Issue 34 • December 2013

Connection

The official magazine of Composites Australia

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Dreamliner launches the composites age

Australia's story behind the revolutionary aircraft

AUSTRALASIA'S LEADING MANUFACTURER AND DISTRIBUTOR OF COMPOSITE MATERIALS

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President's letter

The federal election has come and gone with little debate about manufacturing policy. In my view, governments have a role in creating an environment in which industries can make the most of the opportunities that exist and have the fortitude to invest in new ones. While future challenges are impossible to predict, what is certain is that an economy better able to switch gears, develop innovative solutions, and re-deploy old activities, jobs, and industries will be least susceptible to adversity.

The US economy has long been a bellwether for our domestic market and while there are still powerful headwinds, the underlying condition of the US economy is improving, according to the International Monetary Fund (IMF). Overall, the IMF reports that the improvement in the underlying conditions of the US economy "bodes well for a gradual acceleration of growth". We live in hope that the government's policies to repeal the carbon tax and the mining tax, provide a 1.5% company tax cut and a promise to fund billions in infrastructure projects will stimulate demand for Australian-made goods and lead to sunnier economic conditions.

Against this backdrop, Composites Australia has continued to profile the capabilities of the composites industry and Australian-made composite products and processes through its annual schedule of trade nights and workshops and involvement in events such as National Manufacturing Week.

With the support of the Victorian government, we recently brought US composites expert Bob Lacovara to Australia to present a series of technical workshops on new developments in out-of-autoclave processes, offering potential for new products and new markets for Australian manufacturers. In an interview for this issue on page 8, Lacovara says we are entering a new era for manufacturing. Advanced composite components are no longer the exclusive domain of high performance, high budget projects such as aircraft, Formula 1 racing cars and America's Cup yachts.

A feature of the Australian composites industry, particularly evident in our members, is the willingness to share its knowledge and experiences. We saw this in action at a trade night earlier this year when Clive Watts, Managing Director of Sydney-based CST Composites shared his philosophy of investing 30 per cent of revenue back into R&D to build a global customer base and global opportunities.

More recently, Ken Freeman hosted a closed moulding technology clinic at his company's plant, Tricomposites, in Laverton North, Victoria. This proved a highly successful format for composite practitioners to explore closed moulding technologies, exchange ideas and experiences.

New materials were explored and profiled at a technology workshop at Deakin University's Carbon Nexus - the $34 million pilot-scale carbon fibre production research facility in Geelong. Associate Professor Jeffrey Wiggins, a highly credentialed US expert in composites fabrication and materials science, shared his research on improving the accuracy of modelling techniques that will expedite the development of composite materials into application.

Stimulating innovation through collaboration is the purpose behind the Composites Australia advanced materials network which continues to match capabilities to opportunities.

Your association continued its work to up-skill structural, mechanical and civil engineers in the design and analysis of composites with the delivery of workshops in three states this year. Developed and facilitated by Dr Rodney Thomson, the Program Manager for Design and Analysis at Advanced Composite Structures Australia Pty Ltd, the program introduced the design of structures using advanced composite materials via examples, case studies and problem-solving exercises.

I take this opportunity to thank our speakers, sponsors and everyone involved in delivering such a full program of activities. A glance at the program for 2014 (inside cover) provides a sense of the opportunities that lie ahead.

A highlight of the program is the annual conference. Building on the success of our international composites conference this year, Composites Australia is again partnering with the CRC-ACS and, with the support of Sampe and ACCS, we are working to provide a program that brings the very latest in knowledge and developments on the theme: Materials for a lighter, smarter world.

I look forward to seeing you in Newcastle in April and wish you and your loved ones a safe and very happy festive season.

Genelle Coghlan

NEWS

$12 million plant upgrade for Nuplex

In a welcome sign of confidence in the industry, prominent manufacturer, supplier and industry supporter Nuplex Composites is investing $12 million to increase the capacity of its facility at Wacol, Queensland.
Due to be completed by December 2014, the 12 month construction project will see new and innovative processing technologies introduced, as well as the creation of an additional 10 production jobs.

The plant produces the locally developed range of Polyplex unsaturated polyester resins and Aquaguard gelcoats.

It will continue to operate throughout the upgrade to ensure continuity of supply, said Zel Medak, ANZ General Manager for Nuplex.

Nuplex Composites is increasing the capacity of its Wacol facility.

"Like many manufacturing industries within the region, composites continues to have its challenges, however this investment demonstrates our confidence in the industry and commitment to maintain a robust local supply chain for our loyal customers in both the Australian and New Zealand markets," Mr Medak said.

"We will also continue to invest heavily in research and development to provide our customers with innovative solutions from our technical centres of excellence at Botany in New South Wales, Wacol and Auckland in New Zealand."

Lightweight solution for mines

Responding to market demand, RPC Technologies has designed and developed an innovative lightweight mine ventilation duct made out of carbon fibre.

The carbon fibre duct is Fire Retardant and Anti-Static (FRAS) compliant, half the weight of its fibreglass counterpart, stronger than traditional solutions and can withstand a higher vacuum, says RPC.

"Particular effort was put into defining and sourcing the right type of carbon fibre fabric, resin and foam for the construction to meet customers' requirements without compromising on quality," says the company.

RPC's Virginie Dorbais handles the company's carbon fibre mine vent duct with ease.

The traditional filament winding method of manufacturing, used by RPC for fibreglass pressure pipes and ducting, was not suitable for the new materials. The company developed an alternative method and the necessary equipment to enable the processing of carbon fibre into the filament winding process at the same rate as its usual production.

The lightweight solution decreases WHS risks associated with handling of mine vent ducting during installation, RPC says.

The innovation earned a highly commended at the PACE Zenith Awards

Kiwi leadership change

The October annual general meeting of the Composites Association New Zealand (CANZ) saw Bobbie Mortensen step down as President after eight years in the role. Bobbie passed the torch to Susan Lake

Lake's background is as a composite structural engineer with companies including High Modulus and Gurit. She is currently employed in the manufacturing sector by Core Builders Composites based in Warkworth, New Zealand.

"My primary goal for the coming year is to promote the association and the capabilities of our members to the wider New Zealand industrial and infrastructure sectors," Ms Lake said.

Bobbie said the association fulfilled a vital role in the industry and cited successes in introducing a training qualification, holding the annual conferences, the close working relationship developed with the Marine Industry Association, and the relationship with Composites Australia that sees more New Zealanders attending the Australasian composites conference each year.

"When I took on the role as President in 2005 it was not my intention to hold the position for so long and while I have enjoyed the challenge and achieved many of the objectives I set, it is time for a new face at the helm," said Bobbie.

Aussie composites technology steers America's Cup win

When Australian Jim Spithill steered Oracle Team USA across the line to win the coveted America's Cup in September, in his hands was a piece of Australian carbon fibre technology.

Australian skipper Jim Spithill steers Oracle Team USA to victory in the final race of the 34th America's Cup. © ORACLE TEAM USA / Photo: Guilain GRENIER

Sydney boat builders and composite components specialists McConaghy Boats Australia plucked the brilliant red carbon fibre wheel from their stock after an email from Oracle Team USA in early December 2012.

After some modifications to meet the required specifications, the wheel and associated steering mechanisms were delivered to the Cup defenders. Like the largely Australian crew, the Aussie designed components were critical to the fine control, and therefore the performance, of the massive, predominantly carbon fibre 72ft (21.9m) catamaran, as it powered through the testing course at unprecedented speeds to win the Cup 9-8 over Team New Zealand after a stunning comeback from 8-1 down.

The involvement in the winning yacht, and the subsequent announcement that Australia would be the challenger of record for the next America's Cup, delivered a much-needed fillip for the McConaghy team. Like the rest of the global marine industry, the company has weathered some tough years in the fall-out of the GFC.

While the dates, types of boat, format and rules for the next Cup series are to be determined, excitement is already building in the Australian yachting community.

"It would be a great challenge to unite behind. There are enough skills in Australia – the sailors, the ship building technology – to have a good go at it," says McConaghy Boats project manager Eric Desjardins.

"The design and rules won't be known until early 2014. There will be some restrictions but the organisers typically would allow technological breakthrough."

The company's involvement in the America's Cup goes back to 1991 with the construction of Australia's two challengers for the Cup – Syd Fischer's 'Challenge Australia' and the 'Spirit of Australia' for Iain Murray. Working hand-in-hand with Ford Aerospace, McConaghy researched, developed and produced all the componentry (mast, rudder, keel, wheels, pedestals, etc.) for these yachts.

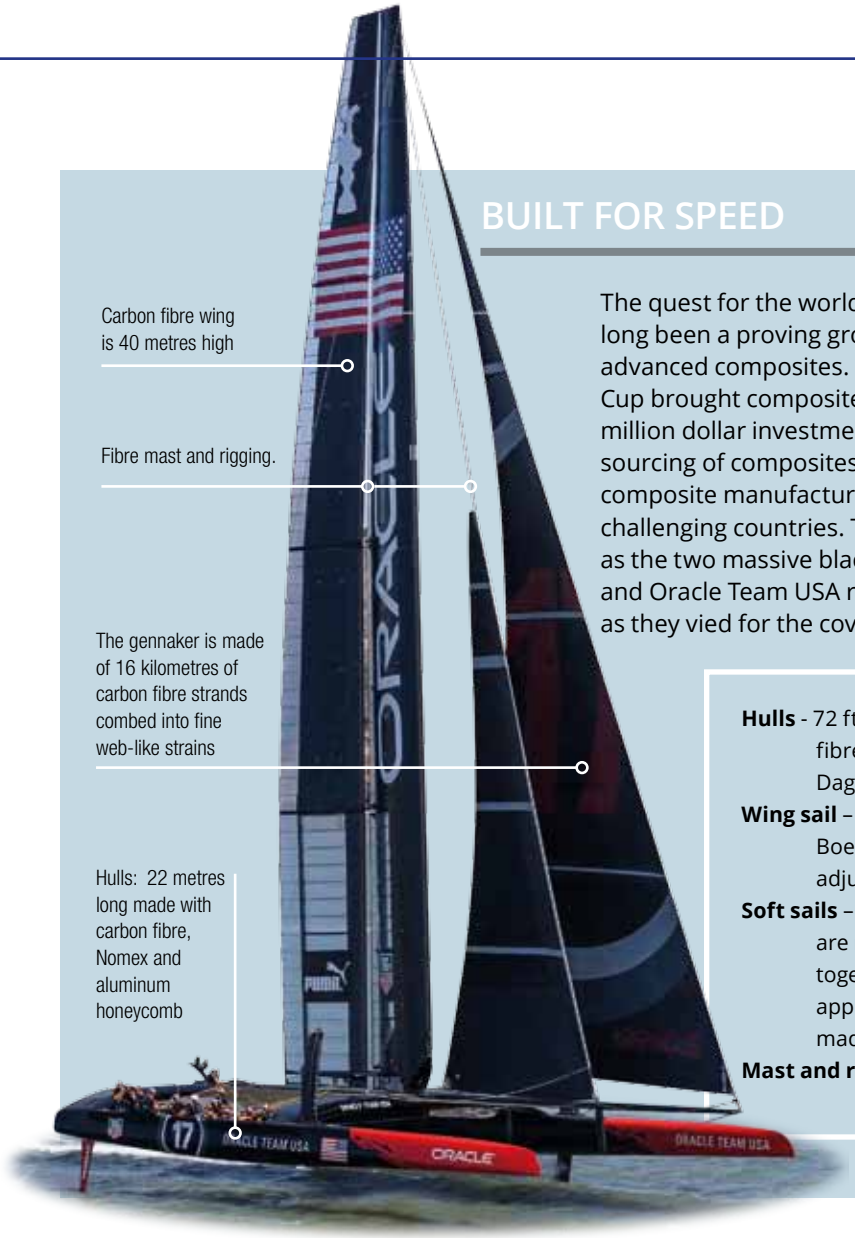
"This led to massive advancements in the design, construction methods and materials providing the foundation for the company's world-wide reputation for our ability to produce lightweight, custom components," says Desjardins.

"Since then, McConaghy has had extensive involvement in the building of every Australian challenger to the America's Cup, as well as producing high-tech componentry for other countries challenging for the Cup."

The company's market extends beyond high performance yachts and yachting componentry. A current project is the supply of custom built GRP components for the Australian Navy's Hobart Class Air Warfare Destroyer project underway in Adelaide.

The company continues to push boundaries and innovate, drawing on a network of Australian marine engineering expertise to engineer and produce carbon fibre or GRP prototypes to ensure the design of its composite parts, especially the highly loaded parts, are absolutely correct. "We are very conscious that crews are out there on the water are relying on our parts for their safety in conditions which can be very tough," says Desjardins.

BUILT FOR SPEED



The quest for the world's oldest trophy, the America's Cup, has long been a proving ground for the performance capabilities of advanced composites. But the new rules for the 34th America's Cup brought composites and technology to the fore. Multi-million dollar investments in research and development and sourcing of composites for the building of the yachts boosted composite manufacturers across the globe, and particularly in the challenging countries. The result was an unforgettable spectacle as the two massive black catamarans Emirates Team New Zealand and Oracle Team USA reached unprecedented speeds on water as they vied for the coveted trophy before a world audience.

Hulls - 72 ft long (22 m) made with carbon fibre, Nomex and aluminium honeycomb Dagger boards, foils and rudder – carbon fibre

Wing sail – 131 ft high (25 ft taller than the wing of a 747 Boeing jet) carbon fibre main element with adjustable flaps

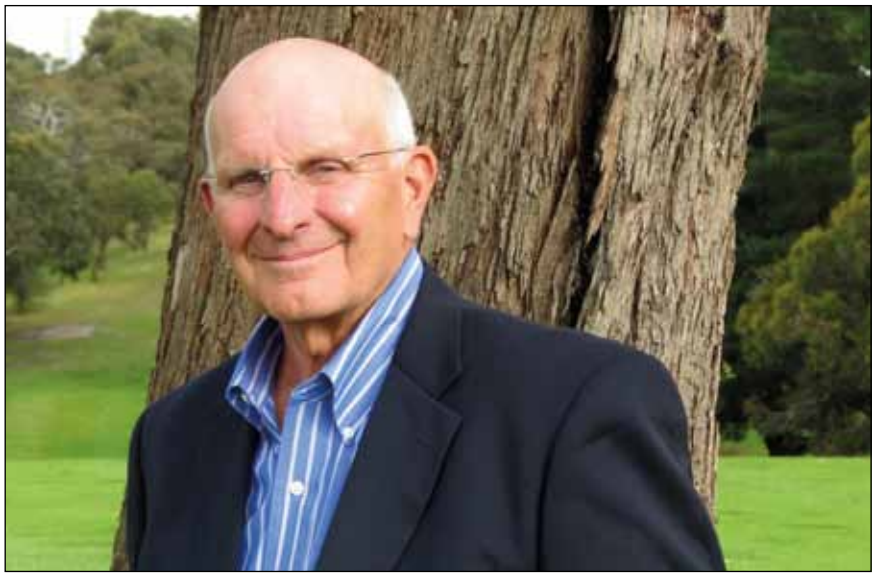
Soft sails – the jib (950 sq ft) and gennaker (2475 sq ft) are made of 3Di: carbon fibre strands combed together into fine weblike strains before applying them into a mould. The gennaker is made of 10 miles of carbon fibre strands

Mast and rigging – high performance carbon fibre

(source: Oracle Team USA)

Manufacturing step-change underway

Globally we are entering a new era for manufacturing, according to US composites expert Bob Lacovara.



US composites expert Bob Lacovara in Australia.

Brought to Australia by Composites Australia, to deliver a series of technical workshops on new developments in out-of-autoclave processes, Lacovara says advanced composite components are no longer the exclusive domain of high performance, high budget projects such as aircraft, Formula 1 racing cars and America's Cup yachts.

Advanced composite materials, such as carbon fibre, are fabricated to provide maximum tensile and compressive properties to lightweight, high performance materials. Traditionally products are cured using high heat and pressure in specialised autoclaves. However autoclaves are very expensive capital equipment, costly to operate and the production cycle time is slow.

While the out-of-autoclave process (i.e. vacuum infusion) can be traced back to the 1940s, recent developments, especially in the materials used in the process, are enabling manufacturers to obtain very similar properties in products that would previously require the costly autoclave technology, says Lacovara.

The emergence of vacuum bag only prepregs that provide better resin flow characteristics, assisting in void reduction, combined with advances in vacuum infusion processing are eliminating the need for an autoclave to produce the desired high performance components.

For consumers of advanced composite products this means greater competition, cost savings and efficiencies. For manufacturers it means opening new markets never before within their reach, says Lacovara.

> **"I believe we may have seen the last aluminium airliner built..."**

"The out-of-autoclave process makes manufacture in advanced composites, using carbon fibre, much more accessible to main-line manufacturers. The cost of equipment is a lot more affordable and that brings advanced composites within the reach of more manufacturers than in the past. At the same time it reduces the cost of advanced composites and therefore we are starting to see opportunities for greater use."

Lacovara says out-of-autoclave processing is taking off in the aerospace industry. See page 10 for details of how Boeing is using out-of-autoclave processing in the manufacture of its 787 Dreamliner. Lacovara also cites the adoption of vacuum infused composite out-of-autoclave technology by Bombardier to produce the carbon fibre wing skins for their C Series aircraft.

For Lacovara the developments mark an end of an era. "I believe we may have seen the last aluminium airliner built. By all accounts, the aerospace industry is predicted to grow at about 14% a year over the next decade and composites is going to grow with that market as well as increase market share."

Similarly, Lacovara predicts market growth in the automotive industry, driven by the pursuit of lightweighting of vehicles in a climate of high fuel prices and government regulation.

"We are seeing the game changing. While the raw material costs more, we are seeing advanced composites gaining market share in the automotive industry, on the basis of performance, especially in Europe where fuel prices are so high," he says.

Lacovara says the Australian workshops aimed to demonstrate that the processing of advanced composites using out-of-autoclave technology was within the means of many composite manufacturers.

"Change is not going to happen overnight. It may take 10 years but the opportunities are now there for manufacturers across many markets."

For the 2014 Calendar of Events see the inside back cover or go to www.compositesaustralia.com.au/events

Sykes has sights on gold at Rio

Sykes Racing is on a mission to produce the fastest rowing boats on the water at the 2016 Rio Olympics. As with all contemporary elite water sports, the innovative use of composites and new technologies will play a key role in achieving this goal.

Success in elite rowing comes from a combination of an excellent crew and pushing the limits of design and composites technology, achieving minimum weight and maximum speed.

Since its first World Championship in 1974, Geelong-based Sykes has worked closely with Australian rowing teams, providing the platform for four Olympic and 17 World Championship wins. Over the years, the Sykes team of leading designers, engineers, technicians and composite craftsmen, in collaboration with top international competitors and coaches, has developed numerous performance boosting innovations that have become the global standard in elite rowing boats. "For us, innovation comes through collaboration in design, construction and testing in partnership with world leaders in technology and the sport, so that our boats evolve in every possible way, giving the crews the competitive advantage," says Managing Director Jeff Lawrence.

With the assistance of a Victorian Government grant, Sykes has recently invested in a five-axis head-milling machine, allowing them to produce a finely finished product with greater precision and speed from the point of design to manufacture. The CNC technology takes a design directly from the computer to finished moulds in a matter of hours.

"Using advanced computer modelling we can now evolve and test designs faster than ever before," says General Manager Stuart Wilson.

The road to rowing gold starts here, with the new CNC technology installed at Sykes Racing.

While Sykes knows what to expect from the new technology in some areas, the company is keen to explore its potential for improvements in other aspects of the production line, and through partnerships and collaboration with other organisations.

Dreamliner launches the composites age

October 2013 marked the arrival of Australia's first Boeing 787 Dreamliner. This is Australia's story behind the revolutionary aircraft.

Boeing's 787 Dreamliner marks the beginning of a new era in commercial aviation – the advanced composites era.

The 787 is the first commercial aircraft to use advanced composites to such an extent – by weight, 50 per cent is composite materials. A majority of the primary structure is made of composite materials, most notably the fuselage.

The choice of materials was driven by Boeing's decision to develop an aircraft with the lowest operating costs over the life of the airplane. Selecting optimum materials required analysis of every area of the airframe to determine the best solution based on the operating environment and loads experienced over the airplane's life.

That's where Boeing Australia subsidiary, Boeing Aerostructures Australia, came to the fore, winning the right to manufacture the critical control surfaces of the 60.1 metre wings for the 787 series. It was a highly competitive process that sees the aircraft assembled in Everett and Charleston, USA from components produced from around the globe.

The win was the culmination of many years of work for Michael Edwards and the Boeing Australia team.

"From a research perspective we are the largest for Boeing outside the US. We have 30 people on-site, all working on composites," says Edwards, General Manager of Boeing Research and Technology – Australia.

While most manufacturers were using pre-preg composites, the Melbourne-based team developed, tested, certified to the strict aviation standards, and then put into production their innovative resin infusion composite technology. This process removes the need for a traditional autoclave oven process, significantly reducing costs. The breakthrough is the culmination of many years of refinement and development of work undertaken some 10 years ago in a Boeing Aerostructures Australia collaboration with the Cooperative Research Centre for Advanced Composites Structures (CRC-ACS).

"It was the new technology that came with resin infusion technology and the team's proven expertise to take the innovation to production that was our unique differentiator and earned us the place on the 787 program," says Edwards.

"Today, Australia is recognised as home to one of the world's leading centres for the manufacture of advanced composite structures, building critical control surfaces for the 787 Dreamliner and exploring new applications of resin infusion for future airplane developments." – Boeing

"Our challenge was to take a development program to commercialisation and the production of 10 pairs a month for delivery on schedule to Seattle."

To achieve its goal, Boeing has invested several hundred million Australian dollars in technology and skills at its Fishermans Bend plant to support delivery on the 950 orders for the 787-8 and future derivatives planned for the Dreamliner.

Some 1,600 people are now employed at Fishermans Bend with the vast majority involved in the Dreamliner production line.

A shining example of lean manufacturing theory in practice, the production line brings together advanced composites technology, robotics and technical and engineering expertise to take the raw carbon fibre from lay-up for each of the four moveable trailing edge wing components, through the resin infusion process and curing ovens and on to assembly. Quality and adherence to production timelines are monitored

throughout to meet the Everett assembly schedule.

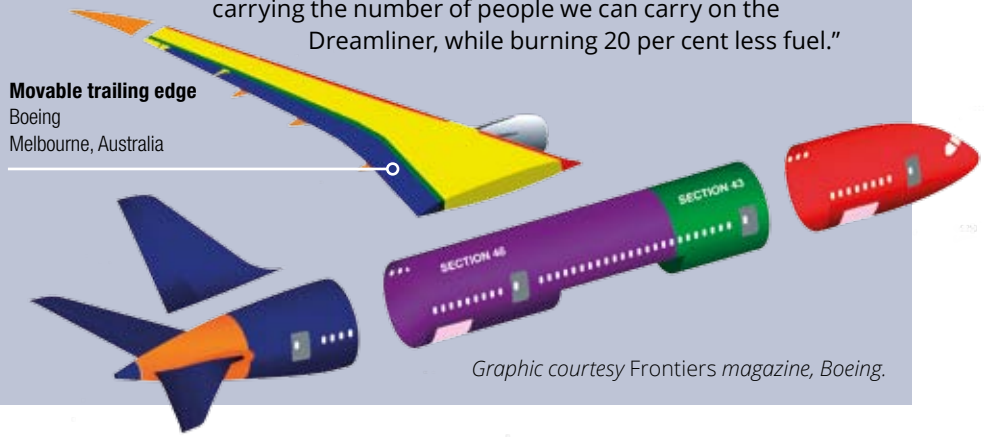
Boeing enthusiastically hails the success of the Australian group on its website: "Today, using this technology, Australia is recognised as home to one of the world's leading centres for the manufacture of advanced composite structures, building critical control surfaces for the 787 Dreamliner and exploring new applications of resin infusion for future airplane developments."

While Edwards is obviously extremely proud of his team's achievements to date, Boeing Research & Technology – Australia is looking to the future.

"Now we've proven resin infusion for the 787 design our research focus is on achieving step changes that will increase productivity and reduce parts count and applying these to future programs," says Edwards.

THE COMPOSITE AGE FLIES IN

"There was the jet age, then the 747 arrived, and then there was the Dreamliner," says Jetstar Dreamliner pilot Captain Jeremy Schmidt. "I think the composite design, along with the other special features of the 787, make this a defining moment in aviation. Carbon fibre allows you to do things you couldn't do before and the wing is one example. You can't get the aerodynamic shape with aluminium that you can get with composite, so using the composite has allowed the design engineers to make a more efficient wing. It's just another reason why this aircraft has a lower fuel burn. It's a milestone in aviation because it's not often you see an airplane carrying the number of people we can carry on the Dreamliner, while burning 20 per cent less fuel."



Graphic courtesy Frontiers *magazine, Boeing.*

Mechanically Fastened Joints in Composite Structures

Composite Engineer's Viewpoint
By Rik Heslehurst PhD, MEng, Beng (Aero) FIEAust, FRAeS, CPEng

Part 10 – Ply Configuration Effects

In this article we consider laminate configuration effects. Configuration effects are both the percentage of fibres in any one direction and the through the thickness placement of the plies. Both of these aspects require an understanding of the effects on structural performance of mechanically fastened joints in composite structures.

Ply orientation percentage effects have been considered on both mechanical property and stress concentration issues. Figures 1 and 2 both show the ply orientation variation effects on bearing and shear strength of specific laminate material. Clearly mechanical joint performance is impacted from ply configuration changes. Likewise the ply orientation percentages changes the stress concentration level for net tension stresses and bearing stresses as seen in Figure 3 and 4, respectively.

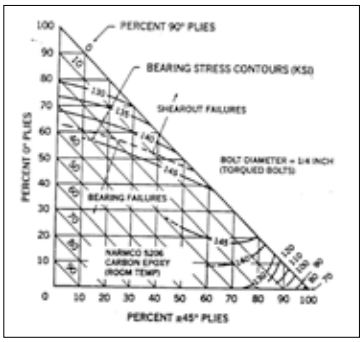


Figure 1: Bearing Strength with Ply Orientation Changes (Hart-Smith)

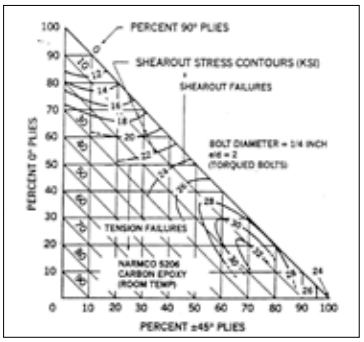


Figure 2: Shear Strength with Ply Orientation Changes (Hart-Smith)

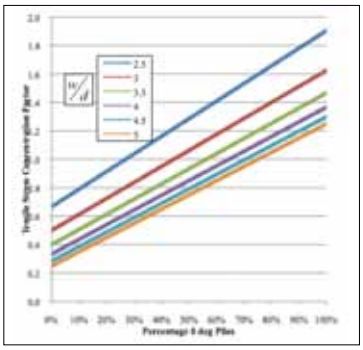


Figure 3: Tensile Stress Concentration Factors with Ply Orientation Changes

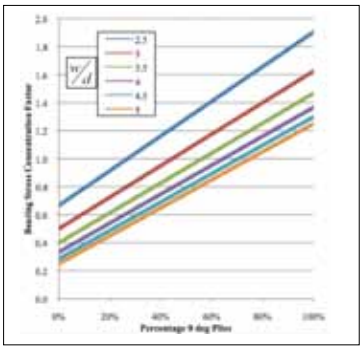


Figure 4: Bearing Stress Concentration Factors with Ply Orientation Changes

Ply stacking sequence has previously been shown to have an effect on the flexural rigidity. As seen in Figure 5 the fastener rests on the elastic bed of the laminate thickness. The positioning of stiffer plies towards the outside of the laminate will change the flexural support bed characteristic. Hence, the deformation and support of the fastener can be then modified by the bending stiffness parameter:

$$k_b = E_1^f / E_1^o$$

Where:
E_1^f – Effective flexural Young's Modulus
E_1^o – Effective flexural Young's Modulus

Changes in the ply configuration by varying the percentage of plies in the various directions not only influences the stress concentration factors, but also modifies the multi-row fastener first and subsequent ply load share. Figure 6 illustrates the relationship between the fastener bending stiffness (K_f) and laminate axial stiffness (K_{plate}) for a 3-row fastened joint. The values of the fastener stiffness and plate stiffness are as follows:

$$K_{plate} = \frac{EA}{L} \propto Et$$

$$K_f = \frac{1}{C}$$

Where:

$$C = \frac{8}{t_{av} E_f} \left\{ A \left(\frac{t_{av}}{d} \right)^2 \left[B + \left(\frac{t_{av}}{d} \right)^2 \right] + H \right\}$$

The various parameters are explained in Nui.

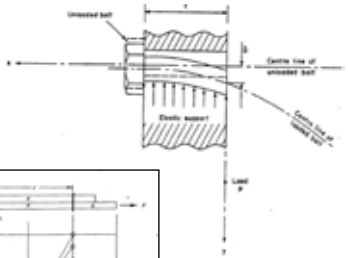


Figure 5: Fastener Bending on an Elastic Bed (Engineering Science Data Unit)

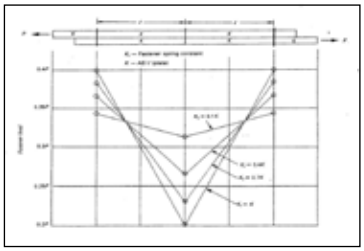


Figure 6: 3-Row Fastener Load Share with Varying Fastener Stiffness to Plate Stiffness Ratio (Michael Nui)

To view all articles in this series go to www.compositesaustralia.com.au. In the next article we discuss off-axis loading – because composite laminates are generally orthotropic, any loading off the material axis results in general orthotropic behaviour. This has significant implications for the laminate design with fasteners that are loaded off-axis. I welcome questions, comments and your point of view. I may publish your questions and comments, and my response in future newsletters.

For information. Email r.heslehurst@adfa.edu.au

Quickstep ramps up production

The former Boeing Bankstown Airport facility is once again humming with activity as Australian-based advanced composites manufacturer Quickstep ramps up production of parts for the Joint Strike Fighter (JSF) program and Lockheed Martin's C-1301 Super Hercules.

Some 80 people are now working on the production line to ramp up output to 1800 carbon fibre parts a year for the JSF program. By the end of 2013, the plant will have shipped approximately 196 JSF parts to the US, Quickstep Managing Director Philippe Odouard says.

The plant is also gearing up for full production of the carbon fibre wing flaps for 24 aircraft a year for Lockheed Martin, a contract won against international competition.

The two major aerospace military contracts mark a major milestone for the company – the transition from predominantly research and development to commercialisation, manufacture and globalisation of markets.

Odouard credits the company's success to its technical creditability built on peer-reviewed research and development in composites technology; knowledge of the aerospace and composite markets; and its multi-national structure. The company has been operating in the US since 2004 and in Germany since 2007, where its operations are primarily focussed on R&D and marketing. Australian government assistance was also "very helpful" throughout the process, said Odouard.

Production is currently based on traditional autoclave processes but the company is working towards qualifying aerospace parts using its patented Quickstep Process system for manufacturing large carbon fibre components. "So far there have been half a dozen of these machines produced. They are used by ourselves or have been sold to research institutes and other manufacturers," says Odouard.

The out-of-autoclave process moulds carbon fibre components using resins and technology developed by Quickstep.

The biggest sale of the technology, valued by Quickstep at EUR4.2 million, has been to leading Russia-based aircraft composites manufacturer ORPE Technologiya in July this year. ORPE will use the process to manufacture carbon fibre shields for space satellites used for telecommunications, navigation and meteorology, says Odouard. "The parts encase the top of the satellite for the first minutes after launch and then they are discarded. When you accelerate at launch you need a strong aerodynamic structure to protect the satellite and keep friction to a minimum," he says.

Above. Quickstep CEO Philippe Odouard

"ORPE traditionally use autoclaves but they are expanding the quantities they need to produce and came across our out-of-autoclave process. We showed them our machine in Germany and they sent us some of their material to demonstrate its capability."

Odouard admits introducing new technology and processes to the conservative aerospace and automotive markets has been a long tough road since the first technology patents in 2001. A team of 20 R&D staff ensures innovation and development remains a priority for the company.

"Up until 2008/09 our focus was on developing the technology, working with universities to prove it works and trying to get it recognised," says Odouard. The challenge was: how do we industrialise the technology and get it recognised and sold into the aerospace market? We license the technology; make the machine and manufacture components. That's the Quickstep business strategy today."

Left. Artist's representation of satellite shields to be built by ORPE using the Quickstep Process and technology.

Information: www.quickstep.com.au.

Skycraft redefines the future of freestyle motocross

A combination of Australian vision, creativity, motorsport engineering excellence and composites expertise has come together to create the world's first purpose-built freestyle motocross machine.

Officially launched in October to an international audience at the American International Motorcycle Expo in Florida, Skycraft is a collaboration between the Australian street wear company Unit and world-renowned motorsport entity Triple Eight Race Engineering Australia.

Conceptualised by Unit co-founder Ian Everest and engineered by Ludo Lacroix of Triple Race Eight Engineering Australia, the Skycraft prototype challenges conventional motorcycle design rules.

With weight reduction a central goal, Skycraft is constructed almost entirely from carbon fibre and titanium components. At just 75 kilograms (165 pounds), the bike is over 25 per cent lighter than a standard motocross machine.

The eye-catching Skycraft showcases Australian carbon fibre expertise.

Using their expertise in manufacturing bespoke composite components and prepreg autoclave technology, LSM Advanced Composites in Queensland built the heavy duty carbon fibre monocoque frame, which contains the fuel cell, as well as the carbon fibre swingarm, which has the muffler integrated inside it.

Meanwhile, Lightning Composites, also based in Queensland, went back to "old school methods" to build the radically designed tail piece combination of a seat, mudguard and grab handle, radiator shroud and number plate.

Both companies are long-standing suppliers of composite components to Triple Eight Race Engineering, best known for their Red Bull Racing Australia Super V8 racing cars.

LSM Managing Director Liam Mahoney said: "This was a particularly enjoyable challenge. When Ludo contacted us with the intricate specification for the bike our composite design team was proud to have the opportunity to work with him in formulating a solution for this unique project. The detailed CAD was extrapolated into our robot machining facility to produce a tooling board mould especially for rapid autoclave prototype manufacture.

"Considering a FMX (Freestyle Motocross) bike is required to perform spectacular leaps into the air, designing a laminate that provides the structural integrity for the landing, whilst incorporating the fuel cell and the muffler in the swingarm, certainly had some deep and thoughtful design moments," Mahoney said.

Lightning Composites Director Bruce Mooring, a motorbike enthusiast and keen motocross rider, is also clearly proud of his team's contribution and has praise for the "very nice job" done by LSM.

Unit's Skycraft provided a rare opportunity to showcase his team's innovation and skills in producing high performance motorsport components, a market that normally demands absolute confidentiality.

"We have been doing the composites components for Red Bull cars for years but everything is understandably top secret so this is one of the first things we have built that we are allowed to show to the public," Mooring said.

With a rough drawing of the number plate and a foam mock-up of the tail piece and radiator shroud, Lightning had scope to innovate and contribute something special.

"We were given a fairly open brief and, as is commonly said, had to perform composite miracles," Mooring said.

"They were built through old school methods, from building the wooden moulds through to using vacuum infusion."

Unit's Everest said: "The original design brief recognised the opportunity for an 'out of the box' product for freestyle motocross. All other forms of motorcycle sports use purpose built machines.

"As an experimental platform, Skycraft will allow for test data and rider feedback to lead towards a potential production bike."

Nexus for carbon fibre research

Kerryn Caulfield with Jeffrey Wiggins

More than 100 delegates from the composites industry and research community attended a technology workshop with Associate Professor Jeffrey Wiggins, a highly credentialed US expert in composites fabrication and materials science.

Organised by Composites Australia and hosted by Deakin University at the Waurn Ponds campus, delegates were treated to a sneak preview of the Carbon Nexus facility – the $34 million pilot-scale carbon fibre production research facility.

Associate Professor Wiggins, Director of the School of Polymers and High Performance Materials at the University of South Mississippi, has extensive industry-based R&D experience. He spoke on his current research which focuses on improving the accuracy of modelling techniques that will expedite the development of composite materials into application.

The presentation provided insight into the complexity of research underway around carbon fibre and the collaborative effort of two US universities with Deakin to develop knowledge on the production of carbon fibre. The University of Southern Mississippi, which is working on precursor polymers, sends material to the University of Kentucky, to convert it to a "white fibre" precursor that is sent to Deakin, to convert to carbon fibre on the Carbon Nexus "single tow line" - the laboratory-scale apparatus that enables a single bobbin of fibre to be converted to carbon fibre.

Growing production defies the challenges

Victorian manufacturers, Revolution Fibreglass, are going from strength to strength.

Launching the company's newly expanded premises, State Minister for Manufacturing, The Hon. David Hodgett MP said that Revolution was "a terrific example of a local manufacturing firm that is successfully overcoming industry challenges. The new facility will give Revolution the space it needs to manufacture an even larger range of fibreglass products."

Over 100 guests from industry and government attended the event, organised by Composites Australia and hosted by owners Robert Miller and Shane Robertson.

Miller said the expansion, the purchase of new technology, and a commitment to training the next generation of composite technicians, marked a new era in the company's development.

Established over 40 years ago, Revolution has undergone a period of rapid expansion since Robert Miller brought the company in 2006, growing from a staff of two to 13.

The company manufactures a range of fibreglass products, including caravan components, slides, showers and shower bases, nose cones, car parts and steam vacuum machines, exporting to America, England and Malaysia.

Composites Australia CEO Kerryn Caulfield said the night was a celebration for all sectors of the industry. "Revolution Fibreglass is an excellent example of how the composites industry can meet the growing demand for lighter, more durable, high strength components and products," she said.

Both the Minister and Ms Caulfield commended Miller and Robertson on their support for the Victorian Composites Trade Certificate III program, a joint initiative of Composites Australia, Manufacturing Skills Australia and Kangan Institute. The company has two apprentices enrolled in the course and provides industry-based experience for a further seven.

Mr Hodgett said that the Victorian Government was critically aware of the challenges facing manufacturers. "I know that, every day, manufacturing firms deal with a high Australian dollar, intense import competition, high energy costs, weak local confidence and shifting consumer preferences," he said.

For information: on Victorian Government programs to assist manufacturers go to www.business.vic.gov.au/grants-and-assistance

Growing product range: Robert Miller (centre) shows Victoria's Minister for Manufacturing David Hodgett and Composites Australia Chief Executive Kerryn Caulfield the first batch of radomes manufactured to the design and specifications of a contractor to the armed forces.

New Members

CDR Polymers

The team behind Custom Designed Resinous POLYMERS (CDR Polymers) offers almost a century of experience in composite polymers.

Founded in 2010, the team comprises former Monsanto/Huntsman Chemical Company employees, each with 30 years or more of technical service and resin development experience in composites and a global R&D network.

They support the Australian composites industry with innovative resins, vinyl esters and gelcoats, technical support and the development and production of custom-designed resins.

CDR Polymers can custom design polyester laminating resins, gelcoats, flowcoats and vinylesters plus resins for infusion/RTM, corrosion, pultrusion, sheeting and for sheet moulding and bulk moulding compounds (SMC and BMC).

The company's manufacturing facility and laboratories are in Melbourne, supported by warehousing in Melbourne and Brisbane.

Contacts:
Enzo Palma – m: 0404 003 294
Geoff Houghton – m: 0466 553 779
Keith Ayres – m: 0490 009 776

D & H Enterprises

D & H Enterprises Pty Ltd

D & H Enterprises Pty Ltd specialises in composites for the automotive and marine industries, consultancy and education.

Formed in 1982 and based on the Mornington Peninsula in Victoria, the company provides specialist repairs, parts and mouldings to composite sports cars including Austin, Bolwell, Cobra, Corvette, Ferrari, Healey and Lotus.

The company's project portfolio includes involvement in the development of solar powered vehicles and innovative products such as Human Powered Vehicles (HPVs), composting machines for the poultry industry and sport equipment.

Company director Don Elliott has been involved in the composites industry since 1973 and was an active Committee Member of the Composites Institute of Australia (CIA), Victoria, during the 1990s and a member of the inaugural committee to develop composites training courses for the Victorian composites industry which are replicated in other states of Australia.

While semi-retired from the composites industry, Don continues to consult to various education facilities in the field of composites and project-driven learning.

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W: www.dhenterprises.com.au

Fly Synthesis Aust P/L

Victorian-based light aircraft agent, Caz Monteleone (above) is gearing up to enter the export market with an Australian designed and manufactured light aircraft.

"Our plan is to use advanced composite materials and manufacture efficiently and economically to be competitive in the world market," says Caz.

The owner and founding director of Fly Synthesis Australia, the aircraft will be the realisation of a plan that began when he learned to fly in 2003. That challenge brought composites and Caz together - he calls it "the synergy".

At that time most recreational planes were either made from riveted aluminum or rag and tube. While gliders had used composites for some time, it wasn't very common to see their use in light aircraft, other than for fairings and non-structural parts, says Caz. Wanting to buy an aircraft and to keep up with technological advancements, Caz began to consider the pros and cons of aluminum versus composite construction.

"I became convinced that my aircraft had to be made from composites. With its better corrosion resistance, strength to weight ratio and, more importantly, fatigue resistance, it was a no brainer," he says.

In 2004, Caz became the Australian agent for Fly Synthesis, an Italian company specialising in the manufacture of composite light aircraft. The business has expanded from importing and selling the Fly Synthesis range to providing repairs, manufacture of small parts, as well as modifications to existing designs.

Based in Donnybrook, Victoria, the company has an airstrip and service hangar where the team, including a mechatronics engineer experienced in composites, a CAD designer and, more recently, a composites apprentice, are working on the development of the new aircraft.

"In the near future, we will be exporting aircraft and no longer importing," says Caz.

Contact: www.flysynthesis.com.au

2014 AUSTRALASIAN COMPOSITES CONFERENCE

Materials for a lighter, smarter world

April 7 to 9, 2014 Newcastle, Australia

After the success of their 2013 conference, Composites Australia and the CRC-ACS are again partnering to present the 2014 Australasian Composites Conference to be held in Newcastle, NSW on 7 to 9 April.

With the theme ***Materials for a lighter, smarter world***, the conference program will cover every aspect of the composites value chain through industry presentations and academic papers showcasing innovations, engineering applications and fabrication solutions with a focus on the latest developments in areas such as:

- weight reduction for energy efficiencies
- novel designs and processes
- performance modelling
- materials of the future.

"We are fortunate to have the support of SAMPE and the ACSS in developing an outstanding program of topics and speakers," says Kerryn Caulfield, Chief Executive, Composites Australia.

"The conference brings together local and international speakers and attendees from key industries, including aerospace, automotive, building and construction, civil infrastructure, energy, marine, mining and transport. It provides the industry with an excellent platform for interactive discussions and networking across the composites value chain of raw material and equipment suppliers, manufacturers, distributors, design and engineering consultants, government and research and development organisations."

Nicholas Melillo, from Boeing, is heading to Newcastle to present a keynote address to the Australian industry.

Keynote speaker

Nicholas Melillo, a senior manager in the Boeing Company Research and Technology business unit, will deliver the keynote address. Melillo currently leads the Advanced Design Technologies Organisation, a team that develops and implements innovative solutions for Boeing products.

He has participated in the development of several Boeing products, including the RAH-66 Comanche, V-22 Osprey, YF-23, F/A18-E/F Super Hornet, MD-11, and T-45 Goshawk. He recently served as airframe and subsystems design team leader for the Phantom Eye hydrogen-powered unmanned demonstrator aircraft.

His address will focus on the use of rapid prototyping to evaluate new technologies without the risk and cost of production and on the Boeing Company experience with several recent prototype efforts that have resulted in the insertion of advanced composite technologies into future products, reducing costs and increasing performance.

The venue

The coastal town of Newcastle is a significant hub for Australian composite manufacturers and provides the perfect setting for Australasia's premier composites conference.

More information and registration
www.compositesconference.com
or call Composites Australia on 03 9429 9884.

SPONSORS

This conference would not be possible without the generous support of our sponsors. We thank the following companies and organisations for their commitment to the advancement of the composites industry.

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Knowledge, ideas exchange

Some 40 industry members, representing more than 30 organisations, attended a clinic for composite practitioners wanting to explore closed moulding technologies.

The event, hosted by Ken Freeman, Managing Director of Tricomposites, at the company's Laverton North (Victoria) plant, explored efficiencies; choices in equipment and material inputs; and considerations on complexity of part shapes and expected volumes.

Ken Freemanand his staff generously shared their experiences and gave delegates a tour of the Tricomposites production facility.

The clinic, organised by Composites Australia at Freeman's instigation, proved to be a valuable opportunity for composite practitioners to consider closed moulding technologies as well as exchange ideas and experiences.

Freeman, who is keen to advance the technology, produces composite components for Australian caravan manufacturer Jayco. He shared the Jayco "mantra" with the group: get your inputs right, get your processes right, and measure everything. The result should be consistency of parts and the elimination of variability.

Discussions focused on the specific attributes of closed moulding processes and how they can result in tangible benefits for manufacturers, including:

- Higher levels of quality control; improved surface finish – both sides
- Enhanced cost control; more reproducible parts; improved shop conditions – cleaner with less VOCs (volatile organic compounds)
- Lower employee attrition rates; more effective training, as the science of closed moulding replaces the "art" of open mould processing.

The forum explored:

- Tooling costs and investing in tooling expertise
- Speed of loading moulds
- Process fragmentation
- Matching technology employed to match
- Production volumes
- Skill requirements.

Events Schedule 2014

March

Tuesday 4
Victoria

Emerging Manufacturing Techniques Workshop
One day technical workshop delivered by Mr Rowan Paton, Program Manager, Materials and Manufacturing at Advanced Composite Structures Australia Pty Ltd.

April

Monday 7 – Wednesday 9
Newcastle, NSW

Composites Australia and CRC-ACS Conference
One day technical workshop followed by two day conference program with more than 40 international and Australian speakers and peer reviewed papers.

Tuesday 29
Victoria

Composites in Infrastructure Seminar
One day technical seminar to review success of composites in infrastructure/ civil engineering and to look to future opportunities and how these can be realised.

May

Tuesday 13 – Friday 16
Sydney

National Manufacturing Week
Industry exhibition with opportunity to showcase members' composites capabilities and products.

Thursday 15
Sydney

Public Sector Support for Manufacturing: opportunities for the composites industry
To be held at the 2014 National Manufacturing Week venue, this seminar will feature a panel of representatives from government and other relevant agencies plus Composites Australia members who have successfully leveraged support packages to build their businesses.

Thursday 22
Western Australia

Emerging Manufacturing Techniques Workshop
One day technical workshop delivered by Mr Rowan Paton, Program Manager, Materials and Manufacturing at Advanced Composite Structures Australia Pty Ltd.

For full details and to register go to
www.compositesaustralia.com.au/events

Disclaimer: This schedule was current at time of going to print but is subject to change. Composites Australia is not liable for any loss or expenses incurred due to changes in the program.

June

Monday 2 – Thursday 5
Seattle WA, USA

SAMPE Tech 2014 Technical Conference
Visit www.paper.sampe.org to submit your abstract.

Thursday 17
Victoria

The Essentials of Textile Reinforced Composites
One day technical workshop delivered by Dr Dieter Veit, Vice Director of the Institute for Textiltechnik der RWTH, Aachen University, Germany.

Thursday 21
Victoria

Closed Moulding Technology Workshop
A one-day workshop for practitioners who want to explore closed moulding efficiencies and choices in equipment and material inputs considering the complexity of the shape and expected volume of the part.

September

Tuesday 2
South Australia

Practical Design & Analysis of Composites
A full day technical workshop with Dr Rod Thomson, Program Manager for Design and Analysis at Advanced Composite Structures Australia Pty Ltd (ACS Australia).

Tuesday 9
Queensland

Emerging Manufacturing Techniques Workshop
One-day technical workshop delivered by Mr Rowan Paton, Program Manager, Materials and Manufacturing at Advanced Composite Structures Australia Pty Ltd.

October

Monday 13 – Thursday 16
Orlando, Florida, USA

CAMX – The Composites and Advanced Materials Expo
ACMA and SAMPE have joined forces to produce a new super industry event that connects and advances all aspects of the composites and advanced materials communities. Visit www.theCAMX.org USA

Wednesday 29 –Thursday 30
Victoria

Growth Opportunities for Composites in Australia: Leveraging global trends
A workshop with Professor Andrew Walker, CEO of the National Composites Certification and Evaluation Facility and Director of the School of Materials, University of Manchester, United Kingdom.

November

Thursday 27
Queensland

Composites Australia end-of-year function
Evening presentation and networking event