

FUSION

MAGAZINE #2 | 2025

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SIMPLE**



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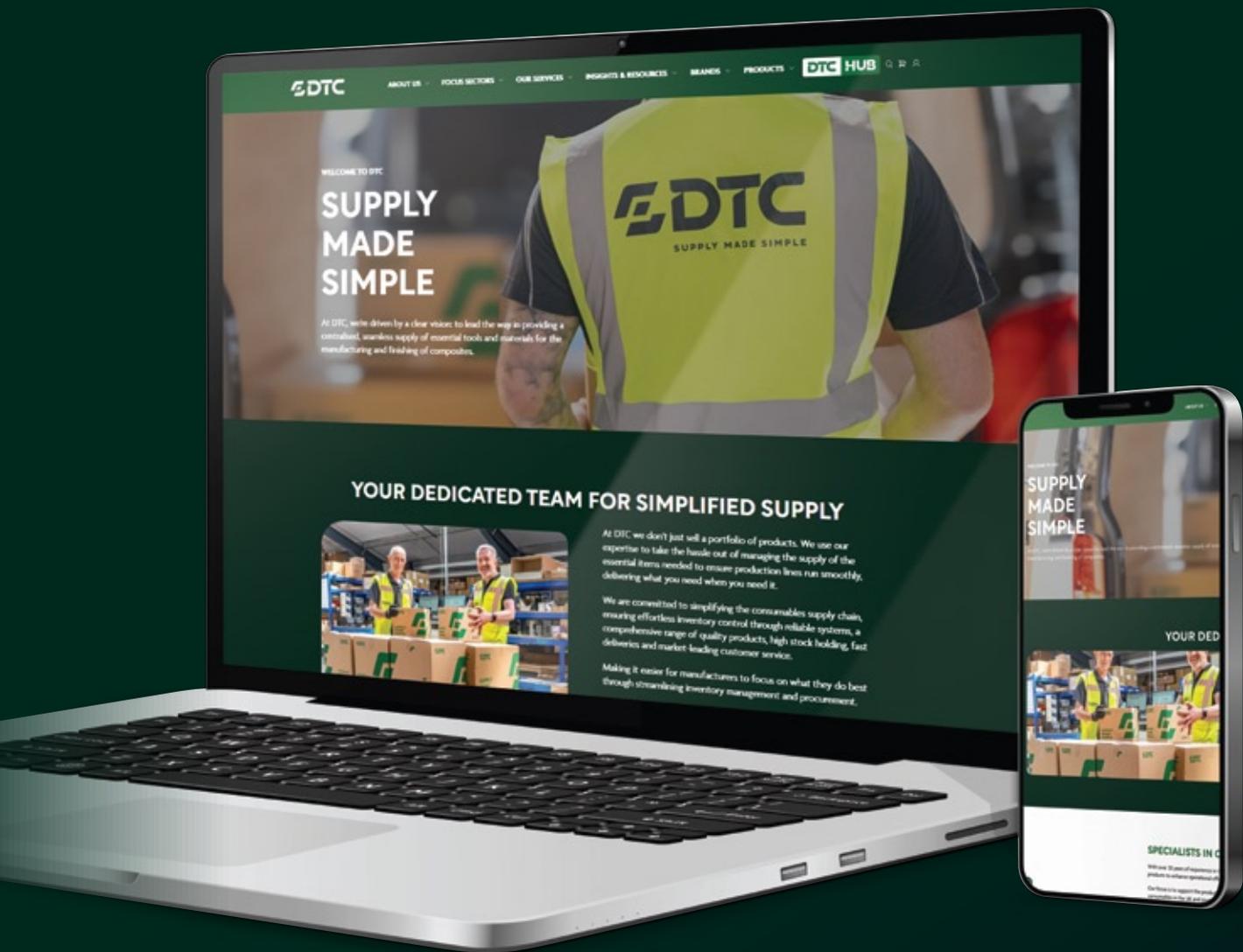


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Fusion Magazine Editor: Harvey Taylor



SMARTER, FASTER, EASIER: THE NEW DTC WEBSITE

We are pleased to announce that our brand-new website is now live.

Rebuilt from the ground up, the site reflects our refreshed branding with a modern, streamlined design. Navigation has been improved to make it easier than ever to explore our services, discover our expertise, and learn more about the industries we support.

The site delivers all the functionality you are familiar with, enhanced with richer content and a more engaging experience. From detailed insights into our approach to simplified access to product and service information, our new digital platform has been designed with you in mind.

Visit us online and experience the next chapter of DTC.



THE FUTURE OF FASTENERS: SMALL PARTS, BIG IMPACT

In complex industries such as aerospace, defence, automotive, and marine, performance often hinges on the most minor details. Fasteners, although rarely in the spotlight, are critical components that hold advanced structures together and ensure their long-term reliability. As technology evolves, these seemingly simple parts are undergoing their own quiet revolution.

Lightweight and Strong

The demand for lighter, stronger materials has driven a shift toward titanium, aluminium alloys, and even composite fasteners. In aerospace, shaving grams from each bolt can add up to significant fuel savings. In marine environments, advanced coatings and corrosion-resistant materials ensure durability in saltwater conditions.

More innovative Coatings and Surface Treatments

Fasteners are also benefiting from new surface engineering technologies. Coatings designed to resist extreme temperatures,

vibration, and chemical exposure are extending lifetimes and reducing maintenance cycles. This not only improves performance but also lowers total lifecycle costs.

Smart Manufacturing

With Industry 4.0 reshaping production, even fasteners are becoming "smart." Embedded RFID tags and traceability systems allow manufacturers to track every component from assembly to maintenance. This reduces errors, improves compliance, and streamlines supply chain management.

Beyond the Basics

What was once considered a commodity is now a field of innovation. Fasteners today must strike a balance between performance, weight, safety, and sustainability. As industries continue to push the boundaries of engineering, these small parts will remain at the centre of big advances.





SELF-HEALING PAINTS: SCIENCE FICTION OR THE FUTURE OF COATINGS?

For decades, the idea of a car or aircraft repairing its own paint scratches seemed like something pulled from science fiction. Today, advances in material science are bringing self-healing paints out of the laboratory and closer to commercial use.

The principle is simple but powerful. Specialised polymers are engineered to react when damaged, flowing back into minor scratches or using embedded microcapsules that release repair agents when the surface is disrupted. In some cases, heat or even sunlight can trigger the healing process, restoring the coating's smooth finish without the need for human intervention.

The implications are enormous. In the automotive industry, self-healing paints could mean fewer repairs, extended lifespans for coatings, and reduced use of solvents and consumables. For aerospace

and marine applications, the benefits are even more significant. Surfaces constantly exposed to abrasion, weathering, and impact could maintain performance and appearance far longer than traditional paints allow.

Of course, challenges remain. Cost, durability in extreme conditions, and scalability of production are all hurdles to overcome. Yet, with global industries under pressure to reduce waste and improve sustainability, the motivation to solve these challenges is stronger than ever.

Self-healing paints may not yet be standard in every workshop or factory. Still, they offer a clear glimpse into the future of coatings: more innovative, more sustainable, and surprisingly resilient.

THE SHIFT TO WATER-BASED COATINGS IN PAINTSHOPS

Paintshops are facing a period of change as water-based coatings steadily replace solvent-heavy paints. Growing environmental regulations and heightened awareness of worker health have accelerated this shift, pushing industries to adopt cleaner and safer alternatives. For many, the move is more than compliance, it is an opportunity to rethink long-established practices.

Water-based coatings offer clear environmental benefits, significantly reducing volatile organic compound emissions that have long been a concern in both production and finishing environments. They also improve air quality within workshops, thereby lowering health risks for operators who spend long hours near paints and sprays.

Yet the transition is not without its challenges. Solvent-based paints have been the standard for decades, prized for their reliability, durability and ease of use in demanding environments. Water-based coatings often require different handling techniques, longer drying times

and more controlled conditions. Paintshops have had to adapt equipment, retrain staff and refine processes to ensure quality remains uncompromised.

These adjustments are already paying dividends. As more companies invest in advanced spray technologies, controlled curing environments and operator training, the performance gap between solvent and water-based systems continues to close. In some cases, water-based coatings now outperform traditional methods, offering smoother finishes and improved consistency.

For paintshops, this evolution is not just about meeting regulatory demands. It represents a broader commitment to sustainable practices that also enhance long-term efficiency and competitiveness. Those willing to adapt are discovering that water-based systems can deliver both environmental responsibility and high-quality results, thereby securing their place in the future of industrial finishing.





BEHIND THE SCENES OF YACHT INTERIORS: MATERIALS, PRECISION AND LUXURY ENGINEERING

Step inside a superyacht, and it feels like a world apart: hand-finished woodwork, silk-soft fabrics, stone surfaces that gleam in the light. What is less apparent is how much of this beauty is engineered. Every detail has been designed not only for style but also for survival at sea.

The Weight Challenge

Nothing onboard can simply be heavy for its own sake. A wall that looks like carved oak may, in fact, be a honeycomb core faced with the thinnest of veneers. A marble tabletop could be merely a skin of stone bonded to a lightweight composite. These illusions are the secret of yacht interiors, enabling designers to deliver elegance without the burden of unnecessary weight.

The ingenuity extends further than most realise. Traditional plaster gives way to foam cores wrapped in carbon fibre. Even seemingly minor details matter, such as brass fittings that are hollowed out, mirrors that utilise lighter substrates, and ceramic tiles that are backed with foam. Every gram saved contributes to improved performance and fuel efficiency.

Engineering for the Sea

Strength is just as essential. Furniture that shifts on land would rattle itself apart at sea. That is why fittings are crafted with exacting tolerances, materials are chosen to resist the constant push and pull of moisture,

and every surface is finished to withstand vibration. It is a silent form of engineering, invisible yet vital.

The marine environment presents unique challenges. Salt air causes metals to corrode, temperature changes make materials expand and contract, and continuous motion stresses every joint. A dining table becomes a complex piece of engineering, with hidden brackets that allow movement without failure and surfaces treated to resist moisture penetration.

Sound also presents a significant challenge. The hum of engines and slap of waves threaten the serene atmosphere that owners expect. Advanced acoustic materials are woven into walls and ceilings, often disguised as decorative elements. What appears to be fabric wall covering may contain sophisticated sound-absorbing layers.

The Craft Behind the Curtain

Traditional craftsmanship merges with cutting-edge technology. Master woodworkers adapt centuries-old joinery techniques to work with modern composites. Upholsterers learn to work with fire-retardant fabrics that meet marine safety standards. The attention to detail is extraordinary: a single cabinet might take weeks to perfect, with each component tested for durability,

Modern yacht interiors seamlessly incorporate technology in ways that seem effortless. Entertainment systems vanish into furniture at the touch of a button. Climate control systems respond without any visible controls disrupting the aesthetic. The challenge lies in routing cables through structures without compromising both their strength and appearance.

The Human Element

No two interiors are alike. Owners bring their own tastes, priorities, and visions of luxury. This personalisation process can take years, with designers working closely to understand not just aesthetic preferences but also how the yacht will be used. Each decision ripples through the design: material choices affect weight distribution, furniture placement influences traffic flow.

The collaboration extends beyond the design team. Naval architects ensure that layouts work in conjunction with the vessel's structure. Classification societies verify that installations meet safety regulations. Craftsmen contribute expertise on what is possible within marine constraints.

The Art of Invisible Excellence

Yacht interiors are more than decoration. They are a performance where materials, precision and design work together to create

environments that must be as resilient as they are beautiful. The accurate measure of success is when guests never think about the engineering that makes their comfort possible.

This invisible excellence represents the pinnacle of design achievement: creating spaces so perfectly adapted to their purpose that the complexity disappears, leaving only beauty, comfort, and the endless horizon beyond.



TOP TIPS FOR CUTTING CARBON FIBRE

WITHOUT THE COMPLICATIONS

Carbon fibre is a favourite material in automotive, aerospace, and high-performance industries thanks to its strength-to-weight ratio and rigidity. However, cutting it can be tricky. Poor techniques can lead to frayed edges, tool wear, and even health hazards from airborne dust. With the right approach, these challenges can be managed effectively, saving time, money, and stress on the workshop floor.

1. Choose the Right Tools

Selecting the correct cutting tools is the first step. High-speed steel blades, diamond-coated tools, and tungsten carbide tips can reduce fraying and wear. For larger sheets or high-volume cutting, consider CNC machines or automated saws to ensure precision and consistency.

2. Control the Feed Rate

Feed rate is critical. Too fast, and fibres splinter; too slow, and heat build-up can damage both the material and the tool. Aim for a steady, moderate pace, and always follow manufacturer recommendations for feed and speed.

3. Use Proper Support and Clamping

Secure the material firmly to prevent vibration, which causes uneven cuts and delamination. Support on both sides of the cut, especially for thin sheets, can dramatically improve finish quality.

4. Minimise Dust and Keep Safe

Carbon fibre dust is not just messy; it can be harmful if inhaled. Use dust extraction systems and wear appropriate PPE, including respirators and gloves. Wet cutting is also an option for specific setups, keeping fibres contained and tools cooler.

5. Plan Your Cuts

Planning the sequence of cuts avoids unnecessary handling and reduces errors. Start with smaller sections or less critical pieces to test settings, then move on to the full components. This approach reduces waste and ensures consistent quality.

6. Maintain Your Tools

Carbon fibre is abrasive, and blades will wear faster than with traditional materials. Regular inspection, sharpening, and replacement extend tool life and maintain cut quality.

7. Train Your Team

Even the best equipment cannot compensate for lack of experience. Training operators on correct techniques, tool care, and safety protocols is crucial for a productive, safe workshop.

Why It Matters

Efficient and clean carbon fibre cutting reduces rework, improves product quality, and protects workers. For high-volume workshops, these tips save time, money, and headaches while maintaining the high standards required in aerospace, automotive, and advanced manufacturing.





F1 FUEL FOR THE FUTURE: HOW SUSTAINABLE BLENDS ARE RESHAPING MOTORSPORT

Formula 1 has long been the proving ground for automotive innovation, and today one of its biggest challenges is fuel. With sustainability at the heart of future regulations, the sport is moving toward fully synthetic and renewable blends that aim to cut carbon emissions without sacrificing performance.

The shift is already underway. In 2026, new engine regulations will mandate 100 percent sustainable fuels. This is not simply a box-ticking exercise but a major engineering leap that demands collaboration across energy companies, racing teams, and governing bodies. The fuels are being designed to perform at the same level as traditional petrol, ensuring no compromise in speed or reliability.

Formula 2 and Formula 3 are expected to run on sustainable fuels ahead of F1, allowing engineers to trial and refine blends before they are rolled out at the top tier. These series act as a live testing ground, ensuring the technology is proven in racing conditions.

Beyond the track, the implications are significant. Motorsport has always influenced consumer markets, and developments in sustainable fuel could play a part in reducing emissions in aviation, freight, and everyday road transport. The intense pressure of racing provides the perfect environment to accelerate breakthroughs that might otherwise take decades.

What is clear is that the next era of Formula 1 will not only be about who crosses the finish line first, but about who leads the charge in redefining fuel for a sustainable future.





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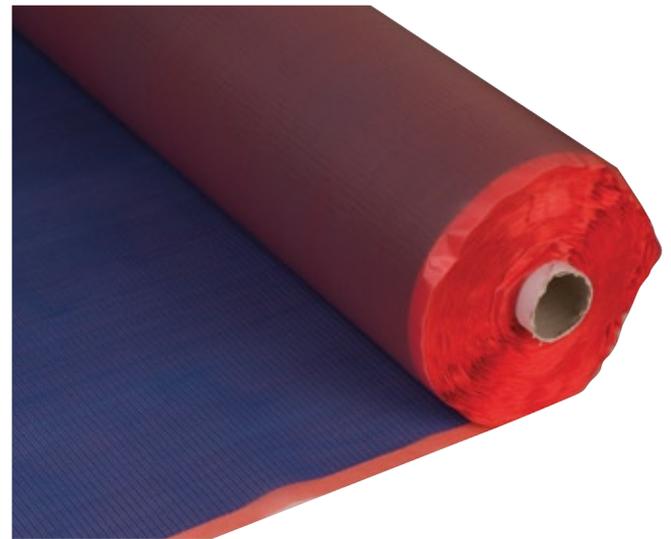
Triplefusion 3-In-1 Mesh, Release Film and Peel Ply **1520mm x 100m**

Unique triple combination of resin flow mesh joined with a perforated release film and peel ply; helps reduce working time and labour costs. Available in medium and fast flow formats.

Specification:

- Medium flow speed
- 135gsm flow mesh
- Combined with P31 release film and nylon or polyester peel ply
- Fast flow speed
- 260gsm flow mesh
- Combined with P16 release film and nylon or polyester peel ply

best for ✓ Large flat panels



Twinfusion 2-In-1 Mesh and Release Film **1450mm x 100m**

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Specification:

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- Combined with P31 release film
- Fast flow speed
- 260gsm flow mesh
- Combined with P16 release film

best for ✓ Medium to large contoured mouldings

ADDITIVE MANUFACTURING: HYPE VS REALITY IN INDUSTRIAL APPLICATIONS

For over a decade, additive manufacturing has been heralded as a revolution in the making. Promises of lighter components, unprecedented design freedom and reduced waste have kept 3D printing in the spotlight. Yet when it comes to high-demand industrial environments, the real picture is far more nuanced.

Where Additive Manufacturing Excels

The ability to create complex geometries with fewer material constraints remains the core strength of additive manufacturing. The aerospace and medical sectors have adopted it for parts where weight reduction or patient-specific design offers clear benefits.

Rapid prototyping also remains a decisive advantage, with lead times reduced from weeks to hours.

New advances in metal printing, particularly powder bed fusion and directed energy deposition, are beginning to deliver parts with properties that rival traditional manufacturing. For low-volume, high-value components, additive manufacturing can already be the most efficient choice.

The Barriers to Scale

Despite its successes, additive manufacturing is not yet ready to replace mass production methods. Build speeds remain slow compared to machining, moulding or stamping. The exceptionally high cost of raw materials, specifically high-grade metal powders, is also a barrier to broader adoption.

Quality assurance poses another challenge. Ensuring consistent microstructures, surface finishes and dimensional accuracy requires intensive post-processing and inspection. For industries such as automotive, where tolerances and reliability are non-negotiable, this makes integration less straightforward.

Energy consumption also remains a consideration. Many additive processes, particularly metal printing, require significant power for heating and cooling cycles, which can impact both operating costs and environmental targets.

The Middle Ground

The real opportunity lies between the hype and the limitations. Many manufacturers are finding value in hybrid strategies, which combine additive manufacturing with traditional processes. Printing near-net shapes and finishing them with CNC machining reduces material waste and speeds up production without compromising quality.

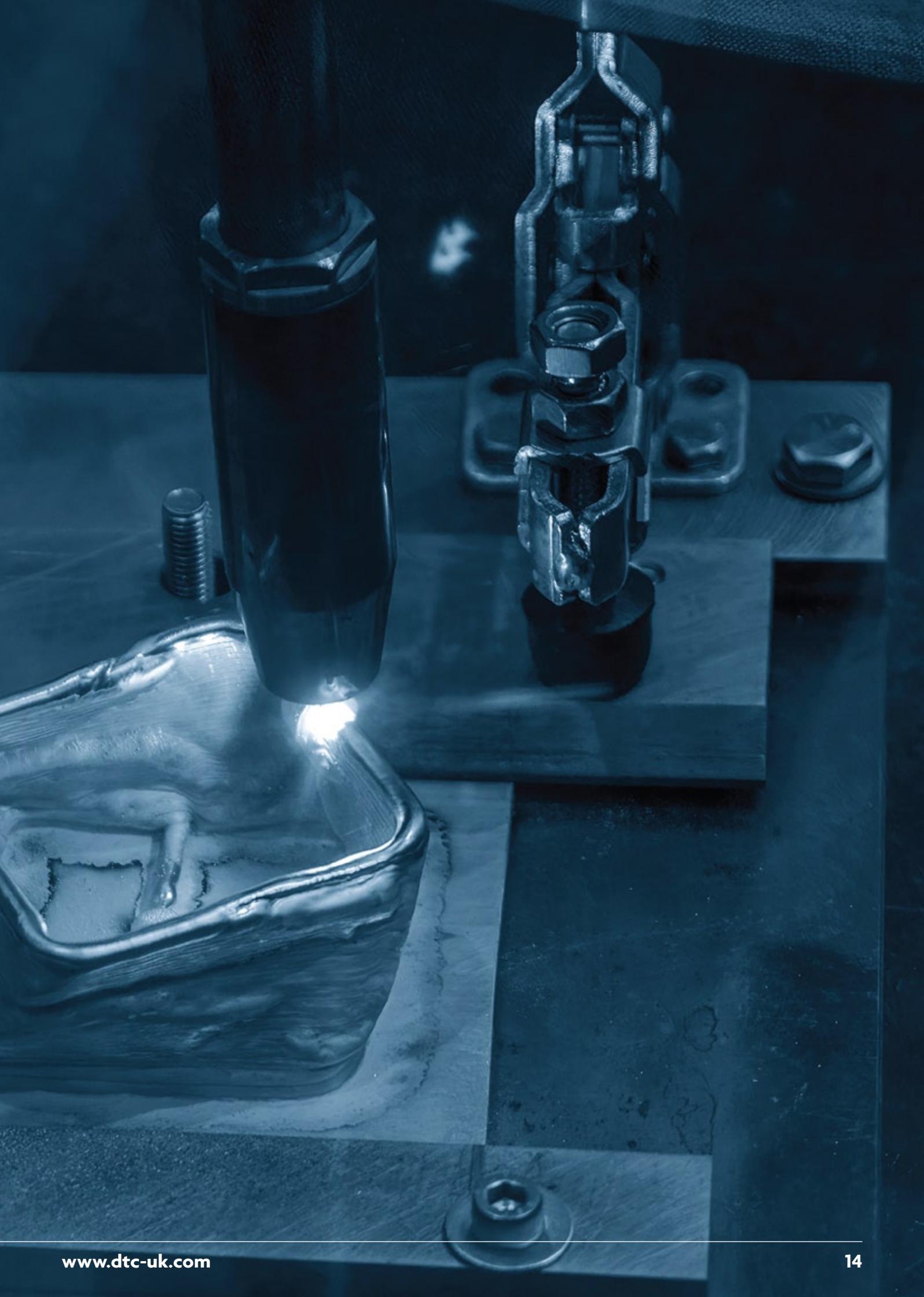
Tooling is another area where additive manufacturing has proven its worth. Jigs, fixtures and mould inserts produced through 3D printing can save significant time and cost while improving flexibility on the shop floor.

Looking Ahead

The future of additive manufacturing will likely be defined by incremental integration rather than wholesale disruption. As equipment improves, materials diversify and certification processes mature, its role within industrial supply chains will continue to expand.

Rather than replacing conventional manufacturing, 3D printing is evolving into a complementary technology. The companies that benefit most will be those that view it not as a silver bullet, but as a strategic tool deployed where it adds clear value.





THE REAL STORY BEHIND TOOL LIFETIME

WHAT IMPACTS IT - AND HOW TO EXTEND IT

In busy production environments, tool wear is often treated as an inevitable part of the job. But tool life is influenced by much more than just frequency of use. Storage conditions, operator habits, working environment and consumable selection all play essential roles in determining how long your tools perform at their best.

Understanding these factors can help reduce premature wear, improve safety and save money across the business. Here is a closer look at the most common causes of tool degradation and what you can do to prevent them.

Improper Storage

Tool care begins before use. Storing tools in damp or cluttered spaces can lead to rust, damage or reduced accuracy over time. This is particularly critical for precision instruments. Introducing organised storage systems, clean workstations, and controlled environments can dramatically extend tool life.

Environmental Conditions

Tools are affected by the air around them. Fluctuations in temperature, high levels of dust or humidity, and exposure to chemicals can lead to corrosion, distortion or general wear. For sectors such as marine, composites and aerospace, managing environmental exposure is vital for tool longevity.

Operator Habits

Even the best tools will wear quickly if used incorrectly. Excessive force, poor handling and skipping maintenance are all common causes of damage. Training staff to follow best practices and encouraging a culture of care can make a significant difference to tool lifespan and performance.

Consumable Compatibility

Using the wrong consumables can accelerate tool wear. For example, an overly abrasive disc or unsuitable cutting fluid can cause unnecessary strain. Always pair tools with the right accessories for the material, process and application to reduce friction, heat buildup, and wear.

Lack of Maintenance Routines

Neglecting simple maintenance can shorten the life of even the most robust tools. Regular cleaning, checking for damage and replacing worn parts all contribute to longevity. Implementing routine inspections ensures tools remain safe, sharp and reliable.

A Smarter Approach to Tooling

Tool life is not just about how often a tool is used. It is about how it is stored, handled, maintained and supported. Paying attention to the details at every stage of a tool's life cycle helps avoid costly breakdowns and ensures consistently high performance.

By focusing on these often overlooked factors, workshops can protect their investment and raise their standards.





LayerLOCK

6 LAYER BOOTH PROTECTION SYSTEM

The BAXT LayerLOCK 6 layer Booth Protection System, is a Seal & Peel coating for spray booths.

The system protects spray booths against dust & overspray, reducing pollution, reducing clean-up time, therefore reducing production and operation costs, resulting in a safer and more productive working environment.

LayerLOCK is a 6 layer system, designed to trap overspray between each layer, then roll up and dispose of, keeping the booth clean and light.

Key Features

- Easy peelable coating for protection of spray booth walls against overspray
- Available in a kit - as a system to provide enough coverage m², for a standard size spray booth
- Provides clean, light working environment
- Easy to apply and peel off wall, (Supplied ready to use, no mixing)
- Can be applied with spray gun or paint roller

Waste

- Dispose as chemical waste



Can be applied with:





SUPPLY CHAINS UNDER PRESSURE:

DEFENCE MANUFACTURING
IN A SHIFTING WORLD



Defence manufacturing is undergoing a period of profound change. Rising geopolitical tensions, disrupted trade routes, and fluctuating costs have put pressure on supply chains that were once seen as reliable. For contractors and suppliers, the challenge is no longer simply about cost efficiency. It is about ensuring resilience and the ability to deliver equipment on time under demanding conditions.

Globalisation brought many strengths to the sector, but long and complex networks are now a vulnerability. Lead times are growing, freight costs have become increasingly volatile, and the risk of sudden disruption is never far away. In this environment, agility is becoming as important as innovation. Defence companies need the ability to adjust sourcing, adapt transport routes and secure critical materials quickly when conditions change.

One response gaining momentum is the move towards localisation. Governments and prime contractors are placing a greater emphasis on working with domestic and regional suppliers. This shift is about more than securing stock. Local partnerships reduce the risks of transit delays, improve oversight of quality and strengthen sovereign capability, which is increasingly seen as essential in procurement strategies. For smaller suppliers, this creates an opportunity to establish lasting relationships within major programmes by demonstrating consistency and reliability.

For suppliers seeking to remain competitive, it is no longer sufficient to meet delivery schedules. Success now rests on offering transparency in sourcing and logistics, adaptability to adjust production and inventory, rigorous adherence to quality and

security standards, and a willingness to innovate in how materials are managed. Those who can combine flexibility with technical excellence are positioning themselves as vital partners in a market that values dependability more than ever.

The resilience of defence supply chains is becoming a strategic asset in its own right. The ability to maintain flow, reduce risk and secure access to critical materials is increasingly tied to questions of national security. Those who invest now in robust, transparent and adaptive approaches will be best placed to deliver the capabilities required in an uncertain future





CASE STUDY:
**LUXURY YACHT
BUILDER CHOOSE
DTC TO UPGRADE
PAINT SHOP FACILITY
WITH LATEST IN SPRAY
BOOTH TECHNOLOGY**



Plymouth, Devon. A prestigious yacht manufacturer located in the historic coastal city of Plymouth, Devon. A need arose at the large manufacturing facility to accommodate specialist refinishing and personalised colour coding procedures and so they reached out to trusted supplier Direct Tool Company.

The luxury yacht building company previously had 3 individual spray booths, 2 of which were standard car-sized booths, and one was 5 meters long. When attempting to spray large fly bridges these booths fell far short of what was required in terms of size. A permanent made for purpose solution was desperately needed.

As such, size was of paramount importance to this project, it was the number one concern. Once a location was identified as suitable to install a booth of sufficient proportions for painting even the largest objects on a regular basis. After a few discussions and a thorough evaluation, DTC presented a recommended solution. This quickly led to approval and sign off from the engineering team and the project began promptly.

DTC installed a single large booth of 20M x 10M X 3.8M (WXDXH). The booth features a sliding door midsection which allows it to be

quickly and easily partitioned into 2 separate 10M booths to allow simultaneous spraying of smaller projects. This partitioned design pattern ensured that the spray booth can always be operating at maximum capacity – regardless of the size of the object that is being sprayed.

“The size and scale of the spray booth that was needed added considerable complications. With some careful calculations the final installation included 4 separate extraction motors / fans, and 2 separate input motors / fans. The burner boxes were 16 meters cubed, which is over 5 times larger than those you’d see in a standard car-sized spray booth!”

Explained Warwick Binks, Head of the DTC Projects division

The ceiling filtration system again surpasses anything that would be installed in a standard spray booth. It has 52 filters installed throughout the booth, as opposed to 4 in a standard car spray booth. Additionally, 24 side extraction filters were installed to remove harmful fumes, and 32 pocket filters were installed within the extraction machinery.

DTC delivered a turnkey solution covering everything from the booth itself through to exhaust and input ventilation systems that lead to the roof. Additionally, DTC installed a paint storeroom and a paint mixing room in the near vicinity of the new booth – further increasing productivity and optimising operative workflows.

DTC delivered the project both on time, and within budget. The end result is that now the luxury yacht manufacturer are now able to have 6 operatives working on two fly bridges simultaneously. They can also transition between smaller and larger objects with the minimum of hassle, and productivity will benefit dramatically as a result.

“May I say you guys did a superb job on site and it was a pleasure having you. In my time I have had a few spray booths fitted but none I have never needed to get 100% involved in to make them meet the deadline without a fuss! Thank you for your support on this project, very much appreciated.”

Said their Operations Manager



TURNING OCEAN WASTE INTO ENGINEERING MATERIALS:

A Q&A



Q: Why are engineers even looking at ocean plastics as a material source?

A: The sheer volume of plastic waste in the world's oceans makes it both an environmental crisis and an untapped resource. By repurposing this waste into composites, industries can reduce reliance on virgin polymers and contribute to sustainability targets.

Q: Are ocean plastics strong enough for demanding applications?

A: Not on their own. However, when processed and combined with fibres or resins, recycled plastics can form lightweight composites with surprising durability. Trials in automotive panels and consumer goods are already showing promising results.

Q: Where is this approach being tested today?

A: Automotive suppliers have begun using recycled PET bottles in interior trim. Sports equipment brands are experimenting with marine plastics in helmets and footwear. While aerospace is more cautious, there is active research into reinforcing ocean-derived polymers for non-structural parts.

Q: What are the biggest challenges?

A: Consistency and quality. Ocean plastics vary in type, contamination, and degradation. Sorting, cleaning, and processing add cost and complexity, making scale a key hurdle. Engineers also need to prove long-term performance before wider adoption.

Q: What could this mean for the future of engineering?

A: If supply chains mature, ocean plastics could become a recognised feedstock for sustainable composites. It is unlikely to replace advanced fibres, but it could play a valuable role in reducing waste and offering lighter, greener alternatives for select applications.

5 WAYS SMART LABELLING CAN SAVE TIME AND PREVENT ERRORS

How better labelling prevents mix-ups in high-volume workshops

In high-output manufacturing and engineering environments, even the slightest delay or mistake can snowball into significant inefficiencies. One of the most overlooked contributors to these issues? ...Labelling.

Whether it's consumables, tools, components or materials, poor labelling creates confusion, misplacement, and wasted time. But with modern solutions like colour-coding, QR codes and RFID systems, workshops can avoid these pitfalls and boost accuracy and productivity in the process.

Here are five innovative labelling methods that are helping manufacturers stay on track:

1. Colour-Coding for Instant Visual Clarity

Colour-coded labels are a fast and intuitive way to group items by type, use, or urgency. Whether used for abrasive grits, adhesives, or safety-critical tools, a consistent colour system helps operators quickly identify what they need, reducing the risk of grabbing the wrong item in a busy environment.

2. RFID for Real-Time Tracking

Radio Frequency Identification (RFID) technology allows items to be tracked in real time, reducing stock discrepancies and helping prevent loss or theft. Unlike barcodes, RFID tags don't require line-of-sight scanning, making them ideal for toolkits, mobile trolleys, and enclosed storage bins.

3. Durable, Industrial-Grade Materials

In harsh workshop conditions, labels need to withstand heat, solvents, dust and abrasion. Using industrial-grade materials with strong adhesives ensures labels stay legible and secure, especially on PPE, containers and rotating tools where standard labels would wear away or fall off.

4. Digital Integration via QR Codes

QR code labelling can link directly to technical data sheets, safety documents, or even training videos. This not only improves traceability but also enhances safety by giving operators immediate access to critical information, without the need to leave the work area.

4. Standardised Labelling Systems Across Departments

One of the biggest sources of confusion comes from inconsistent or ad-hoc labelling. By implementing a centralised system, with clear guidelines on formats, codes and colour use, workshops can eliminate ambiguity, especially during shift handovers or interdepartmental work.

Smarter Labels, Smoother Operations

As operations scale and workshop processes become more complex, the small details matter more. Smart labelling systems don't just prevent mistakes, they enable smoother workflows, better communication, and a safer, more efficient working environment.

If you're still relying on handwritten tape or inconsistent stickers, it might be time to give your labelling strategy a professional upgrade.



THE 80% PROBLEM:

WHY SCOPE 3 EMISSIONS AND COMPOSITE WASTE ARE DERAILING NET ZERO GOALS

A closer look at the hidden majority of carbon emissions and the recycling challenge that's stumping entire industries



The Hidden Majority of Emissions

When manufacturers set net zero goals, they often focus on the emissions they can see and control: energy usage, heating, and on-site processes. These are Scope 1 and Scope 2 emissions. But there's a much larger problem lurking in the shadows.



Scope 3

Accounts for the indirect emissions created across the entire value chain, from the mining of raw materials to end-of-life product disposal. This encompasses supplier manufacturing processes, transportation, product use, and waste management. For many sectors, Scope 3 emissions make up as much as 80 percent of total carbon output.

Tracking Scope 3 is inherently complex, requiring collaboration with suppliers, transport providers, and even customers. Without tackling it, any sustainability claim remains fundamentally incomplete. Yet the statistics reveal a concerning gap: 90% of manufacturers lack comprehensive Scope 3 tracking systems, with 60% citing supply chain data as their biggest sustainability challenge.

The Composite Waste Conundrum

This tracking challenge becomes particularly acute when dealing with composite materials: one of modern manufacturing's most problematic waste streams. Composites are prized across aerospace, marine, automotive, and sporting industries for their strength-to-weight ratio, corrosion resistance, and design flexibility. These same properties make them extraordinarily difficult to recycle.

Consider the aerospace sector: a single commercial aircraft contains approximately 20% composite

materials by weight. When these aircraft reach end-of-life after 20-30 years of service, those composite components (primarily carbon fibre reinforced plastics) become virtually permanent waste. The fibres and resins are so tightly bonded that they cannot simply be melted down like metals or reformed like traditional plastics.

The wind energy industry faces a similar challenge. As first-generation wind turbines installed in the 1990s reach retirement, their massive composite blades are ending up in landfills. A single turbine blade can be over 100 meters long and weigh 15 tons, with most of that weight being non-recyclable composite material.

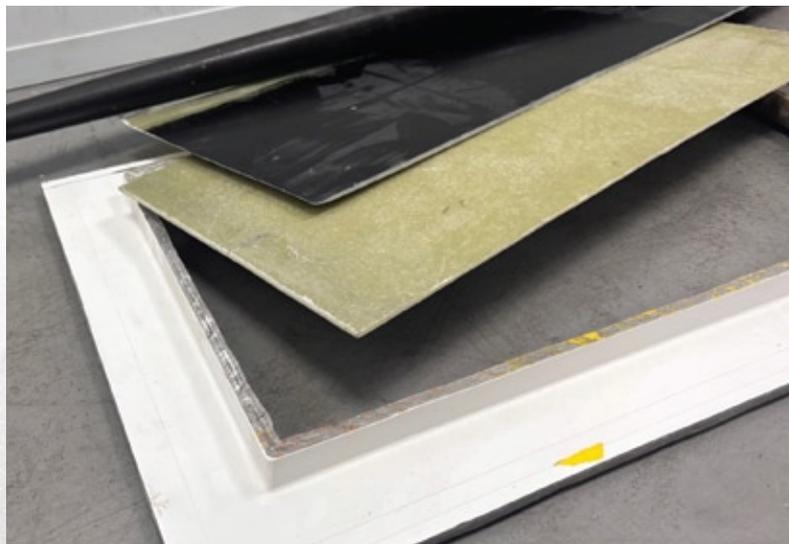
Boeing estimates that by 2030, approximately 6,000 commercial aircraft will be retired globally. Without viable recycling solutions, the composite components from these aircraft represent a mounting waste crisis that directly undermines Scope 3 emission calculations.

Signs of Innovation

Despite these challenges, promising developments are emerging across the recycling landscape. Chemical recycling processes are being developed to break down resins and recover fibres, though energy requirements remain high. Companies like Carbon Conversions and ELG Carbon Fibre are pioneering mechanical processes that can retain fibre integrity at 90% of virgin quality.

Some manufacturers are also embracing design for disassembly approaches. Airbus has begun incorporating removable joints and separable materials in newer aircraft designs. At the same time, BMW's i3 electric vehicle was specifically engineered to allow carbon fibre components to be easily separated during recycling.

However, these initiatives remain largely experimental or small-scale. Mainstream adoption requires significant investment in specialised recycling facilities, government incentives, and unprecedented



collaboration between manufacturers who have traditionally viewed recycling as someone else's problem.

Practical Steps Forward

Manufacturers serious about addressing their full carbon footprint can begin with these concrete actions:

Immediate steps:

- Map your complete Scope 3 footprint, including end-of-life disposal
- Engage suppliers with specific emissions data requirements
- Conduct comprehensive audits of current waste streams

Strategic initiatives:

- Explore closed-loop material sourcing partnerships
- Join industry recycling consortia and pilot programs
- Integrate recyclability requirements into product design specifications

Why action can't wait

Addressing Scope 3 emissions and composite waste transcends compliance targets; it's about resource security and competitive advantage. As regulations tighten and customers demand transparency, manufacturers with comprehensive sustainability strategies will differentiate themselves in an increasingly conscious market.

The companies investing in these solutions today are building the infrastructure and partnerships needed to thrive in tomorrow's circular economy. Those waiting for perfect solutions may find themselves overwhelmed by both regulatory pressure and mounting waste disposal costs.

Composite waste recycling remains one of the biggest missing links in the journey to net zero. But with innovation accelerating and collaboration increasing, that link is finally being forged.



WHAT MAKES THE SOUTH POLE SO HARD?

THE ENGINEERING BEHIND THE ARTEMIS LUNAR ROVERS

When NASA returns astronauts to the Moon later this decade under the Artemis programme, the choice of landing site is far from random. The lunar South Pole has become the centre of attention because of its potential reserves of water ice, locked away in permanently shadowed craters. This resource could one day sustain long-term exploration and even fuel future missions. But the very features that make the South Pole so attractive also make it one of the most demanding environments for engineers to design for.

Extreme Temperatures

Unlike the more familiar equatorial regions of the Moon, the South Pole experiences relentless extremes. Areas in permanent shadow can plunge to minus 200 degrees Celsius, while sunlit ridges can climb well above boiling point. To put this in perspective, Mars rovers like Perseverance deal with temperature swings of roughly 100°C - impressive until you consider that lunar rovers must handle twice that range while cycling between extremes in minutes rather than seasons.

Any rover designed for Artemis must survive, operate, and cycle between these extremes without suffering mechanical or electrical failure. Engineers are developing advanced thermal control systems, heavily insulated batteries, and redundant electronics to ensure survivability. Lockheed Martin's concept vehicle uses phase-change materials and heat pipes like those on spacecraft, while General Motors' design incorporates automotive-grade thermal management scaled up for lunar conditions.

Harsh Terrain

The South Pole is littered with steep crater walls, sharp rocks, and surfaces that have never been compacted by human activity. Unlike Mars, where wind erosion has smoothed many surfaces over millions of years, the Moon's airless environment preserves every impact crater and razor-sharp rock fragment. For a rover expected to carry astronauts and scientific payloads weighing up to 500 kilograms, stability and traction are critical.

Designs under consideration integrate lessons from terrestrial off-road vehicles and planetary rovers, pairing wide wheels or flexible tracks with adaptive suspension. The goal is to create a vehicle that can safely navigate 15-degree slopes through fine regolith and rugged terrain while maintaining precision control. Current prototypes feature wheels nearly twice the diameter of those on Mars rovers, distributing weight to prevent sinking into loose material.

Energy and Endurance

Because of the long shadows and limited sunlight angles at the South Pole, traditional solar-powered designs face severe constraints. While equatorial rovers can rely on predictable 14-day cycles of sunlight, South Pole missions may encounter weeks of continuous shadow. Engineers are testing high-efficiency solar arrays capable of capturing oblique sunlight, battery packs using advanced lithium-sulphur chemistries that perform better in extreme cold, and even radioisotope thermoelectric generators for backup power.

The energy budget is punishing: each rover must power not just propulsion and computing, but also active heating systems, communications systems. Every component, from drive motors to computing hardware, must be optimised to use energy sparingly while still offering reliability across multi-day missions covering distances of up to 20 kilometers.

Human-Centred Design: Beyond Robotics

Unlike previous robotic rovers, the Artemis Lunar Terrain Vehicle will be crewed - a fundamental shift that touches every aspect of design. The cabin must accommodate two astronauts wearing pressurised suits that limit mobility and visibility, requiring intuitive controls that can be operated with bulky gloves. The rover needs redundant life support systems, emergency shelter capabilities, and the ability to serve as a mobile habitat for up to seven days.



Visibility presents unique challenges: lunar dust kicked up by the rover can obscure vision for minutes in the low-gravity environment, while the harsh lighting contrasts of the South Pole create deep shadows where traditional cameras fail. Engineers are incorporating advanced sensor fusion, combining visible light cameras with thermal imaging and LIDAR to create a comprehensive view of the terrain.

The psychological aspect matters too. Unlike robotic missions, where operators can pause and analyse for hours, crewed rovers must respond instantly to crew decisions while providing enough situational awareness to prevent dangerous mistakes. The interface design draws heavily from aircraft cockpit principles, with heads-up displays and haptic feedback systems that work through pressure suit gloves.

The Bigger Picture

These engineering efforts go beyond reaching the Moon. The rovers being designed today will lay the foundation for sustained surface operations and may even influence vehicles intended for

Mars exploration in the future. Technologies being developed for lunar thermal management could prove invaluable for Mars night survival, while the human factors research will inform the design of pressurised rovers for the Red Planet.

The challenge of the lunar South Pole is forcing engineers to combine innovation across multiple disciplines, from energy storage and robotics to human factors and materials science. Success here will validate approaches for even more ambitious destinations: the moons of Jupiter and Saturn, where similar temperature extremes and energy constraints await.

The Artemis rovers are not simply tools of transportation. They are a vital link in enabling humanity's next steps beyond Earth, serving as mobile laboratories, emergency shelters, and the mechanical backbone of lunar exploration. If they succeed, the South Pole may not just be a proving ground for engineering; it could be the gateway to the rest of the Solar System.



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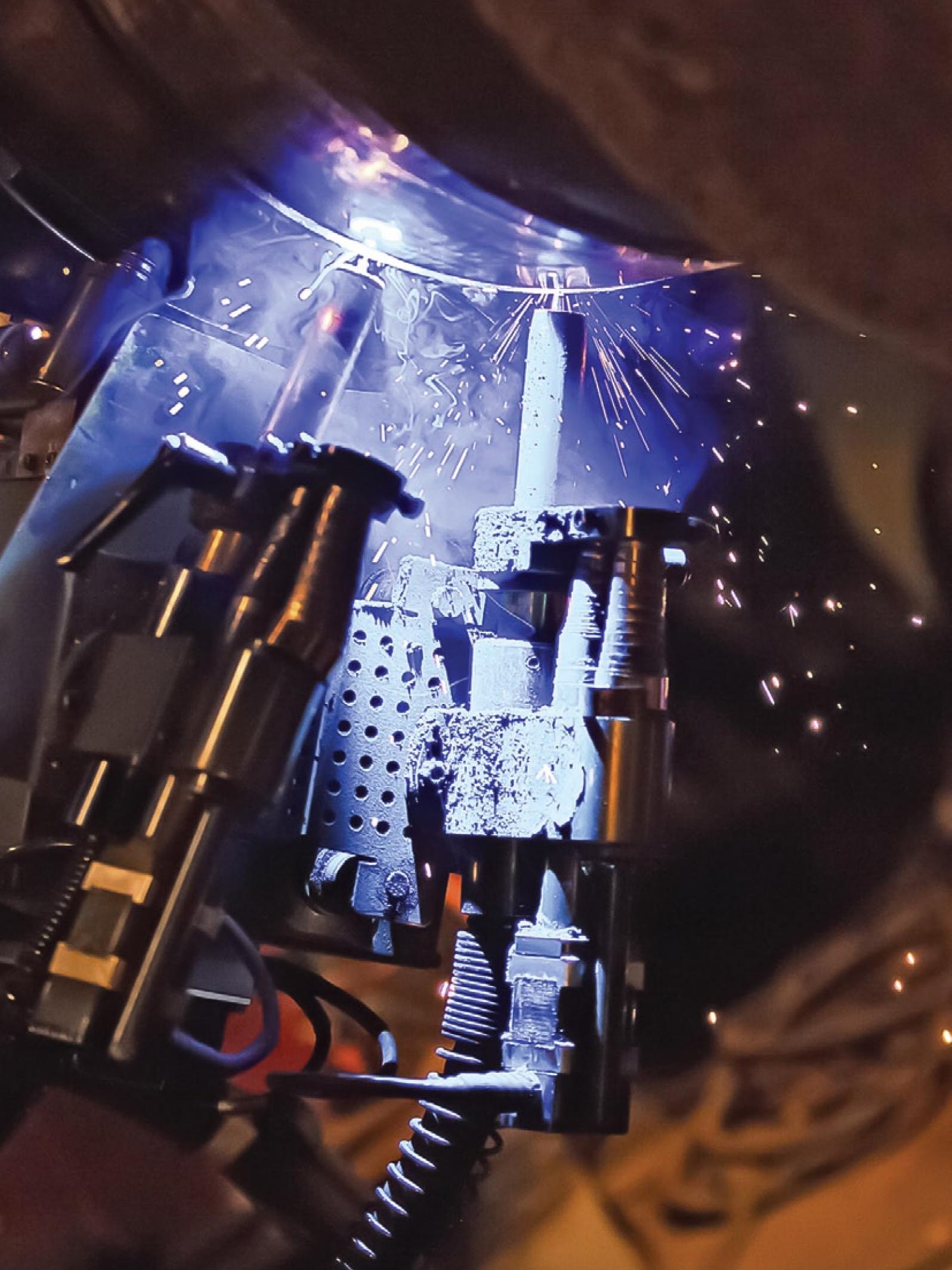
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SURFACE FINISHING TECHNOLOGIES TO WATCH

From plasma treatments to nano coatings, how surfaces are engineered for durability and performance

In modern manufacturing, performance is no longer just about the core material. Increasingly, the difference between a good product and a great one comes down to the surface. The treatment, coating, or engineering of materials has become central to durability, weight reduction, efficiency, and even sustainability.

Plasma Treatments: Cleaner, Stronger Bonds

Plasma technology is transforming how industries prepare surfaces. By altering the surface chemistry of metals, plastics, or composites at a molecular level, plasma treatment improves adhesion without adding weight or bulk. In the aerospace and automotive industries, it is already being used to ensure stronger bonding of adhesives and coatings, while reducing reliance on harsh chemical primers.

Nano Coatings: Performance at the Smallest Scale

Nano coatings are delivering a significant impact in fields where durability is paramount. By layering protective films only nanometres thick, manufacturers can build in resistance to corrosion, abrasion, and even microbial growth. Applications stretch from marine components exposed to saltwater to medical devices requiring sterile protection to tools that stay sharper for longer.

Thermal Spray Coatings: Extreme Protection

In harsh operating environments, thermal spray remains a go-to technology. Whether it is turbines enduring intense heat or industrial machinery resisting wear, spraying molten particles onto surfaces provides a shield that can dramatically extend the lifetime. As sustainability pressures rise, thermal spraying is increasingly being refined to reduce energy consumption and waste.

Functional Finishes for New Demands

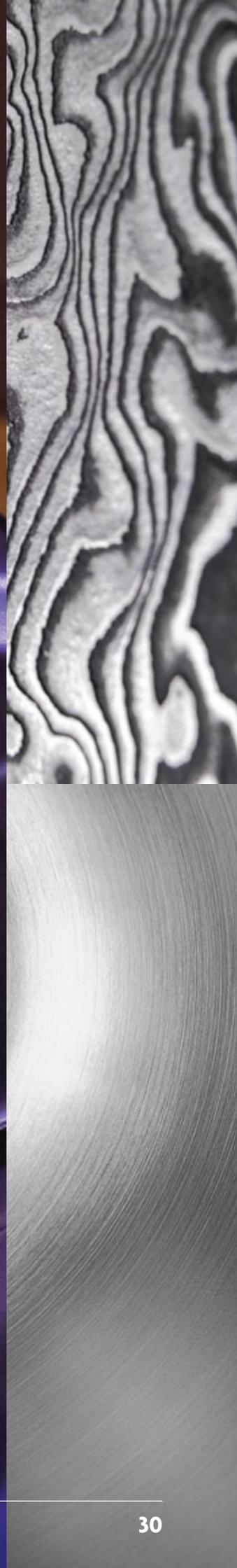
Not all surface finishing is solely about durability. Anti-reflective coatings improve optical performance. Conductive finishes enable the use of lighter components in electronics and defence applications. Hydrophobic

and ice-phobic finishes are in development for the aviation and marine industries, offering potential safety and efficiency benefits.

What This Means for Industry

As manufacturing moves toward lighter, stronger, and more sustainable designs, surface engineering will continue to play a defining role. Emerging finishing technologies promise not just protection, but more brilliant performance.

For industries under pressure to extend component life, reduce waste, and maintain reliability in demanding environments, surface finishing is no longer an afterthought — it is part of the engineering solution





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