Connection

Issue 38 · March 2015

The official magazine of Composites Australia

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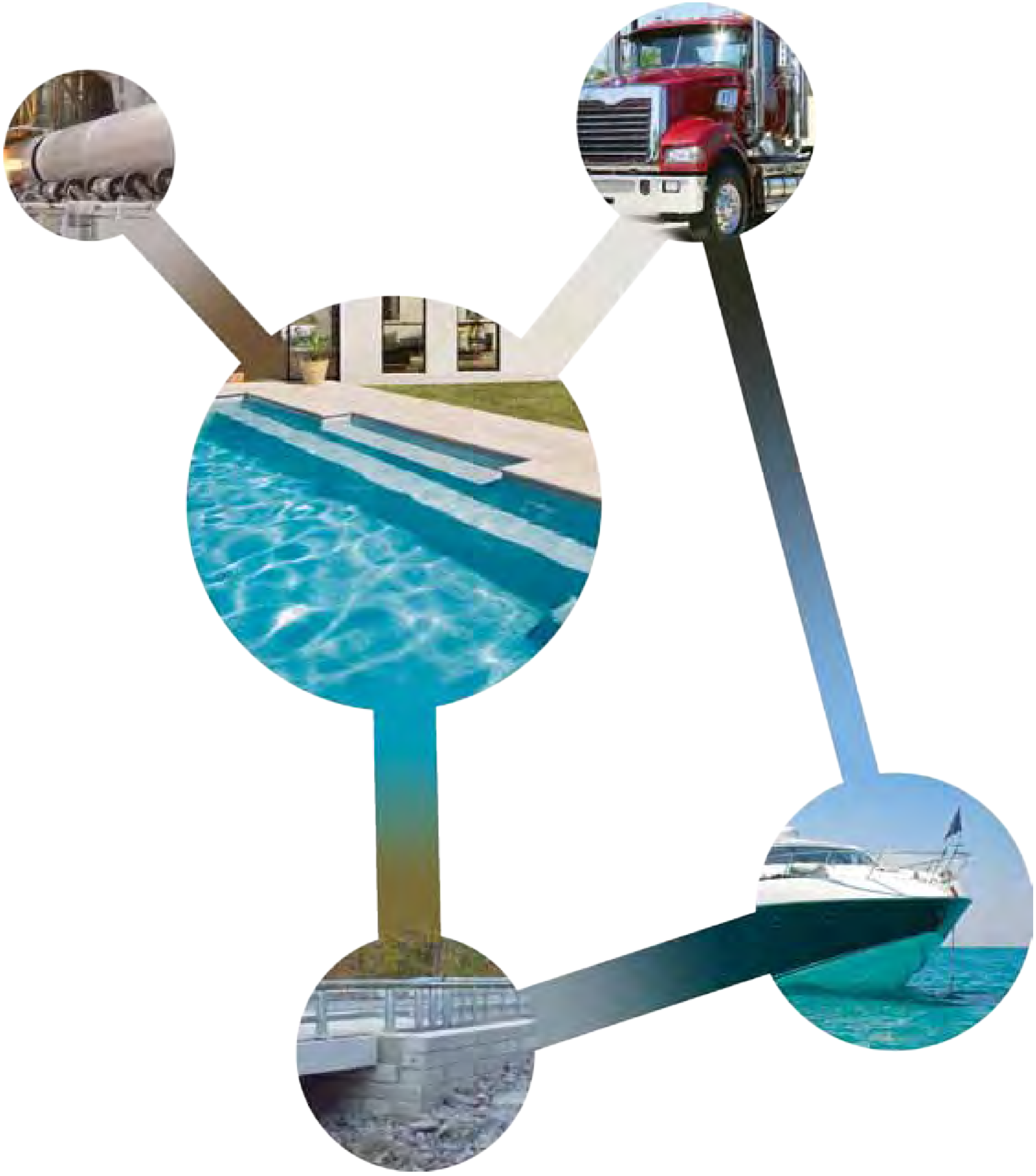

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President's letter

In this month in 1990, Composites Australia was officially registered as an association, the peak body constituted to represent the Australian composite sector.

It was an era of political and economic turmoil within which the Australian economy suffered its worst recession since the Great Depression – coined the "recession we had to have" by the then Treasurer and Deputy Prime Minister Paul Keating. In contrast to the current record low interest rate of 2.25% (at the time of writing), interest rates hit 17% in February 1990.

Remembering 1990, as some of us do, puts the current economic environment and the business of composites in perspective. It reminds us that economic downturns are cyclical, and will end, to be followed by good times again. It reinforces the importance of Composites Australia and its role: to represent our sector to government, foster skills and knowledge development, and profile composite materials and technologies to existing and potential new markets.

Over the past ten years alone, Composites Australia has held more than 150 events, including, annual conferences and exhibitions, workshops, technology clinics, industry briefings, trade tours and demonstrations that have attracted over 10,000 attendees. Additionally, it has distributed over 13,000 magazines profiling the sector's capabilities and processed close to 1000 industry enquiries. Traffic for our website *www.compositesaustralia.com.au* continues to grow at an average rate of almost 20% each quarter since the launch of new initiatives in November 2013.

Composites Australia continues to work on sector standards to pave the way for new applications, such as civil infrastructure. New initiatives, such as the market entry program into Asia (with particular emphasis on Malaysia and Indonesia) to showcase Australia's composite transformative technologies, are being added to our portfolio of member benefits.

The Composites Australia and CRC-ACS Conference and Trade Show has grown to become a valuable source of information and technical knowledge, providing access to the entire value chain from raw materials to the most limited applications, and enhancing the visibility of our industry among end-users.

This year's conference, to be held on the Gold Coast in April, continues this trend with a program rich in content from a strong line-up of local and international industry, technical and scientific speakers.

Recognising that composites manufacturing is enabled by innovative research and collaborative networks, the conference links the academic world and the commercial production of composites.

It provides opportunities for composite professionals to express their wisdom, judgment and vision on the art of composites amongst likeminded industry practitioners. It is also a festive forum — a place to catch up with old friends, suppliers and customers. More information on the conference is on Page 7 and on the website *www.compositesconference.com.au*

I hope you enjoy this edition of *Connection* and I look forward to joining you at Sanctuary Cove, Queensland on 22 and 23 April.

Genelle Coghlan

NEWS

Innovation in composite aircraft repairs

An ongoing challenge for aviation maintenance, repair and overhaul (MRO) service providers is how to easily and cost effectively make durable low temperature cure tooling that is suitable for accurately repairing damaged small to medium sized composite parts or for fabricating new replacements.

GMS Composites' low temperature epoxy prepreg repair tooling for the Boeing 777 flap leading edge.

For reverse engineering MRO jobs, tooling needs to exactly match the composite part taken off the aircraft for the best fit, plus the tool must provide structural support during the autoclaving stage at moulding temperatures of up to 177 °C (350 °F).

Sam Weller, Managing Director of Melbourne-based custom prepreg manufacturer GMS Composites, says that while wet resin tooling systems are well established they are not ideal for many composite MRO facilities where shop floor operators are much more familiar with handling and using prepregs.

The company has developed a low temperature epoxy prepreg tooling system to meet the needs of aviation MRO service providers. According to Weller, the system is proving itself at a major aerospace MRO operation that repairs Boeing 777 composite parts and reverse engineers other aircraft components.

"While eliminating the mixing, mess and handling issues associated with a traditional wet resin tooling system, our epoxy carbon fibre prepreg tooling system has improved reverse engineering fabrication capabilities by enabling more dimensionally accurate MRO aircraft parts to be moulded," says Mr Weller.

"This prepreg tooling system is now used as an autoclave support tool for repairing a variety of composite parts, including a Boeing 777 leading edge wing flap section autoclaved at 177 °C (350 °F) and a nose cone part."

GMS Composites specialise in the development of prepreg systems for the production of high strength components with minimal weight, incorporating epoxy prepreg resins with the latest carbon fibre and aramid fibre technical fabrics and cores.

The company's ongoing international growth strategy targets Asia, India and the Middle East, where GMS Composites see a growing demand for high performance composites in niche markets that use prepreg materials, such as aerospace and defence, automotive, motorsports, and high-end sporting goods.

CME earns General Motors supplier excellence award

General Motors in Australia has recognised Melbourne-based Composite Materials Engineering with the highly regarded Supplier Quality Excellence Award for the second consecutive year.

The Quality Excellence awards are determined by Metric Selection Criteria, where Tier 1 suppliers and their performance are measured against a table of 13 key requirements.

CME, a supplier to the automotive industry for more than 30 years, has been at the forefront of composites development in vehicles with both General Motors Holden and Ford.

"Our primary focus has been to deliver weight reduction solutions to the sector through advanced technology," says Managing director Brian Hughes. "We have been using this expertise to help diversify our business into other key industries for the past five years, but have not lost focus on the auto industry as this award shows."

Prospective customers often use the automotive industry as a gauge of a company's capabilities, Mr Hughes said.

CME manufacture a large range of composite components for the automotive industry including spare wheel tubs, underbody shields and body panels. Focusing on weight reduction and material substitution, the company has diversified its business to include products used in building and construction, food handling, electrical, transport and logistics.

This loading press is an example of the advanced technology CME uses to deliver quality weight reduction solutions for customers such as General Motors.

It's time to ramp up exports

The power of proximity to Asia and a lower Australian dollar will no doubt stimulate export opportunities for Australian products and services and a new generation of exporters, says Kerryn Caulfield, Composites Australia Executive Officer.

Australia's engagement with the global economy offers business, and the community as a whole, both challenges and opportunities. The recent fall of the Australian dollar (to 0.78 cents against the US dollar at the time of writing) has changed the dynamics for international customers purchasing Australian products.

According to Gareth Hutchens of the *Sydney Morning Herald*: "The dollar has fluctuated between $US0.4775 and $US1.10 since it was floated in 1983, and its 30-year average is $US0.70, so theoretically the dollar can still fall." The bellwether for the Australian economy, the US economy has been improving in recent months, and experts believe it will continue to improve. All indications are that it's time to ramp-up existing export markets and/or start exporting. Certainly, reports from the Australian marine sector are that offshore enquiries have increased and that there are tentative signs of optimism.

Composites Australia's export initiative with the CRC-ACS and Advanced Composite Structures Australia is targeting the automotive, aerospace, oil & gas, infrastructure and ground transport sectors in Malaysia and Indonesia. The initiative is based on collaboration and the premise that knowledge and networks are the keys to unlocking export opportunities. A webinar in February provided the composite industry with the findings of scoping missions to the countries and organisation of trade missions for 'export-ready' composite manufacturers is underway.

The lower dollar motivated Brian Hughes, CEO of Composite Materials Engineering, to send his sales team overseas to proactively secure orders. "Our experience shows the tipping point for our offshore customers is around A$0.76 exchange rate," says Brian. "While our exports have been steadily growing for a number of years, the recent fall in the dollar is an opportunity for us to ramp up our relationships."

The Australian government's growing number of Free Trade Agreements in the Asian region is also offering opportunities, as N J Robinson's Bruce Garbutt notes in the article on Page 15.

As part of the Asian export initiative, Composites Australia is developing a Directory of Australian Composite Industry Capabilities to support Austrade's efforts in identifying and developing export opportunities. The directory will also inform the Victorian government's Manufacturing Productivity Networks program.

More information: Export-ready companies seeking more information on the trade missions can contact Andrew Beehag E: a.beehag@crc-acs.com.au

Composites Australia and CRC-ACS
2015 Conference & Trade Show

Composites Australia CRC-ACS

GAME ON!
WINNING WITH COMPOSITES

The 2015 Composites Australia and CRC-ACS Conference and Trade Show to be held on the Gold Coast on the 21 to 23 April 2015 is Australia's premier event for composites manufacturers, suppliers, engineers, designers and researchers.


Keynote speaker: Professor Axel Herrmann, Managing Director of the Airbus subsidiary Composite Technology Centre Stade, Germany

The conference brings together local and international speakers and attendees from key industries and fields of research, including aerospace, automotive, building and construction, civil infrastructure, education and training, marine, resources and transport.

To be opened by The Honourable Karen Andrews, Parliamentary Secretary to the Minister for Industry and Science, the conference is attracting global and national industry leaders and promises delegates two powerful days of knowledge exchange, networking and business development opportunities.

Delegates and speakers are travelling from as far afield as Canada, Germany, Iran, New Zealand, Saudi Arabia, The Netherlands, USA and Uzbekistan.

Overseas visitors

Keynote speaker Dr Michael (Mickey) McCabe, Executive Director of the University of Texas at Arlington Research Institute, an acknowledged leader in technology-based economic development and materials research, will set the scene with his presentation on *Strategies for Winning with Composites in a Global Market.*

A second keynote will be presented by Professor Axel Herrmann, Managing Director of the Airbus subsidiary Composite Technology Centre and Chief Executive Officer of the European composites innovation network CFK-Valley Stade. He will speak on *Key technologies for composite structures in eco-mobility and transport industries.*

Mr Sean McKay, President and Chief Executive Officer of Canada's Composites Innovation Centre will speak on the work of FibreCITY, a global effort to facilitate commercial use of biocomposites.

Industry opportunities

Dr Martin Jones, from ACS Australia, will outline some of the key technology outputs of the CRC-ACS as it approaches the end of its five year term, and how they can be accessed by the industry.

Tony Stanton, Engineering Manager – Asia Pacific for Gurit Pty Ltd will present case studies on the successful application of advanced composites in commercial vessels.

Other topics include: new and emerging technologies, materials and processes to improve manufacturing efficiency, the quality of outputs and how to open new markets; infrastructure applications and repair; structural design, analysis and testing; developments in polymers, advanced composites, bio composites and recycled-mixed composites.

Australian identities

Well-known members of the Australian composites industry, research and technical community presenting at the conference, include: Brian Hughes, Managing Director of Composites Materials Engineering; Professor Chun Wang, Director of the Sir Lawrence Wackett Aerospace Research Centre at RMIT University; Andrew Beehag and Michael Heitzmann from Advanced Composite Structures Australia; Russell Varley and Menghe Maio from CSIRO, and Lucy and Chris Cranich, consulting materials scientists with PATH; and internationally recognised composites consulting engineer Rik Heslehurst who will also present a pre-conference workshop on Tuesday 21 April on *The Art and Science of Bonding Composite Structures.*

More information: Full details and registration are available on the website www.compositesconference.com

SPONSORS

The conference would not be possible without the generosity of our sponsors and supporters:

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Matrix raises the bar on buoyancy structures

Innovative Australian design and composites manufacturing technologies are delivering competitive solutions for the oil and gas sector.

Western Australian-based Matrix Composites & Engineering has delivered one of the largest installation buoyancy structures in the world to international offshore oil and gas contractor Heerema Marine Contractors (HMC).

The 12.3-metre high, 6.44-metre long buoy, which was delivered in December, will be used on the Ichthys LNG project off the coast of Western Australia.

Weighing 103 metric ton (MT) in the air and providing 150MT of uplift in seawater (the equivalent of eight large public buses), the massive buoy is the latest example of the flexibility and capability of Matrix's modular building block buoyancy system.

The buoy is made up of 72 standard elements held in place with a through member and forms part of a modular installation buoyancy package that will be used to deploy HMC's subsea production equipment onto the seabed, 250 metres below the water.

The project is the latest in a growing list of international projects and high profile contracts for the WA composites manufacturer that has included providing buoyancy for the survey vessel searching for the debris of flight MH370, as well being approached by Hollywood director James Cameron to supply buoyancy for his Deepsea Challenger diving submersible.

"There is nothing like our buoyancy in the marketplace today," says Matrix CEO Aaron Begley. "The standard, modular design of the buoyancy, as used in the 150MT structure, allows it to be reassembled into different configurations if client requirements change. This means only one set of modules needs to be purchased in order to satisfy an entire set of requirements, representing a significant cost saving for clients as well as eliminating the time factor involved with manufacturing new buoyancy. Manufacturing efficiency is also maximised as customised configurations can be assembled from a single standard building block element."

A tough, impact and abrasion resistant fibre skin is applied to protect the buoyancy, which is filled with hollow fiberglass macrospheres manufactured by Matrix. These form a major part of the module's core, giving it strength as well as maximum buoyancy uplift. A proprietary, computer-operated injection

Matrix delivers the massive buoy to global oil & gas contractor HMC for the deployment of LNG sub-sea production equipment off the coast of Western Australia.

process forces syntactic resin into the moulds, forming a strong, durable and multi-level polymer composite. The module is then removed from its mould and quality inspected before spray painting with highly durable and solvent-free epoxy coating and curing in temperature controlled ovens. To compete in the global market, the company's modern plant in Henderson, WA, applies LEAN Production principles and highly automated manufacturing processes, including moving work cells and production lines, automated chemical processing, robotics and a Scada-based control system.

"Our automated manufacturing processes deliver a range of efficiencies and competitive advantages, including shorter production timeframes, greater output, higher labour productivity and lower costs, while reducing waste and plant downtime," says Mr Begley. The facility, which is the largest composites syntactic plant in the world, also gives the company the ability to manufacture other composite materials, while the real time monitoring, data collection and traceability, combined with rigorous testing, supports quality assurance and compliance with certification standards.

Boasting the largest syntactic plant in the world, Matrix's manufacturing facility in Henderson, WA, is geared for compliance with rigorous certification standards.

A combination of innovative IP for a niche market combined with advanced manufacturing technology, processes and business acumen, supported by a network of sales offices in all five continents, is enabling Matrix to grow its reputation and business.

Eco Casa, a dream home built with a vision for green composites

Brisbane boat builder Ian Wright's dream home may be small in size but it is huge in vision for the future of composites in the construction and housing marketplace.

Setting new standards for 'green' buildings: Eco Casa showcases a revolutionary biocomposite building panel material and frameless assembly system, the use of sustainable, renewable or recyclable fixtures plus high-efficiency water and power conservation systems.

The house marks the launch of a 'green' composite building material and assembly method developed by Ian's company Norman R Wright and Sons in conjunction with Gold Coast supplier ATL Composites.

Originally looking for a sustainable product to add 'green' boats to his range of high performance commercial and pleasure craft, Ian had the idea that the material would also be ideal for use in the housing industry.

Two years in development, drawing on the expertise of the composite engineering and chemical professionals in both companies, the revolutionary building panel material and frameless assembly system went through a long process of engineering analysis and certification before the plans for Ian's dream home were approved.

A boat builder constructed the two sections (the 2m x 4m stairwell and the 18m x 4m house) and installed all fittings in the Norman R Wright factory.

"After earth works and the foundation posts and stairwell were in place we transported the house to the site and then a crane lifted it into place," says Ian.

The whole house weighs less than nine tonnes and is so stiff it only needed two slings for the lift.

Perched on top of a windswept hill in Wynnum North overlooking the ocean, 'Eco Casa' is fitted out with the same meticulous attention to detail and finish as Ian's boats, using sustainable, renewable or recycled materials throughout.

At less than eight squares it is small by many people's standards but Ian says the open plan design is spacious for his needs, especially compared to living on a boat! He has big plans for the new building material that the Eco Casa showcases.

"This is a very different move for our company," says Ian. "Wright and Sons has grown organically over the past century based on a very conservative business model.

"I originally wanted a product to build green boats, but then I thought it would be ideal as a building material. It's revolutionary, I don't believe there's another eco-product like it.

"It can be used to build very strong buildings, very quickly. It's waterproof, has better weathering capabilities than timber and it will be cheaper than conventional building materials.

"The high wind loading of the structure, its light weight and the highly efficient insulation of the

Clockwise from far left: The ultra-lightweight, strong biocomposite house was prefabricated in the Norman R Wright boatbuilding 'shed'. The foundations and stairwell ready for the delivery of the upper-storey. Weighing less than nine tonnes and so stiff the crane only required two slings to lift the complete upper-storey onto the piers.

70mm thick outer, ease of assembly and installation, make it attractive for a wide range of applications both here and overseas, from emergency to permanent housing to multi-storey solutions for environmentally conscious European cities under pressure to increase housing density," he says.

Director Nicholas Cossich said ATL Composites has considerable experience in developing products for the building industry and in composite products derived from natural, sustainable sources. ATL chemists had a strong personal interest in the latter, however there was little demand from fabricators.

"It takes someone like Ian, who has the foresight, and the courage of his convictions to bring a new product and a project like this to reality," said Mr Cossich.

Composite Sandwich Structure Design Requirements

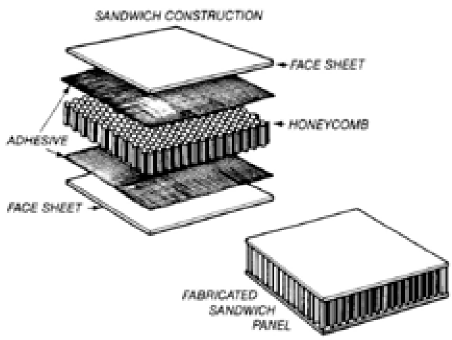
Composite Engineer's Viewpoint
By Rik Heslehurst PhD, MEng, BEng (Aero) FIEAust, FRAeS, CPEng

Part 3 – Terms, Definitions and Global Properties

This article explains in some detail the terms and definitions that are unique to sandwich structures, plus their global stiffness and strength properties. Is there a simple way of determining the flexural rigidity of sandwich panels with composite facings? How does the comparison between monolithic and sandwich structures fair with respect to stiffness and strength? Read on for the answers to these questions.

Terms

Sandwich structures are formed from three basic parts:



- **Facings or skins** – the outer layer of the sandwich panel, made of either metal or composite material. The facing is generally selected for in-plane strength and stiffness properties, but resistance to impact and the environment are also important. The design of the composite skins requires some thought for the ply orientation and, to some extent, ply position.
- **Core** – the bulk of the sandwich panel. The core is typically selected for low density properties, but the transverse compression strength, shear strength and shear stiffness properties are also very important.
- **Bondline** – the interface between the facings and the core is an adhesive bondline. The bondline willt ransfer the differential axial stress between the facings and core through shear stress in the adhesive bondline. (Do not take the adhesive bondline for granted.)

Definitions

Modulus (Stiffness) Ratio – the ratio between the Young's modulus of the facing and Young's modulus of the core. This ratio is typically very large:

$$\frac{E_f}{E_c} >> 1$$

Note that with orthotropic materials the facing Young's modulus will vary with axial direction. The above ratio is generally considered by using the longitudinal or largest value of the facing Young's moduli.

Thickness Ratio – the ratio between the facing thickness and the core depth. This ratio is typically large:

$$\frac{t_c}{t_f} \geq 4$$

This ratio allows for a number of simplifying stress analysis assumptions.

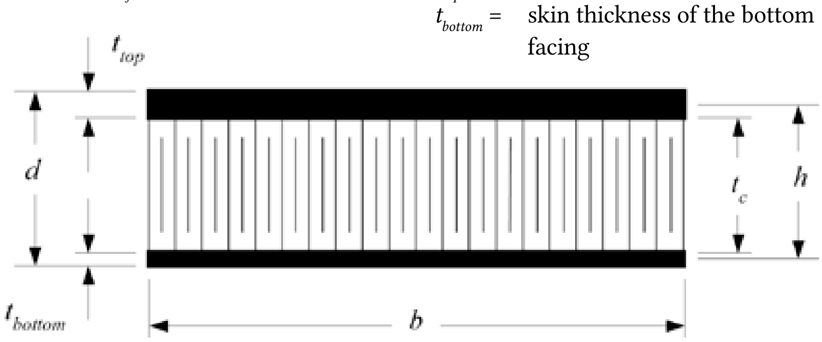
Panel Geometry – the panel planar dimensions are much larger than the skin thickness:

a and $b >> t_f$

Structural Nomenclature

The standard sandwich panel structural nomenclature is illustrated in the figure below where:

E_f = longitudinal Young's modulus of a facing
$E1_{top}$ = longitudinal Young's modulus of the top facing
$E2_{top}$ = transverse Young's modulus of the top facing
$E1_{bottom}$ = longitudinal Young's modulus of the bottom facing
$E2_{bottom}$ = transverse Young's modulus of the bottom facing
$\lambda_{top} = 1 - (\upsilon_x \upsilon_y)_{top}$
$\lambda_{bottom} = 1 - (\upsilon_x \upsilon_y)_{bottom}$
$(\upsilon_x \upsilon_y)_{top\ or\ bottom}$ = major and minor Poisson's ratios, respectively, for composite facings
E_c = Young's modulus of the core
b = panel width
d = panel depth (facing thickness + core thickness)
t_f = facing (skin) thickness if both facings are the same thickness, otherwise
t_{top} = skin thickness of the top facing
t_{bottom} = skin thickness of the bottom facing



Sandwich Panel Geometry Nomenclature

t_c = core thickness

h = depth of beam between facing centroids

$$= t_c + \frac{t_{top} + t_{bottom}}{2}$$

G_c = Shear modulus of the core

D = Flexural rigidity of panel

Global Properties

Assuming that the facing $I_o = 0$ and the core Young's modulus is $E_c << E_f$, an approximate bending stiffness relationship in the longitudinal direction for the sandwich panels is:

$$D_1 = \frac{E_{1_{top}} t_{top} E_{1_{bottom}} t_{bottom} h^2}{E_{1_{top}} t_{top} \lambda_{top} + E_{1_{bottom}} t_{bottom} \lambda_{bottom}}$$

For identical materials in the facings:

$$D_1 = \frac{E_{1_f} t_{top} t_{bottom} h^2}{\left(t_{top} + t_{bottom}\right) \lambda_f}$$

And with the same thickness for top and bottom facings:

$$D_1 = \frac{E_{1_f} t_f h^2}{2\lambda_f}$$

The approximate solution is in error of less than 1% if the following two conditions apply:

1. $$3\left(\frac{h}{t_f}\right)^2 > 100$$

2. $$6 \frac{E_{1_f}}{E_c} \frac{t_f}{t_c} \left(\frac{h}{t_c}\right)^2 > 100$$

The relationship between monolithic plate bending stiffness and sandwich panel bending stiffness and bending strength can be expressed as:

$$\frac{D_{sand}}{D_{mono}} = \frac{3}{4}\left(\frac{h}{t_f}\right)^2 \quad \frac{\sigma_{sand}}{\sigma_{mono}} = \frac{2}{3}\left(\frac{t_f}{h}\right)$$

For sandwich panels with orthotropic facings we can express the in-plane stiffness and flexural stiffness matrices as:

In-plane stiffness matrix:

$$A_{ij} = \begin{bmatrix} \frac{2E_{f_1} t_f}{(1-\upsilon_{21}\upsilon_{12})} & \frac{2\mu_{21} E_{f_1} t_f}{(1-\upsilon_{21}\upsilon_{12})} & 0 \\ \frac{2\mu_{21} E_{f_1} t_f}{(1-\upsilon_{21}\upsilon_{12})} & \frac{2E_{f_2} t_f}{(1-\upsilon_{21}\upsilon_{12})} & 0 \\ 0 & 0 & \frac{G_{f_{12}} t_f}{(1-\upsilon_{21}\upsilon_{12})} \end{bmatrix}$$

Flexural stiffness matrix:

$$D_{ij} = \begin{bmatrix} \frac{E_{f_1} t_f h^2}{2(1-\upsilon_{21}\upsilon_{12})} & \frac{\mu_{21} E_{f_1} t_f h^2}{2(1-\upsilon_{21}\upsilon_{12})} & 0 \\ \frac{\upsilon_{21} E_{f_1} t_f h^2}{2(1-\upsilon_{21}\upsilon_{12})} & \frac{E_{f_2} t_f h^2}{2(1-\upsilon_{21}\upsilon_{12})} & 0 \\ 0 & 0 & \frac{G_{f_{12}} t_f h^2}{2} \end{bmatrix}$$

A relationship between the in-plane stiffness matrix and the flexural stiffness matrix for sandwich panels is as follows:

$$\left[D_{ij}\right] = \left[A_{ij}\right]\frac{h^2}{4}$$

In the next issue of *Connection* we will discuss Sandwich Structure Manufacturing Processes. There are a couple of basic manufacturing methods that are used in composite skinned sandwich structures. The benefits and limitations of each will be discussed in the next issue. All published articles in the Engineer's Viewpoint series are available online at www.compositesaustralia.com.au/industry. Rik welcomes questions, comments and your point of view by email to rik@abaris.com

New proof test for bonded composite repair

By Andrew Gunnion, Principal Engineer, Advanced Composite Structures Australia Pty Ltd

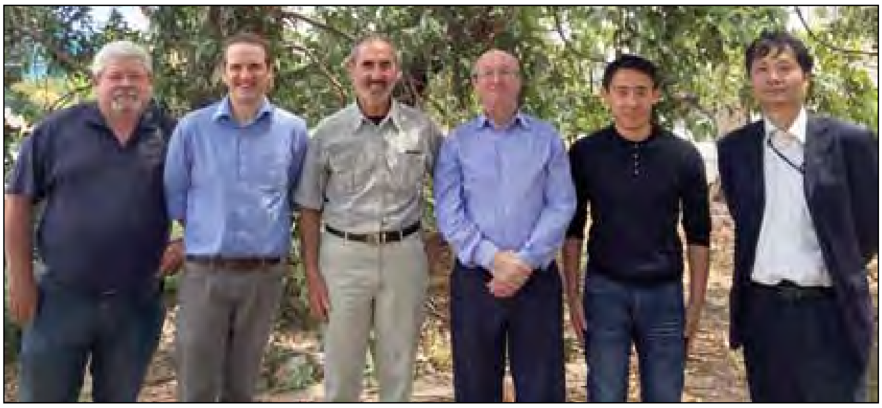
As new aircraft programs drive the use of composites into safety-critical primary structure, the design and certification of repairs becomes ever more challenging. Common repair techniques such as patch repairs are only suitable for relatively thin structures, while bolted repairs have limited capacity for strength restoration.

For heavily-loaded structures, scarf repairs, where a region of pristine material around the damage site is cutout to accommodate a flush bonded repair, may be the only viable solution to avoid costly component replacement. However, there is currently no accepted non-destructive inspection method for assessing the quality of the bond. This is a major obstacle for the adoption of bonded scarf repairs to primary structures.

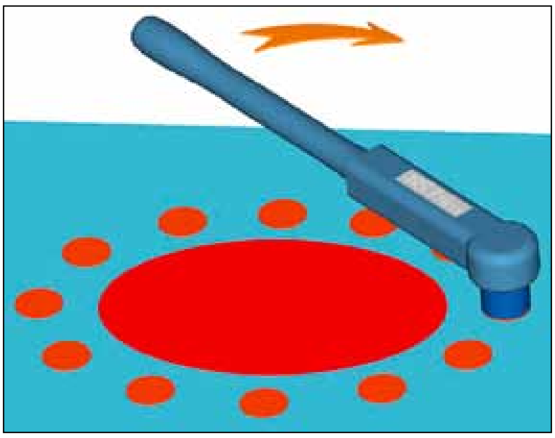
One potential technology under development is the laser-induced shock proof test. In this process, a high-powered laser initiates a shock wave that travels through the thickness of the structure by vaporising a sacrificial surface overlay. On reflection from the back face of the structure, the tensile stresses from the shock wave will rupture weak bonds. Energy levels must be set to avoid damaging pristine material. While promising, this technology requires further development and has some practical limitations, particularly for field application.

Within the Cooperative Research Centre for Advanced Composite Structures (CRC-ACS) Robust Composite Repair Project, the Defence Science Technology Organisation (DSTO) and ACS Australia are working to develop a simple bonded-repair proof test that has many practical advantages. In this process, small circular discs of patch repair material (coupons) are bonded simultaneously around the perimeter of the bonded repair. In this way, the coupons are fully representative of the patch, being made of the same materials, cured under the same conditions and prepared using the same procedures by the same technician. The quality of the patch repair can then be inferred by strength assessment of the satellite coupons. The coupons are designed to be tested in shear through a torsion loading, and their low profile enables them to remain on the aircraft as an enduring indicator of bondline health.

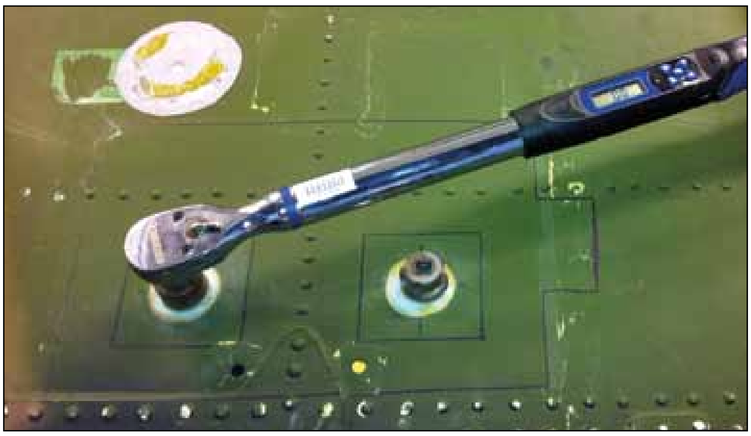
This proof test has been published in industry journals, presented to certification authorities and discussed with industry groups. Feedback received has been used to refine the methodology, increasing the maturity and chances of future adoption by the industry. In the closing stages of the project, it is planned to complete a demonstration for the Australian Defense Force.



The Robust Composite Repair Project team (l -r): John Freeman, Andrew Gunnion, Alan Baker, Daniel Bitton, Paul Chang, John Wang



Above. Conceptual image showing a bonded repair surrounded by satellite proof test coupons.



Above. Early prototype of the test, being performed on a section of a helicopter structure

Australia's top guns target markets

It is more than 50 years since Neil Robinson saw a need in the Australian FRP industry for a light, easy to use, affordable spray machine.

N J Robinson's Matthew Palmer (left) and Bruce Garbutt with one of their latest customised systems. The equipment dispenses Scotec modified polyester to protect under road traffic light signal loops. It uses a BPO (Benzol Peroxide) catalyst system and a water tolerant polyester resin.

With the help of local engineers Brian Palmer and Bruce Garbutt, Neil developed the Robo Mk1, the first Australian-made chopper gun and a revolution for the industry.

A short-time later, Brian and Bruce joined Neil at Brisbane-based N J Robinson, which remains the only specialised spray machinery manufacturer in Australia.

"Neil had been dabbling in fibreglass and came across a European chopper gun and it was so big and clumsy, he thought he could come up with something much easier to use," recalls Bruce.

"We started by importing all the pumps from the US and making the chopper guns and roving choppers but then we moved into making all of it ourselves."

The company has undergone several changes in management since Neil's death in 1970, and a change of ownership, however Bruce and Brian's son Matthew heads the company today, continuing to manufacture and service customers large and small across Australia, South East Asia, the South Pacific, Europe and the US.

While still offering a comprehensive and continually evolving range of off-the shelf spray machinery, the company is growing its reputation in the research and education marketplace, building equipment tailored to the requirements of government, defence and university research centres.

The growing list of tertiary clients includes the University of Wollongong, Queensland University and the University of Southern Queensland.

"We are currently building machinery for the University of Thailand for the opening of their composite training and research centre," says Bruce.

"We hope to do more in that area. The Free Trade Agreements now in place in Asia, and with Korea, Japan and China coming through shortly, hopefully they will be of benefit to us."

Similarly, developing machinery tailored to the needs of Australian composite manufacturers continually challenges the skills and expertise of the N J Robinson team.

The company has developed specialised equipment for epoxies, polyurethane, glass reinforced concrete, chip gelcoat spray and other material pumping dispenser units used in most parts of the manufacturing industry.

"There is always something new happening here," says Bruce.

The focus on quality, which the company's founder insisted on, remains today. "We are still selling parts to machinery that is 23 years old," says Bruce. That ethos, and an astute eye on emerging future trends, have enabled the company to survive the GFC and remain competitive.

Carbon Fibre Future Directions Conference 2015

By Derek Buckmaster, Director, Carbon Nexus

At the third biennial Carbon Fibre Future Directions conference, run by Deakin's Carbon Nexus in Geelong in February, attendees gained a unique insight into several of the most significant global developments in composites innovation.

A total of 44 speakers –19 from industry and 16 from overseas – covered a wide range of topics, including the growing use of carbon fibre by the automotive industry; examples of new carbon fibre applications in buildings and infrastructure; innovative new precursor materials targeting lower production cost; and insights into the growth of the global carbon fibre market. The conference was opened by Deakin Vice-Chancellor, Professor Jane den Hollander.

Mustafa Yilmaz, Executive Director of DowAksa, one of the companies involved in the new Institute of Advanced Composites Manufacturing Innovation (IACMI), gave an overview of the objectives and challenges to be overcome by the new institute, which was formally announced by US President Obama in January.

Mustafa Yilmaz, Executive Director of DowAksa

DowAksa, Ford, Dow Chemical and the University of Kentucky are all key members of IACMI and their presentations gave delegates an exceptional view on how these groups see this new institute developing and contributing to composites manufacturing innovations.

Patrick Blanchard, Technical Leader for Lightweight Materials R&D at Ford Motor Company, described the latest exciting announcements by Ford regarding their growing use of carbon fibre – both in the recently announced Ford GT40 supercar and in some more 'unexciting' applications.

Ute Spring, R&D Director at Dow Chemical Company for external and strategic relationship management for lightweight composites in Europe, described how she is managing and coordinating Dow's composites activities for key strategic markets, with a particular focus on automotive growth, where she has broad experience.

Delegates and speakers toured the globally unique carbon fibre processing technologies dedicated to research and development and training.

Doctor Matthew Weisenberger from the University of Kentucky described the latest research being carried out at the Carbon Materials Group in the University's Centre for Applied Energy Research. This included the influence of processing on the structure and properties of precursor materials, nano-carbons for thin-film thermoelectric power generation and thermal management of composites.

Jake Dingle, CEO of Carbon Revolution, updated the conference on his company's recent move to a larger purpose-built factory and the exciting growth they foresee in a range of markets for their lightweight wheel technology.

Professor Bronwyn Fox, Research Director for Carbon Nexus at Deakin University, described the latest developments underway in her team's understanding of fundamental structure-property relationships and some of their achievements in the rapid curing of composites.

Stuart McKenzie, CEO of ArcActive in New Zealand, described progress on the development of a novel Lead Acid Battery electrode for what they see as the next generation mass market car – the Micro Hybrid Vehicle.

Conference delegates toured the Carbon Nexus facility at Deakin University, viewing the carbon fibre processing lines in action. Steve Atkiss, Operations Manager for Carbon Nexus, described the wide range of processing research that is being undertaken for a number of global industry partners on the lines. For most delegates this was their first chance to see an industrial-scale carbon fibre production process – traditionally closely held by manufacturers – in operation and up-close.

Carbon fibre rescue stretcher takes off

An Australian designed and made carbon fibre stretcher is set to bring about big improvements to air medical and search rescue teams around the globe.

The sleek, light design by Brisbane-based CarbonAero Designs (ASC Composites) represents the first major change in air rescue stretcher design in more than 20 years, says General Manager Dijon Johnson.

"Commonly used stretchers are heavy, bulky and cumbersome to use in confined spaces. We have designed a light, strong and crash tested stretcher that can be used in aircraft, boats and ambulances. It is designed for ease of movement from one vehicle to the other as the patient travels to the destination hospital without the need to leave the stretcher.

"Because of weight savings alone, it has huge benefits in terms of occupational health and safety for the rescue and medical personnel, as well as reducing fuel consumption."

Wholly designed and manufactured in Australia under tight ISO9001 procedures, CarbonAero's new product is getting international attention from military and rescue organisations, following its display at a number of exhibitions, says Mr Johnson.

It is constructed predominantly in carbon fibre using a prepreg out-of-autoclave process at the company's plant in Stapylton, south of Brisbane.

The company identified the need in the market through a director's involvement with private air medical transport.

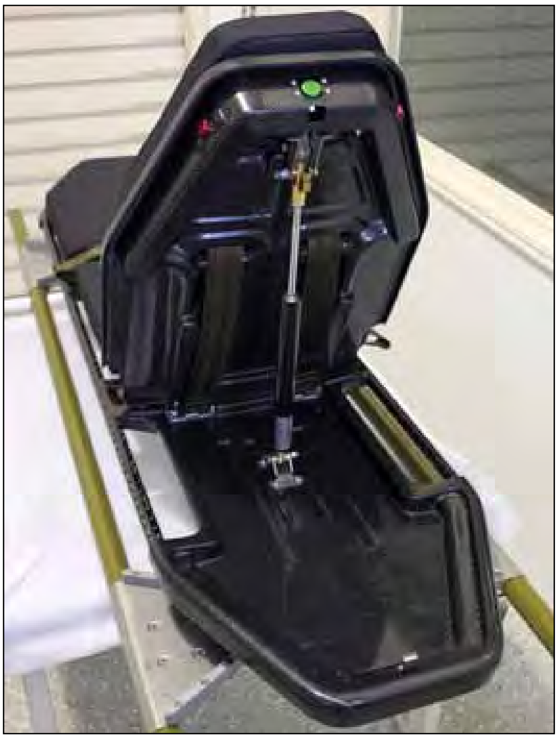
ASC Composites General Manager Dijon Johnson is continually on the look out for new carbon fibre product opportunities

The stretcher is among a growing range of products ASC Composites is developing under the CarbonAero brand in a diversification strategy that is taking the composites specialist into new markets, including bespoke furniture design and manufacture, architecture, automotives, and a range of medical rescue equipment complementing the stretcher.

Forever looking for new product ideas, the innovative team has developed a carbon fibre Cooler Box System to help racing drivers control their body heat, along with other first-to-market products.

Established in 2008 the company has grown to 14 staff across engineering design and fabrication, and business development.

"We are fortunate our engineers have a wealth of knowledge gained from experience in performance racing and aerospace," says Johnson. "Our team has the capability to engineer virtually anything from carbon fibre!"



Above and left: Carbon Aero's carbon fibre air medical and rescue stretcher is designed to meet the needs of the air medical, rescue and defence markets.

Contact: CarbonAero Designs 1300 911 997
www.carbonaero.com.au

Alliance for green composite that out-performs carbon fibre

Melbourne-based Futuris Automotive and Swinburne University of Technology are partnering with US materials scientists across industry, academia, and government to replace heavy steel structures in cars with composites reinforced with ultra-strong, lightweight nanoparticles extracted from trees.

American Process Inc. (Atlanta, Georgia, USA) and Futuris Automotive have formed the R&D partnership with researchers at Georgia Institute of Technology, Clark Atlanta University, Swinburne and the USDA's Forest Products Laboratory.

Futuris designs and manufacturers high-tech seats and interiors for the luxury car market, selling into global vehicle supply chains for major car companies, as well as Chinese manufacturers and the electric vehicle pioneer Tesla.

The goal of the project is to replace heavy steel structures within cars, such as the seat frames, with advanced reinforced polymers that have cost parity with traditional materials.

Futuris CEO Mark De Wit said the company continuously seeks out promising emerging technologies in materials science to provide innovative, high quality, and cost competitive automotive interior solutions.

"We sponsor R&D for the most exciting technologies, like nanocellulose which, we believe, will lead to the development of cost effective composite materials that can challenge the latest advanced steels and other materials in terms of performance, manufacturability and cost."

American Process Inc. CEO Theodora Retsina said nanocellulose had even lower weight than carbon fibres and was just as strong.

Swinburne is working with Futuris Automotive in the research and development of sustainable automotive manufacturing processes and products through Australia's AutoCRC. Associate Professor Igor Sbarski, head of the University's polymer and material sciences laboratories, and Dr Mostafa Nikzad are leading the research into advanced composites utilising nanoparticle technology.

Events Schedule 2015

April

Tuesday 21 – Thursday 23
Gold Coast, QLD

Composites Australia and CRC-ACS Conference and Trade Show
A one-day technical workshop followed by a two-day conference program and accompanying trade show with more than 40 speakers and peer-reviewed papers.

May

Tuesday 5
Sydney

Graphene Technology Clinic
A half-day technology clinic featuring Phil Aitchison, CEO of NanoCarbon, an Australian developer of commercial graphene products. Mr Aitchison will be joined by a panel of speakers who will outline the value proposition for graphene and how it is likely to enhance the performance of polymers and composites.

June

Wednesday 10
Sydney

Introduction to Composite Repair and Rehabilitation of Steel Infrastructure
This one-day introductory course will span the topic of repair and rehabilitation of infrastructure using composite materials. The course is designed for engineers unfamiliar with composite materials and/or their use in repair applications, as well as composite technicians seeking to learn about infrastructure repair.

July

Tuesday 21
Adelaide

Introduction to Composite Repair and Rehabilitation of Steel Infrastructure
This one-day introductory course will span the topic of repair and rehabilitation of infrastructure using composite materials. The course is designed for engineers unfamiliar with composite materials and/or their use in repair applications, as well as composite technicians seeking to learn about infrastructure repair.

August

Thursday 17
Melbourne

The Art and Science of Bonding Composite Structures
This full-day course with composites engineering consultant Dr Rik Heslehurst will provide extensive discussion and demonstrations of surface preparation of composite materials, the science of adhesively bonded joint design and the issues that ultimately determine the successful outcome of the joint design and fabrication.

October

Thursday 29
Melbourne

Introduction to Composite Repair and Rehabilitation of Steel Infrastructure
This one-day introductory course will span the topic of repair and rehabilitation of infrastructure using composite materials. The course is designed for engineers unfamiliar with composite materials and/or their use in repair applications, as well as composite technicians seeking to learn about infrastructure repair.

November

Tuesday 24
Melbourne

Composites Australia end of year function
An evening industry site visit, presentation and networking event.

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.