

Connection

Issue 37 • December 2014

The official magazine of



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Australia



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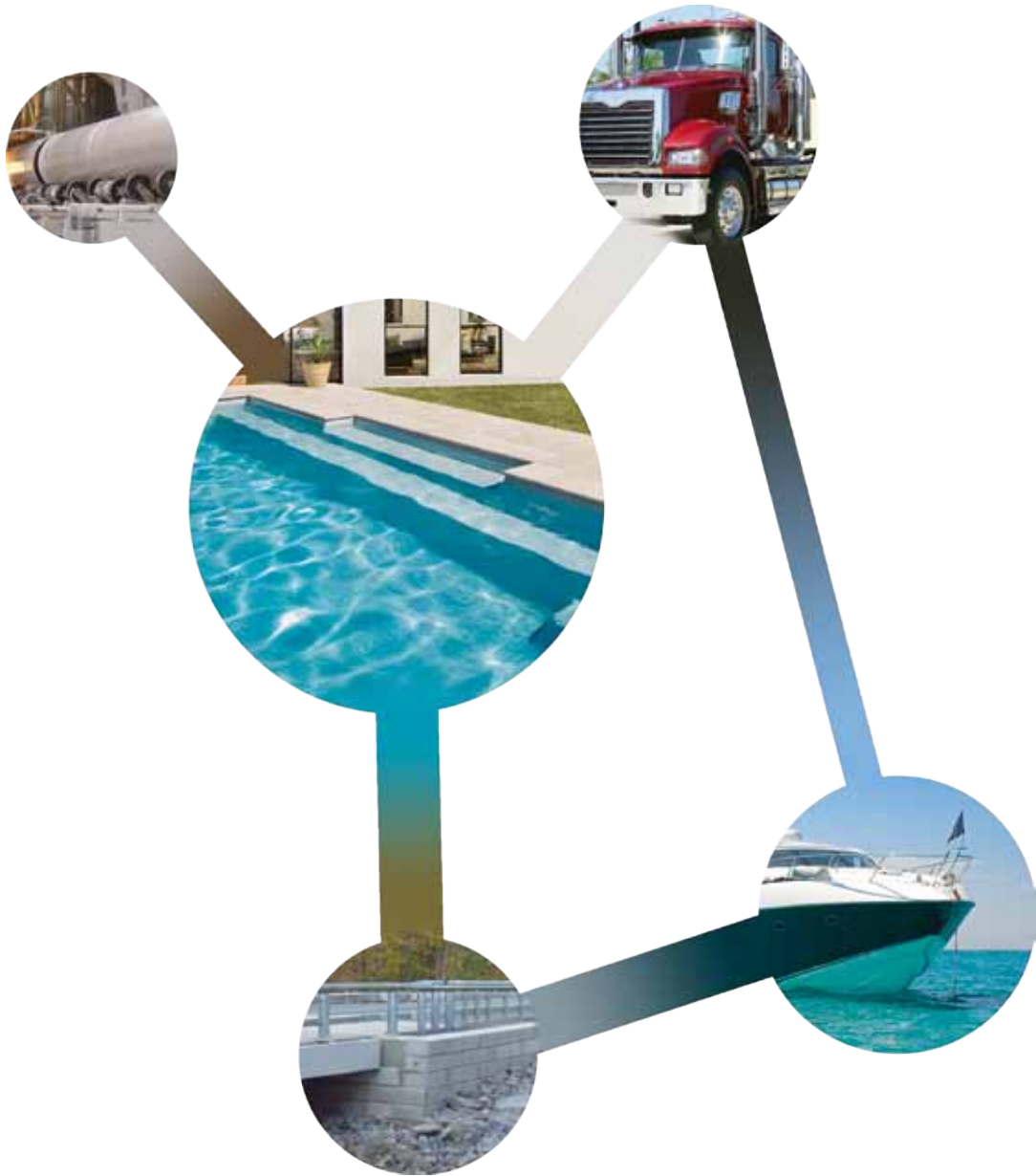
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HMAS Success. A team of scientists is building the case for greater use of composites in new Australian Navy vessels. Image: Australian Department of Defence.



Feature article

Advancing composites in infrastructure

Mal Cowan (Nuplex) and Glenn Swarbrick (Swarbrick and Swarbrick Yachts) at the Perth forum.

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President's letter

Recent months have been extremely busy for Composites Australia as we implement several significant new initiatives to advance the industry.

In my last editorial, I informed readers of a number of industry programs being released through the Federal Government's Industry Innovation and Competitiveness Agenda, which is aimed at "building a strong, prosperous economy and a safe, secure Australia". It is heartening to see composites singled out as a growth sector in two subsequent Federal industry policy documents. Accordingly, between writing this editorial and when you receive this magazine, Composites Australia will have led a delegation of composite practitioners to Canberra to meet with senior members from the office of the Minister for Industry to provide an accurate insight into the composites sector and what will be required to achieve the government's policy objectives.

Increasingly, businesses are recognising the power of collaboration, networking and partnerships over competition. In this spirit, 2014 has seen the development of a number of collaborative programs for the advancement of the Australian composites industry.

In an initiative funded by Austrade as part of the Asian Business Engagement Plan, Australia's composite transformative technologies are being showcased to Asian markets. Led by Composites Australia and with the support of the Cooperative Research Centre for Advanced Composite Structures (CRC-ACS), the initiative seeks to improve Australian business links into Asia. At a forum in February 2015, members will be briefed on the findings of the first stage of this program, including background data developed by the Indonesian and Malaysian trade commissions on the size, scope, prospects and policies for each of the target market sectors. The second stage will be the matching of Australia's capabilities in the sectors for meetings with key decision makers and leadership of the industry sectors for trade missions to each country. See page 6 for more details.

Through funding support from the Victorian

Government's Manufacturing Productivity Networks Program, Composites Australia aims to create collaborative networks to accelerate the appropriate uptake of closed-moulding technologies in Victoria. The aim is to introduce manufacturing efficiencies and reduce the cost of producing composite components. Australian composite professionals are clearly open to learning about new technologies and processes, with the first course held recently in Melbourne booked out well in advance. A second technology clinic is planned for next March.

To further the development of standards and guidelines for bridge rehabilitation and new bridge construction using advanced composite technologies – an area that we all know offers great opportunities – we have established the Advanced Composites Infrastructure Hub with META (the Manufacturing Excellence Taskforce of Australia). Technology clinics in Perth, Melbourne and Brisbane in recent months attracted high levels of interest and commitments from industry and academia to work together to boost the use of advanced composite technologies in Australian infrastructure.

At the same time, Composites Australia is pulling together an excellent program for the 2015 conference to be held at Sanctuary Cove on Queensland's Gold Coast in April.

Clearly the above initiatives demonstrate the effectiveness of Composites Australia and the benefits of supporting your industry association through membership.

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



Genelle Coghlan

NEWS

Green skateboard wins JEC Asia Innovation Award

An Australian skateboard which was developed to raise awareness that composites can be responsible to the environment as well as a performance product, has won a prestigious international innovation award.

The Archer Cork Skateboards won a JEC Asia 2014 Innovation Sustainability Award. Lavender Composites supplied materials and knowledge in the research, development and production phases to produce a vibration-reducing cork composite skateboard.

The skateboard, featured in *Connection* March 2014, is constructed using Amorim's CoreCork, reinforced with bComp Amplitex Flax fabrics and infused with Sicomin GreenPoxy.

"This innovation started out as a challenge to see how best to suppress the vibration on a skateboard, but in the course of doing so created a laminate that surpassed our expectation. It not only displayed a vibration reduction, but did so using materials that are sustainable. This is important for all of us to see that going green does not mean a compromise in performance, it can actually improve it," says Simon Heading, technical sales

consultant at Lavender Composites and designer and manufacturer of Archer Cork Skateboards.



Lincoln Heading rides the award winning "green" skateboard.

Quickstep joins Thales Hawkei project

Thales Australia has selected Sydney-based advanced composites manufacturer Quickstep Holdings as exclusive supplier of the bonnet, side skirts and mud guards for their Hawkei vehicles.



Thales is currently bidding to supply the Australian designed and manufactured Hawkei to the Department of Defence, to replace Army Land Rovers. Final approval is expected in 2015, which could lead to the production of up to 1,300 Hawkei vehicles over four years.

The Letter of Intent with Thales is Quickstep's first agreement for use of its Resin Spray Transfer (RST) technology, developed for the automotive industry.

Australian composite manufacturers are among the local supplier network for the Thales Hawkei vehicles

"It represents a crucial stepping-stone towards commercialising the RST technology within the automotive industry. The application of the RST process to the bonnet – a one-piece sandwich structure – will dramatically reduce assembly costs as well as the weight of the vehicle," says Quickstep Executive Director, Philippe Odouard.

As reported in the July 2014 issue of *Connection*, RPC Technologies has a pre-contract agreement to manufacture the composite dashboard assemblies for the Hawkei.

Queensland takes lead on fibre composite bridge standards

Queensland's Department of Transport and Main Roads has recently published technical specifications and design criteria for the manufacture and installation of fibre composite bridge girders.

Six years in the making, the specifications pave the way for increased use of fibre reinforced polymer (FRP) composite girders to be used as super structures on the state's new bridges and for the repair of deteriorating timber bridges.

Composites Australia welcomed the approval of the technical specifications, supported by a new manual on design criteria for bridges and other structures that includes a section on the design of FRP girders.

"The Queensland government is to be commended for taking the lead on these standards, opening opportunities for Australia's composites manufacturers and suppliers to enter this infrastructure

market," said Composites Australia Executive Manager Kerryn Caulfield.

Dr Ross Pritchard, Executive Director (Structures Technical Advice) said: "The advancement of these specifications for the manufacture of FRP and installation of fibre composite girders demonstrates TMR's commitment to work with industry and academia to introduce innovative products". **See pages 8-10 for more news on composites use in infrastructure.**

Support for entry to Asian markets

Australia's composite transformative technologies are being showcased to Asian markets in an initiative funded by Austrade as part of the Asian Business Engagement Plan.

Led by Composites Australia and with the support of the Cooperative Research Centre for Advanced Composite Structures (CRC-ACS), the initiative seeks to improve Australian business links into Asia.

"With the support of Austrade we are focusing on profiling Australia's advanced composites manufacturing technologies, including advanced materials, in the Malaysian and Indonesian markets," said Composites Australia Executive Manager Kerry Caulfield.

"Activities include a trade mission for export-ready Australian advanced composites companies and R&D organisations to meet with peak industry bodies in those target markets. The initiative is targeting the automotive, aerospace, oil and gas, infrastructure and

ground transport sectors in both countries.

The program began in October with the Indonesian and Malaysian trade commissions developing background data on the size, scope, prospects and policies for each of the market sectors.

"Activities include a trade mission for export-ready Australian advanced composites companies and R&D organisations..."

"Composites Australia and the CRC-ACS will be working closely with the Trade Commissioners in Malaysia and Indonesia to match the capabilities of Australian advanced composites manufacturers and research organisations with identified opportunities.

"We believe there are opportunities for innovative Australian composites companies to enter Asian markets that are

looking for solutions that will deliver on their objectives.

"It could be components for low cost green cars, materials and technology to manufacture creative bridge design or prefabricated homes, or technology to detect and repair failing infrastructure in the oil and gas sector. These are all areas in which Australian composite companies have proven expertise. With the help of Austrade this project will identify opportunities to match this expertise with Asian market needs.

"We are extremely fortunate to have the advice, expertise and support of the trade commissioners in formulating our approach to the market and facilitating the meetings with decision-makers for peak industry bodies in both countries," Ms Caulfield said.

More information: The findings of this Austrade research will be presented to the composites industry at a half-day seminar in Melbourne on Wednesday, 18 February 2015. Contact: admin@compositesaustralia.com.au

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Scientists build case for Navy uptake of composites

Research underway at the Port Melbourne-based Maritime Division of the Defence Science and Technology Organisation (DSTO) is paving the way for new applications for thick advanced composite structures.

Dr Asintha Nanayakkara and Dr Nigel St John are members of a team focused on developing skills and knowledge of thick composite structures, covering the spectrum from material selection, design and structural analysis, manufacture and testing, through to damage and fatigue prediction techniques.

While there has been a lot of research conducted on the manufacture, design and testing of thin composite components there is less knowledge of the behaviour of thick composites, says Dr Nanayakkara.

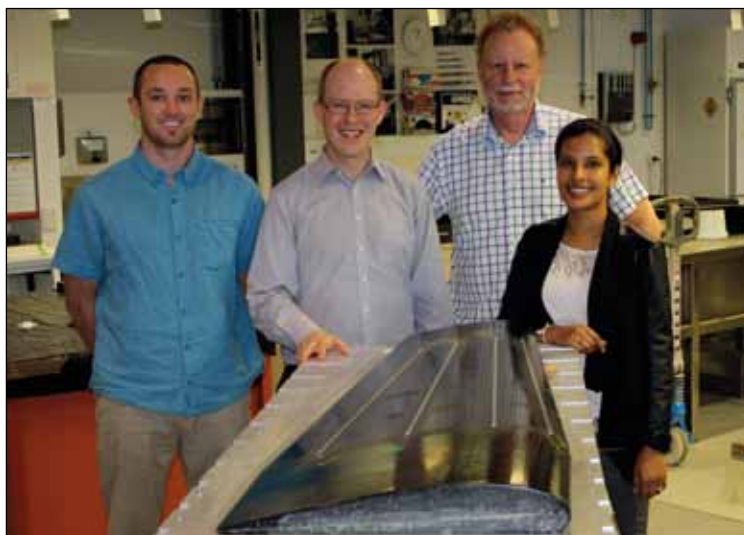
“A better understanding will lead to broader applications. Our focus is on thick curved composite structures for applications involving hydrodynamic loading such as rudders and control surfaces (hydrofoils),” she says.

“Thick composites are very complex, and have different properties to thinner composites due to their three-dimensional structure, thus their performance characteristics are different and, under water, the forces from shock are unique.”

Starting in early 2013, at the well-equipped DSTO research laboratories, work began to design and manufacture four versions of the 1.5m long hydrofoil in various combinations of core, outer ply materials and using out-of-autoclave manufacturing methods. The final model was laidup using a glass sourced from local manufacturer, Colan, for the core plies and a large tow carbon fabric from GURIT for the outer plies. The resin was infused using a closed mould RTM process. The thickness of the hydrofoil tapers from 100mm to 50mm. Curing the thick composite using RTM presented the first of several challenges for the project team.

“One of the issues with the manufacture of thick composite structures is controlling exotherm in the resin because you get too much heat from the resin,” says Dr St John. “So we did it in two halves, manufacturing each at 50mm thickness to give a combined thickness of 100mm in the final structure.”

Drawing on the DSTO’s advanced tools in modelling and test validation and the resources of partners at the UNSW Australia (University of New South Wales) and the University of Tasmania’s Australian Maritime College work on smaller scale foils, the large foil has been put through rigorous fatigue testing, with the results now being validated using Finite Element Analysis.



Top. Building the case: DSTO staff (left to right) Russell Cairns, Andrew Phillips, Nigel St John and Asintha Nanayakkara with the thick composite foil.

The results will inform specification for thick composite structures for future Australian Navy ships and submarines as well as identification and/or development of techniques such as acoustic emission, for the early identification of delamination and compressive, tensile and fatigue failure.

As well as the work on rudders and foils, the DSTO is testing composites in frigates and looking at robust composite sonar dome structures.

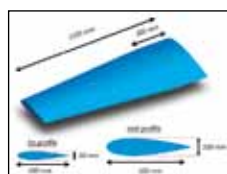
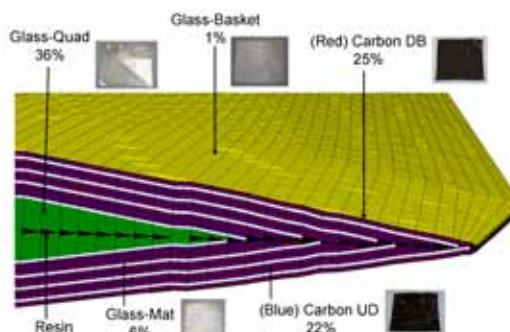
Like the Boeing Dreamliner, the team hopes to see future Navy vessels built with increasing proportions of advanced composite components as research proves

the benefits and provides solutions to barriers.

“One of the issues for advanced composites is to get people to take account of the life-cycle costs,” says Dr St John. Using more composite components would

reduce life-cycle costs due to the reduced weight; the ability to make complex shapes (less machining); and the anti-corrosion properties; and tailored mechanical behaviour in hydrodynamic control surfaces and rudders, increasing efficiency of the vessels’ movement through water.

Below. Profile of the material structure of the hydrofoil.



A schematic of the hydrofoil.

Advancing composites in infrastructure

Composites Australia and META (the Manufacturing Excellence Taskforce of Australia) have joined forces to bring the benefits of advanced composites technologies to Australian infrastructure projects.

“The Special Interest Hub for Advanced Composites in Infrastructure is bringing together leading researchers in the field, the composites industry, engineers, designers and infrastructure authorities to share knowledge

ADVANCED COMPOSITE STRUCTURES SHOWCASE

An audience of over 60 composite practitioners and infrastructure specifiers couldn't help but be inspired at a forum in Perth showcasing innovative and high quality Australia, and international infrastructure projects.

Brian Nelson, a structural engineer with Capital House Australasia, was unequivocal in his advocacy for composites technology. It is often the only material solution that meets both the performance specification and the creative brief for small bridges and architectural structures.

Glenn Swarbrick, whose family company pioneered marine composites in Australia during the 60s, outlined his professional journey from making ocean going yachts to aesthetically beautiful civic art and small bridges, applying the company's unique knowledge of composites technology.

The most profound example of the structural integrity of composites in infrastructure was presented by Tony Stanton. Tony showcased Gurit's Middle East portfolio of projects that bake in temperatures of up to 130°C. The aesthetic prize goes to the Pont y Ddraig (The Dragon's Bridge) at Foryd Harbour, Rhyl in Wales. Spanning 80 metres, the bridge boasts a 45-metre mast and two walkways, resembling the wings of a dragon, that lift to allow boats to pass.

Gosnell Council's faith in composite technology was showcased as the attendees assembled on the light-weight 21-metre single span Centennial Pioneer Park Pedestrian Bridge over the Canning River.

Skip Miller, Senior Design Engineer with the Composites Consulting Group, advised the audience that the rapidly decreasing technology costs are allowing developed countries to build wonderful structures competitively. He outlined, in order of cost, the available composite technologies and creative examples of their application in pedestrian bridges.



Western Australian manufacturers, engineers and designers gather on the Centennial Pioneer Park Bridge to advance composites in Australian infrastructure.

Detours and road closures are less than tolerated by busy commuter-based communities. Prefabricated, lightweight, easily transportable bridges offer Accelerated Bridge Construction solutions. Design approaches and unique applications will continue to be developed to exploit the advantages of Fibre Reinforced Plastics (FRP). To that end, a significant opportunity exists for more efficient and aesthetically appealing structural forms to be conceived and constructed using advanced composite technology.

Alan Wilkes from META introduced the Special Interest Hub for Advanced Composites in Infrastructure and was delighted with the enthusiastic response from the Western Australian composites community.

“Many of the companies expressed strong interest in joining the Hub and being part of what we are doing,” Alan said.

“The technical content of the presentations given was very enlightening. We look forward to continuing to open companies' minds up to what is possible.”

and work together to identify and harness the opportunities,” says project leader and highly respected composites engineer Dr Rik Heslehurst.

Dr Heslehurst’s primary focus is to progress development of standards and guidelines for the use of advanced composites in infrastructure under Australia’s unique conditions and identify capabilities within the composites industry and infrastructure project opportunities for advanced composite materials.

“There is a small but growing number of really exciting infrastructure projects around the world, and in Australia, demonstrating that advanced composites enable innovative, dramatic and more efficient structural forms, repair and strengthening systems, to be conceived and constructed says Kerryn Caulfield, Executive Manager, Composites Australia.

“Australia is engaged in world-leading research in this area, and with industry and academia working together, we can be at the forefront of this exciting new era in infrastructure.”

Recent reports by Infrastructure Australia and the Australian Local Government Association highlight the need for multi-million dollar investment in the repair and strengthening of Australia’s ageing and deteriorating bridges.

Events in Perth, Melbourne and Brisbane in October and November introduced the Hub and promoted awareness of the opportunities for composites professionals, researchers, engineers and designers. See page 10 for more.

More information: Dr Rik Heslehurst: rik@abaris.com
Alan Wilkes, META: alan.wilkes@meta.org.au www.meta.org.au

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Forum sparks collaboration on advanced composite infrastructure repair systems

A recent forum, attended by some 80 academic and industry experts, showcased Australia's capabilities in delivering advanced composite solutions for bridge repair and rehabilitation.

Hosted by Swinburne University of Technology in Melbourne and organised by Composites Australia and META, the forum sought to engage the industry and academic sectors in collaboration using the Special Interests Hub for Advanced Composites in Infrastructure. The Hub aims to increase the use of advanced composite technologies in Australian infrastructure construction and repair projects.



Co-chairs of the collaborative research and industry forum, Professor Riadh Al-Mahaidi and Kerry Caulfield in the Swinburne Smart Structures Laboratory.

"The expertise in the room was amazing," says Kerry Caulfield, Executive Manager of Composites Australia.

"From this forum came a collective understanding of the very significant knowledge and experience that has developed in Australian universities, the composites industry and government road authorities. It was pleasing to see such a strong unity of purpose and recognition of the extensive knowledge and experience Australia has in this area, and the value and importance of a collaborative, coordinated approach such as that afforded by the Special Interest Hub."

Mario Fantin, Principal Bridge Engineer at VicRoads, spoke from more than 40 years' experience in bridge projects, sharing how carbon fibre technology is currently being used in response to some major challenges the road authority is facing, particularly in relation to catering for heavier Higher Productivity Freight Vehicles. He also spoke on

VicRoads' review of AS5100 Bridge Design, in which sections of the Australian Standard relating to the use of carbon fibre for bridge strengthening and rehabilitation are being rewritten.

Michael Kemp, General Manager of Wagners CFT, spoke from more than 12 years' experience in the application of structural fibreglass components to civil engineering applications, including project management of the design and installation of the first composite fibre road bridge in Australia in Grafton, NSW and the first in Queensland, on the Blackbutt - Daguiar Highway.

Riadh Al-Mahaidi, Professor of Structural Engineering and Director of the Smart Structures Laboratory at Swinburne University of Technology, co-chaired the forum with Ms Caulfield. Professor Al-Mahaidi spoke from more than 15 years' research and practice on life-time integrity of bridges, particularly in the area of structural strength assessment and retrofitting of concrete infrastructure using advanced composite materials. Professor Al-Mahaidi's research has had a significant impact on the way bridges are assessed and strengthened for improved load rating. He shared the story behind the development of the innovative FRP anchorage system developed specifically for the West Gate Bridge strengthening project.

Professor Xiao-Ling Zhao, Chair of Civil Engineering at Monash University and author of the book *FRP-Strengthened Metallic Structures* (CRC Press 2013), provided an overview of FRP strengthening of metal structures as reported in the July 2014 *Connection* magazine.

Similarly, Professor Thiru Aravinthan, Director and Professor of Structural Engineering, Centre of Excellence in Engineered Fibre Composites University of Southern Queensland travelled from Toowoomba to share his research in fibre composites structures, pre-stressed concrete technology and structural rehabilitation. Professor Aravinthan has been a Council Member of the International Institute for FRP in Construction since 2010.

Dr Pedram Mojarrad, from Sika Australia Pty Ltd, outlined international and Australian Codes of Practice for Structural Strengthening, and Tony Stanton, from GURIT Pty Ltd, outlined case studies from his company's global advanced composites infrastructure projects.

'Car of the Future' drives composites innovation

Innovative engineering, design and increased use of advanced composite materials are adding new excitement to Australia's popular motorsport V8 Supercars.

V8 Supercars launched the 'Car of the Future' in 2013, ending the Ford vs Holden era by opening the door to other car makers. The new specifications encouraged teams to build lighter, more economical and agile cars that are highly competitive, making racing even more interesting for its millions of fans.

The opportunity for innovation and to join forces with Volvo Car Australia after many years with Holden was enough for Garry Rogers, a veteran of 50 years in the sport, to put aside any thoughts of retirement.

The Melbourne-based Garry Rogers Motorsport (GRM) team of engineers, designers, metal and composite technicians set about designing and building two Volvo S60s to maximise racing performance within the strict rules of the sport.

For GRM's composites manager Scott Compson and his team, the contract with Volvo and the 'Car of the Future' requirements opened opportunities to maximise the weight and aerodynamic advantages offered by innovative composites technologies. "We are in a lucky position to be able to do real-life trials of new and innovative products and processes without the regulatory restrictions that govern the aerospace industry. Suppliers approach us to test new products in the demanding motorsport environment that they want to bring to the market," says Mr Compson.

Using Kevlar, e-glass and a tailor-made hybrid glass aramid fabric that has superior impact and tear resistance, Mr Compson's team designed and built new moulds, introducing composites materials to an increased number of components, including door skins, front bar, rear bar, wings, guards, induction and cooling ducting, door trims, impact absorption structures, switch housings, airbox and brake driver cooling system.

"V8 Supercars still don't use composites, especially carbon fibre, to the same extent as Formula 1. It's been a gradual increase as changes in FIA approved regulations allow," says Compson.

"We try to get the advantage by using materials that are wear resistant, lightweight and have strength but flexibility. Each composite part is half the weight and lasts longer than the same component in metal. A lot of effort goes into layout design and material selection to maximise each component's performance," says Mr Compson. The GRM design of the Volvo S60's front bumper bar and aluminium and composite wings has proven critical to its performance. The GRM team designed and manufactured prototypes in various shapes and sizes for aerodynamic testing at the Royal Australian Air Force Base at East Sale before settling on the final combination.

The hard work over 12 months paid off with a brilliant debut for Volvo in the 2014 V8 Supercar series that has seen young driver Scott McLaughlin claim nine ARMOR ALL Pole Positions and four wins, upsetting the Holden/Ford dominance and creating massive spectator interest in the closely contested races.

Volvo Car Australia's then Managing Director, Matt Braid said at the February 2014 launch: "As the first luxury car manufacturer to enter V8 Supercars with a factory team, we're delighted to reveal our Volvo S60 race car to meet the challenge of the world's toughest touring car series and strengthen the presence of the S60 model line – and Volvo brand – here in Australia."

The striking blue Valvoline GRM Volvo Polestar S60 won two races at the recent Phillip Island V8 Supercar Championship thanks to brilliant driving by Scott McLaughlin, clever pit tactics and some innovative composites technologies.



Composite Sandwich Structure Design Requirements



Composite Engineer's Viewpoint

By Rik Heslehurst PhD, MEng, BEng (Aero) FIEAust, FRAeS, CPEng

Part 2 – Design requirement checklist

This article discusses the design requirements for composite skinned sandwich structures. As there are several unknown parameters in composite-skinned sandwich structures, a good set of design requirements is invaluable for the successful development of this type of structure.

The basic customer requirements must address the following aspects for a sandwich structure design and fabrication:

Performance

Functional Performance:

- Tensile or compressive or shear strength of sandwich structure facings
- Axial or shear stiffness of sandwich structure facings
- Facing materials of the sandwich structure
- The density of the sandwich structure
- The core materials for the sandwich structure
- Coefficient of thermal expansion of the core and facing materials in the sandwich structure
- Coefficient of moisture absorption of the core and facing materials in the sandwich structure
- Corrosion potential of the core and facing materials in the sandwich structure.

Spatial Constraints:

- Planar geometry of the sandwich structure
- Attachment method of the sandwich structure
- The sandwich structure edge constraints

Appearance

- The sandwich structure edge requirements (squared, tapered, taper angle, etc)
- Surface finish: i.e. do the facings need to be painted or protected?
- If mechanical fasteners are being used, will flush-head fasteners be required?

Time

- Time to fabricate the sandwich structure, including curing time of facings and core-to-facing bonding
- Durability of the sandwich structure (life-time)
- Storage of sensitive materials: i.e. film adhesives, facing prepregs
- Life-cycle

Cost

- Materials in the sandwich structure
- Expendable materials used to fabricate the sandwich structure
- Co-bonding or secondary bonding of facings to core
- Installation of the sandwich structure to other structures (time and personnel)
- Inspection of fabricated sandwich structure (time and personnel)
- Maintenance and repair
- Life-cycle

Manufacture/assembly

- Quantity to be manufactured
- Co-bonding or secondary bonding of facings to core?
- Curing temperature and conditions
- Trimming and cutting operations
- Joining requirements
- Number of operations to fabricate the sandwich structure
- NDI equipment required for inspection of the sandwich structure

Company capabilities

- Materials storage facilities
- Fabrication facilities and equipment
- Machine shop capabilities
- Clean room availability

Standards

- Legislated requirements
- Company requirements
- Industry fabrication requirements
- Testing

Safety of Personnel

- Cutting and grinding (machining composites)
- Handling of hazardous materials
- Composite and adhesive curing

Environmental Issues

- The damaging environment
 - Fluids
 - Gases
 - Acoustic
 - Impact
 - Electrical
 - Cyclic loading
- Disposal of contaminated waste used during sandwich structure fabrication
- Disposal of sandwich structure materials at the end of the structures/ components life-of-type

Maintenance & Repair

- NDI equipment needed to inspect the sandwich structure in-service
- Repair materials and equipment required
- Trained personnel to undertake the maintenance and repair activities.

In the next issue of *Connection* we will consider the terms, definitions and global properties of composite skinned sandwich structures. There are a few terms, definitions and global properties unique to sandwich structures and these will be explained in some detail. All published articles in the series are available online under 'For Industry'.

Rik welcomes questions, comments and your point of view by email to rik@abaris.com

Composites Australia and CRC-ACS 2015 Conference & Trade Show



GAME ON! WINNING WITH COMPOSITES



Dr Michael (Mickey) McCabe, Executive Director of the University of Texas at Arlington Research Institute.

The 2015 Composites Australia and CRC-ACS Conference and Trade Show will be held on Queensland's Gold Coast on 22 – 23 April with a workshop on Tuesday 21 April.

The conference is attracting local and international industry leaders and researchers and promises delegates two powerful days of knowledge exchange, networking and business development opportunities at the stunning five-star Sanctuary Cove Resort.

With the theme *Game on! Winning with Composites*, topics include new and emerging composite technologies and materials; new product development; innovative solutions to design and engineering challenges; novel and new technical applications and processes; performance analysis and standards; and marketing and business strategy.

"The conference and trade show is an excellent opportunity for composite professionals and academia to come together to remain at the forefront of emerging trends, make and renew connections and share their knowledge and experiences," says Kerry Caulfield, Executive Manager of Composites Australia.

"A hallmark of this annual conference is the generosity of industry leaders who share the stories of their journeys, knowledge and experience mixed with the extremely strong academic streams.

"It is this strong mix that has built up the conference to be the most important event for the industry in the region.

"It is made possible through the support of our partners, the CRC-ACS, the invaluable contributions of SAMPE and the Australian Composite Structures Society (ACSS) and our generous sponsors."

Keynote speaker is Dr Michael (Mickey) McCabe, Executive Director of the University of Texas at Arlington Research Institute. Dr McCabe will speak on

Strategies for Winning with Composites in a Global Market.

Dr McCabe joined the institute this year (2014) after nine very successful years as Executive Director of the University of Dayton Research Institute.

Under his leadership, the University of Dayton and its Research Institute became a regional leader in technology-based economic development and a national leader in materials research, ranking second in the US in materials research volume according to the National Science Foundation.

Prior to joining the University of Dayton, Dr McCabe's experience included directing the development and application of advanced composite materials for all jet engine composite components at GE Aircraft Engines. He was responsible for the material selection, process development and the production of certification composite fan blades for the GE 90 engine. Prior to that, he managed various technology operations for Armco Inc.

that supported their aerospace advanced materials business.

Dr McCabe holds technical experience and background in the areas of polymers, fibres and composite systems including organic matrix composites, ceramic matrix composites, and carbon/carbon materials. He is the sole inventor on US Patent #4,661,336 concerning the production of carbon fibres.

Dr Rik Heslehurst will present the pre-conference workshop on *The Art and Science of Bonding Composite Structures*, an extensive discussion and demonstration of surface preparation of composite materials and the global science of adhesively bonded joint design.

More information: Full details on the conference, registrations, call for papers and speakers are available on the website www.compositesconference.com

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Keen interest in new closed moulding technologies

Australian composite professionals are clearly keen to explore new manufacturing technologies and techniques, with registrations for the recent closed moulding technology clinic in Melbourne outstripping available places.

Thirty people from across Australia, who make products for a wide range of markets, spent two days in intensive training with Charles Tur, RTM/Infusion technology specialist from USA-based Magnum Venus Products (MVP).

Through theory, demonstrations and hands-on training they learned how to take their production into closed moulding, including the next generation process, Infusion, using the Flex Moulding Process.

"We know many manufacturers in Australia have already made the move to traditional closed moulding, such as Light RTM or classic bag infusion, but they have been unable to make complicated parts with an undercut using those methods. Flex Moulding

Process not only solves the problem of producing complicated parts, it allows for multiple parts to be injected," says Joan Tracy, MVP's Vice President International Sales.

"Using a flexible membrane is the key to making parts with an undercut that cannot be produced using the rigid counter-moulds in traditional Light RTM. With a reusable membrane, you have the

benefit of working with an undercut, and it ultimately saves money, time and waste material over the classic infusion bag," Ms Tracy said.

In support of his industry, Stephen Campbell of Composite Constructions generously provided the venue for the course. It was the first in a series bringing latest technologies in closed moulding production to Australian manufacturers with funding support from the Victorian Government's Manufacturing Productivity Networks Program.



The second course in the series will be held in Melbourne on 4 and 5 March 2015.
For more information visit
www.compositesaustralia.com.au/events



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Composites 'top hat' secures *Silent ANZAC*

The historically significant contents of the World War I Australian submarine HMAS AE2 are secured for the future with an Australian advanced composites 'top hat'.

The submarine was the first to make its way through the Dardanelles' minefields and forts as the ANZACs landed. Known today as the 'Silent ANZAC', it sits upright in 73 metres of water in the Sea of Marmara where it fell in battle on 30 April 1915.

In June this year, the submarine's contents were viewed for the first time, when the hatch was opened by a multi-nation expert team led by the AE2 Commemorative Foundation.

The Foundation enlisted the support of Australian-based advanced composite manufacturer and composites specialist RPC Technologies to design and manufacture a 'top hat' in Glass Reinforced Plastic (GRP) to replicate the opened conning tower hatch and secure the sub's contents.

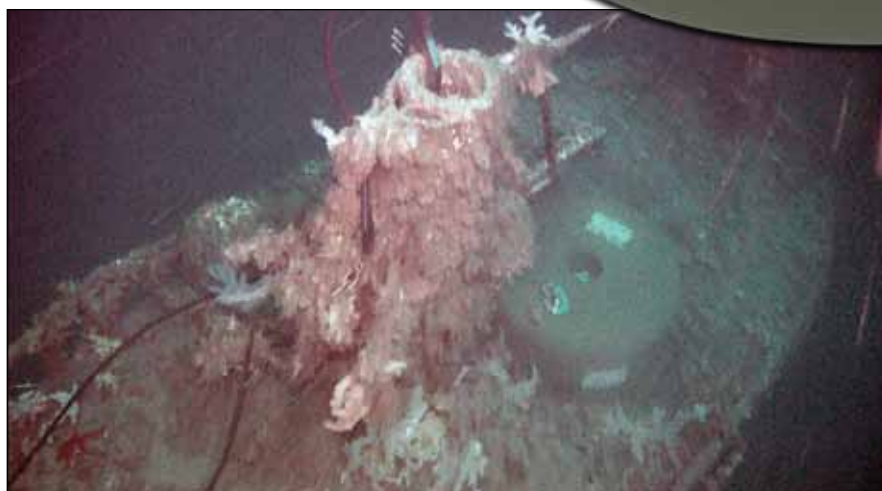
John O'Brien, RPC's Maritime Business Development Manager, coordinated the project. "The impressive strength-to-weight characteristics of composite materials made GRP a natural choice for the top hat. GRP also offered the lifelong corrosion resistance needed in an underwater environment as well the strength to properly secure the vessel from unauthorised entry," said Mr O'Brien.

James Zegir, RPC's Defence Technical Manager and designer of the top hat said: "Composite materials, like GRP, give us the ability to produce complex shapes to enable multiple components to be moulded into one part, which also helps to save on weight and reduce manufacturing costs".

The Foundation said the project was an extraordinarily successful collaboration of experts, all volunteers, drawn from Australia, USA and Turkey, and acknowledged the generous support of RPC Technologies.

RPC's Managing Director Tony Caristo said the company was fortunate to have some of the world's leading composite engineers to draw upon when faced with such challenges.

The huge amount of footage obtained during the survey of the 100-year-old time capsule is being analysed by experts on the AE2CF team, the Australian National Maritime Museum and the Museum of Western Australia.



Top. The Australian designed and built advanced composite 'top hat' before it was put into place on the WW1 Australian submarine lying at the bottom of Turkey's Sea of Marmara.

Left. The 'top hat' in place, securing the historically significant contents of the *Silent ANZAC*.

Research to catapult UK composites to success

Kerryn Caulfield reports on her visit to the University of Sheffield Advanced Manufacturing Research Centre (AMRC) with Boeing, where she meets two Australian research engineers focused on making the composite industry more competitive.

Born out of a vision to apply Sheffield's traditional expertise to new materials, the University of Sheffield Advanced Manufacturing Research Centre (AMRC) with Boeing was established in 2001 as a £15m collaboration between the university and aerospace giant Boeing, with support from Yorkshire Forward and the European Regional Development Fund.

This partnership between industry and academia has become a model for research centres worldwide, including the Melbourne-based Swinburne University AMRC.

Its primary aim is to help manufacturers become more competitive through the application of new techniques, materials, technologies and processes.

Built on a former open cast coal site, the AMRC is a far cry from the days of riots against the closures of the pits. Indeed, those heady days in the 80s motivated the UK government to invest in High Value Manufacturing and emerging

technologies, particularly composites materials, through its Catapult funding program. The program recognises that to increase the role that manufacturing plays in the growth of the economy requires investment in new knowledge and a demonstration of the benefits for industry to adopt the innovation.

Now employing around 200 highly qualified researchers and engineers from around the globe in two purpose-built centres on the Advanced Manufacturing Park in South Yorkshire, the Sheffield centre has grown rapidly, particularly after securing a further £10m funding for the 4,500 m sq AMRC Rolls-Royce Factory of the Future in 2008 and a new Design Prototype and Test Centre.

More than 80 member companies pay an annual fee to access the AMRC resources and expertise. Importantly, these companies all help determine the research program to ensure manufacturable and merchantable outcomes.

The composites research group focuses on four identified priorities: solutions for the composite machining community; automated manufacturing technologies; advanced curing technologies that provide alternatives to autoclave; and novel materials and processing, including dry-fibre processing, bio-composites, process simulation and life-cycle analysis.

It was a proud moment when I was introduced to two accomplished Australian research engineers leading projects at the centre. Educated at Deakin University, Dr Betime Nuhiji left Geelong in 2010 to take up a prestigious position at the University of Leeds in England. Her recent appointment at the AMRC Composites Centre is providing further scope to progress her work with advanced composites.

"The composite research at the AMRC focuses on the production and machining of composite components. As an example, I'm working on a disruptive technology to manufacture composite materials - microwave curing. By utilising this technology, we are demonstrating the potential for this method to offer great savings in cure time and energy without compromising quality," says Dr Nuhiji.

The Director of the AMRC's Composite Systems Innovation Centre is another Aussie, Professor Alma Hodzic. Researchers and PhD students under her supervision conduct internationally collaborative research projects in life-cycle assessment of aerospace emissions, covering all aspects of engineering materials manufacturing and transport. Prof. Hodzic's current projects include bio-polymers and bio-composites, multifunctional technologies involving inkjet printing in composites, recycled polymers for structurally loaded structures, novel high-performance impact resistant composites and hybrids, and more. Professor Hodzic is Editor in Chief for *Advanced Manufacturing: Polymer and*



Accelerating the British composites industry through research: (l-r) Dr Hannah Tew, Kerryn Caulfield and Dr Betime Nuhiji tour the AMRC with Boeing Composites Centre in Sheffield.

Composites Science, established this year with Maney Publishing.

Recognising that engineering drives technology change throughout the economy, the UK government, along with employers, has invested in skills and specialist training provision to complement the AMRC R&D facility and to fortify the country's manufacturing sector. The AMRC Training Centre opened its doors for the first time in October 2013. It is an amazing place, with state-of-the-art machinery and technology, teaching rooms and open learning areas for over 100 apprentices in advanced engineering fields aligned to the Centre's research groups. These schemes come with much greater levels of employer engagement, helping to ensure their needs are met.

Indeed, the UK is experiencing a renaissance in apprenticeships. The Engineering Employers Federation reports that in engineering and manufacturing technologies new starts in 2012/13 reached over 66,000, which was 13% of all new apprentice starts.



The robotic filament winder machine used by Dr Nuhiji's group is an example of the advanced technologies available to composite researchers at the AMRC.

Vale Geoffrey Ross Jefferson Coghlan - Australian composite pioneer

Geoffrey Ross Jefferson Coghlan was a visionary who in his early 20s saw an industrial future for Australia.

He envisioned the growth of Australian manufacturing through technology transfer and, in conjunction with one of Britain's oldest textile firms, introduced the manufacturing of woven fibreglass fabric into Australia.

In 1954, he established Colan Products and 60 years later Colan, headed by his daughter Genelle, remains at the forefront

of industrial textile manufacturing in both composites and safety and protective textiles.

A contributor to the framework of business leadership, Mr Coghlan was one of the foundational members of the Australian Institute of Company Directors. He died on 23 October 2014 aged 87 and is survived by his wife Pamela, four children, 11 grandchildren and two great-grandchildren.

Many members of the composites industry attended the Sydney funeral.



Research round-up

Chemical arms give carbon fibre gripping power

Australian researchers are giving carbon fibre the gripping power it needs to be able to stand up to motoring impacts.

Ms Linden Servinis, a PhD student at Deakin University, and her colleagues have developed a treatment for carbon fibre that makes it 16% stronger by forming extra chemical 'arms' that grip onto the resins enabling the material to withstand greater impacts.

While carbon fibre composite materials are extremely light-weight and stronger than steel, in high impact

situations such as a car crash, the individual fibres break free of the resin and the strength is lost.

Ms Servinis and her colleagues have discovered that large sections of the carbon fibre surface, which were previously thought to be unreactive, are an untapped resource for chemical reactions.

"This research seeks to prevent composite failure by adding new chemical arms with reactive chemical hands at the ends. These hands can

then grab onto the resin in a chemical reaction, and prevent failure, making a stronger material," Ms Servinis said.

By creating a less damage-prone material, Ms Servinis hopes to increase the likelihood of wider carbon fibre uptake by the automotive industry.

"This and other research at Deakin is providing a better understanding of the subtle molecular interactions which can have a large impact on composite performance," said Ms Servinis.

Closed moulding reduces styrene emissions

A European-wide study has compared the styrene emission levels from three commonly used composite processing techniques.

The study looked at conventional hand-painted gel-coating, in-mould

gel-coating with a separator fabric and in-mould surfacing with silicone shim processes to establish if styrene levels can be significantly reduced by the adoption of closed mould systems.

The hand-painted technology was

found to have significantly higher levels of styrene emission than the two closed mould processes. For the open mould process, the average styrene

levels were in the range 28-70 parts per million (ppm).

The two closed mould technologies were shown to significantly reduce the measured styrene levels, to lie in the range 0.23-0.37 ppm, demonstrating a reduction in average styrene emission levels of more than 98%.

The research is part of a two year €1.4million collaboration led by Plymouth University and funded by the European Union's Framework Programme 7 (FP7), seeking to develop an innovative environmentally friendly gel-coating technology for composites to reduce VOC emissions, processing time and cost. www.InGeCt.eu

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Composites welding technique developed in Australia

Australian breakthroughs in techniques for welding composite materials promise to dramatically change aerospace engineering by cutting aircraft construction time and cost.

University of Queensland PhD student Luigi Vandi is refining the new process that allows carbon-epoxy composite materials to be welded by incorporating a thin layer of weldable material during the manufacturing process.

"Using this process, welding composite materials takes only 15 minutes, compared to a typical two-hour process for conventional adhesive bonding methods," says Valdi.

His research involves unravelling the molecular mechanisms at the interface between the composite and the weldable material. Understanding the molecular process ensured the technology could be safely implemented in aircraft engineering and construction, says Valdi.

Events Schedule 2015

February

Wednesday 18
Melbourne

Austrade Research on Indonesia and Malaysia Markets

A half-day seminar to share the findings of Austrade research for the Asian Business Engagement project. To be presented by Andrew Beehag, Utilisation Manager at the CRC-ACS.

March

Wednesday 4 – Thursday 5
Melbourne

Closed Moulding Technology Clinic

A two-day technology clinic offering Australian practitioners high level instruction and hands-on demonstrations of next generation closed moulding technology.

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 Adelaide 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 Adelaide 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

Monday 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 Adelaide 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 10
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.



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