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From the WTIA CEO

Public safety is at risk unless politicians legislate to enforce compliance with Australian standards for fabricated steel. There are buildings and infrastructure across Australia, manufactured from imported fabricated steel, that do not meet Australian standards. This country urgently needs laws to ensure all fabricated steel erected in Australia is certified as compliant, with all relevant standards enforced.

The WTIA recently received copies of documentation that show a grain silo under construction in a rural Australian location is being built from imported fabricated steel modules that are not compliant.

A WTIA-certified, senior welding inspector’s report showed that 10 separate items tested did not comply. Problems identified by the tests included undersize, missing and incomplete welds.

A separate qualified consultant’s visual weld inspection of the imported silo support structure found none of the welds inspected was compliant with the Australian standard, AS/NZS 1554.1:2014. Both reports include photographs that clearly show the sub-standard welds.

Despite the serious safety issues raised in these reports, construction of the silo is proceeding, without rectification of the non-compliant welds. Without rectification, the silo could collapse and cause a number of fatalities as a result.

This silo is just one example of major a problem across the nation. Approximately 85% of the 600,000 tonnes of imported fabricated steel that enters Australia each year is non-compliant.

My colleagues and I in the steel supply chain have provided details of dangerous structures, including a footbridge between two schools in Western Australia, to government agencies but our warnings have been largely ignored.

It seems our governments are not taking public safety seriously. Right around Australia, there are bridges, light poles, crash barriers, road gantries and other infrastructure manufactured from imported, fabricated steel that has never been certified as being safe—all have the potential to fail and cause loss of life.

Compliance with Australian standards is not mandatory and there is no way anyone can legally force the owner to rectify the sub-standard workmanship. As it stands, the Australia Standard is a toothless tiger. We need a law that says no fabricated steel structure can be erected in Australia without being inspected and certified as compliant.

There is a watchdog, the Australian Competition and Consumer Commission, that protects children from unsafe imported toys, but there is no regulation to protect the Australian public from imported, fabricated steel that poses serious safety risks to all Australians.

The Australian welding and fabricating industry is not seeking special treatment from our government, just compliance with the same set of rules that govern Australian-made steel fabrications, for imported steel.

The Australian steel industry’s future is at risk and while it is important to retain a vibrant industry, public safety must be paramount in politicians’ minds. While we need fair competition for Australia’s fabrication and steel industry, more importantly, we must protect lives.

The WTIA is proposing a bipartisan approach from all politicians to support such legislation. The WTIA has recommended a two-tiered scheme with audited self-certification permitted for some fabricated products, but compulsory third-party certification for fabricated steel used in high-risk projects, such as road, rail, mining and energy infrastructure.

As the welding industry’s peak body, the WTIA is in a position to manage the scheme at no cost to the Federal Government, including facilitating independent, third-party qualified inspectors to ensure welds on imported steel were safe.

We need commitments from all sides of politics to legislate. Must we wait for deaths to occur? We need action now.
FROM THE WTIA CEO

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Inside the Industry: Breaking News

Training Partnership to Boost Steel Industry

The WTIA aims to develop a stronger skills base for the Australian steel industry through a partnership with TAFE NSW. The two organisations have signed a memorandum of understanding (MoU), with the WTIA aiming to get similar agreements in place with TAFEs across the nation.

WTIA will work with TAFE NSW to implement a consistent standard of welding training, certified to ISO 9606. Together, the organisations will reinstate the trade of welder to the TAFE syllabus, instead of light or heavy fabrication worker categories, and ensure training is more industry focused.

Lucy Arundell, TAFE NSW Illawarra’s Institute Director said, “Together, TAFE NSW and WTIA will strive to secure the future of the Australian welding industry by producing highly skilled, qualified welding professionals.”

SA Government Pledges $50 million to Upgrade Arrium’s Whyalla Steelworks

The South Australian Government has pledged $50 million to support the new owner of the Whyalla steelworks. South Australian Premier, Jay Weatherill has also called for a bipartisan commitment from both major parties federally to contribute $100 million towards the funding facility to give the Whyalla steelworks the best chances of a long-term future.

This would mean the total funding being offered to a new purchaser would be $150 million. The investment would support the long-term sustainability of steelmaking at Arrium and maintain the company’s operations in South Australia. The funding will be allocated to technological efficiencies or upgrades in the Whyalla operations, to ensure that tax-payer money is spent to benefit the thousands of jobs at Arrium and in the wider supply chain.

Australian Government Selects DCNS For the Future Submarine Project

The Australian Government has selected French naval shipbuilding company DCNS as its preferred international partner for the design of 12 Future submarines for the Royal Australian Navy.

The Australian Government stated: “The decision was driven by DCNS’s ability to best meet all of the Australian Government’s requirements. These included superior sensor performance and stealth characteristics, as well as range and endurance similar to the Collins Class submarine. The Government’s considerations also included cost, schedule, program execution, through-life support and Australian industry involvement.”

“This success has been made possible thanks to the strong teamwork between the French Authorities, DCNS and our industrial partners,” said DCNS Chairman and CEO, Mr Herve Guillou.

“France and Australia have been allies for more than 100 years and we look forward to further strengthening this time honoured relationship and honouring the trust the Australian Commonwealth Government is placing in us for this ground breaking project,” Mr Guillou said.

Subject to discussions on commercial matters, the design of the Future Submarine will begin this year.
Federal Government Announces Build Locations for Offshore Patrol Vessels, Pacific Patrol Boats, and Future Frigates

The Australian Government has announced the build locations for 12 offshore patrol vessels (OPV) and up to 21 pacific patrol boats, in addition to nine previously announced Future Frigates as part of the government’s $40 billion Naval Shipbuilding Plan. The Australian naval program is expected to generate more than 2,500 jobs.

Two shipyards have been selected to implement the naval program with the major warships to be constructed in Adelaide and minor vessels in Henderson, Western Australia.

Offshore Patrol Vessels
The construction of the OPVs is scheduled to begin in 2018 in Adelaide, following the completion of the air warfare destroyers and transfer to Western Australia, when construction of the Future Frigates begins in Adelaide in 2020. Netherlands-based Damen and Germany’s Fassmer and Lurssen have been selected to design the new OPVs. The OPV program is valued at more than $3 billion and is expected to secure over 400 direct jobs.

Future Frigates
For the Future Frigates programme, BAE Systems with the Type 26 frigate; Fincantieri with the FREMM frigate and Navantia with a redesigned F100 have been shortlisted to refine their designs.

The frigates will be installed with the Australian-developed CEA Phased-Array Radar and will be built in Adelaide in 2020. Netherlands-based Damen and Germany’s Fassmer and Lurssen have been selected to design the new OPVs. The OPV program is valued at more than $3 billion and is expected to secure over 400 direct jobs.

Pacific Patrol Boats
Under a combined first and second pass approval for the replacement Pacific Patrol Boats (PPBs), Austal Ships has been selected as the preferred tenderer to construct and maintain up to twenty-one replacement steel-hulled PPBs in Henderson, Western Australia. Austal will provide support for the replacement PPBs, including deep maintenance from Cairns, Queensland. The program is expected to be worth more than $500 million and will generate over 130 jobs.

Source: www.naval-technology.com

ASC Welcomes Future Submarine Announcement

Australian submarine builder and maintainer ASC congratulated DCNS on being selected as the Government’s design partner for Australia’s Future Submarine project and congratulated the Government on completing a very thorough and professional Competitive Evaluation Process.

Interim Chief Executive Officer Stuart Whiley said the decision to build the 12 future submarines in Australia was recognition of ASC’s highly skilled workforce and their recent productivity improvements.

“ASC has more than 2,600 men and women currently working on submarines and warships; it’s the largest and most capable naval shipbuilding workforce in Australia and the quality of their work is world class,” he said.

“I congratulate the thousands of workers and suppliers whose commitment to innovation and continuous improvement on our Collins Class program has been a major factor in giving the Government confidence to build the future submarine fleet in Australia.

“ASC is committed to working collaboratively with DCNS from the earliest stages and sharing our unique understanding of Australian submarine requirements and conditions to ensure we build on Australia’s sovereign submarine capability to meet future needs.”

“We are committed to continuing the improved levels of availability and reliability of the Collins Class submarines and being a major partner in the future submarine project. We believe our involvement in both projects will ensure a seamless transition between the two classes and deliver an enduring and potent submarine force for the Royal Australian Navy.”

Image Courtesy of ASC.
Inside the Industry: Breaking News

CSIRO Launches New Advisory Services to Help Business Mix the Right Science Formula

CSIRO has launched a new business advisory service to help Australian and international businesses make the right science and technology investments for the future.

To mark the launch, CSIRO has released a report on how businesses can prepare for an uncertain future. *Australia 2030: navigating our uncertain future* outlines four scenarios for Australia’s future and identifies growth opportunities under each. It also presents a framework to guide business planning and investment in research and development. The service will be delivered by CSIRO’s advisory and foresight group CSIRO Futures.

CSIRO has been researching megatrends for a number of years but this new approach will put that into practice by working with industry to explain how they can set their businesses up for the opportunities and challenges these megatrends might present. The next stage of this work will be to develop specific roadmaps for Australia’s key industry sectors including METS (mining equipment, technology and services); advanced manufacturing; medical technologies and pharmaceuticals; oil, gas and energy resources; and food and agribusiness.

Furphy’s Invest Millions

*By David Lee (Source: www.sheppadviser.com.au)*

A new multi-million dollar investment into improving stainless steel operations at J Furphy & Sons is set to be in operation by the end of July.

The $3 million project, dubbed Project 150 after the company’s celebration of 150 years, began in December 2015 and has seen a 1,500sqm complex constructed on the New Dookie Road site in Shepparton, Victoria.

The complex features a 40m long section with an overall height of 22m and will allow for a more efficient construction of the company’s stainless steel tanks and will provide the opportunity for growth of the tank production.

This new expansion is the first since the company installed a 32m high roof building just over five years ago, which has also been utilised to improve stainless steel tank operations.

J Furphy & Sons managing director, Adam Furphy said, “This expansion will provide us with the capabilities for big improvements in our working space and allow for a better flow in the production line.”

“The reason for the expansion is mainly about improving efficiencies, but is also to allow for growth and the production of a quality product. We want to be able to cope with doubling our current capacity and this will help us do that. We also need to do everything we can to improve our cost base.”

“The new space will enable us to receive and work on materials entirely under cover, meaning our current quality levels will be achieved a little easier.”

“We will begin fitting out the complex soon with world-leading, automated welding, forming and finishing equipment that has been purpose built for the production of stainless steel tanks. Our stainless steel tanks section is utilised across many industries including dairy, beverages, food, chemical, industrial and water treatment, Australia wide. Our output for these products is strong at the moment.”
Steel Alloy Shows Record-Breaking Shock Resistance

A team of engineers from the University of California, San Diego, the University of Southern California and the California Institute of Technology has developed and tested a type of steel with a record-breaking ability to withstand an impact without deforming permanently.

The new steel alloy could be used in applications from drill bits, to body armour for soldiers, to meteor-resistant casings for satellites. The material is an amorphous steel alloy, a subclass of steel alloys made of arrangements of atoms that deviate from steel's classical crystal-like structure, where iron atoms occupy specific locations.

To make the solid materials that comprise the alloy, the team mixed metal powders in a graphite mould. The powders were then pressurised at 100MPa and exposed to a current of 10,000Ampers at 630°C during spark plasma sintering. This technique allows for enormous time and energy savings.

Australian Researchers Combine Robotics and 3D Printing In Prosthetic That Restores Sense of Touch

A collaboration between the University of Melbourne, the University of Wollongong, and several other institutions coordinated by St. Vincent's Hospital's Aikenhead Centre for Medical Discovery, is studying the way the human arm communicates signals to the brain, with the intention of reproducing that signaling process artificially.

Right now they’re working on prototyping a robotic arm that would use 3D printed microchips to facilitate communication between implanted electrodes and natural tissue and muscle. The project stems largely from the research of Mark Cook, a neurologist at St. Vincent's, who used a highly complex set of mathematical models to record and decode the electrical activity happening in the brains of test subjects as they performed different movements. By analysing the recordings, Dr. Cook was able to ascertain which combinations of electrical signals correlated to which movements.
International News

Canadian Innovation

Canadian Welding Association Executive Director, Dan Tadic discusses the state of the Canadian welding industry, with a particular focus on its growing number of innovative new technologies. All these new welding technologies and processes are improving quality, increasing productivity and, most importantly, inspiring a new generation of welders, engineers, and technologists. The future is bright for the Canadian welding industry.

In the last 25 years, the Canadian welding industry has really come of age. Dozens of new welding technologies and process have been developed, and our universities are doing incredible work in developing new technologies and process that will have practical industry applications in the years to come.

Whether we are welding on heavy machinery, construction, or pipelines, welding light gauge materials or even micro joining technologies, these new technologies are having a profound impact on our economy and industry, helping improve productivity.

A new generation of digitally controlled GMAW (Gas Metal Arc Welding) technologies has been developed to better control arc welding spatter and heat input, reduce fume generation, improve tolerance to bridge wide gaps, and reduce defect rates. These innovations include: RMD (Regulated Metal Deposition), STT (Surface Tension Transfer), CMT (Cold Metal Transfer), and many other technologies.

Over the last few years, a whole new generation of AC/DC Sub Arc welding technologies have made ground breaking advances that allow for significant improvement in weld penetration control, resulting in increased productivity and quality.

Welding lasers are gaining prominence in the automotive steels industry, particularly in applications that merge GMAW with laser hybrid applications. Recent developments include Laser Wobble Welding. In this process, moving a high power density laser spot size in a circular, linear figure 8 (or infinite ‘∞’ fashion) at 300Hz, the Wobble optics have been able to weld materials that were considered unweldable without the addition of alloying filler wires.

In our automotive welding research, the need for lighter weight and better performance (such as crashworthiness) in vehicles is pushing us to develop and optimise laser and resistance spot welding processes for assembly of ultrahigh strength steel (over 1500 MPa).

Newly patented laser processing technology for multiple memory NiTi alloys are expected to see commercial products in the next five to ten years. These products will be capable of multi-level actuation and multi-force functions in various industries, including in the dental, sporting, and automotive industries.

The patents on Friction Stir Welding (FSW) technologies have expired and many researchers are developing new applications for this technology for welding a very broad range of metals, including pipe.

In addition, optimisation of FSW process parameters is being utilised to join dissimilar magnesium alloys. This innovation will come from the development of process parameters that will promote increased weld strength, while reducing the corrosion susceptibility. Plasma electrolytic oxidation coatings are also being used to improve the corrosion resistance of welded components.

The research in computer models of welds will change the way welded structures are designed and fabricated in order to: minimise distortion and optimise weld sequence and fixtures; minimise the risk of fracture and maximise fatigue and creep life; and enable us to see weld pools, microstructures, stress...
and strain. The welding industry is evolving—there is no need to play ‘what if’ games any longer.

The smart WPDS (weld procedure data sheets) will change training for welding technology. Vision and Sensing technology will help to evolve welding, as the cost of sensors and computation drop to new lows. This has opened the door wider for real-time monitoring feedback on automated systems, and for augmented reality based quality control during manual welding.

These new, evolving technologies will improve quality, increase productivity, develop new welding applications, and inspire a new generation of engineers, technologist, and welders. Our welding industry has a very bright future with numerous technological innovations to look forward to.

About Dan Tadic

Dan Tadic is the Executive Director of the CWA, appointed to the role in 2009. Dan has been a member of the CWA since 1979 and has served on a number of executive committees designed to promote welding industry initiatives and support welding education. Dan was a strategic account manager for Praxair (the largest industrial gas company in North and South America) for 30 years before joining the CWA.

About the Canadian Welding Association

With more than 63,000 members and 24 chapters across Canada, the Canadian Welding Association (CWA) is a not-for-profit division of the CWB Group. The CWA is a national membership driven association, which provides all welding professionals the opportunity to exchange information, share knowledge and resources, and work with government and regulatory agencies and each other to advance the welding profession, its products and its practices. For more information, visit: www.cwa-acs.org.

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National Manufacturing Week: The Home of Innovation

Held from May 11 to 13 in Sydney, this year’s National Manufacturing Week (NMW) saw more than 200 companies exhibit, 50 speakers and over 5,000 visits by attendees. The event showcased hundreds of products and services, each and every one demonstrating its own breed of innovation, advancement and opportunity for collaboration.

This year’s event was defined by the twin themes of innovation and collaboration, with several seminars focused on the opportunities available to manufacturers to aid in breaking down barriers to innovation.

“The time for action is now,” urged the Hon Karen Andrews MP, Assistant Minister for Science, in a keynote address on NMW’s final day.

“I know that Small and Medium Sized Enterprises have had some hesitation in the past around approaching the universities for partnership - due to barriers such as cost - but I invite businesses to come talk to the Department of Industry, or to me personally: because there are some real opportunities on the table, and we are keen to help business make connections that can support your growth,” said Ms Andrews.

The Assistant Minister’s comments were reflected throughout the NMW program. Western Sydney University’s Dr Sasha Alexander challenged visitors with the observation that, “Every time a stranger enters the business, innovation happens.”

Dr Alexander went on to explain how an outsider’s view of your business - from industry partners, consultants and even competitors - can challenge your assumptions, opening your eyes to new markets and product development opportunities.

Tim Mclean, Managing Director of TMX Lean Solutions, discussed the application of lean management principles away from the factory floor, in areas such as administration, marketing, sales and customer service. Mclean urged Australian manufacturers to be innovative, to adapt lean management principles in a different way to reduce overheads and remain competitive.

Bob Paton, CEO of Manufacturing Skills Australia, delved into the skills that are necessary to drive a robust Australian manufacturing sector. He contended that Australia needs to find a new place within the global manufacturing sector by embracing technology and adopting a fresher way of thinking. According to Paton, Australian manufacturers must implement transformative technology, such as three and four-dimensional printing, and the internet of things. We must explore new horizons defined by innovative risk-taking, and focus on the convergence of services and products.
INSIDE THE INDUSTRY: NMW 2016

Welding Technology Zone

The Welding Technology Zone showcased innovations from some of the welding industry’s leading names, including Kemppi, Fein, Innovative Welding, Ensitech, Klingspor, Metal Science Technologies, Weldbrush and many more.

Kemppi held major demonstrations at the event, presenting its latest technologies and solutions. Kemppi’s Regional Sales Manager, David Coleman said, “We were on our feet all day, from day one: showing customers our entire range, especially our Pulse FastMig and our new automation products. Kemppi brought a wide range of products to NMW, from basic machines to the latest solutions, to show industry the latest technology in action.”

For many, the TIG Brush system is one of the industries greatest developments. It’s inventor and manufacturer, Ensitech, presented - for the first time – insight into its unique fluid delivery system that puts an end to ‘dipping’ processes for stainless steel weld cleaning and passivation. Ensitech’s Esther Sokoya said, “This new system is clean, efficient and effective: and judging by the feedback we received at NMW, it’s a very welcome development.”

Fein & Tyrolit also exhibited in NMW’s Welding Technology zone, providing rolling demonstrations of the company’s advances in metal polishing equipment and techniques.

As the only event that brings different sectors of the industry together, NMW creates real opportunities for participants. Exhibition Director, Robby Clark said, “There is a great deal of strength in Australia’s manufacturing sector. The feedback from exhibitors is that visitors are looking keenly at opportunities to transform and expand their capabilities: an observation that is supported by strong attendance at our NMW Seminar Theatre events, which gave businesses opportunities to collect new information and ideas for growth.”

Those in Sydney were lucky enough to have the conference in their hometown this year. However, Reed Exhibitions has announced that NMW 2017 will take place in Melbourne, giving residents there the chance to rub shoulders with the industry’s best. From 9 to 12 May 2017, the event will be co-located with Austech and the Safety First Conference and Expo, as well as AUSCLEAN Pulire.

NMW is Australia’s largest, longest-running manufacturing event, presenting the industry with insight into technology, products and services, all of which are designed to assist in opening up new business prospects.
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Day two of National Manufacturing Week featured a panel discussion on the topic of ‘Quality, Anti-Dumping and Strengthening Local Industry’. The discussion was led by three experts from Australia’s steel industry: Tony Dixon, CEO of the Australian Steel Institute; Ron Barrington, Managing Director of Cullen Steel; and Peter Meaker, National Business Development Manager of Opie.

The discussion was kicked off by Tony Dixon, who detailed the factors currently affecting the Australian steel industry. According to Mr Dixon, the biggest challenges are low utilisation levels throughout Australian manufacturing plants (and therefore reduced profit margins), combined with competition from low cost, often poor quality imports.

Ron Barrington confirmed that it is nearly impossible for Australian manufacturers to compete with these low cost imports, particularly those from China. Mr Barrington said that while in Australia the average hourly wage for a boilermaker is $32, in China it is just $1.50 per hour.

Clearly, on cost, Australia cannot compete. However, when it comes to efficiency, the Australian steel industry is approaching world best practice. On average, the production rate of Australian workshops is 10 to 15 hours per tonne. In China, it is 40 to 50 hours per tonne. In Germany, which is the benchmark for world best practice, it is five hours per tonne.

According to Peter Meaker, Australia’s current trade agreement means that the scales are tipped in China’s favour, which increases the prevalence of these low cost, poor quality steel imports.

All three speakers agreed that the way forward for the Australian steel industry will require a multi-pronged approach. Mr Barrington asserted that innovation and technology are central to securing the future of the steel industry. All welding workshops will need to take advantage of technological advancements such as welding robots, and help promote the idea that welding is no longer a dirty job on the factory floor, rather it is one that requires both engineering and IT skills.

Mr Dixon detailed the important role that Australian state and federal governments need to play in securing the future of the steel industry. According to Mr Dixon, for all taxpayer funded infrastructure projects, Governments need to ensure that Australian Standards are enforced, undertake independent third party certification of all contractors, and implement post-project auditing and review of quality assurance and control methods. And, if contractors are found lacking in terms of quality control and assurance, they should be banned from undertaking all future Government-funded projects.
The AFP facility features a coordinated multi-axis robot and spindle system for maximum control over fibre trajectories and part geometry. The facility also includes a head for laying four parallel 0.25” thermoset composite tows, as well as a specialist thermoplastic processing head for in-situ melding (melting and welding) for one-shot part fabrication.

The UNSW’s integrated end-to-end composites research facility includes: automated and traditional laminate fabrication (prepregs and vacuum infusion); aerospace-grade autoclave curing (up to 1.1m x 1.5m); static and dynamic materials characterisation (500kN servo-hydraulic Instron, 1800J impact tester, thermal environment chamber); and a unique multi-axial structural characterisation facility (4x100kN dyna-cells on a flexible test bed).

The facility is supported by state-of-the-art sensors and data acquisition capability including: full-field optical strain measurement; and embedded fibre-optic embedded strain and acoustic emission measurement.

The research laboratory is housed within brand-new laboratories created as part of $70 million refurbishment of UNSW Mechanical and Manufacturing Engineering.

The University of New South Wales (UNSW) has commissioned a new coordinated facility for composites research, through investment in automation infrastructure. The cornerstone of the new facility is Australasia’s first turnkey Automated Fibre Placement (AFP) robot cell. The automated facility was purchased from Automated Dynamics Corporation in America, through active financial support from the Australian Research Council (ARC) and UNSW, as well as several partner universities and industries. Professor Gangadhara Prusty, from UNSW’s School of Mechanical and Manufacturing Engineering explains the features, objectives, and future direction of the brand new facility.

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This facility will serve as a multi-disciplinary research platform for national composite science and engineering into the next decade. The facility brings together major research institutions and technology providers from across the Australian and New Zealand composites industries.

On 6 May 2016, Australian Research Council (ARC) awarded $3.8 million under the Industrial Transformation Research Program to establish a new ARC Centre for Automated Manufacture of Advanced Composites (AMAC), with the aim of developing a new generation of innovative researchers who can transform Australia’s high-performance carbon composites manufacturing industry.

Led by Professor Gangadhara Prusty, from UNSW’s School of Mechanical and Manufacturing Engineering, the centre will use advanced automation technology to position Australian manufacturers as world-class agile producers of high-value advanced composite structures.

The centre will partner with Australian National University (ANU), led by Associate Professor Paul Compston and the Technical University of Munich, led by Professor Drechsler, Head of the Institute for Carbon Composites.

The AMAC centre will partner with a range of companies and industries who have contributed significantly by cash and in-kind commitments. These partnering industries include the Ford Motor Company, Omni Tankers, Advanced Composite Structures Australia, Australian Institute of Sport, Carbonix, AFPT, FEI, the Australian Nuclear Science and Technology Organisation (ANSTO), and the Defence Science and Technology Group (DST-G).

The AMAC centre will incubate the next generation of automated composite manufacturing innovations and innovators to drive future business in a highly collaborative environment. AMAC lowers the barriers for Australian industry to access, engage, adopt and propagate automated composite manufacturing innovations.

Specifically the AMAC will:

- Promote integrated innovation in automated composite manufacture from material design to product realisation.
- Incorporate key Australian composites innovations into the automated manufacturing process chain.
- Train a generation of composite manufacturing innovators at the frontier of industry-focused research.
- Foster strong collaborations between Australian universities and a host of global organisations which vertically span the composites sector from national research providers to large Original Equipment Manufacturers (OEMs).
- Drive growth and productivity in the sector by strategically targeting the translation of commercialisable intellectual property.
- Achieve criticality in advanced composite manufacturing research for a long-term shift in Australia’s research and development capability in the field.

Features of the Automated Manufacture of Advanced Composites Centre

The AMAC Centre will include the following key features:

Vertical sector engagement: end-user partners from aerospace, marine, automotive, sports, and energy sectors; with capability, experience and culture to achieve the research training aims.

End-to-end proposition: from micro-nano scale materials science for enhanced material and structural functionality, to prototyping with AFP technology that cuts across several sectors.

Scope for physical or digital products: outcomes include enhanced capability for bespoke, flexible manufacturing in Australia, or the creation of digital exports (component designs with advanced material specifications, optimised robot placement paths and process parameters) that are compatible with global automated systems.

Internationalisation: research training experience with international partners at the cutting edge of AFP manufacturing technology development and adoption in developed economies.

Diversity of industrial experience: the strategy for human capital development includes compiling the required 1-year of industrial research training with experiences at more than one industry partner.
3D Printing: International Trends & Markets

A well-known researcher in additive manufacturing, Professor Ian Gibson has extensive experience in developing new applications such as multi-material systems, micro-RP, and tissue engineering. As the Head of Deakin University’s School of Engineering, Professor Gibson leads an exciting and progressive group of nearly 100 staff. He was responsible for setting up a number of new courses in Deakin’s Centre for Advanced Design and Engineering Training, particularly an exciting new Design Technology teaching program, with streams in Industrial Design, Medical Devices, and Sports Technology. Professor Gibson has also assisted a number of countries to establish rapid prototyping associations and a number of companies to implement 3D printing technology.
Once called ‘Rapid Prototyping’, when it first entered the market, 3D printing allowed product developers to generate physical prototypes quickly and easily. This helped numerous industries create products as quickly and easily as possible. 3D printing has evolved, and according to Ian Gibson, Professor of Industrial Design and Head of School at Deakin University’s School of Engineering, has far greater potential and application.

According to Professor Gibson, 3D printing is a technology driven by three industry segments for three very different reasons.

The automotive industry needs the technology to speed up the product development process to suit the mass market. To get a product right, developers must go through many iterations of a design so that it can be fine-tuned to suit the objectives of the designer, user and manufacturer.

A product needs to be made to be safe, effective, and visually appealing, all at an affordable price. Nowhere is this more important than in the automotive industry, which is perhaps the most competitive and highly developed industry we have.

The aerospace industry needs 3D printing for different reasons. This industry needs products that are as technically efficient as possible. These products have components that are as strong and light as possible, with aerodynamic surfaces that are defined by precise mathematical equations. Such equations and concepts are driven through digital platforms, linked through to advanced manufacturing technologies like 3D printing, to make it possible for us to reach for the stars.

The third industry to drive the advancement of 3D printing is the medical industry. Through this technology we are able to create customised solutions based on the geometric data generated from an individual person’s body. Technology like Computerised Tomography (CT), which can generate a form of 3D x-ray, can be used as a design base for the creation of implants, prosthetics, and orthotics. 3D printing can easily take the data generated by CTs, MRIs, and 3D ultrasounds to create the physical devices to precisely fit a patient.

In recent years, Professor Gibson notes, there appears to be a fourth industry driving the development of 3D printing. Entrepreneurs are starting to realise that 3D printing is one of a series of technologies that is disrupting the normal process of business development.

The lowering cost of 3D printers has made it possible to provide fast, easy and low-cost solutions in niche areas. It is possible for a company to set up on the surf coast, making custom fins to suit any surfboard design. Equally possible is the ability of a gaming enthusiast to create self-designed gaming figures and distribute them to other players around the world, working out of his or her bedroom.

However, Professor Gibson cautions that one must be mindful that 3D printing is both an enabling and an enabled technology.

“3D printing certainly has enabled us to create solutions that only a few of us could have conceived of only a decade ago,” said Professor Gibson.

“However, 3D printing would not have existed were it not for 3D solid modelling CAD. Initially, CAD was not simple and easy enough for there to be widespread use of 3D printing. Now it is possible for children to use Google Sketchup and similar software to create complex 3D geometry with little or no training or cost,” said Professor Gibson.

“Similarly, 3D data capture was awkward and costly until just recently. Now it possible to generate 3D models captured from your smart phones. New 3D printing supported businesses can be set up in minutes and can have a global presence through the use of portal solutions like Shapeways and i-Materialise.”

Professor Gibson refers to this phenomena as the ‘Technology Convergence’ effect.

“Whilst we may declare that 3D printing is a revolutionary technology, it is in fact enabled by a chain of other technologies that are converging to provide an effective, usable and cost-effective platform for 3D printing to thrive,” said Professor Gibson.

“I have seen this happen in robotics, drones, smartphones and many other applications. The reality is that all these technologies evolve to become what they are, and one can only look backwards through time to identify the 3D printing revolution.”
AMGC: Partners for Growth in Advanced Manufacturing

Established by the Federal Government, the Industry Growth Centres Initiative is an industry-led approach designed to drive innovation, productivity, and competitiveness by focusing on Australia’s areas of competitive strength and strategic priority.

The Initiative is focused on key issues such as deregulation, skills development, collaboration and commercialisation in six sectors:
- Advanced Manufacturing
- Cyber Security
- Food and Agribusiness
- Medical Technologies and Pharmaceuticals
- Mining Equipment, Technology and Services
- Oil, Gas and Energy Resources

Dr Jens Goennemann, Managing Director of the Advanced Manufacturing Growth Centre (AMGC) explains that, “The AMGC is one of the Government’s Industry Growth Centre Initiatives, going back to the 2014 investigation undertaken by McKinsey & Company: Compete to Prosper.”

“Compete to Prosper indicated that Australia needs to focus beyond its own borders and toward global markets. In order to remain competitive, we need to focus on our areas of strength, rather than areas where we are less likely to succeed and unable to close the gap. Australia simply cannot compete with other countries in areas like labour costs,” said Dr Goennemann.

The Advanced Manufacturing Growth Centre
The vision for the AMGC is to develop an internationally competitive, dynamic and thriving advanced manufacturing sector, which is critical to the long-term health of Australia’s economy.

This vision will be realised by the very hands-on business model that has been adopted by the AMGC.

“We intend to link large, globally operating companies with small and medium sized local Australian companies, academia, and research institutions, to work together on concrete projects. This will enable our domestic small and medium sized companies to become part of the global supply chain,” said Dr Goennemann.

These projects are targeted at bridging the ‘commercialisation-valley-of-death’ — the period in which products or technology is still maturing, while cashflow is dwindling. As is often lamented, too much time spent in this phase usually results in a failure to reach commercialisation.

“The chances of success are very high; much higher than just waiting for an invention to find its way through the valley-of-death by itself, and hoping for commercialisation before it runs out of steam,” said Dr Goennemann.

Despite the valley-of-death, there are already a number of success stories within the manufacturing sector; stories of small companies that have grown into medium-sized enterprises because they have gained access to the global market.

For instance, Marand transformed itself from an automotive brand into a booming defence force supplier; a vital cog in the global supply chain for fighter jets and aircraft in many nations. Marand started to witness a downturn in its existing marketplace, and rightly thought that it could utilise its existing capabilities in another sector.

It is this kind of innovative thinking that Australia’s manufacturing industry needs to adopt in order to remain globally competitive.
However, according to Dr Goennemann, “Mindset is the main barrier to breaking into global supply chains. We must invert our focus of competing against Australian companies — we are far too small a market. Today, the competition is a global competition. Advanced manufacturers are those that have a sustainable, successful business model.”

“The second barrier in breaking into global supply chains is a limited understanding or definition of what manufacturing is. A manufacturer is not just someone who produces something—this is only one value add factor. Manufacturing includes research and development, logistic support, marketing, sales, and after-sales service—it is the entire value chain,” said Dr Goennemann.

“Those manufacturers who spend less on production and significantly more on intangible value like research and development, and marketing, are the ones more likely to succeed.”

What Is An Advanced Manufacturer?

Advanced manufacturing isn’t an industry classification – it’s a way of operating. Advanced manufacturers often offer high-end products and services, in sectors such as precision manufacturing and medical technology. But businesses in many other sectors, including agriculture and mining, also increasingly depend on technology, parts and equipment made by advanced manufacturers.

In the process of establishing the AMGC, more than 80 manufacturers were consulted, including some of Australia’s most globally competitive businesses, to gain a deeper understanding of their comparative advantages and their needs, including what government regulatory changes may enable them to become even more competitive.

The AMGC found that advanced manufacturers have leading-edge skills, capabilities, technologies and practices that cannot be replicated in low-cost operators. They focus on:

• High-value but globally competitive products and services
• Design-led production
• Quality, specialised manufacturing
• Mass customisation via short, highly customised production runs
• Increasing the scope of their services across the value chain
• Integrating with global supply chains

Welding And The AMGC

“Welding is an enabling technology and one used throughout the entire value chain, not just during the production phase,” said Dr Goennemann.

“By working collaboratively on projects with multi-national organisations, smaller companies are brought into the global supply chain. The chances of success are very high; much higher than just waiting for an invention to find its way through the valley-of-death by itself.”

“Australian welding companies must be competitive over this entire value chain. Australian welding companies cannot compete on cost, but they can compete in terms of value for money, particularly over the entire lifecycle of a project.”

“Australian welding companies can improve upon this further by staying ahead of the game, and by ensuring that the Australian welding industry is more agile, has a skilled workforce and utilises the latest technology including virtual reality training and robotic systems.”

“Wherever welding plays a role in projects and there is the chance to team up with multi-national enterprises, this is where Australian welders have an opportunity. There are a number of vertical Growth Centres—Mining Equipment, Technology and Services, and Oil, Gas and Energy Resources—that manufacture large-scale infrastructure. Welding has a place in all of these, offering innumerable opportunities,” said Dr Goennemann.

For further information about the AMGC, please visit: www.amgc.org.au
Revisions & Reviews of Australian Standards

Standards are living documents which reflect progresses in science, technology and systems. To maintain their relevancy, all Standards are periodically reviewed, with amendments and revised editions published. The last few months have seen a variety of reviews take place, with Standards across steel structures, steel fabrication and erection, pipelines and pressure vessels all affected.

Steel Structures

In recent months, there has been significant activity in relation to Australian Standards that govern steel structures. As reported in Australian Welding in March 2016, the WTIA submitted a project to Standards Australia to revise AS/NZS 2980 Qualification of welders or fusion welding of steels to align it with the requirements of ISO 9606-1 Qualification testing of welders-Fusion welding-Part 1: Steels. The WTIA is pleased to report that the project submission was successful and work will commence shortly to prepare a public review draft. The revision proposes to retain the existing AS/NZS 2980 acceptance criteria for the welding of steel structures, but allow for users who need to comply with ISO and other requirements. Importantly, this revision will be synergistic with the WTIA’s development of the National Welder Certification Register.

Separate to this submission, the reinforcing steel industry’s proposal to amend to AS/NZS 1554.3 to resolve a number of issues which arose subsequent to the publication of the 2014 edition of AS/NZS 1554.3 has also been successful. The WTIA will be working with the reinforcing industry to facilitate the amendment, including the development of a specialist welding supervisor for the reinforcing industry consistent with ISO 14731 and the relevant competencies within AS 2214.

Join the WTIA

Help Secure the Future of Australia’s Welding Industry: Become a WTIA Member Today.

The WTIA is dedicated to providing members with a competitive advantage through access to industry, research, education, government, and the wider welding community. Our primary goal is to ensure that the Australian welding industry remains both locally and globally competitive, now and into the future.
Steel Fabrication and Erection

Regarding steel fabrication and erection, public comment recently closed on the proposed standard DR AS/NZS 5131 Structural steelwork – fabrication and erection. The drafting committee is scheduled to meet to resolve public comments shortly.

In preparing the draft, the drafting committee took cognisance of the Australian Steel Institute’s Code of Practice Structural Steelwork Fabrication and Erection, EN1090-2 Execution of steel structures and aluminium structures Part 2: Technical requirements for the execution of steel structures, and the more recent work within ISO circulated as ISO/CD 17607 Execution of steel structures.

The proposed standard considers fabrication and erection activities including welding, bolting, surface protection and inspection activities, and introduces the fundamental concept of a risk-based fit-for-purpose categorisation (Construction Category or CC) of a structure and its parts. Once published, it is anticipated that AS 4100 will be amended to remove the existing fabrication requirements and refer to AS/NZS 5131.

Aged Standards Review

Of significant concern to the welding industry was the identification in 2015 of many standards of importance to the Australian welding industry as being aged and potentially subject to withdrawal, revision or confirmation. Standards including AS 1674.1, AS 2812, AS 3545 and the AS 2205 series were identified, and it has been recommended that most of these standards be reconfirmed to maintain their relevancy. It is anticipated that one or two of these aged standards may require a minor revision and in one case, a direct text adoption of the relevant ISO standard will be considered.

Pipelines

Within the pipeline sector, as reported in Australian Welding (March 2016), the revision of AS/NZS 2885.2 has been completed. The revised version is now available for purchase.

Pressure Vessels

Within the pressure vessel industry, the revision of AS 1228 Pressure equipment – Boilers has now been completed and is currently being prepared for publication.

ISO Meetings

Australian delegates recently attended two ISO meetings. ISO Committee TC167 met in London and considered comments (including Australian comments) pertaining to ISO/CD 17607 noted above. A review of these comments is currently being undertaken.

Australian delegates also attended the ISO Committee TC44/SC11 meeting, as well as its working group WG2 meeting in Essen. Of primary interest to Australia was the revision of ISO 14731 (a key document referenced in AS/NZS ISO 3834) and the planned review of ISO 9606-1.

It is expected that the revision of ISO 14731 will be circulated for comment in the coming months as ISO/DIS 14731. ISO/SC11 also resolved to commence the five year review of ISO 9606-1, which has just commenced.
Not all dust is combustible. In fact, limestone dust is used in coal mines to reduce explosion hazards. However, materials which can burn or corrode in contact with oxygen can form combustible dusts. These ‘reactive’ materials include: metals, plastics, coal and other carbonaceous materials, grains, wood and paper, and many organic compounds such as additives, solid food products and pharmaceuticals.

Dusts vary in their potential for combustion and in how violent their airborne dust deflagrations may be. For a dust deflagration to happen, it takes a large enough and dense enough cloud of the dust to become airborne at one time and then contact an energy source strong enough to cause ignition.

For some dusts it may take only a static spark to ignite a dense cloud, while others might require an open flame or contact with a hot surface.

Operations that involve heat, such as welding, can easily cause combustible dust explosions. Dust trails on the surface of work benches and materials can even act as an ignition fuse. Therefore, it is crucial that good housekeeping practices are in place at all times to prevent unnecessary dust accumulation.

Minimising the Risk
According to AS 1674.1-1997 Safety in welding and allied processes - Fire Precautions, prior to the commencement of welding in hazardous areas, the following precautions should be taken to prevent fire, explosion, injury or other danger:

- Identify and control any fire hazard (including combustible dusts) within 15m.
- Consider relevant hazards that may exist outside the immediate 15m radius.
- Consider the possibility of changing circumstances during hot work and whether these may render the area unsafe.
- Properly ventilate the work area.
- Suitably locate the equipment.
including emergency firefighting equipment.
- Isolate the area where the work is to be performed.
- Provide a safe entry to and exit from the work area.
- Test for the presence of any flammable vapours and dusts within 15m and in any pipe, drum, tank, vessel or equipment adjacent to or involved in the work.
- Ensure any vapour is less than 5% of its lower explosion limit (LEL).

All testing should take place as late as practical before the hot work is commenced, subject to it being not more than two hours beforehand.

Once these measures have been implemented, the responsible officer can then perform a thorough inspection of the site, and issue a hot-work permit. This permit may specify that a firewatcher is stationed in the work area, to safeguarding personnel and equipment.

How to Train Staff
In the event of a combustible dust explosion, workers are the first call of defense in preventing and mitigating the hazard. If the people closest to the source of the outbreak are correctly trained, they can be instrumental in recognising unsafe conditions, taking preventative action and alerting management to the incident.

Operations that involve heat, such as welding, can easily cause combustible dust explosions. Dust trails on the surface of work benches and materials can even act as an ignition fuse. Therefore, it is crucial that good housekeeping practices are in place at all times to prevent unnecessary dust accumulation.

All employees should be adequately trained in safe work practices that are applicable to their job task, as well as on the overall arrangement of dust control and ignition source control. They should be trained before they start work, and ideally at periodic intervals to refresh their knowledge.

A qualified team of managers should be responsible for annually conducting a workplace analysis, prior to the potential hazard. Supervisors and managers should be thoroughly aware of the dust and ignition control programs that their workplace has instilled.

Summary
It is integral that welders understand the materials present in their working environment, and how they can cause or contribute to a dangerous incident.

Given the right amount of energy and volume, dust or powdered forms of certain types of solid materials can be easily ignited when airborne. This makes it crucial for welders to know when this type of hazard is present, and take all appropriate steps to prevent potentially devastating explosions. All tools, materials and surfaces should be regularly inspected to confirm the presence of flammable or combustible dusts, and any other potential hazards.

References
- American Welding Society, Safety and Health Fact Sheet No. 41, Combustible Dust Hazards in the Welding and Cutting Environment.
Tax Return Tips & Tricks for Welders & Fabricators

All the tips and tricks below are designed to help lower your tax bill and achieve your maximum refund entitlement. Compiled by one of Australia’s leading taxation experts Online Tax Australia, these tax tips will help you save both time and money when preparing your tax return, and help ensure you avoid possible ATO penalties and exorbitant interest payments. There are a number of tax deductions available to welders and fabricators come June 30. However, when it comes to claiming these benefits, the sheer volume of information can be overwhelming.

According to Owner and Director of Online Tax Australia, Michael Moran, “Everyone should be aware of the tax benefits that are available to them. This ensures that they claim a deduction for any out of pocket expenses incurred throughout the course of the year. This is true for every industry, but particularly in the building and construction industry, where the volume of deductible expenses can quickly add up over the course of routine business.”

Vehicle Expenses
You are able to claim the cost of your personal car, if it is used for work purposes. This may include: travel between work locations; travel to attend meetings, conferences, training courses, client and customer meetings; and travel to pick up goods, supplies or equipment.

Travel between home and work is considered private travel and is not a tax deduction. This includes situations where minor work-related tasks are completed between home and work, such as collecting mail, trips to work outside of normal office hours even if you are on call.

There are two methods available to calculate car expense claims on your tax return: the kilometre based method; and the log book percentage claim, which requires that a log book is completed for 12 consecutive weeks.

Cents Per Kilometre Method
Some guidelines for the Cents Per Kilometre Method:
• You can only claim up to 5,000km per year using this method. So, if you think you use your car more than this, the Car Logbook Method might be a better option for you.
• You do not have to keep a vehicle log book but you should retain a diary indicating the types of work related trips used to support the kilometres claim.
• The ATO can ask you to explain how you calculated your claim, as well as how the use of your car was work related.
• You can claim 66 cents per work related kilometre, regardless of the size of your car or its engine.

Car Logbook Method
A few things to keep in mind if you opt to use the car logbook method:
• You must be the owner of the car for which you wish to claim expenses.
• You must keep a logbook for 12 continuous weeks, but you only have to do this once every five years (not every year).
• You must record all business related trips taken in the car, while also maintaining a log of the total kilometres travelled. This provides the basis for the actual business use percentage to be claimed.
• You must keep receipts for all car-related expenses including insurance, servicing costs, registration and any other running costs. Petrol expenses can be estimated based on the total kilometres travelled and the average price of fuel.

Tools and Equipment
The cost of any tools or equipment purchased can be claimed as a tax deduction on the condition that the tools directly contributed to earning your income, and you can demonstrate that they were used primarily for work, rather than private use.

For items that cost less than $300, their total cost can be claimed. For items that cost more than $300, you can claim a depreciation amount for the decline in value year-on-year.

The costs of repairs, insurance, and any necessary upgrades to tools or equipment are also tax deductible.

Work Clothing and Uniforms
The costs associated with renting, buying, laundering and repairing eligible work clothing and uniforms, are tax deductible. Eligible clothing and uniforms include items that have your employer’s logo permanently affixed. If your work clothes can easily double as casual clothes (such as jeans or a casual top), then they’re no more tax deductible than
employees, with each case requiring specific consideration.

For example, you may be eligible for a ‘zone rebate’ if you live or work in a remote or isolated area of Australia (not including offshore oil or gas rigs) for at least 183 days of the tax year. There are some exceptions can be made should the stay overlap more than one tax year. This rebate is designed to compensate individuals for the isolation, harsh climate and high living costs that are usually associated with living in remote areas. FIFO workers who live in one zone but work in a different zone, will benefit from the zone rebate only if they live in a remote area.

Travel expenses between your home and your FIFO location are not deductible as the ATO deems that travel to be similar to any employees travel between home and their normal workplace. This includes travel to and from the airport and airfares to the specific location. In addition, if you’re required to move closer to a new employment site, you can’t claim relocation expenses.

There are a range of out of pocket expenses that are deductible when living away from home including local travel for business purposes, accommodation and meals. Receipts should be retained in order to claim these expenses.

Australian residents are taxed on their worldwide income, so if you have to work in a foreign country, your income will still be subject to Australian taxation law.

For further taxation advice, please visit www.onlinetaxaustralia.com.au.
The 5th conference of the Combined Australian Materials Societies; incorporating Materials Australia and the Australian Ceramic Society.

Join Australia's largest interdisciplinary technical meeting on the latest advances in materials science, engineering and technology.

Our technical program will cover a range of themes identified by researchers and industry as issues of topical interest.

Opportunities for sponsorships and exhibitions are available.

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Major Changes to the IWT Qualification Pathway

The WTIA is pleased to announce major changes to the International Institute of Welding (IIW) International Welding Technologist (IWT) qualification pathway. Individuals are now eligible to undertake the IIW IWT qualification via recognition of prior learning and experience. Previously, access conditions for the IWT required an Associate Diploma in Engineering (or related discipline). These changes mean that more welders and fabricators than ever before are now eligible to access this highly valuable qualification.

With recent changes, individuals can now access the IWT course and examinations via recognition of their prior learning and professional work experience. This is called the ‘Experiential Route’.

An applicant may be eligible via the Experiential Route if they hold an IIW International Welding Specialist (IWS) diploma, and at least six years of experience (in the past eight years), working as a Welding Technologist, after gaining the IWS diploma.

The role of a Welding Technologist combines high-level theoretical skills with practical management of welding engineering projects.

Plus, in conjunction with the University of Wollongong, the WTIA has launched a newly restructured training course, which will enable graduates to obtain the globally recognised IWT or International Welding Engineer (IWE) qualification (depending on the applicant’s prerequisites).

Covering all aspects of welding, IWE and IWT qualifications can reward graduates in significant ways, including higher salary potential, stronger employment demand, and better job stability.

It is envisaged that these certifications will take on even greater significance in the coming 12 months. And, with so few people in Australia currently certificated to the globally-recognised IWE or IWT standard, now is the time to enrol in the WTIA’s newly restructured course.

Early enrolment will put you ahead of the curve, boost your career and earning potential, and make you the preferred candidate for large-scale pipeline projects around the globe.

Facilitated by leading international welding expert, Madeleine du Toit (Professor, Welding Engineering Research Group, at the University of Wollongong), the WTIA’s newly restructured course will cover welding processes, equipment, materials, construction, design, fabrication, and applications engineering. The face-to-face training phase will be delivered on campus at the University of Wollongong.

This course will be of great benefit for engineers, technologists, welding coordinators, technical, quality or works managers in the fields as diverse as pipework and pipelines, structural steelwork, bridges, pressure vessels, storage tanks, ship-building and ship repair, power generation equipment and material testing, amongst others.

For further information, visit: http://wtia.com.au/professional-development or email: training@wtia.com.au.

Upcoming WTIA Courses

IIW International Welding Inspector – Standard
29 August, Sydney

IIW International Welding Inspector – Standard
29 August, Melbourne

IIW International Welding Inspector – Standard
5 September, Mackay

IIW International Welding Inspector – Standard
19 September, Brisbane

WTIA Welding Technology Appreciation for Engineers,
30 August, Darwin

WTIA Welding Technology Appreciation for Engineers,
14 September, Sydney

WTIA Welding Technology Appreciation for Engineers,
27 September, Perth

WTIA Welding Technology Appreciation for Mining Personnel
20 September, Hunter Valley

IIW International Welding Engineer
26 September, Wollongong

IIW International Welding Technologist
26 September, Wollongong
Project Spotlight: Windsor Road Bridge

Project Overview
- **Company**: S&L Steel
- **Project**: Sydney Metro Northwest, Transport for NSW
- **Client**: Impregilo Salini Joint Venture (ISJV)
- **Date**: November 2015 to current
- **Services Provided**: steel fabrication and surface protection, on-site installation and shop detailing.

Project Background
Sydney Metro is Australia’s biggest public transport project.

Stage 1 – the $8.3 billion Sydney Metro Northwest – includes the elevated skytrain viaduct, taking Australia’s first fully-automated metro railway above Sydney’s North West for 4km between Bella Vista and Rouse Hill.

The skytrain will be between 10m and 13m above ground level, made up of 1,216 concrete segments and supported by 130 piers spaced approximately 39m apart.

The skytrain includes a new 270m long cable-stay bridge over Windsor Road at Rouse Hill, similar in design to Sydney’s Anzac Bridge and destined to become an iconic landmark.

The bridge deck will be supported by a single plane of 32 cables in a modified fan arrangement, and two steel towers, up to 45m high.

The bridge is consistent with the overall form of the skytrain and takes a continuous curve over Windsor Road. This requires a flexible support structure, and hence the use of steel for the two towers, rather than the usual concrete—steel is much more elastic and pliable. In fact, when the two steel towers are first installed, they will not be completely straight. It will not be until the 32 cables are tensioned that the two towers will ultimately align.

Sydney Metro Northwest – formerly known as the North West Rail Link – opens in the first half of 2019.

S&L Steel’s Scope
S&L Steel is engaged by the Impregilo Salini Joint Venture to fabricate two large steel towers, which support the curved bridge deck for the skytrain tracks.

The towers are each 45m high, and approximately 6m wide. With a weight of 240 tonnes each, once the towers are complete, they will be the heaviest items that S&L Steel have had to transport.

Within these towers, there are cable anchors and guide tubes, which are 110mm thick anchorage plates aligned to a precise angle with special heavy guide tubes attached to fix the high strength cables used for suspension of the bridge deck from the towers. Freyssinet is undertaking the tensioning and cabling work.

The tower is designed using 350 grade steel for its additional strength, as well as its excellent weldability and good formability.

S&L Steel commenced work on the towers in November 2015, with a dedicated crew working non-stop. It is expected that the fabrication work will be completed by early May, with delivery and installation to occur almost immediately.

Founded in 1974, S&L Steel is a leader in structural steel fabrication, engineering and erection, providing expert services on some of Australia’s largest infrastructure projects. S&L Steel has current WTIA certification to AS3834 (Part 2) and will receive its ISO 9000 QA certification this month. For more information, visit www.slsteel.com.au.
INSIDE THE INDUSTRY: PROJECT SPOTLIGHT

About Sydney Metro Northwest

Australia’s largest public transport infrastructure project, Sydney Metro Northwest (formerly North West Rail Link) will be the first fully-automated metro rail system in Australia. It is on track to open in the first half of 2019.

The project will deliver eight new railway stations and 4,000 commuter car parking spaces to Sydney’s growing north-west. Trains will operate every four minutes in the peak, with at least 15 trains an hour. Sydney Metro Northwest will deliver a reliable public transport service to a region which has the highest car ownership levels per household in Australia.

There are 16 construction sites for the project, with three core zones:

- Epping to Bella Vista Station: tunnel work
- Bella Vista Station to Rouse Hill Station: embankment and skytrain
- Rouse Hill Station to Tallawong Road: surface or bridge and viaduct structures Metro Trains Facility

The project includes construction of twin 15km tunnels from Bella Vista to Epping, which, upon completion, will be Australia’s longest rail tunnels.
69th IIW Annual Assembly & International Conference

Hosted by the WTIA in Melbourne from July 10 to 15, the 69th International Institute of Welding (IIW) Annual Assembly and International Conference was attended by more than 700 people, including over 100 Australian delegates. With representatives of more than 55 IIW member countries and various local and international technical experts in attendance, the event generated new ideas, and fostered a whole range of new collaborations.

Opening Ceremony
A lone didgeridoo player, accompanied by projections of Australia’s natural wildlife, kicked off the Opening Ceremony. This haunting display set a spectacular tone for the week-long event. A traditional Aboriginal smoking ceremony was followed by the opening address from Professor Gary Marquis (IIW President), before Cécile Mayer (IIW CEO) and Geoff Crittenden (WTIA CEO) presented the 2016 IIW Awards.

The 2016 IIW Awards
The 2016 IIW Awards recognised all those who have made significant contributions to the global welding industry and the IIW, and paid tribute to the extraordinary achievements of the eminent individuals in whose honour many of the IIW Awards were named.

This year, 12 awards were presented: awards for outstanding technical achievements; awards for exceptional contributions to both the IIW and the broader welding industry; and awards for accomplishments in educational programs, regional activities, and activities to improve quality of life.

Many of the global welding industry’s experts were recognised, including Australia’s own Professor John Norrish, who was awarded an IIW Fellow. With over 50 years’ experience, Professor Norrish took up the Chair of Materials Welding and Joining at the University of Wollongong in 1995. Author of the book Advanced Welding Processes, John is a member of the Welding in the World Editorial Board, the Vice-Chair of Commission 12, and in 2005 won the prestigious EO Paton Award for contributions to welding research. His research includes welding automation, mechanisation and robotics, GMAW optimisation, and laser hybrid welding.

An Australian team from Arup and Yongnam won the Ugo Guerrera Prize for the design and fabrication of the roof of the National Stadium at the Singapore Sports Hub. The Ugo Guerrera Prize recognises an outstanding welded construction. Completed in 2014, the movable roof on the 55,000 seat National Stadium is the world’s largest free-span dome, with a span of 310m and a raise of 85m. The structure is formed by a series of criss-crossing triangular trusses made up of circular hollow sections. Connections considered fatigue, plus ultimate limit design, which led to the design and installation of formed, profile cut, tube-to-tube connections.
The IIW was founded in 1948 by the welding societies of 13 countries who considered it crucial to make more rapid scientific and technical progress possible on a global level. Their vision was for the IIW to be the international vehicle by which innovation and best joining practices could be promoted, while providing an international platform for the exchange and dissemination of evolving welding technologies and applications.

General Assembly
The 2016 IIW General Assembly progressed smoothly, with a number of new Board members appointed, including a new President Elect—Mr Douglas Luciani from Canada (currently the IIW Treasurer) who will commence from 2017.

Cécile Mayer, Chief Executive Officer of the IIW, also provided an update on a number of new initiatives being implemented by the IIW. These initiatives include a major website upgrade, production of a series of corporate brochures, and the relocation of the IIW head office to Yutz, in the north east of France.

Technical Working Units
The IIW’s Technical Working Units examine all key aspects of materials joining that are of prime relevance to industry. The extensive network of Technical Working Units addresses all significant, ongoing issues and current ‘hot topics’ to ensure the efficient transfer of knowledge and solutions to industry.

With a total of 17 Technical Working Units, each Unit includes one delegate per member society per country, who has voting rights. The Technical Working Units are categorised according to three main themes: Processes, Structural Integrity, and Human Aspects. All 17 of the Technical Working Units met during the Annual Assembly.
Social Events
In addition to the robust program of technical lectures and demonstrations, the IIW International Conference featured various social events. All these events were designed so that attendees could sample a flavour of Australia’s culture, as well as network with their international counterparts. According to all the IIW delegates, the social calendar was extremely well-received.

Welcome Reception
Held immediately after the Opening Ceremony, delegates had the opportunity to meet and mingle with one another at the relaxed Welcome Reception. In addition, international guests had the chance to meet some of Australia’s native wildlife, with koalas, dingoes, and even snakes on hand for photo opportunities.

Australian Evening
The Australian Evening was held at Melbourne Public—an iconic Melbourne watering hole, set on the banks of the Yarra River. The night gave all attendees the chance to experience real Australian culture, with a night to remember.

Young Professionals Events
The Young Professionals networking events offered attendees the chance to meet and mingle with their peers in a relaxed setting, helping form many new working relationships.

Closing Celebration
The Closing Celebrations were definitely memorable. All attendees enjoyed fine Victorian produce throughout the relaxing and enjoyable dinner. Towards the end of the evening, the dance floor was full, with everyone taking full advantage of forging new working relationships.
On behalf of the WTIA and the IIW, I would like to thank all of the IIW Annual Assembly and International Conference sponsors, including:

- Platinum Sponsor, DCNS Australia
- Gold Sponsor, EWM
- Our three Silver Sponsors, BOC, voestalpine Böhler Welding and Kiswel
- Australian Evening Sponsor, ANSTO
- Stationery Partner, The Lincoln Electric Company
- Media Partner, Build Magazine
- Technical Commission Sponsor, Kemppi
- Volunteer Sponsor, Defence Materials Technology Centre

I would also like to thank all our exhibitors, including:

- Bisalloy Steels
- BOC
- Cigweld
- Ensitech
- EWM
- Intercad
- K-TIG
- Kemppi
- Kiswel
- Lincoln Electric
- Metal Science Technologies
- Springer
- voestalpine Böhler Welding

Without the generous support of our sponsors, and the innovative demonstrations from our exhibitors, we simply could not hold this event.

Geoff Crittenden, WTIA CEO
A History of Welded Warships

Dr Cannon opened the 2016 Houdremont Lecture with an overview of the construction of two of the United Kingdom’s naval warships: the HMS Leda, and the HMS Seagull.

Both vessels were Halcyon-class minesweepers, and were built side-by-side in 1937, before being commissioned in 1938. They each had a length of 74m, a beam of 10m, a top speed of 17 knots at a displacement of 1,750 tons.

However, there was one major difference between the two warships. The HMS Leda was constructed using the traditional method, which relied on rivets. Whereas, the HMS Seagull was the first Royal Navy ship to be built entirely without rivets—she relied on welded joins instead.

The riveted ship, the HMS Leda was completed in 84 weeks. The welded ship, HMS Seagull, took eight weeks less, completed in just 76 weeks.

However, there was one major difference between the two warships. The HMS Leda was constructed using the traditional method, which relied on rivets. Whereas, the HMS Seagull was the first Royal Navy ship to be built entirely without rivets—she relied on welded joins instead.

During sea trials, the welded ship, HMS Seagull, showed no weaknesses in connection, no signs of racking or bending, and was watertight—something that a riveted vessel simply could not achieve.

It was not until 1956 that the HMS Seagull was decommissioned. She had a working life of 20 years, throughout which her welded joins were able to stand the test of time.

Current Australian Navy Ships

The Royal Australian Navy’s current warships are still very similar to its 1938 United Kingdom counterparts. The length and beam ratios of modern warships are almost the same—it is really only the size of the ship, and the types of weapons on-board that have progressed.

Air Warfare Destroyers

The Hobart Class Air Warfare Destroyer will deliver an effective, flexible and sustainable Air Warfare Destroyer capability for the security of Australia.

Each of the warships has a 146.7m length, 18.6m beam, a 7.2m draft, and a full load displacement of 7,000 tonnes. With a crew of 180 people, the destroyers have a top speed of 28+ knots, with a range of 5,000+ nautical miles at 18+ knots.

ANZAC Class Frigates

Australian shipbuilders Tenix Defence Systems commenced construction of ten Anzac Class frigates (eight for Australia and two for New Zealand) in 1989. The first frigate for the Royal Australian Navy, HMAS Anzac, was commissioned in May 1996. The 3,600 tonne frigates have a length of 118m, a beam of 15m and a draft of 4m, and at the maximum displacement have a speed of 27 knots.

Fatigue of Welded Joints

The main cause of fatigue loading on welded joints in warships is the flexing of the vessels as they travel through the seaway. This is compounded by the complicated patterns caused by wave loading—the flexing of a warship at its stern varies considerably to the flexing of its bow, because the two areas of the warship are subject to different stresses. It follows that the welded joints of a warship are subject to varying stresses, and therefore varying levels of fatigue.

According to Dr Cannon, some of the warships in service in the Royal Australian Navy have exhibited such weld fatigue. Fatigue cracks have been discovered in the bilge keels of the frigates which have been primarily caused by wave loading.

In order to repair the fatigue cracks the bilge keels were removed from the ship and a redesigned bilge keel was attached in its place.

In order to test the weld integrity of the redesigned bilge keel, sea trials were undertaken. Unfortunately, during these sea trials, DST Group were unable to replicate extreme conditions.
wave loads. As such the monitoring technology was left on-board for two years to enable compilation of long-term data.

This long-term data indicated that the critical locations on the vessel were no longer on the outside, but were inside the bilge keel, where non-destructive testing methods were almost impossible to apply. However the redesigned bilge keel was adequate for the projected life of the ships. Long term data recorded by DST Group on another class of ship determined that the contribution of whipping and slamming was found to increase weld fatigue failure by as much as 30 to 59%.

Modern Torpedo Technology

According to Dr Cannon, modern torpedo technology is very different to the traditional portrayal of torpedoes glamorised in World War II movies. Today, torpedoes leave a warship or submarine and travel at their design depth where they find the magnetic signature of their target, and detonate. This explosion sends up a shock wave and forms a gaseous bubble of 10 to 15m radius. The bubble rapidly expands and contracts due to the surrounding hydrostatic pressure and creates pulses of waves, which cause the warship to whip, before the bubble jets through the ship, snapping it in two. Obviously, it is almost impossible to design against such an extreme load.

Welding Maintenance

One of the main issues surrounding welded joints in warships is that the larger the ship, the longer it is kept in service (due to economic constraints). So, the problem of how warships, their welded joints, and the effects of corrosion are handled becomes very important. Fortunately, in Australia, codes of practice are under development.

About Dr Stuart Cannon

Stuart Cannon holds the position of Research Leader: Maritime Platform Performance in the Maritime Division of DST Group. He is responsible for research programs in Platform Systems Analysis and Performance, Advanced Materials and Fabrication methods and Naval Power and Energy. Additionally Stuart is responsible for all surface platform research in support of the Royal Australian Navy's surface fleet, as well as the future surface ship acquisitions.

Dr Cannon is a trained naval architect who specialises in the surface warship performance. He has a bachelor's degree in Nautical Studies, a master's degree in Offshore Structures, and a doctorate in Naval Architecture.

His research ranges from the behaviour of ships in a seaway to determining the residual strength of a ship following weapons damage. Dr Cannon has been involved in a variety of structural investigations on the fleet and has advised the Defence Materials Organisation on projects such as the Armidale Class Patrol Boats, the Air Warfare Destroyer and the Amphibious ships. He received a Chief of Defence Force Commendation for his work investigating the circumstances that lead to the loss of HMAS Sydney.

Dr Cannon is a Fellow of the Royal Institution of Naval Architects and Engineers Australia, and is a Chartered Professional Engineer. He is a member of Lloyds Register of Shipping Technical Committee, and the International Ship and Offshore Structures Congress Naval Vessel Design committee. He is also an Adjunct Professor in the National Centre for Maritime Engineering and Hydrodynamics at the Australian Maritime College at the University of Tasmania.
Subsurface, time-dependent microstructural damage at welds in equipment in power and process plants, for example, occurs due to combinations of residual and operating stresses and the deteriorating effects of time accelerated by the operating environment at elevated temperature.

In his presentation at the IIW International Conference, *Principles for Estimation of Remaining Lives of Welded Pressure Components at Elevated Temperatures*, Dr Martin Prager from the United States considered welds exposed to typical sources of damage, and provided comments on modern methods of inspection of welds as applied to pressure vessels and piping employed in such service.

According to Dr Prager, it has become increasingly clear that welded components are often the weak link in vital operating equipment (for example, in refineries and electric power plants) and proper regard for safety and economical operation requires understanding all potential damage mechanisms. If that is done, proper equipment, personnel and procedures can be used to assure timely detection of damage and quantifying its extent and rate of accumulation.

Unfortunately, there is little in the way of guidance to assure an equipment owner that the assessment methods and NDE employed will properly accomplish the necessary tasks. For example, in a typical power plant there may be thousands of metres of seam welded piping and numerous sources of stress concentrations that can lead to premature elevated temperature failure.

The same is true in refineries and chemical plants. Piping must be inspected for subsurface, microstructural damage that interacts with sound waves in ways that do not resemble the results obtained with calibration standards obtained by machining grooves or drilling holes.

There is growing concern for the safety of long ago installed austenitic and ferritic alloys in vessels and piping operating at high temperatures. Now, also of growing concern, are modern creep strength enhanced ferritic steels that have been improperly fabricated or suffer rapidly-spreading, hard-to-detect weld heat affected zone (Type IV) damage.

**Creep Damage of Welds**

It is recognised that welds are usually the weak link in a structure or pressure component in elevated temperature service. The one thing more likely to fail than a weld at its full high temperature design stress is the repair of that weld after it has failed. To prevent these unsatisfactory outcomes from developing, extra attention must be paid to assure the proper selection of materials and welding procedures, execution of the weld and then, optimal heat treatment. However, special qualification requirements to deal with this complex problem are seldom demanded except, perhaps, for aerospace components intended for human transport.

Dr Martin Prager is the Executive Director of the Welding Research Council, where he has led many industry-wide development projects, including the electric power industry’s response to high temperature failures of longitudinally welded chrome-moly steam piping and optimisation of dissimilar metal welds for creep service. Dr Prager worked at Rocketdyne on the large liquid launch engines for the Apollo project, solving welding, heat treating and performance problems with materials as diverse as aluminum alloys, stainless steels and high-strength, high-temperature alloys including those of titanium, nickel and niobium. His studies led to development of tools for assessment of creep-life (Omega Method) and toughness adopted in API and ASME fitness-for-service standards.
**Issues**

Dr Prager went on to address the question of why a weld or a weld repair may be of high quality by all measures of tensile strength, toughness or soundness, and yet inadequate for elevated temperature service. In fact, sometimes the very characteristics that lead to superior short term ambient temperature qualification test performance may be in conflict with the qualities desired for longevity of the weld or repair.

A partial list of damaging factors which may adversely influence the life expectations for welded components is listed. The list should be considered in developing procedures and requirements for qualification of fabrication welds and repairs. It may serve as a check list of factors to be avoided or minimised. Each of the items listed, when present, may impair the durability of the resultant joint. The qualification test needs to reveal any negative interactions.

Additionally, the specimens should be of sufficient size to allow for the presence of beneficial and adverse factors due to the differing microstructures to be revealed. Finally, the test must be planned to be at an appropriate temperature and duration to expose potential problems. This can be accomplished by selecting the stress and temperature considering minimum and most probable base metal properties and proper estimates of the LMP constant.

**Potentially Adverse Factors for Performance**

1. Substantially different creep rates of base metal and weld deposits
2. Extensive precipitation of embrittling or hardening phases in base metal and/or weld metal that may occur with increasing time and temperature
3. Stress concentrations caused by geometrical factors associated with the weld joint
4. Differential thermal expansion of weld deposit and base metal
5. Degradation of creep strain tolerance (embrittlement, loss of ductility) of weld deposit with time and temperature
6. Development of high levels of multi-axial stresses in the HAZ of weld deposit due to locally differing strain rates facilitating void initiation and growth
7. Excessive over-matching or under-matching in selection of weld consumables
8. Over-tempering in the fine grain region of the HAZ of CSEF alloys during welding
9. Micro-fissuring or grain boundary liquation near the fusion line that may lead to low strain tolerance in weld HAZ (especially in highly alloyed materials)
10. Embrittlement in grain coarsened region of HAZ

**Understanding and Applying the LMP Constant**

The LMP is more than just related to the activation energy for the elevated temperature behavior of interest (such as tempering, creep rate, and stress-rupture time).

The respective LMP constant value enables direct calculation of the effect of a change in temperature on degree of tempering, the creep rate, the stress rupture life, and so on. Therefore, knowing the constant with some reasonable degree of accuracy is important. The value of 20 is a good ball park value for several related properties of low alloy steels (such as tempering and stress-rupture time). In contrast, for stress-rupture behaviour of stainless steels, an LMP constant of 15 is widely used even though for many of these alloys the correct value may be significantly higher or lower.

**In Closing**

Remaining life assessments for aging equipment and repair procedures for damaged components operating at temperatures high in the creep range can be validated by stress-rupture tests in which design level (operating) stresses are applied in the same direction as encountered in service.

As noted earlier, the test specimen should be of sufficient size that the various microstructures incorporated in it are present and the stress state developed due to locally differing creep strain rates are present in the specimen in the course of the test.

It should be possible to compare data on the performance of the repair with results of welds prepared using the original fabrication procedures. Specimens should be prepared so that the fusion lines on both sides of the test welds are included in the gauge length with ample length of base metal between the fusion lines and the specimen grips to minimise the effects of the specimen shoulders on stress-rupture life.

Obviously, when making any repairs all apparent damage must be removed. It is wise to remove additional surrounding material since significant, but undetected, creep damage may extend well beyond the cavitation, cracking or defects leading to the repair. Excessive heat input when making repairs should be avoided as it leads to wider heat affected zones and possibly coarser precipitates.
Robotic Welding & Cutting in The Mining Industry

Although Australia has not been a leader in the development of robotics, it has produced some innovative, world leading applications. In 2015, a unique robot welding system was developed for adaptive maintenance welding of heavy mining buckets and dump truck bodies. The portable robot utilises a laser camera for multi-pass welding and to cope with complex weld joint geometry. Results show that weld completion time savings of 70% are typical, whilst 90% is not unusual. Peter Kuebler, BOC’s Key Customer Technical Solutions Engineer, described the innovations that enabled the rapid deployment of this system with minimal jigging and programming in challenging environments.

After developing and installing the most versatile multi-process welding robot in Australia last year, BOC and its integrator partner Robot Technologies Systems Australia (RTA) delivered significant improvements in safety, quality and productivity for its customer.

Presenting at the IIW International Conference, Peter Kuebler shared the innovations that enabled the deployment of a portable robot, which utilises a laser camera for multi-pass welding and complex weld joint geometry.

Background

In recent years, falls in iron ore and coal prices have led to a decline in profitability for mining companies. As a result, mining suppliers have been under tremendous pressure to reduce the costs of maintaining, repairing and remanufacturing mining and haulage equipment.

"With the downward pressure on costs, some companies started to investigate the suitability of utilising robotics to automate repair welding," explained Kuebler.

"This automation had previously been considered impossible due to extensive programming time, the size and geometry of the equipment, and the damage, distortion and uneven wear of components."

"Advanced laser seam tracking, adaptive welding software, a new generation welding system and a modular robot configuration were used to develop a unique robot welding system for adaptive maintenance welding of heavy mining buckets and dump truck bodies," said Kuebler.

Advanced Laser Seam Tracking imaging for welding and other processes has evolved into intelligent laser vision and sensing systems. Using a line configuration, the camera now only requires three measurements to recalculate the welding trajectory in 3D or 6D, allowing seam-finding to take only a matter of seconds.

"Today’s advanced, real-time laser tracking enables high-speed adaptation to dimensional variations, requiring minimal programming and tooling. Tracking ensures precise weld wire positioning in the joint, which enhances weld quality and appearance," said Kuebler.

Adaptive Welding Software

The laser camera that was used includes adaptive welding software, which is essential for multi-pass welding. Travel speed and weave amplitude are modified to suit variations of root gaps and joint cross-sectional areas. If a gap exceeds a given dimension, the algorithm will stop the robot and move to the next tack or joint.

"The software enables real-time adjustment of weld placement and parameters for each pass using a fill control algorithm, which allows the controller to calculate the location of subsequent passes. This dramatically reduces programming time and maximises productivity."

The laser camera is also used to ‘visually’ inspect the completed weld. The 2D images can be recorded, providing a permanent record of the weld profile and an
A professional welding engineer and metallurgist, Peter has over 35 years experience in the construction, fabrication and welding products industries. He is a qualified International Welding Engineer and has a degree in metallurgy from RMIT. Peter has held management, technical and consulting positions with a wide range of companies, and is currently employed by BOC as Key Customer Technical Solutions Engineer. In this role, he is responsible for co-ordinating technical support for BOC’s largest customers as well as marketing of welding automation equipment.

**Minimal Programming Time**

Conventional offline programming software has had mixed success. While the software can convert a 3D CAD job model into robot language for uploading to the robot controller, it does not cater for optimising torch angles, arc start-end sequences or multi-pass welding.

In response to these limitations, RTA developed generic program libraries for certain types of multi-pass welds, resulting in a range of fillet and butt weld libraries that are constantly being added to. Each library contains the essential welding program data and requires little to no intervention by the robot operator.

For welding insert pieces into bucket walls, an import utility was developed to convert data encoded within a DXF file into data the robot can use to scan and weld the piece. The operator only has to “teach” the robot where the piece is located in space and the robot can then use the laser camera to search for the part and build weld paths based on data within the DXF file.

This has enabled SMW Group, BOC’s mining equipment refurbishment customer to minimise programming time and rapidly deploy the robot as new jobs arrive. The robot can then be taken on-site to minimise downtime of critical components.

**A New Generation Welding System and Modular Robot Configuration**

The robot cell for SMW Group was manufactured by RTA and is comprised of a Kawasaki RA 15X robot equipped with an ewm Phoenix 552 welding package and a ServoRobot PowerCam laser vision system. A customised bracket on the robot wrist houses the laser camera, preheat temperature sensor and monitoring camera for the operator.

Built on a modular base, the robot cell can be positioned on, beside or beneath the component being welded. The robot is capable of operating at ambient temperatures of up to 45°C and weld continuously within its reach envelope, with minimal downtime between passes.

Utilising a liquid cooled torch permits welding of these components at currents up to 500amps. Deposition rates of up to 6kg/hour are regularly achieved even in the vertical welding position, using 1.6mm gas shielded flux cored wire.

“The robot has reduced overall production costs, improved safety, quality and reporting, and broadened customer range of work scope capabilities,” said Kuebler.

“The savings in welding times are typically 70%, whilst 90% savings are not uncommon. Robot welding of new 25 millimetre floor plates into a dump truck took less than 10% of the time taken for manual welding.”

**The Future**

By combining new generation robotics, laser camera, plasma cutting and welding packages with local innovations, these portable robot cells are proving to be extremely competitive and will continue to significantly improve efficiency in the welding industry.
Welding Challenges of the Collins Class Submarines

Daniel Miller is the Principal Structural Engineer at ASC, and is responsible for the technical integrity of engineering direction for in-service support and major dockings holding technical authority delegation in structural and material domains on the Collins Class Submarines for the Royal Australian Navy. Daniel graduated from Monash University in 1996, with a Bachelor of Engineering (Civil) specialising in Structural Engineering. In 1998, he completed a post graduate diploma in Materials, Welding and Joining at the University of Adelaide.
Both of these maintenance procedures involved careful planning, particularly in terms of balancing the hull once it was cut in half—a specially designed cradle was constructed to ensure the stability of the vessel at all times.

Similarly, the pre-heat welding processes and non-destructive testing and validation of weld quality, once the motor and generators were back in position, were extremely rigorous.

All welding maintenance work carried out on the Collins Class submarines is subject to rigorous non-destructive testing and validation, with industry best-practice results, including:

- 100% visual inspection
- 100% magnetic particle inspection
- 100% penetrant inspection
- 100% ultrasonic inspection
- 10 - 100% x-ray inspection

Future Technologies: TIP-TIG

TIP-TIG is a hybrid welding process, based on Gas Tungsten Arc welding. TIP-TIG can provide high quality, high deposition rates with low heat input values, consistently delivering high quality metallurgical results on a number of alloys.

According to Daniel, ASC has had great success in recent times with this new technology, particularly in terms of increasing productivity and lowering costs during inonel clad welding refurbishment. As such, it comes as no surprise that ASC is currently qualifying the process for use in pressure hull welding.
Modular Construction
Code of Practice

Australia’s modular construction industry is valued at approximately $4.5 billion. While significant, this sum represents just 3% of Australia’s total construction industry value. Despite the clear merits of this building method, Australia’s modular construction industry is fragmented. The transportation costs and prevailing misconceptions that modular is low on quality, and high on cost, only exacerbates this fragmentation. It’s no surprise that engineers, developers, construction contractors and asset owners are looking to improve modular projects and technologies through the adoption of an industry standard code of practice.

Currently, there is no industry code or standard governing modular construction in Australia. With an increasing number of modular buildings being erected, architects, engineers and construction contractors alike are subject to a range of inefficiencies, created by having to conform to existing building codes, which simply do not allow for the particularities of modular construction.

During the IIW International Conference, James Murray-Parkes, Director of Brookfield Multiplex Engineering Innovations Group (BMEiG), discussed the work that the newly formed Modular Construction Codes Board is undertaking to rectify this situation. The Modular Construction Codes Board is a first for the Australian construction industry. While its principal partners include Monash University, the Australian Steel Institute, Engineers Australia, and the Victorian Government, the Board has also united fiercely competitive companies, such as Brookfield Multiplex, Lendlease, Lang O’Rourke and Arup.

These Australian construction industry giants are, for the first time, working together for the common good: an industry-wide code that governs modular construction.

According to Murray-Parkes, benefits that the code is likely to foster are wide ranging. It will enable greater control over the quality of products used, making the industry more productive and efficient. The code improves the safety and speed of modular construction, reducing impacts on communities and the environment, and provides guidance on improved design practices, reducing the risks involved for investors. It encourages communication between the manufacturer, the builder, the architect and the designer.

Clearly, the code will improve outcomes for all parties involved.

James Murray-Parkes is an innovative, multi-disciplined scientist and engineering professional offering a broad range of expertise, experience and leadership. With his vast experience earned mainly through his tireless work in forensic engineering, high load structural connection failure investigation and remedial design, James’ unique connection designs are at the forefront of assembly and subassembly manufacture in not only the construction industry, but also the defence, automotive and the energy sectors, and have all benefitted greatly from his innovations.

Complimenting a long history as a connection design engineer, James is the instigator and co-founder of the Australian Engineered Fasteners and Anchors Council, and the Modular Construction Codes Board. James has held Fellowships at several highly distinguished universities and was the second person in history to be awarded the prestigious professorial of practice appointment at Monash University. Throughout the course of his career, James has contributed to, or been responsible for, over 30 patents and more than 750 major projects.
The Model Code

The code will govern DfMA (Design for Manufacture and Assembly). It is expected to include all aspects of manufacturing from quality control of final products, raw materials and the application of protective systems, right through to certification by an independent third party.

The durability of modular buildings will also feature heavily in the model code, which provides guidance on, and outlines standards concerning, the degradation of products by corrosion, fatigue and UV. The code will also outline classification of the built environment, fatigue testing requirements, and appropriate maintenance schedules.

With transportation and on-site erection playing such a major role in modular construction, the model code will encompass general guidelines for the storage of modular construction materials; transportation, lifting and on-site connection considerations; and on-site inspections. Taking a holistic approach to modular construction, the code will even outline the considerations for disassembly, relocation, and recycling of materials.

Welding in Modular Construction

A variety of research and testing has been conducted into the role that welding has to play in modular construction, particularly in the areas of performance, the effects of transportation, and the durability of modular structures.

Results of connection testing indicate that welded joints offer the highest stiffness and capacity. Further, the addition of welded gusset plates improves the stiffness and capacity of bolted end plate connections. However, in most cases weld cracking still appears to be the primary failure mechanism of beam-to-column joints, apart from the gusseted end plate connection where the bolt sheared.

Case Studies

Perth Stadium Roof Truss

The 60,000 seat, 42m high, five-level Perth Stadium will be a world-class venue, capable of hosting all manner of sporting and entertainment events. James Murray-Parkes and BMEiG provided structural design and optimisation solutions for the project. One highlight of these solutions was the optimisation of 52 roof truss elements and the patented ‘cylindrical multi-hinge connection’. This connection facilitated easy on-site erection of large truss sections and made fine adjustment possible by allowing the entire truss to pivot about its fixing point while still on the crane. The revised design reduced mass and sped up construction, and the entirety of each roof truss was prefabricated off-site and transported as a single piece.

TIC TOCC: Meyer Timber Commercial Office Project

James Murray-Parkes’ and BMEiG designed the unique patented TIC TOCC connection system—a continuous post tensioning system specifically designed for use in multi-storey structures. In the Meyer Timber office project, the system included engineered timber wall panels to provide bracing and compressive support, whilst the TIC TOCC connection provided a post tension tie-down anchoring system offering excellent resistance to lateral loads caused by wind and seismic events. This innovative system enabled the entire base building, including roof frame elements to be installed on-site within three days. This patented system represents over a decade of learnings in the prefabricated and modular construction field.
Recognising the important role manufacturing plays in Australia’s economy, RMIT’s Advanced Manufacturing Precinct was established in late 2011 to meet the challenges facing the industry and to enhance the delivery of skills, enabling Australia to:

- Effectively compete in global markets
- Deliver capability to reposition manufacturing industry beyond its origins as labour intensive and production driven
- Provide the link between education, research and industry
- Identify new materials and processes based on additive technology

A multi-disciplinary team led by internationally recognised researchers bring together combined skills in applied design, research and development, and engineering to design to develop new complex products and processes.

The Advanced Manufacturing Precinct houses the most comprehensive range of additive and subtractive technologies locally, which provide access to cutting edge solutions to assist industry to develop new conceptual products or re-engineer existing products.

The facility has been used by many researchers, students and industrial organisations in the aerospace, biomedical and defence industry sectors.

At RMIT, IIW delegates had the chance to view a range of additive manufacturing technology, including selective laser melting, direct laser metal deposition, fused deposition modelling, and Objet and U-Print machines. Delegates viewed RMIT’s internationally recognised multi-axis CNC machines (Okuma and Haas), which are used for machining high-performance alloys and composites for engineering applications.

IIW delegates also visited RMIT’s industrial automation facility, viewing a range of automation robotics that are able to simulate manufacturing production lines used in the furniture, textile and design industries. For further details about RMIT’s Advanced Manufacturing Precinct, please contact Professor Milan Brandt at milan.brandt@rmit.edu.au.

Throughout the IIW Annual Assembly and International Conference, delegates were treated to a variety of technical visits to some of Melbourne’s leading scientific and technological facilities. Delegates were able to see and experience some of the developments and innovations that Australian industry has to offer.

Our thanks to all of the organisations that facilitated these visits, including Bombardier, Brookfield Multiplex, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Royal Melbourne Institute of Technology (RMIT), and Swinburne University.
Bombardier Transportation’s Centre of Excellence

As the world’s leading manufacturer of both planes and trains, Bombardier has built an extensive and diverse portfolio of winning mobility solutions.

Everywhere people travel by land and in the air, a Bombardier product is ready to transport them. From category defining business jets and commercial aircraft designed for the challenges of today, to sleek high speed trains and public transit that’s smarter than ever.

Bombardier Transportation has enjoyed over 60 years of operations in Australia. During this time, Bombardier has provided the full spectrum of rail solutions from the manufacture of commuter trains to the supply of complete rail transportation systems and integration. With local engineering and manufacturing capabilities, they also provide solutions for signalling, propulsion and control technology, asset management, and through-life support.

As a rail technology leader, Bombardier has more than 1,100 employees in Australia and operates in 22 locations across the country. Their manufacturing hub is headquartered in Victoria, with maintenance facilities across the country. Bombardier’s Centre of Excellence for Industrial Design and Engineering is based in both Brisbane and Melbourne, which allows for customised rail solutions to suit local conditions.

Whilst visiting Bombardier’s Centre of Excellence in Dandenong, IIW delegates were treated to a behind the scenes look at the A to Z manufacturing process for both the Melbourne E-Class tram and VLocity regional trains that travel throughout Victoria. Melbourne’s tram network is an iconic symbol of the city and one of the largest tram networks in the world. Bombardier is supplying 70 new FLEXITY trams that were specially designed to perform in Melbourne’s transport ecosystem, and operate along existing rail infrastructure.

During the tour of Bombardier’s production lines, delegates had the opportunity to meet with a range of skilled employees and experience all the elements that go into creating some of the most innovative transport rolling stock for Australia, including: industrial design and planning, engineering, welding, boiler making, bogey assembly, as well as a variety of maintenance repairer processes.

The IIW delegates were excited to learn that Bombardier has developed an on-site welding school at its Centre of Excellence. Here, Bombardier employees are given the opportunity to qualify, and re-qualify, their skills and certifications; an offering Bombardier has also extended to their wider supply chain.
Swinburne’s Advanced Manufacturing & Design Centre

Bridging the gap between imagination and reality, the Advanced Manufacturing and Design Centre’s (AMDC) demonstrator Factory of the Future provides industry and organisations with unparalleled facilities and equipment with which to explore conceptual ideas for manufacturing next generation products. The AMDC is a state-of-the-art facility that gives researchers and students the opportunity to use the latest manufacturing and design techniques and technologies.

Opened at Swinburne’s Hawthorn campus in 2014, the centre is a hub for researchers carrying out world-leading research and education.

The AMDC shares its equipment, knowledge and commercial outcomes. This collaborative approach is building strong links across the higher education, research, vocational training and manufacturing sectors, and will enhance Australia’s ability to develop an internationally competitive, highly productive and technologically advanced manufacturing sector.

The $100 million centre was built with the support of the Commonwealth Government, which provided $40 million of funding.

IIW delegates were treated to a tour of the five studios within the Factory of the Future, which include:

**3D Visualisation and Design Studio**: featuring advanced visualisation tools that allow for intuitive real-time interaction with realistic 3D imagery.

**Rapid Manufacturing Studio**: equipped with advanced additive manufacturing tools that facilitate conversion from digital concepts to metal, plastic or ceramic prototypes.

**Advanced Inspection and Machining Studio**: advanced machining capability combined with state-of-the-art inspection equipment for developing high quality components.

**Biodevice Innovation Studio**: combines electronics, optics, chemistry and biomaterials-handling with rapid prototyping to produce innovative new medical devices.

**Design for Resource Efficiency Studio**: design, development and assessment of recycling and manufacturing processes to maximise resource efficiency.

An IIW delegate trying out the immersive 3D cave in the Factory of the Future.

IIW delegates learning about Swinburne’s Multi-Axis Substructure Testing System.

Delegates discuss the need for resource efficiency in manufacturing processes.
CSIRO’s new $6 million additive manufacturing centre, Lab 22, is making metal additive manufacturing more accessible for industry and increasing its adoption across Australia. Located in Melbourne, Lab 22 offers Australian companies a unique opportunity to access and explore new technologies so that they can innovate with much less capital investment risk involved.

CSIRO experts work closely with companies on cost-effective solutions, catering to a wide spectrum of requirements, such as increasing the speed, performance and affordability of technologies. CSIRO is able to capture 3D data and simulate both the manufacturing process and in-service part performance. Their designers can turn a new design idea into a testable prototype within a week.

The state-of-the-art equipment at Lab 22 includes: Arcam A1, Concept Laser M2, Optomec LENS MR-7, Voxeljet VX1000, and Cold Spray Plasma Giken.

IIW delegates were provided with an informative and interactive seminar session, followed by a tour of the 3D printing facility.

During the tour, delegates had the opportunity to ask questions about the technology, coming away with a much better understanding of how 3D printing can help transform business models, as well as enhance global manufacturing competitiveness.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is the federal government agency for scientific research in Australia. Founded in 1916, the CSIRO is helping to shape the future of Australia by using science to solve real issues. One of the world’s largest, most diverse scientific research organisations, CSIRO expertise includes everything from astronomy and animals, to mining and manufacturing. The CSIRO facilitated a site visit for IIW delegates to their additive manufacturing centre, Lab 22.

CSIRO’s machines can be categorised based on how the raw material is fed (powder bed, cold spray, blown powder) or their heat source (e-beam or laser). They can also handle a wide variety of materials including ferrous metals, non-ferrous metals and sand.

Lab 22 offers metallic 3D printing (such as titanium and aluminium); advanced machining for improved profitability; surface engineering for enhanced performance; laser assisted additive deposition; and laser heat treatments.

IIW delegates learn about Lab 22’s range of facilities.
Australian Synchrotron

The Australian Synchrotron is a world-class national research facility that uses accelerator technology to produce light a million times brighter than the sun. The facility has ten different experimental stations, or beamlines, which harness that light – ranging from infrared to X-rays – empowering researchers to study the fundamental structure and composition of materials, on scales ranging from the atomic to the macroscopic – with a level of detail, speed and accuracy not possible in conventional laboratories.

The Australian Synchrotron helps industry partners to interrupt, boost and manipulate the most basic of processes to overcome technical hurdles and roadblocks to drive product innovation, with applications including:

- Advanced manufacturing: additive manufacturing and composite materials
- Agribusiness and food: biofortification and solid state analysis
- Biotech and health: drug discovery, drug and health product development, medical device development, scale-up and quality control
- Energy: extraction and conversion of energy
- Environment: environmental monitoring and waste management
- Resources: mineral processing, process validation and exploration
- Transport and defence: energy storage and transportation

Australian Synchrotron Group Leader Industry Engagement, Kerry Hayes, hosted IIW delegates on an extensive behind-the-scenes tour of the Synchrotron. The tour started on the mezzanine level, a vantage point providing an overview of the MCG-sized facility, before moving to the technical floor. The delegates took advantage of opportunities to ask questions of the Synchrotron’s beamline scientists and technicians.

"We were encouraged by the strong international make-up of the IIW delegation," Ms Hayes said. “We were delighted to welcome specialists from industries as diverse as shipbuilding and high-pressure gas storage.”

To discover how the Australian Synchrotron can help you problem-solve and innovate, contact: industry@synchrotron.org.au or (03) 8540 4232.
DCNS is a leader in naval defence and a major player in marine renewable energies. As an international high-tech company, DCNS uses its extraordinary know-how, unique industrial resources and capacity to create a range of increasingly innovative solutions and services. DCNS designs, produces and supports submarines and surface ships, provides services for naval shipyards and bases and offers a wide range of marine renewable energy solutions. In April 2016, DCNS was selected as the Australian Government's preferred international partner for the design of 12 Future Submarines for the Royal Australian Navy. DCNS Australia was the platinum sponsor for the 2016 IIW Annual Assembly and International Conference.

With a workforce of over 12,700 people, DCNS is the only company in the world to be competent in the construction of both conventional and nuclear submarines, delivering vessels of between 2,000 tonnes to 14,000 tonnes for navies all around the world.

DCNS currently designs, builds and maintains the Scorpene ® 2000 conventional-propulsion submarines for Brazil, Malaysia, India and Chile.

DCNS also designs and builds the Barracuda, a state of the art submarine for the French Navy dedicated to deal with an ever-growing array of challenges. The first-of-class, the SSN Suffren, started sea trials early this year and will enter service in 2017. Between 2017 and 2027, six Barracudas will replace the six Rubis-Améthyste-class boats currently in service.

The Australian Government Selects DCNS for the SEA1000 Future Submarine Program

The Australian Government has selected DCNS as its preferred international partner for the design of 12 Future submarines for the Royal Australian Navy.

The announcement was made by the Australian Prime Minister the Hon. Malcolm Turnbull, the Minister for Defence, Senator the Hon. Marise Payne, The Minister for Industry, Innovation and Science, the Hon. Christopher Pyne and The Chief of Navy, Vice Admiral Tim Barrett.

The Australian Government stated, “The decision was driven by DCNS’s ability to best meet all of the Australian Government's requirements. These included superior sensor performance and stealth characteristics, as well as range and endurance similar to the Collins Class submarine. The Government’s considerations also included cost, schedule, program execution, through-life support and Australian industry involvement.”

“This success has been made possible thanks to the strong teamwork between the French Authorities, DCNS and our industrial partners,” said DCNS Chairman and Chief Executive Officer, Mr Herve Guillou.

“France and Australia have been allies for more than 100 years and we look forward to further strengthening this time honoured relationship and honouring the trust the Australian Commonwealth Government is placing in us for this ground breaking project,” Mr Guillou said.

Subject to discussions on commercial matters, the design of the Future Submarine with DCNS will begin this year.
e-Commerce & Certification Platform WeldQ Launched

The WTIA is pleased to announce that its brand new WeldQ software platform was launched at the IIW Annual Assembly and International Conference. WeldQ has been developed by the WTIA ANB and its systems partner, Smart Welding Pro, to provide a software as a service cloud based e-commerce platform that is capable of managing all ANB qualification and IIW certification requirements.

One of WeldQ’s main functions will be to manage the National Welder Certification Register. The purpose of the register is to provide Australian welders with certification to ISO 9606-1 and AS 2980, in order to increase their employment opportunities on major projects and shut-downs internationally.

The WTIA’s scheme has been designed to world’s best practice and will bring the standard of welding in Australia up to the highest levels.

At time of publishing, the WTIA is assessing examiners and testing and training centres around the country and preparing to commission this module of the e-commerce platform. To register your interest in becoming a testing or training centre, please email info@wtia.com.au.

Designed around the latest cloud based software WeldQ is:

- **Cost Effective** – no expensive hardware or development, and licensing costs to meet all needs
- **Flexible** – able to cope with variations in systems, processes and services
- **Reliable** – latest software ensures performance, access and security
- **Simple** – simple to use established workflows with low training requirements
- **Efficient** – high user input minimises administration time.
- **Multi-Lingual** – easily translated into a range of languages

**Features**

- **Programs** — create and manage qualifications and certifications with pre-configured IIW compliant workflows
- **Examinations** — manage exams for online or pen and paper delivery; perform online evaluation and marking, and publish results
- **Roles** — assign users to roles as administrator, examiner, assessor and invigilator
- **Libraries & Archives** — store documents and selectively provide access to certain user types, complete with document control features
- **Fees** — set fees on a per module basis, invoice as needed or automatically trigger payment
- **Accounting** — online payment gateway integration and detailed accounting reports
- **Administration** — streamline all administration processes, including cancelling awards, recording application changes, and keeping file notes
- **Reporting** — a range of customisable reports
Standard Configuration

WeldQ has a range of modules which can be configured to deliver:

Certification
• Pre-requisite assessment and cross checking
• Online panel review and approval
• Assessment and renewal tracking and notification
• Certificate, card and stamp preparation and delivery

Audit
• Remote audit functionality

Examination Management
• Online registration and fee payment
• Pre-requisite assessment
• Online, written and practical exam delivery
• Multiple choice and short answer questions database
• Random exam paper generation
• Collaborative online marking system
• Comprehensive candidate feedback system
• Database storage of results
• Diploma, card and stamp preparation and delivery

Optional Modules
• Mobile App - Apple or Android
• Welder Certification Register to ISO 9606 -1 AS2980
• Fabricated Structural Steel Compliance Scheme
• Pressure Plant Compliance Scheme
• Welding Equipment Compliance Scheme

ANB Administration Made Easy

Cloud-based Access, Anywhere
Staff and applicants can access the software from a web-browser, saving you hardware and maintenance costs.

High Security & Reliability
Hosted at a high security data centre with redundancy and accessed through secure communication protocols, and with automatic back-up of data, your peace of mind is guaranteed.

Comprehensive Solution
Conduct online examinations, maintain data, documents, certificates and history all in one place; WeldQ is a one stop shop.

Highly Scalable
Our cloud servers balance the load based on number of users and scale up automatically—say goodbye to slow systems and upgrades.

Cutting Edge Technology & Support
Latest cloud-based technology and tools, and a support team that will look after you 24x7.

Superior Service for Your Clients

Online Applications & Assessments
Welding professionals may apply (and be informed of their progress) at any time at their convenience. They can pay fees online through secure payment gateway, and be notified of results and awards automatically.

Manage Portfolios with Quicker Applications
WeldQ gives you the ability to maintain qualifications, work experience and professional development records including certificates online. Not only that, records are automatically compiled and attached to an application.

E-Passport
The mobile app allows your clients to carry authenticated electronic certificates at all times to demonstrate their qualifications. Welders can seek confirmation for prolongation, and certificates are reissued with qualification extension log.

Easy to Use
Transparent processes and easy to use interfaces mean that even the least computer literate clientele can use WeldQ with very little training.

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Notes:
1. A user is defined as an individual involved in the management of the system i.e. administrator; auditor; examiner; marker.
2. Online training, user manual and data storage are included in the price.
3. If required implementation configuration or customisation is charged separately.
Defence SMART Group

The Defence Smart Group met recently, with attendees including representatives from the Defence Science and Technology Group and the Defence Materials Technology Centre (both of which are part of Australia’s Department of Defence), Civmec, Bisalloy, the Australian Submarine Corporation (ASC), ATTAR, and the WTIA.

The meeting commenced with an update from Geoff Crittenden, WTIA CEO, on the WTIA’s activities within Australia’s defence shipbuilding sector. Geoff detailed his recently published paper, Welding Support for the Defence Industry, which outlines two key issues:

1. The capability of the Australian welding industry to supply the necessary high-calibre skilled welders for the defence shipbuilding program.
2. The importance of technology transfer from the defence shipbuilding program to the broader industrial sector.

Geoff’s presentation was followed by a briefing from ASC, who are working collaboratively with DCNS on the defence shipbuilding projects. ASC emphasised how early it was in the project, and provided comprehensive information on some of the challenges that have already been identified, particularly in terms of sourcing the right calibre of welders.

There followed a broad ranging discussion in which members of the Group provided updates on their current activities. Bisalloy noted that they are very keen to supply steel for the project, but it is early days yet.

The Group agreed that the WTIA should promote its training programs, and strongly supported the establishment of the National Welding Certification Register, which members saw as a huge benefit in identifying the correct levels and calibre of manpower for the shipbuilding project.

The WTIA was also encouraged by the members of the Group to continue to pursue this issue with both State and Federal Governments, and it was confirmed that the WTIA was due to meet with the Federal Government’s Department of Defence Shipbuilding Taskforce the week after the SMART Group meeting.

There was some discussion around DCNS partnering within the program, and the need for a welding capability statement was identified.
Professor Norish noted that the Defence Materials Technology Centre (DMTC) was looking into a welding capability statement, and agreed to facilitate a meeting between the WTIA and DMTC, to agree upon a single position for presentation to government and DNCS. This meeting has now occurred, at which it was provisionally agreed that the DMTC and WTIA will sign a Memorandum of Agreement (MoU).

Road and Rail SMART Group
The most recent meeting of the Road and Rail SMART Group was held in the new WTIA offices in Pymble, on 11 April. Some of the largest players in Australia’s transport industry were present, including representatives from Roads and Maritime Services (New South Wales), the Department of Transport and Main Roads (Queensland), VicRoads (Victoria), and the Department of Planning, Transport and Infrastructure (South Australia).

During the meeting, the Austroad Steel Fabrication Specification was discussed in detail, particularly the adoption of the fundamental concept of a risk-based fit-for-purpose categorisation (Construction Category or CC).

Currently, three construction categories (CC2, CC3 and CC4) are denoted in this document, for which the requirements increase in strictness from CC2 to CC4. The same approach is also a core part of the new Australian Standard AS/NZS 5131 (recently released for public comments).

The discussion moved then to a new course that WTIA is introducing, ‘Supervising Welding of Reinforced Steel Cages to AS1554.3’. Recently, WTIA was made aware that, although there is a dedicated Australian Standard, there is an underestimation about the importance of welding reinforcing bars for concrete structures.

The WTIA has been provided examples of failures or non-conformities in a number of minor and major concrete structures. As such, the Group welcomed the new WTIA course and confirmed support for its development by providing case studies and relevant course material.

APT Group
The APT Group recently met to discuss the PG9 (Welding Procedure Database) project. With the first year of the project almost complete, the WTIA reported the results of the weld qualifications to Group members. The welding procedures that are being developed as a result of these weld qualifications will be available to all participating members. The Group is looking forward to commencing the second round of qualifications.

The next national APT Group meeting is scheduled for August 2016.
Can you provide some guidelines on tack welding?

There are two types of tack welding that are employed in holding parts together: tack welds that will be incorporated into the final weld; and bridge tacks that hold the parts together until sufficient production welding has been carried out, and they can be removed.

Often, tack welds are subject to cracking because they are too short or insufficient preheat is applied. The following guidelines will ensure that tack welds are successful:

1. Both the welder and tack welding procedure must be qualified to the applicable standard e.g. AS/NZS 1554.1.
2. The required preheat needs to be applied prior to tack welding.
3. The surface to be tack welded shall be free from paint, oil, grease, moisture, mill scale, heavy rust, flame-cut slag or any other foreign matter. Surface contamination creates cracks in the tack welds.
4. All tack welds shall be of sufficient size and length, and spacing. The length shall be no more 40mm and four times the thickness of the thicker part. A spacing of 250mm maximum is recommended.
5. All tack welds shall be made to the same quality requirements as the final weld and shall be made with the same class of consumables specified for the weld.
6. As a general rule, tack welds should be avoided at the edges or at locations where the welds cross.
7. All tack welds shall be examined visually before taking up full welding. If there is any visible crack, tack welding has not been correctly applied and tacking procedures will need to be evaluated.

AS/NZS 1554.1:2014 provides requirements for tack welding in Clause 5.5.

Reference
Can you provide some detail on the delay in NDT of 0.5Cr 0.5Mo 0.25V steels after PWHT?

Early Cr-Mo-V steels had the possibility of reheat cracking, which occurs in the heat-affected zone of welds during postweld heat treatment or during service at elevated temperature. The factors that contribute to reheat cracking are:
- a susceptible alloy composition;
- a susceptible microstructure;
- a high level of residual strain combined with some degree of triaxiality;
- temperature in the strain relaxation (creep) range.

Most alloy steels suffer some degree of embrittlement in the coarse-grained region of the heat-affected zone when heated at 600°C. Elements that can promote embrittlement are Cr, Cu, Mo, B, V, Nb and Ti. But S, Sn and possibly P can produce low melting point eutectics along the grain boundaries in the coarse grained region. This results in intergranular cracking known as reheat cracking. Molybdenum-vanadium and molybdenum-boron steels are particularly susceptible, especially if the vanadium is over 0.1%.

Micro cracks that form during postweld heat treatment are likely to extend during service at elevated temperature. There are indications that a structure having poor ductility will be more susceptible to elevated temperature embrittlement. Likewise coarse-grained material is more likely to crack than fine grained. It follows that the use of low heat input processes will be better than submerged arc welding, when combating reheat cracking.

Delay in NDT until after PWHT ensures re-heat cracking has not occurred in these susceptible steels. PWHT may also be used to combat Hydrogen Assisted Cold Cracking in Steels by stress relieving and hydrogen diffusion. This is a separate cracking phenomenon. In both cases NDT may be carried out as soon as the weldment reaches ambient temperature following the PWHT cycle.

Reference

About the WTIA Hotline
All Corporate WTIA Members have access to the Hotline, which is manned by Technology Manager, Sasanka Sinha. Sasanka is also happy to provide initial help on technical matters to non-members. To reach the WTIA Hotline, please phone 1800 620 820.
For Your Diary

Upcoming Events

Whether you need to brush up on skills learnt years ago, want to try your hand at something new, or crave some networking opportunities, there is an industry event for you. For further information on any of the events listed below, or any WTIA events, please email events@wtia.com.au or phone +61 (0)2 8748 0100.

August
9th Pacific Rim International Conference on Advanced Materials and Processing
1 to 5 August, Kyoto
http://web.apollon.nta.co.jp/PRICM9

September
Australian Steel Convention
11 September, Melbourne
www.steel.org.au

European Symposium on Pressure Equipments (ESOPE)
13 to 15 September, Paris
www.esope-paris.com

IAS Steel Conference
13 to 15 September, Santa Fe
www.siderurgia.org.ar

19th Annual Aluminium Conference
20 to 21 September, Miami
www.aws.org

3D Printing Asia Expo
20 to 22 September, Gaungzhou
www.3dprintingasiaexpo.com

October
10th International Conference on Trends in Welding Research
11 to 14, Tokyo
www.trends2016.org

Materials and Maintenance Advancements for Mining
14 October, Kalgoorlie
www.materialsaustralia.com.au

2nd Pressure Equipment Workshop 2016
14 October, Auckland
www.hera.org.nz

American Society for Non-Destructive Testing Annual Conference
24 to 27 October, Long Beach
www.asnt.org/annual

EuroBLECH 2016
25 to 29 October, Hanover
www.euroblech.com

November
FABTECH 2016
16 to 18 November, Las Vegas
www.fabtechexpo.com

4th International Conference on Mechanical Engineering, Materials Science and Civil Engineering
19 to 20 November, Sanya
www.icmemsce.org

December
CAMS 2016 - Advancing Materials and Manufacturing
6 to 8 December, Melbourne
www.cams2016.com.au

Additive Manufacturing Americas
7 to 9 December, Pasadena
www.amshow-americas.com
Revision of Technical Notes
Call for Volunteers

The WTIA is pleased to announce that the process of revising its Technical Notes has commenced. The technical revision of WTIA Technical Note 11 Commentary on the Structural Steel Welding Standard AS/NZS 1554 is already complete, with the new version to be available for purchase in the coming weeks.

Following the completion of the revision of Technical Note 11, the WTIA has commenced the revision of all other technical notes.

In order to incorporate as much industry knowledge and experience as possible, the WTIA is calling for interested industry and academic expert volunteers to form a working group to review each Technical Note.

The working group will meet electronically (via Skype or similar). After an initial review by the working group, the Technical Note will then be peer reviewed by a select industry group. The WTIA is now calling for suitably qualified, experienced volunteers to assist in the initial review of:

1. Technical Note 1 Weldability of steels
2. Technical Note 6 Control of Lamellar Tearing

Expressions of interest should be sent to Bruce Cannon (WTIA Technical Publications Manager) via b.cannon@wtia.com.au. Please include contact details, qualifications, experience and the technical note(s) in which you are interested.

What Are Technical Notes?
The WTIA’s Technical Notes should be read alongside the relevant Standard, technical guideline or Code of Practice, where applicable (in some cases, the WTIA’s Technical Notes even pre-date Standards). In general, the WTIA’s Technical Notes are intended to:

- Present background material which could not be included in the Standards
- Discuss the intent of the Standards
- Explain the application of the Standards and Codes to real life requirements
- Provide technical knowledge for the principal, design engineer, fabricator and inspecting authority to achieve the required weld quality
- Serve as an educational and reference text
- Provide procurement assistance

ABOUT THE WTIA
A not-for-profit, membership-based organisation, the Welding Technology Institute of Australia (WTIA) represents Australia’s welding profession. Our primary goal is to ensure that the Australian welding industry remains locally and globally competitive, now and into the future. WTIA is the Australian representative of the International Institute of Welding (IIW).
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