufacturing Plastics and Composites - the steering group of which we chair) to put tools in place to support our sector.

In 2013 we launched our H&S (Health & Safety) action plan for 2014-17, the details of which were closely aligned with the SiMPLC strategy and focused on the same key areas. This lead to development of our online health and safety management system (HSMS) which was launched along with a self-audit tool for members in November 2016. The tool has been taken up well by industry and is continuously being developed to ensure it remains current. We are now working with member company Towergate Insurance to link this self-audit tool with insurance premiums – the long-term objective is to improve H&S standards across the sector and reward those that perform well.

HSE launched its new strategy in 2016, and so the SiMPLC Steering Group has revised the SiMPLC strategy for 2018-2021 in alignment with this. The new SiMPLC strategy - to be launched later this year - recognises and builds upon work already done and supports the commitment of the composites manufacturing industries to the principles set out in the HSE's strategy for the health and safety system for Great Britain 2016-2020, Helping Great Britain work well. Also, the HSE's Health and Work strategy and plans and its sector plan for health and safety in manufacturing. The two key areas the new strategy focuses on are ill health and reduction of injuries.

Composites UK, through its H&S task group is currently updating our H&S action plan to bring this in line with the HSE strategy. The plan for 2018-21 will be launched at the end of this year. We will be working with our members and the wider manufacturing community to identify the key priorities for the UK composites industry in the key areas of ill health and reduction of injuries, set relevant targets and develop information and tools to achieve these. This will enable us, as the Trade Association for the UK composites industry, to deliver the H&S support it needs.

To keep up to date with our work on H&S follow us on Twitter and LinkedIn where we will post new information and links to relevant websites/tools. If you would like to be involved with our work please contact the office.

If you work with styrene, then make sure you attend our information event on 29th November, Solihull 'Managing Styrene in the Workplace'. Details can be found here: https://compositesuk.co.uk/events/managing-styrene-workplace

The HSMS can be viewed through this link: https://compositesuk.co.uk/health-safety-management-system

Dr Faye Smith,
Chairman of Composites UK

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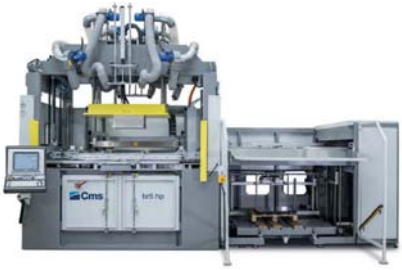

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