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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From the
WTIA CEO

Over the past 12 months, I have been shocked at the number of unsafe steel structures reported by members. The primary cause of these safety concerns has been welding that is not fit for purpose and does not comply with recognised international and Australian Standards.

Among these reported instances were three pedestrian bridges in Busselton, Western Australia, procured from China by Local Government. These bridges pose a potential immediate safety risk to the public, which will only increase over time as durability factors come to bear. Despite the issue being reported to local and state government bodies, no action has been taken.

A Certified Welding Inspector reported low quality welds that were non-compliant with Australian Standards in an imported steel grain silo. WTIA welding engineers confirmed this project was unsafe and unfit for construction without significant rectification work.

Furthermore, when recently speaking with a member company, I was horrified to discovered that there are no regulations covering the manufacture and roadworthiness of towed vehicles, such as caravans, domestic trailers, commercial trailers and boat trailers.

In particular, the structural welds used to build the underpinning steel chassis do not have to comply with the relevant Australian Standards, and the welders making those welds do not have to be qualified or certified to do so. All the Standards are completely voluntary, so manufacturers simply don’t bother, resulting in appalling welds throughout these trailers.

Australian Standards are as good, if not better, than any in the world. The problem is that very few Australian Standards are supported by regulation and are therefore only applied on a voluntary basis. Without any compulsion to manufacture or procure products to a recognised Standard, companies take the lowest cost option which is often detrimental to public safety.

When product is inspected and found to be non-compliant, many refuse to accept responsibility for rectifying the structure, opting instead to take the risk or trying to pass on liability to another part of the supply chain.

When I appeared before the Senate Inquiry into the Future of Australia’s Steel Industry, I was asked by the Hon. Senator Kim Carr whether fabricated steel imported into Australia that did not comply with Australian regulations was deliberately circumventing regulations. I had to reply that there are, in fact, no regulations.

What this means is that the Australian public is being placed at unnecessary risk. The reality is that the failure of welds can cause fatalities. In 1994, the Seongsu Bridge over the Han River in Seoul, South Korea collapsed due to structural failure caused by improper welding of the steel trusses; 32 people died and 17 were injured in the accident.

Whilst the number of reported incidents caused by the failure of fabricated structural steel in Australia are few, the risk of a fatality increases every year. As I noted during the Senate Inquiry, it is inevitable that we will see someone killed, due to improper welding, in the next five years.

The WTIA is committed to ensuring that no Australian lives are lost through an accident caused by non-compliant welding, without causing undue regulatory burden on industry.

To this end, at every possible opportunity, we are publicising the existence of these safety issues, and bringing them to the attention of the relevant government bodies.

We are working alongside the Federal Government and a number of state governments to implement compliance schemes that ensure Standards are fully complied with. These include a compliance scheme for structural steel, another for welding equipment, and another still for light vehicle trailers.
In addition, the Australian Welder Certification Register (AWCR) will ensure that individual welders are properly certified to not only an Australian Standard, but an internationally recognised Standard.

All the work the WTIA is undertaking is focused on ensuring compliance with Australian Standards. After all, it is these Standards which make Australia a safer place to live.

On a positive note, all our efforts are beginning to have an impact. For instance, in conjunction with TAFE NSW and Lincoln Electric, WTIA will provide training, qualification and certification services (including registering welders on the AWCR) for the WestConnex M4 East and New M5 Motorway projects. This is a direct result of the Roads and Maritime Services recognising the importance of welding compliance to Australian Standards.

I’d like to thank all members that have reported compliance issues. I ask anyone that hears of any compliance issues to alert the WTIA, so that we can raise them with the relevant government and industry bodies. Keeping Australians safe is our top priority.

Lastly, on behalf of the WTIA, I’d like to thank our members and clients for their continued support in 2016, extend our warmest wishes for the holiday season, and wish everyone a safe and prosperous new year.
Inside the Industry: Breaking News

Senate Inquiry into the Future of Australia’s Steel Industry Reopened

In November 2015, the Senate referred an inquiry into the future of Australia’s steel industry to the Senate Economics References Committee. With the federal election, this inquiry lapsed.

On 11 October 2016, the Senate agreed to the Committee’s recommendation that this inquiry be re-adopted and, as such, the enquiry has been re-opened. The Committee is to report by December 2017.

All correspondence and evidence previously received for this inquiry has been made available to the new Committee, including that provided by the WTIA, particularly the presentation given by WTIA CEO Geoff Crittenden earlier in the year.

Hazelwood Power Plant to Shut by 2017

Brown coal-fired Hazelwood power plant is expected to be shut completely by April 2017 with around 900 jobs to be lost. Over the last 50 years, the 1,600 MW plant has produced nearly a quarter of Victoria’s coal electricity supply, and currently employs approximately 750 people, with 450 direct employees and 300 contractors.

Built in the Latrobe Valley between 1964 and 1971, the plant required millions in investment, following at least four repair notices from WorkSafe. ENGIE chief executive in Australia, Alex Keisser, said the power station was no longer economically viable. “ENGIE in Australia would need to invest many hundreds of millions of dollars to ensure viable and, most importantly, continued safe operation,” said Mr Keisser.

It is expected that 250 workers will remain onsite from 2017 to 2023 to manage the plant’s rehabilitation.

Source: www.abc.com.au

Ichthys Pipeline Ready for Gas

The offshore and onshore sections of the INPEX-led Ichthys LNG Project’s 890km gas export pipeline were safely welded together in Darwin recently.

Joining the two pipeline sections—882km offshore and 8km onshore—means the pipeline is now ready to deliver gas from the offshore Ichthys Field to the Project’s onshore facilities at Bladin Point near Darwin for processing.

The 42 inch diameter pipeline is the longest subsea pipeline in the southern hemisphere and the third longest subsea pipeline in the world.

“We are very pleased with the overall safety performance during the pipeline manufacturing, construction and installation processes spanning more than four years,” Ichthys Project Managing Director Mr Louis Bon said.

“Building the pipeline involved multiple movements of 73,000 individual 42 inch diameter, concrete coated pipe joints, with each pipe joint weighing approximately 26 tonnes.”

To protect workers from injuries associated with lifting, INPEX used innovative automated lifting equipment at the pipe fabrication and coating yards, and offshore installation vessels utilised state-of-the-art pipe joint handling systems.

“Today’s milestone means we are one step closer to physically connecting our onshore plant near Darwin to our offshore facilities which will be permanently moored in the Ichthys Field for the 40-year life of the Project,” Bon said.
Rheinmetall Defence Appoints Technical Director for Land 400 Project

Rheinmetall Defence recently announced the appointment of Dean Gagnon as Technical Director at Rheinmetall Defence Australia and New Zealand. Gagnon will drive the coordination of Rheinmetall’s technical program for Land 400 Phase 2.

This role will require the manufacture of high end sub-systems, the manufacture and assembly of turrets, the design of vehicle variants, and the production of vehicles.

Prior to this appointment, Mr Gagnon was the Systems Engineering Manager for the Australian Army’s fleet of Mercedes-Benz G-Wagon, which are used for tactical training, disaster relief and securing Australia’s coastline. He also served as an Army Officer in the ASLAV and Tank Programs at the former Defence Materiel Organisation.

Charlie Gas Development Makes Good Progress

The QCG (Queensland Gas Company) Charlie Field Compression Station construction is progressing well, with the construction team now focused on the underground works.

The final pre-fabricated modules arrived in September, and major construction components were delivered in October when mechanical, piping and welding construction began. The electrical team now has over 2km of cable to install.

Overall progress for the 34km gas and water pipelines is halfway complete between the Charlie Field Compression Station and existing facilities at Woleebee Creek near Wandoan, Queensland. The mainline welding for the gas pipeline is complete, and installation and backfill of the pipeline is 56% complete. Stringing and welding of the water pipeline is in progress.

The development involves the construction of 300–400 wells, a large field compression station and associated pipelines and facilities which will feed into existing gas processing and water infrastructure at Woleebee Creek.

Industry Giants Join the Advanced Manufacturing Growth Centre

The Advanced Manufacturing Growth Centre (AMGC) recently announced the signing of Thales as the founding member. Alongside Thales, other new members include Quickstep, The Dow Chemical Company, Siemens, Bosch, Swisse, Laing O’Rourke, SPEE3D, the University of New South Wales and the CSIRO.

All these organisations will work with AMGC to identify major projects that open a pipeline into global supply chains for Australian manufacturers. Linking Australian firms into global supply chains will ultimately provide Australia with a more sustainable and globally competitive future.
Glencore to Restart Coal Mine as Prices Surge

Glencore looks set to restart a coking coal mine in southeastern Australia that was shut more than two years ago, with a resurgence in prices for the commodity breathing new life into the sector.

Less than a year after the coal industry was declared to be in terminal decline, markets for coal used to generate power and make steel have surged - boosted by moves in China to mine less of its own coal and import more. Glencore acquired the underground Integra mine, formally called Glennies Creek, in 2015 after it was mothballed by then owner Vale of Brazil. It plans to restart it early next year.

“The Integra underground mine has been on care and maintenance since July 2014 and Glencore has continued to assess options for a restart against global coal market conditions,” the company said.

The mine is expected to yield 1.3 million tonnes of coal in 2017, according to Glencore. The unprecedented surge in coal prices in the past few months to more than double their June levels is a big fillip for Glencore and other coal miners. Glencore said in October it would rehire about 200 workers at its Collinsville coal mine, after cutting 180 jobs to combat weak pricing.

Source: www.reuters.com
Warrego MP Ann Leahy said that when a global brand like Broadspectrum chose to invest in a community like Chinchilla, “It strengthens local capability and ability to deliver locally-led solutions to the projects already across the Western Downs.”

“It is not every day that one of Australia’s leading contractors, who employ more than 25,000 people across 18 industries and nine countries with an annual revenue of $3.8 billion, opens its door in Chinchilla.”

Speakers at the opening included LNP Member for Warrego, Ann Leahy, with the venue officially opened by Mayor and Councillor for Western Downs Regional Council, Paul McVeigh.

Broadspectrum’s Chief Executive, Resources, Stuart Nevison said: “Broadspectrum is committed to investing in regional Australia. We know that the Australian economy is being challenged by global commodity prices, and we are working hard to lower our costs and improve local supply chain economies.”

“We recognise that the Surat region has a strong supply chain and workforce with developed capability and skills. Across Australia, our investment in the local community is backed by more than 85% of our workforce being locals, and more than 80% of our procurement spent locally. We look forward to building on that, and hope to expand our local Surat workforce by 25%,” Nevison said.

On opening day, Broadspectrum also hosted a facilitated workshop for local schools to identify and create work experience opportunities with Broadspectrum and other local suppliers.

Broadspectrum’s General Manager, Industrial Maintenance, Queensland, Sam Goldsmith said, “We have committed to host a bus full of school kids every quarter from Chinchilla State High School to come to the workshop and learn more about local trades and disciplines they can aspire to. A commitment to regional Australia has to include pathways to living and working locally.”

“In support of this, we are also the Foundation Sponsor of www.localworkers.com.au, which is an online community asset that connects workers with local employers, training and eventually liveability information,” Goldsmith said.

Source: www.chinchillanews.com.au
Apprentice Welders Win At WorldSkills Australia

The recent 2016 WorldSkills Australia National Competition featured over 500 men and women from 60 trades and skills, who converged on the Melbourne Showgrounds to compete in the ultimate skills showdown. Often known as the ‘Skills Olympics’, the three day competition brings together the nation’s best young apprentices, trainees and students who have already competed at their regional level. The event gives competitors the chance to become crowned as Australia’s best, as well as the opportunity to train for a place on the international Skills team to represent Australia.

Twenty two welding apprentice competitors from across the country completed a project over the three day competition which required them to construct a pressure vessel. This was made from a variety of material, including mild steel, aluminium and stainless steel. These materials tested their skills in stick, MIG and TIG welding processes.

Joe Pratt from DMK Engineering won gold in the welding category. Joe completed his apprenticeship with DMK Engineering, passing many weld procedure tests, and gained his welder certification through TAFE SA Mount Gambier. Joe had competed in the national competition in Perth in 2014 and was determined to do well in Melbourne.

DMK Engineering is a growing company with offices and workshops in Mount Gambier and Adelaide. DMK completes projects nationally, specialising in pipeworks for oil and gas and steam, stainless steel for water treatment, viticulture and food industries, as well as fabrication and maintenance. DMK provides full support for their apprentices to compete in the WorldSkills competitions every year.

Dylan Bolch from Macquarie Manufacturing in the Hunter region took out the silver medal in welding, and Darren Barnes from Melbourne came in third.

From competitor to parent, judge to volunteer, staff to the general public, the most fitting way to describe the experience of the National Competition is inspirational. WorldSkills Australia CEO Brett Judd said, “Our recent National Competition was a wonderful demonstration of the strengths of Australia’s vocational training system, and displayed what a skills resurgence in our country would look like.”
International Skills Squad

Dylan Bolch, an apprentice welder from Woodrising New South Wales, who won silver at the WorldSkills Australia National Competition, has been selected to join Australia’s elite international team, known as the Skills Squad, after his successful performance.

Dylan will spend the next year training with a dedicated skills mentor, vying for the opportunity to join over 1,000 young men and women from 75 countries at the WorldSkills International Competition, which is being held in Abu Dhabi in October 2017.

Dylan said of his achievements, “At first I couldn’t believe it, that I had won silver and now to be selected on the Skills Squad team, I’m still pinching myself.”

Dylan’s achievements are a coup for the Australian welding industry, with the profession being identified as experiencing a national skills shortage according to the Australian Government’s National Skills Needs List. There is clearly a strong demand for skilled welders across the nation.

“It’s an amazing experience. It’s going to be a lot of hard work but it will all be worth it. It’s a great opportunity to build connections in the industry and to learn all the new skills from my welding mentor will be fantastic. I can’t wait to get started,” said Dylan.

WorldSkills Australia has selected 24 competitors for the Skills Squad. The first stop on their international journey is a training camp to be held in Victoria, where the competitors will meet with their skills mentors and develop a training plan for the coming months.

About WorldSkills

WorldSkills Australia is one of over 60 WorldSkills International member countries. Every two years, participating members converge at the world’s largest skills competition – the WorldSkills International Competition.

Competitors have to advance from the regional to the national level to prove their commitment and skills in their chosen field and to secure a place in the Skills Squad team; the International Competition is the ultimate test. Members of the Skills Squad become ambassadors not only for their skill, but also their local region, state and country.

WorldSkills’ competitions, aligned to National Training Packages, work to ensure that today’s young people have the skills and abilities to compete in a rapidly changing global marketplace.

The 43rd WorldSkills Competition in Brazil in 2015 saw over 1,200 of the globe’s top tradesmen and skilled people compete for the coveted title of World Champion across 50 skills categories.

WorldSkills Australia’s team of 26 competitors proved to be fierce competition for the other 60 countries in attendance, earning three silver and two bronze medals. Ten of the Skills Squad members received a Medallion of Excellence for achieving an overall score of 500 or above.

For information on WorldSkills, visit: www.worldskills.org.au
BOC Opens Applications Technology Centre

A new-concept welding facility opened by BOC at its Rocklea site in Brisbane is set to be an exciting new hub for product applications and testing, research and development, and training. The facility will primarily be used to demonstrate the latest in welding, cutting and heating technology and automation.

For further information: BOC Applications Technology Centre, 1688 Ipswich Road, Rocklea, Queensland. For appointments contact Peter Kuebler on 0401 997 362.
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Officially opened during a three-day onsite event in November, the Applications Technology Centre contains the latest generation digital welding equipment, GMAW and GTAW arc projectors, and a Kawasaki RA 10L robot equipped with a Servo Robot PowerCam laser vision camera and EWM alpha Q 352 welding package (built by BOC’s automation partner Robot Technologies-Systems Australia).

BOC Technical Manager Peter Kuebler explained the investment will benefit both customers and BOC’s technical specialists across the nation, with the hope that it will contribute to advancements in the metal fabrication industry.

“Productivity is really important as cost pressures increase in our global economy. To assist with this, BOC and RTA have developed world leading robotic applications in Australia and are now starting to see more businesses use automation as an essential vehicle to remain competitive. Smaller customers are upgrading to digital welding machines capable of sophisticated arc characteristics and utilising innovative shielding gas mixtures.”

During the three-day showcase, BOC hosted one-on-one tours, live demonstrations and consultations for customers who travelled from across Brisbane and as far as Townsville—a great start for the centre which aims to foster better collaboration between BOC, its partners and customers.

“We had a great mix of businesses attend, which shows the diversity of the metal fabrication industry—from aluminium road tankers and meat processing, to the academic and research side. They were joined by many BOC applications specialists who were on hand to demonstrate best practice welding procedures and welding quality management.”

Several new processes attracted plenty of interest from attending guests including a special welding process developed by partner EWM for high productivity MIG welding of pipes, along with digitally modified metal transfer GMAW such as coldArc and forceArc as well as hot wire TIG.

“Our team had lively discussions with visitors around the forceArc process for high productivity MIG welding of thick steel sections – typically this can provide productivity savings of 30% to 40%. The TIG projector, which has a brand-new compact design, proved to be a great educational tool to demonstrate shielding gases, allowing customers to easily compare the effect of different shielding gases on the behaviour of the arc.

Kuebler explained the centre will also be a place where BOC can train its own technical specialists across the South Pacific in new welding and cutting applications. Training organisations will also be offered the opportunity to bring teachers and students in to see the latest technology and products being used in real applications.

With a global network of Applications Technology Centres already established across The Linde Group, BOC is keen to contribute to global research and development initiatives, by using the Rocklea facility to evaluate new products and applications, and share local learnings and innovative solutions.

“The opportunities are endless. We are all already intrigued about new advancements being tested in universities and industry, for example rapid prototyping and 3D printing using real welded components for industries such as aviation.”

“Our technical experts want to encourage and support new ideas and concepts with our customers, partners and industry – a meaningful way for BOC to advance our industry and profession as a whole and to keep jobs in Australia,” said Kuebler.
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How To Tell If Your Employees Need Training

Many organisations regularly face the dilemma of identifying whether their employees need training. Sometimes, the identification process can be quite simple. It might be that your organisation has invested in new equipment, or implemented a new procedure, both of which require the training of staff. Alternatively, you might be trying to drive cultural change to modernise or revitalise your organisation. Other times, training might be required because, unfortunately, there has been an accident or incident to which a lack of training has been identified as a contributing factor. Paul James, WTIA Training Manager, takes a look at the process of training needs identification, as well as how to source training providers.

Training Needs Identification

The training needs identification process can be as difficult or easy as you make it. There are many ways; you will hear terms like TNA (Training Needs Analysis) or professional development but at the end of the day, training needs identification is all about gap analysis—what training do you currently have versus what you need or want.

Training needs identification can be performed by developing a Skills or Training Matrix, which compares the skills and knowledge of your employees and your organisation against the required skills and knowledge. This can be performed at the individual level, or for a role within your organisation. It is through this process that the training gap is identified. The completion of a Skills or Training Matrix can also lead to the construction of a detailed Position Description.

Depending on the industry in which you operate, you may need to identify each task that your organisation performs and then identify particular competencies related to each task.

Some industries might be required to perform a Risk Based Training Needs Analysis (RBTNA), which involves calculating a risk score for each task that is performed (likelihood versus consequence). This helps to pinpoint how risk can be minimised, the training required and the most appropriate method of training.

When compiling a Training Matrix or performing a RBTNA, there are a few factors you should consider.

Legislative Requirements

Is there any legislation covering your industry which identifies the training requirements you, or your employees need? In many cases, the answer will be yes. Workplace Health and Safety legislation, the Rail Safety Act, the Passenger Transport Act, Australian and International Standards, and particular Codes of Practice could set out training requirements.

Sometimes companies spend money on qualification of an employee that has no benefit to the organisation. For example, one company paid for the majority of employees to undertake training in Elevated Work Platforms (EWP), even though they only used a scissor lift. Operation of some scissor lifts do not require an EWP qualification. This is why checking all relevant legislation is vital—you need to ensure you know your legal training requirements.

Client Requirements

Are there any skills or knowledge that your clients or customers require? Are there skills or documentation that might be required for your personnel to work at specific locations or with specific organisations? This may include rail safety inductions, white cards, site inductions or specific safety training, such as confined spaces or working at heights.

It is also worth considering whether these skills and knowledge are an ongoing requirement. Do they need refreshing on a regular basis, or are they simply a one off?

Sourcing Training Providers

Once you have analysed your skills gap and identified the training required, what next? It’s time to source the training you need.

Depending on your organisation, you might need to write a business case or justify capital expenditure. Fortunately by now, you have developed your skills matrix or TNA to validate your case. Sourcing training is not as easy as it sounds. Not only are there many providers, there are also many training delivery methods.
If you need competency based training from vocational education, then a good place to find providers is via the Department of Education and Training (www.training.gov.au).

When deciding on the method of training (such as face to face or e-learning), you need to consider the time your employees might need away from their place of work, as well as their ability to study independently and complete assignments.

If you have enough employees who require training, it may even be worth investigating the possibility of in-house training, where a trainer facilitates the course at your own premises, at a time convenient for your business. In-house training course content can often be customised to suit the specific needs of your organisation.

If your training requirement is ongoing (such as first aid courses), it is a good idea to vet your provider thoroughly. Find out what their customer support is like. You should ask a number of simple questions:
- Do they notify individuals when their qualification requires renewal?
- Will your company receive a copy of the qualification for personnel files?
- Is there a discount for multiple people or continued courses?

### Evaluating Training Success

After you have trained everyone, how do you know if it has been effective? The early clues are the obvious ones—employees can use the equipment or they know the process. There are others that may take time to become apparent:
- Increased productivity
- Reduced accidents, incidents and injuries
- Less customer complaints
- Less wastage
- Improved moral

### WTIA Launches Online Training

In conjunction with the American Welding Society (AWS), the WTIA now offers online courses to help develop your welding knowledge. The content has been developed by senior people within the profession and is regularly updated. The courses are available any time, day and night, and are designed as self-paced modules to allow students to complete them in their own time. The courses available are:
- Economics of Welding
- Fabrication Maths - Advanced
- Fabrication Maths - Basic
- Metallurgy - Advanced
- Metallurgy - Basic
- Non-Destructive Testing
- Welding Fundamentals - Basic
- Welding Safety
- Welding Sales Representative
- Welding Symbols

Tips for Successful Recruitment & Retention

Organisations that adopt successful recruitment and retention practices will, all else being equal, achieve far greater success than those which do not. This is especially relevant for the welding industry, where the most productive welders are in incredibly high demand. The cost of a poor hiring decision is estimated at 50% of the salary of the role that is being recruited. Making the wrong hiring decision is an expensive choice and may cost you more than you realise, but with careful planning and preparation it is possible to get it done right.

Poor recruitment processes that lead to bad hiring decisions, and less than optimal employee retention programs that cause a high degree of employee turnover can create massive costs.

There are ‘opportunity costs’ in the form of lost revenue and diminished customer goodwill. There are also other, less tangible, costs such as productivity losses in the shape of low employee morale and extra time spent on training, additional workloads on current staff, and lost business relationships. For those looking to maximise their recruitment and retention efforts, there are a number of ways to do so.

Recruitment

According to Simon Bristow, Senior Regional Director of Hays Recruiting Trades & Labour, “We are seeing a very healthy construction market in many states, which is driving job growth for a range of trades and labour, including good, reliable and experienced welders.”

“Recruitment really does start with good attraction – you need people to know about your job before you can consider them.”

“So firstly, pin down your needs. Do you need a candidate with experience working on fuel storage tanks, in a fabrication environment or installing structural steel on site? Do they need brownfield project experience? The ability to interpret drawings, then mark out and weld, or the ability to work with exactness to high level of tolerances? Do they need various welding techniques or their own tools? What tickets do they need? Must they be qualified to a certain level and able to meet a certain standard?”

“Once you identify your exact requirements, advertise on relevant job portals, ask existing trades if they can recommend anyone, utilise social media and consider using a recruiter who specialises in trades and labour. A recruiter has a network of contacts and we can find the right welder for you – whether for a temporary assignment, permanent role or a temp-to-perm position.”

Get to know what motivates your people and what they value. Everyone is unique, so make sure you talk to your employees about their career plans, situation and what they want.
“When you promote your vacancy, make sure you mention something about your values or what sets you apart as an employer. This is often called your EVP – Employee Value Proposition – as it describes the values, benefits, way of working and appeal of your company.”

“For example, maybe you like to promote from within, so that’s worth mentioning as many welders are looking to work in a stable, established team where their skills are valued. Or perhaps you work on various sites – this can attract people who crave variety. Or maybe you have a strong OH&S record and so can mention your safe work practices,” said Bristow.

“If you use a recruiter, he or she will background check all candidates. If not, thoroughly review CVs and watch out for any red flags. You can also use publicly available information on social media to confirm details on the CV – watch out for inconsistencies.”

“Interview candidates thoroughly – take time to prepare as making the wrong hiring decision can be very costly. You can also test candidates to ensure they have the necessary skills. Don’t forget to reference check, but complete references over the phone. I’m yet to see a bad written reference!”

“Be prepared to negotiate the salary or rate at offer stage.”

“Finally, make sure you have a good induction process in place – no one forgets being left to sort things out for themselves in a new job, so make sure your new employee is properly inducted,” said Bristow.

**Retention**

“When it comes to retention, a ‘one-size fits all’ approach never works. Get to know what motivates your people and what they value. Everyone is unique, so make sure you talk to your employees about their career plans, situation and what they want. Regular performance appraisals are a great way to check in with staff one-on-one. They don’t need to be long or overly formal, but they should involve two-way feedback.”

“Many welders, especially Gen Y, want a manager who is a coach rather than solely an allocator of work. Familiarity is valued and they want to be able to confide in their boss about personal as well as work matters. Therefore, offer coaching and mentoring, get to know your employees and be supportive. Know how to motivate and nurture them, and be collaborative and fair.”

“Work/life balance is another retention tool. During busy times longer hours can become the norm, but try to cut them back if you can. If workloads are no longer manageable in the standard working day, it might be time to find extra help. You could consider a temporary candidate to boost resources short-term.”

“Recognition is also important for retention, but it shouldn't be solely focused on monetary rewards. Give people positive feedback and praise. Internal recognition for a job well done can also go a long way.”

“Despite your best efforts, some staff may still go. An employer brand is affected as much by the people who leave as the people who are still employed. Making leaving a positive experience can be a challenge but it is very powerful for leavers to speak highly of your company even though they no longer work there. Even something as simple as an exit interview can have a positive impact.”

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An Update on Australian Standards

Standards are living documents which reflect progresses in science, technology and systems. To maintain their relevancy, all Standards are periodically reviewed, and amendments and new editions are published. Recently, a number of developments have occurred in relation to Standards governing welding of structures, bridge design, and steel structures.

Welding of Structures
The Standards Australia committee met recently to consider a number of items in relation to the welding of structures. As previously reported, Standards Australia has agreed to two project proposals. The first project will consider minor text amendments, and correct known errors within the 2014 edition of AS/NZS1554.3 Structural steel welding (Part 3: Welding of reinforcing steel). The second project will include the revision of AS/NZS2980 Qualification of welders for fusion welding of steels.

The committee is currently reviewing the requirements for both projects, and will seek clarification from ISO as to the intent of ISO3834, as well as the correction of known errors within AS/NZS1554 (Parts 4 and 5), particularly in relation to various fatigue items. The outcome of the committee’s review will be reported in due course.

Bridge Design
The drafting committee responsible for AS5100.6:2004 Bridge design (Part 6: Steel and composite), has met recently to consider public comments related to the revision of AS5100.6, set to become AS/NZS5100.6 Bridge design (Part 6: Steel and composite construction).

Whilst all comments received have been considered, at the time of writing, resolution is still pending on a number of issues. It is anticipated that work on the draft will be completed in November, with the draft then moving to ballot stage. Publication is anticipated for early to mid 2017.

Steel Structures
Public comment closed in October on the recently circulated draft of AS/NZS5131 Structural steels – Fabrication and erection, which was modified after consideration of public comment arising from the initial public comment draft.

Comments received are currently being considered by the drafting committee, and pending resolution and approval, should see publication in early 2017. This will then lead to the fabrication and erection components in AS4100 being withdrawn and reference made to AS/NZS5131.

It is also anticipated that similar changes will be able to be included within the proposed AS/NZS5100.6, but this will be dependent upon the timely resolution of public comments.
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JOINING SOLUTIONS FOR THE FUTURE
Welding Machine Pre-Start Checklist

Adopting best-practice welding safety procedures is of paramount importance. Incorrect welding practice can result in serious injury, including the risk of electric shock, overexposure to fumes and gases, arc radiation, fire and explosion. There's a lot to be aware of to ensure compliance with the various safety practices outlined by the relevant Australian and New Zealand Standards. However, with due diligence, it's possible to weld with complete safety, along with optimal efficiency.

Before starting any welding operation, a complete inspection of all welding machines and equipment should be undertaken. All it takes on the part of the welder is five to ten minutes before turning on any machinery—it doesn't take much to prevent injury to yourself or to your co-workers.

This daily inspection and pre-start checklist contains guidelines on how to inspect your welding machinery, as well as the details of the particular Australian Standard that supports the practice.

**Recommended Welding Machine Daily Inspection and Pre-Start Check List**

**Power Supply**
Disconnected and isolate the power supply to the welding machine prior to performing these pre-start checks.

**Mains Supply Socket & Switch (AS/NZS3000)**
Inspect for any obvious damage and defects to the switch or socket. Ensure that the correct size plug is fitted to the welding machine for the rated current and duty cycle of the welding machine.

**Plug & Primary Cable Supply to the Welding Machine (AS/NZS3100)**
Check that the power supply cable is of the correct rating for the welding machine, and for any damage to the plug. Special attention should be given to any cuts, burns, abrasions, fraying, or other damage to the cable insulation, which may result in exposed live wires.

**Welding Machine Pre-Start Checklist**

**Welding Machine (AS1966 and AS3195)**
Inspect the exterior of the welding machine for any obvious damage to the cabinet, power switches, indicator lights or controls.

**Welding Cable Connections (AS1674.2)**
Ensure that the welding cable connections to the welding machine are in good condition, and contact surfaces are clean and properly tightened. If terminal posts are used, ensure only brass washers and the correct insulated type brass nut are used. Any unused terminal posts should have an insulated brass nut in place. Ensure that all connections are fully insulated and cables are firmly anchored to fittings.

For a.c. welding machines, check that electrode and work return cables are correctly connected to...
the welding machine. For d.c. welding machines, check
the polarity and ensure electrode and work cables are
correctly connected for the procedure in use and that any
other d.c. welding machines in the vicinity are connected
with the same polarity.

**Welding Cables (Electrode and Work Return Cables)
(AS1995 and AS1674.2)**
Examine all cables (leads) for damage, including cuts or
abrasions, burns, damaged insulation, frayed wires, or
any other damage that may expose live wires. Electrode
and work return cables should be of similar length and
of the same current carrying capacity. Additionally, they
should be rated for the maximum current rating and duty
cycle of the welding activity. Building steelwork shall not
be used as a work return path.

**Welding Cable Extension Connections
(AS1674.2)**
Check that both the male and female connections are
fully insulated with clean contact surfaces, and that all
 fittings are tightened properly, and that there are no
exposed conductors.

**Welding Hand Pieces
(AS2826)**
Check that the welding hand piece is fully insulated and
in good condition. The hand piece must be rated for the
maximum current rating and duty cycle of the welding
activity. Cracked or damaged hand pieces shall be
taken out of service immediately.

**Work Return Clamp
(AS1674.2)**
Check that the work return clamp or connection is
securely connected to the work return cable and the
job close to the welding activity.

**Engine Drive Welding Machines**
Check that all exhaust fume emissions are dispersed
away from the work area and any other personnel
working in the immediate vicinity. Do not use in an
enclosed area or building.

**Voltage Reduction Device (VRD)
(AS1674.2)**
If a voltage reduction device (VRD) is used, ensure
that the indicator lights or voltmeter are functioning
and indicating low voltage. Green indicates safe.
High welding voltage is unsafe, and indicated by a
flashing green or red signal when the welding machine
is operated in a normal welding cycle. This check is
performed with the power switched on.

**Electrical Inspection Tag**
Check that a current electrical inspection tag,
traceable to your equipment maintenance register, is
attached to the welding machine.

**Notes**
1. If on completion of this pre-start checklist you are
unsure of the safety of any part of this equipment,
do not use it. Isolate the equipment and notify
your supervisor immediately, in order for remedial
action to be taken.
2. Fumes are generated by hot work. Take adequate
precautions to limit exposure to fumes from
welding consumables or surface coatings and
contaminants.
3. Ensure that you have all necessary Personal
Protective Equipment in place, dry, and in good
order, before turning on the welding power source.

For more information, download WTIA’s Technical Guidance
Note 7: Recommended Welding Machine Daily Inspection and
Pre-Start Check List.
The Impact of Robotics on Welding

In recent years, the downturn in global economic markets has placed pressure on all industrial sectors, including welding and fabricating. In order to reduce costs and man hours, improve productivity and quality, and increase process repeatability, many welding companies are turning to innovative welding products, services and technologies such as robotics. Although robotic welding has many advantages over manual welding, such as higher production rate, more consistent welding quality, and lower long term operational cost, it is still often considered to be limited to applications with simple geometry and large production volumes. With the advent of technology such as laser vision and automated offline programming, applications and uptake of welding robotics look set to expand.

A State of Change

The bulk of robotic welding installations have been in the automotive industry, where the production volume is often thousands of units per annum, and each robotic welding station only performs a few simple spot or short stitch welds.

According to Peter Kuebler, BOC’s Technical Manager, the use and impact of industrial robots in Australia’s welding industry is currently in a transitional phase. “With the contraction of the automotive industry, particularly the closures of Ford, General Motors and Toyota, welding robotics is in a state of change. In Australia, the automotive industry had the greatest utilisation of robotics for welding. This era is now coming to a close,” said Kuebler.

“The new era of welding robotics will be concentrated in the manufacturing sector and, to an ever-greater extent, jobbing shops that perform metal fabrication.”

“In the past, the benefit of robotics has always been centered on high volume production, but really, the critical aspects that robotic automation addresses are improved safety, improved quality, and improved cost savings,” said Norrish.

For University of Woollongong Emeritus Professor John Norrish, the benefits of robotics are clear. “I know the impact that robotics should have on welding. This is very different from the impact that it is actually having, particularly in terms of take up rate.”

Local Australian steel fabricator Cullen Steel, knows first-hand the positive impact that robotic technology can have on a business. With clients including some of the most prominent companies in Australia, such as Lend Lease and Multiplex, Cullen Steel has a state of the art robotic assembly and welding cell system.

According to Owner and Director of Cullen Steel, Ron Barrington, “Innovation and technology are central to securing the future of the steel industry. All welding workshops 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.”

Earlier this year, Barrington confirmed that it is nearly impossible for Australian manufacturers to compete with low cost imports, particularly those from China.
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. And welding robotics can play a major role in these process and efficiency improvements.

The question then is: why are robotics adoption rates across Australian industry so low?

“In low volume production, the programming of robotics has always been issue. Many companies that have wanted to install welding robotics have simply given up because of the excessive programming time that is required,” said Norrish.

In one case quoted by Norrish, manually programming a robotic arc welding system for the manufacture of a large vehicle hull took more than eight months, while the cycle time of the welding process itself was only sixteen hours. In this case, the programming time was approximately 360 times the execution time—clearly not effective.

However, advancements in on line sensing, laser vision and offline programming technology, will soon see programming times slashed and, hopefully, increased adoption rates.

**Laser Vision**

Some of the recent technological advancements in robotics have seen new processes and projects in the metal fabrication market.

BOC has been working with SuperiorPAK in Bundaberg, Australia’s largest supplier and manufacturer of waste compression equipment. “SuperiorPAK are manufacturing garbage trucks. The interesting part about their business is that the components are quite large, so the component accuracy requirements are not that great. As a result, they have benefited hugely from laser vision in robotics. Previously, manufacturing of large components with welding robots wasn’t viable—with the amount of manual programming time required, the use of robotics just couldn’t be justified. Laser vision has made the use of robots possible at SuperiorPAK,” said Kuebler.

“Similarly, BOC has been working with SMW in Rockhampton, where welding robotics, combined with laser vision, is being used in the remanufacturing and repair of a range of mining equipment.”

In 2015, BOC collaborated with integrator partner Robot Technologies Systems Australia, helped them develop a unique robot welding system for adaptive maintenance welding of heavy mining buckets and dump truck bodies.

The Kawasaki RA 15X robot is equipped with an EWM Phoenix 552 welding package (supplied by BOC) and a ServoRobot PowerCam laser vision system. A customised bracket on the robot wrist houses the laser camera, pre-heat temperature sensor and monitoring camera for the operator.

The portable robot system is capable of operating at ambient temperatures of up to 45°C and can weld continuously within its reach.
envelope, with minimal downtime between passes. Utilising a liquid cooled torch permits welding of these components at currents of up to 500amps.

Deposition rates of up to 6kg per hour are regularly achieved even in the vertical welding position using 1.6mm gas shielded flux cored wire. The resulting savings in welding times are typically 70%. Robot welding of new 25mm floor plates into a dump truck took less than 10% of the time taken for manual welding.

Kuebler is firm that laser vision is the key to robotic welding success, “Laser vision, combined with offline programming, are key to making robotics viable for small production runs. If it takes a day to manually program a job, and the production time is only half a day, it is simply not viable to use a robot.”

Offline Programming

Offline programming utilises CAD models of the robotic system and its surrounding environment to plan and simulate robot programs before uploading them into the real world robotic system for use. One particular benefit of this virtual approach is that many of the programming steps can be automated. Offline programming shifts the burden of programming from the robot operator in the workshop to the software engineer in the office.

According to Norrish, “Automated offline programming is a complete change in the way that robots are programmed. The thing that robots do very well is follow instructions repeatedly without problems. They will work in hazardous environments, and continue working non-stop all day and all night.”

“Over the years, the physical attributes of robots have advanced—there are a range of add-ons and interfaces available, and everything from very small robots that you can pick up with one hand to massive robots with very heavy payloads and facilities such as force control for grinding and cutting. But, while the physical attributes of robots have improved, they have still been impeded by excessive programming requirements,” said Norrish.

Dr Zengxi (Stephen) Pan and his team at the University of Wollongong has developed a system of automated offline programming for a particularly complex short batch fabrication application. The system software incorporates path planning, optimisation and collision avoidance and avoids the necessity for frequent trial and error iterations.

“We started the project at the end of 2008. The Defence Materials Technology Centre (DMTC) sponsored the project on behalf of Thales Australia, for the production of the Bushmaster vehicle, said Pan. “The objective of the project was to design a completely automated system that would make very low production runs feasible.”

“We looked at a welding process which had a very long welding time—it was taking 16 hours for a person to complete the weld—as well as very complicated welding parameters, performed in a very challenging environment. This particular weld required preheating of the steel to 80°C, which meant that the welder had to operate in a hot environment. Clearly, this was physically challenging for the welder and could only be sustained for short periods due to OH&S regulations.”

“Using offline programming, we automated the entire welding process. While it did take us a few weeks to automate the process, the welds are now 99% defect free,” said Pan.

The purpose of automated offline programming is to reduce the amount of human effort required to generate weld programs. According to Pan and Norrish, ideally this should happen without any requirement for human interaction. However, in practice some decisions are required where non-ideal circumstances are identified. This places particular importance on the user interface to deliver detailed information where required, without
overloading the user.

At each stage throughout the automated offline programming process, potential problems are identified with small warnings added to individual weld logs for further inspection. For example, if a weld is generated with close to the limit torch geometry, it is identified and reported. If no action is taken, the weld is exported as normal. In operation, the robot and the welding system are constantly monitored, providing an inherent online quality assurance capability.

Pan has now adapted this technology for a wide range of robot types in a number of industrial applications and continues to research further enhancements for weld repair and additive manufacturing.

Welding Robotics and Jobs

With advancements in robotics technology, and the likelihood of increased industry uptake, the issue of welder employment rates is inevitably raised.

According to Norrish, “Media frequently reports that the more robots we use, the less jobs there are available. This is rubbish. Robots automate processes, making these processes more efficient, ensuring companies stay competitive and thereby generating even more work. Not only that, workers are no longer exposed to fumes, sparks and other workplace hazards. While the nature of the jobs change, the welding expertise required to set up appropriate welding conditions is still essential.”

Global experience confirms that Norrish is correct—enormous robotics automation programs have had a positive effect on employment, in both the United States of America and in Germany, two countries with exceptionally high robotics uptake and usage rates.

According to the International Federation of Robotics, in the United States, the automotive industry has performed well over the last six years, with major manufacturers embarking on restructuring programs that resulted in the installation of some 80,000 industrial robots between 2010 and 2015. This is the largest investment worldwide, second only to China at around 90,000 units. This commitment is reflected in the increasing number of new jobs: the number of people employed in the automotive sector grew by around 230,000 between 2010 and 2015.

Similarly, in the German automotive sector, the number of employees increased parallel to the growth of robotic automation: The increase between 2010 and 2015 averaged 2.5%—the operational stock of industrial robots showed a parallel increase averaging 3% per year.

In essence, welding robotics reduce production costs, which results in better profit margins or lower prices. The increasing market and consumer demand then triggers more jobs.

Not surprisingly, the number of industrial robots deployed worldwide is expected to increase to around 2.6 million units by 2019. That’s about one million units more than in the record-breaking year of 2015. Broken down according to sectors, around 70% of industrial robots are currently at work in the automotive, electrical and electronics, and metal and machinery industry segments.

“Automation is a central competitive factor for traditional manufacturing groups, but is also becoming increasingly important for small and medium-sized enterprises around the world,” said Joe Gemma, International Federation of Robotics President.

Giving Australian Steel a Competitive Advantage

Queensland company, Smart Steel Systems was established with the objective of fabricating structural steel in the most cost-competitive way using ‘artificially intelligent’ robotic technology. Smart Steel Systems’ Brisbane plant is staffed entirely by robots and directed by an artificially intelligent software platform which analyses 3D plans to plot the most cost-effective way to fabricate custom-made structural steel sections.

According to Chris Brugeaud, CEO of Smart Steel Systems, their technology has reduced error rates and slashed the cost of fabricating steel in Australia. “The system more than halves the hours required to produce a ton of fabricated structural steel,” said Brugeaud.

“The thing that is most unique about our system is that, typically, most robotics and automated systems are designed to do the same repetitive task very well—robots are very efficient, but only when it comes to building the same product on a repetitive basis.”

“In contrast, our technology is a task-based automation system. It calculates, and determines how to complete a task in the most efficient way possible, in real time.”

“Our system is able to review a 3D drawing, and seek to understand the tasks that need to be performed, such as cutting a hole in a beam. It deciphers the tasks from the drawing, and then determines the best possible way to perform those tasks.”

“Given this advanced level of artificial intelligence, the system is able to perform one-off automation activities almost as efficiently as a normal automated system can perform repetitive tasks. This gives our system a huge benefit in terms of commercial viability,” said Brugeaud.

Clearly, the Smart Steel Systems technology is globally significant—it effectively programs itself. There are simply no other welding robotic systems on the market with the same level of automation.

“While there are a couple of European companies using similar robotic welding systems, these just don’t have the same level of automation as ours—they are still using a traditional process that relies upon standard robot programming protocols and languages,” said Brugeaud.

Established in 2010, Smart Steel Systems has built a plant able to fabricate large-scale steel products and, over the last few years, has quickly grown from three to nine employees, including four software, mechatronics and robotics engineers.

While the system has been in development for six years, it has only been in commercial operation for the last six months. Through SSS Manufacturing, the operational arm of Smart Steel Systems, the company is now serving Queensland’s construction industry and, in partnership with a number of building companies, has delivered fabricated structural steel to six Queensland factories.

“We are currently using the technology for fabricating structural steel for large commercial buildings and structures. But it could definitely be used in other environments and in other industries.”

Smart Steel Systems was founded by a group of private investors, all of whom have been involved in developing the ideas behind the
Clearly, the Smart Steel Systems technology is globally significant—it can effectively program itself. There are simply no other welding robotic systems on the market with the same level of automation or artificial intelligence.

“As exciting and as large as our potential was, we would have struggled to get the required investment without that early Australian Government support,” said Brugeaud. “The fact that we had secured grant funding from the Government gave us the opportunity to secure private industry funding—we had the ability to leverage the government grant.”

Smart Steel Systems is still in the early stages of revenue generation and plans to start marketing its technology, not just its steel products. It is actively seeking further investment and strategic partners to assist in rolling-out automated fabrication plants around Australia and to license its technology to manufacturers internationally. “We are now transitioning from a development company into an operational company, and are seeking to grow the business and establish partners and strategic investments,” said Brugeaud.

“At the moment, the technology is not mature enough to license. So instead, we’re working to roll out a national network of facilities, demonstrate an integrated network, and we’ll then seek to license the technology across a much broader range of industries, as well as the international market.”

“We’re currently in the process of establishing some interesting strategic partnerships with KUKA Australia industrial robots, and with Bosch Australia, with the view to providing a globally supported network and system.”

According to Greg Sale, KUKA Australia Managing Director and CEO, “KUKA Robotics is an organisation committed to innovation. Smart Steel Systems, a user of KUKA robots, are leading the way in Australia in developing Industry 4.0 level automation technologies. It is impressive to think that they have developed such globally significant automation technology with such a small team in a relatively short period of time, with still more to come.”

For more information about SSS Manufacturing, please visit: www.sssmanufacturing.com
Manufacturing (Still) Matters: Decline is Not Inevitable

By Richard Denniss (Chief Economist, The Australia Institute) and Dr Jim Stanford (Economist and Director, Centre for Future Work).

The painful contraction in Australian manufacturing over the past several years has had a multitude of consequences for the national economy, including labour markets, incomes, productivity, and international trade. The relative importance of manufacturing in Australia’s economy has been declining gradually since the 1960s. However, Australia’s industrial decline has been unique, not typical, reflecting the failure of political will, rather than natural economics. In fact, globally speaking, manufacturing is here for the long run. For Australia to have its fair share of the work and subsequent prosperity, a modern, active policy approach by Australian governments will be required to rebuild Australia as a global manufacturing power.

Australian manufacturing has endured hard times for several years. So long, in fact, that Australians could be forgiven for concluding that industrial decline is a ‘normal’ state of affairs. The manufacturing sector has been in broad decline since 2008, and real output has now contracted every single quarter since September 2011. Over 200,000 manufacturing jobs have disappeared since 2008, and the rate of job loss is accelerating: employment fell 6% in 2015 alone.

Perversely, some analysts and economists have tried to justify and even celebrate this industrial carnage. Manufacturing is portrayed as an old, dying industry. Something that Australia shouldn’t worry about. Free market forces will ensure we automatically specialise in other industries, in accordance with our ‘comparative advantage’.

Manufacturing is in decline everywhere, it is argued: the problem isn’t unique to Australia. And at any rate, government certainly shouldn’t interfere with this natural, inevitable, even beneficial process. It’s best to let markets do what they will.

This complacent view is wrong on several important grounds.

Manufacturing is Not ‘Old’
Manufacturing is not an ‘old’ industry. It is, in fact, the most innovation-intensive sector in the whole economy—and no country can be an innovation leader without the ability to apply innovation in manufacturing. In addition, advanced manufacturing continues to open new frontiers of technology and productivity.

Manufacturing is Not Declining Everywhere
Manufactured goods account for over two-thirds of world merchandise trade, making it the dominant component of all international trade. In fact, global manufacturing output is growing rather than shrinking, as is Australian use of manufactured products. A country that cannot successfully export manufactures will be shut out of most trade.

Australia is Not Too Expensive, Nor Too Remote to Compete
Production costs in Australia are not expensive relative to other industrial countries, so long as the exchange rate for the Australian dollar is maintained at a normal level (in the low US70 cents or lower). At that exchange rate, costs are fully comparable to other industrialised economies.

Many countries around the world (including high-wage industrial countries) are expanding manufacturing output, creating new manufacturing jobs, and boosting manufactured exports. Australia’s experience is not at all representative of the experience of other industrialised countries. Even small remote countries (like Korea, Ireland, New Zealand, and Israel) are growing manufacturing output, and preserving and creating manufacturing jobs—we can’t blame geographic isolation.

Free Trade Will Not Necessarily Replace Lost Jobs
The Australian Government (and general public) cannot simply assume that free trade will replace lost jobs. Unfortunately, free trade is not always balanced or two-way, and a trade deficit can further destroy employment opportunities. The result is idle labour: unemployment, underemployment, and low-wage jobs in non-tradeable sectors.

Government Can and Do Support Particular Sectors
There is no reason why the Australian Government cannot help maintain a robust manufacturing sector. After all, the Coalition clearly favours certain sectors, including
private health cover, self-managed super funds, property developers and mining infrastructure—just not manufacturing. With global experience confirming that government policy plays a key role in fostering innovation, nurturing clusters, and growing demand, Government needs to step up.

Instead of tolerating and ‘explaining away’ industrial decline, Australia needs to join the global manufacturing resurgence. If not, even more of this high-value work will move to other jurisdictions, and Australia’s status as an advanced industrial economy will be in jeopardy.

Australia’s manufacturing downturn is partly the result of major policy errors by government, which accepted too readily the idea that Australia doesn’t really need manufacturing.

The costs of these errors will be long-lasting and broad (felt not just by displaced manufacturing workers, but by the whole national economy). And in the near term, sadly, things will get worse, not better: with the coming closure of automobile assembly plants, and the continuing crisis in the steel industry. But it is never too late to learn from past mistakes.
At this particular moment in history, given the contraction in resource industries and the correction in exchange rates, Australia has a golden opportunity to revitalise its manufacturing capacities. And to prove that it can contribute more to world trade than just extracting unprocessed natural resources.

**Policy Options to Support Manufacturing**

There are a number of key policies that could be implemented by government to stabilise and rebuild Australian manufacturing. By invoking these tools in a comprehensive and consistent effort to enhance the economic and business case for Australian production, there is no doubt that Australia could rebuild and retain a fair share of manufacturing work, incomes, and exports. The successful manufacturing experience of so many other industrial countries proves it.

**Sector Strategies**

Government needs to actively identify manufacturing sectors and sub-sectors with the right criteria for modern success, and then organise multi-faceted strategies to facilitate investment and growth.

**Innovation**

International evidence shows that direct government participation in ‘mission-oriented’ research and innovation is far more effective than hands-off tax credits. Government needs to provide tangible, direct support to innovation in key manufacturing sub-sectors, including public participation in specific projects and product programs. And we need to better target research and development incentives toward sectors with maximum potential for industrial and export success.

**Networks, Eco-Systems and Clusters**

Successful modern industrial policy relies centrally on the connections and collaboration among players from different firms, agencies, and stakeholders. Government can facilitate the emergence of clusters: through initiatives like public-private networks and industrial institutes, support for sector-wide research and skills investments, and measures to better connect public research assets (like universities, CSIRO, and others) with industrial applications.

**Tax Incentives that Matter**

Government needs to focus on fiscal incentives for investment that are linked directly to incremental investment spending. Examples include accelerated depreciation provisions (allowing companies to write off the cost of new investments faster), investment tax credits, and public co-investments in specific strategic projects.

**New Investment Vehicles**

International experience highlights promising avenues for utilising public financial assets to leverage greater investment (including by private firms and investors) in targeted industries. Several countries have established public financing institutions to support start-up ventures in promising sectors, help Small to Medium Enterprises raise capital for growth, provide partial loan guarantees, and support a continued domestic presence by global companies. Australia could do the same.
Leveraging Procurement
Australian governments, public service providers, and infrastructure projects are themselves massive purchasers of manufactured goods. So an obvious way to support domestic manufacturing is to ensure that those taxpayer-financed expenditures generate the maximum possible boost to domestic industry.

Trade that Goes Both Ways
Trade agreements need to be mutual and consistent with broadly balanced trade. And Australian agencies (like Austrade) can be much more pro-active in promoting Australia’s exports, through initiatives like expanded credit financing, initiatives to leverage Australian participation in global supply chains, and government support for international marketing.

Be Realistic About Currency
Policy-makers (within government and the RBA) need to make an explicit commitment that maintaining the competitiveness of Australian industry is a key goal of monetary and financial policies in the future.

Industrial Infrastructure
Heavy government investments in public capital assets of all kinds will play a crucial role in fostering growth and job-creation in coming years. Investment should focus on transportation infrastructure (like rail links, ports, and roads to accelerate supply logistics and exports), utility connections (to ensure the supply of stably-priced, sustainable energy), and modern training facilities (to help better integrate TAFE and university training with industry).

Skills and Capacities
Consistent funding for skills training at all levels (including Science Technology, Engineering and Maths skills in schools, stable and accessible TAFE and VET programs, and support for lifelong learning by adult workers) is essential, as are efforts to more closely link training programs with future workforce needs in strategic sectors.

Source:
Stanford, J. Manufacturing (Still) Matters: Why the Decline of Australian Manufacturing is NOT Inevitable, and What Government Can Do About It, June 2016

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Australian Pressure Equipment Industry Developments

By Roger Griffiths, WTIA President and Chairman of AS/NZS 3788 Revision Committee.

The Australian oil refining industry is declining in the face of increased international competition from new Asian refineries, built to an unprecedented size. It comes as little surprise then that Australia's pressure vessel fabrication industry could also be on the decline. Some larger companies are already struggling or have closed, many smaller fabricators are having to diversify to survive. The situation is made worse by the frequent employment of overseas fabricators, who often deliver sub-standard products. This is all exacerbated by a lack of development in Australian Standards, partly because the Government, without fully understanding the place of Standards in industry and society, has withdrawn its support for Standards Australia.

Australian Oil Refining: An Industry in Decline

Prior to 2012 there were seven major Australian oil refineries, with a total capacity of approximately 760,000 barrels (bbl) per day (120 million litres). Three refineries closed between 2012 and 2015, with four now remaining: Mobil Altona, BP Kwinana, Shell Geelong (sold to Viva), and Caltex Lytton.

The long-term future of these remaining refineries must be in doubt. While it is understood that all four refineries are profitable at the moment, the industry is highly cyclical. An economical source of feedstock is regarded by some as key to the historic profitability of the Altona refinery, when others struggled to break even.

All seven refineries were built in a commercially ‘easy’ or protected environment (such as the Bass Straight crude allocation and Product Exchange). This protection was removed in the late 1980s. Globalisation then put increasing commercial pressure on the refineries. The major competition now comes not from within Australia, but from giant refineries such as the Reliance Refinery in India, which has a capacity of 1,200,000 bbl per day, some 60% greater than the total peak Australian production. The advantages of economies of scale in refining cannot be overstated.

Just before the BP Brisbane refinery ceased production, the Federal Treasurer announced that Australia was not complying with international obligations in regard to oil stockpiles. To address this, a levy on fuel was proposed, possibly 2c per litre. Where this fuel was to be stored was not discussed, and, with the closure of the Brisbane refinery, tankage capacity of approximately two million barrels (320 million litres) was marked for demolition - half of that in just two tanks alone. The irony is that, had the refinery been able to squeeze an additional 1cent per litre in margin, it would almost certainly have stayed in operation.

This is a simple description of a complex situation. Half the refineries in the United States (US) have a capacity of less than 100,000 bbl per day, and not many are much over 200,000 bbl per day. It may be that the extensive US pipeline network allows them to obtain feed at a cost that keeps them profitable.

However, the crude capacity of a refinery is only an approximation to the ‘size’ of the operation—the number and complexity of processes is of at least equal importance. Government policy also plays a part, with refineries in South Africa and other parts of the world acknowledging that they remain in business largely due to a protected environment.

While ‘Free Trade’ is undoubtedly essential for the prosperity of the human race, it does seem that there must be a path—a middle road—that permits governments to provide the infrastructure, including a financial environment, in which their citizens can prosper.

Australian Fabrication

The fact that major fabricators have closed recently is not in itself highly unusual: this has been the case for the whole of my career. However, many of the major Australian fabricators view overseas
competition as a considerable factor in their decline. Some have remained viable despite being close to the brink of closure, with the repair of sub-standard vessels brought in from overseas becoming a staple. The irony is not lost when the fabricator performing the repair was an unsuccessful bidder for the project in the first place.

**Overseas Fabrication**

Many overseas fabricators are much bigger than any in Australia, but the size of the fabricator does not necessarily equate to success. Time and again, overseas fabrication projects fail to live up to Australian Standards, such as those in the following examples.

**Bulwer Island Refinery**

Nearly two decades ago, the Bulwer Island refinery underwent a major expansion, effectively doubling the size of the refinery. The project manager placed the fabrication order with overseas suppliers because he was not confident that the local industry would ‘deliver the scope’ of the project. There is, of course, a great difference between delivering a single vessel ‘many times’ and delivering vessels for a large-scale project on time and to specification. The vast majority of the pressure vessels were therefore built offshore.

Many smaller Australian manufacturers appear to be thriving, and have highly diversified markets. Diversity of market seems to be a critical consideration. It is becoming essential for fabricators not to be seen as specialists in a particular field, which may erroneously cut them out of other markets.

**High Pressure Alloy Reactors, Italy**

The high pressure vessels for this project were built by an Italian fabricator. This was by far the largest fabricator I have ever come across. This company was engaged at some risk: they had been saved from closure by a buy-out from a major international company.

The project included two alloy reactors (2¼Cr 1Mo ¼V) designed for operation at 18 MPa and 450°C, with shells 170mm thick. The nozzles were made from single forgings, so that hub, nozzle neck and flange were all one piece.

During fabrication, a crack occurred which went right through the forged hub (approximately 250mm thick at this point) and extended in a Y shape into the shell, with a total length of approximately 2.5m.

The technical reason for the failure was clear: the fabricator, attempting to save time and cost, had used local pre-heat and a de-hydrogenation post-weld treatment at 350°C, instead of a full intermediate stress relief. The impact far exceeded the potential advantage. For the fabricator I assume this was devastating, and they did indeed go out of business soon after. The real cause of the failure was that in the push for time and cost saving, the basic elements of workshop practice were overlooked or brushed aside. This is implicated in many such failures.
Pressure Swing Absorbers, Korea
There were nine vessels made in Korea, comprised of carbon steel with a 65mm wall thickness, approximately 2m diameter. These vessels were to be in fatigue service, cycling from close to zero to full operating pressure (8MPa) every 17 minutes. The girth welds were radiographed using Cobalt 60 in a single panoramic shot, which is not a sensitive technique.

It was clear that, while some defects had been found and repaired, repair only covered the length of weld stated in the report. Large defects must have been clearly visible beyond the excavated sections. So these vessels were subject to many costly inspections over their lives.

Heat Exchanger, China
An Alkylation Reactor (or Cooler) with a very long U-tube bundle and some 700 tubes was fabricated in China. With anhydrous hydrofluoric acid and hydrocarbon on the process (shell) side, and cooling water on the tube side, leakage was not an option. The tube-tubesheet connections had been specified, noting that the method negated any need to tack the tubes to the (front face) tubesheet before seal welding. On delivery, it was discovered that the fabricator had tack welded every tube to the back face of the tubesheet—1,400 tack welds, none inspected, most inaccessible, and on a critical bundle. The bundle was to be installed vertically in the shell, and turned horizontally for maintenance, during which process very high stresses are placed on the tube-tubesheet junction.

Breechlock Exchanger, Japan
Fabricated in Japan, in the breechlock exchanger in question, the channel was a one-piece forging, 5Cr ½Mo and 1,500mm diameter. The tubesheet was integral to the channel, and was some 300mm thick. This high-pressure / low pressure feed / product exchanger was leaking. The tube-tubesheet seal welds were extensively cracked, and hard, at approximately 350 HV.

Manufacturer’s records showed, in attempting to stress relieve the seal welds, thermocouples were installed directly on the welds, an electric heating pad was placed over the tubes, the temperature held for 30 minutes. The thermocouple itself would have been at a far higher temperature than the weld, and in 30 minutes that enormous mass of metal would hardly raise above room temperature.

Are Australian Fabricators Immune to These Issues?
Issues with the quality of fabrication and workmanship are fairly evenly spread throughout the world, although there are additional cultural issues in some instances. Australian manufacturers are not immune to error; however the general culture of Australian manufacture means that most such errors are relatively insignificant.

The requirement to compete with overseas suppliers can unquestionably lead to compromise. An example was a local manufacturer who fabricated a zirconium heat exchanger. In order to be competitive they sourced low cost Zirconium tubes from a new supplier, but the tubes proved not to be suitable. This cost the fabricator dearly.

There are, however, other examples where the fabricator paid insufficient attention despite there being no commercial pressure. An example is a very small heat exchanger bundle that, over many years, had an average life of a few months to failure. I was convinced, despite the fabricator’s protests, that it was just too small to be taken seriously. When, finally, a bundle was built with ‘normal’ attention to detail it lasted for 16 years until the refinery closed.

This highlights the issue of customer expectations, which play into all this. Much equipment is specified and accepted by project teams focused on immediate costs, who have little or nothing riding on long-term component life. As such, immediate or short-term cost considerations often drive the decision making process, rather than realistic whole-of-life costs. Project teams also have little interest in the future capacity of local industry to supply welders and workers to maintain constructed plant, and the skilled tradesmen lost when work is contracted overseas are not easily replaced.
Australian Standards

The following is the best understanding I have been able to glean from conversations with people who are more closely involved with Standards than I. Approximately 15 years ago, following Government policy, Standards Australia was ‘released’ to the ‘free market’. In 2003, to raise some much needed cash, they sold (or leased) publishing rights to SAI Global, a private listed company (an agreement which ends in 2017 but is subject to renewal). My understanding is that Standards Australia invested the proceeds of the sale just before the global financial crisis, and lost the funds.

This has had a severe effect on industry. Experts are reluctant to provide free input to development of Australian Standards as the writers then have to purchase the standards from SAI Global for the financial benefit of their shareholders. It is understood that SAI Global does not allow libraries to hold Standards. State and federal regulators are therefore not mandating standards as they are no longer freely available.

However, this is not the fault of SAI Global. They paid for the publishing rights and are entitled to a return on their investment. The fault lies in the failure of the Federal Government to understand the role of standards in the community; the way industry supports their development; and the nature of the businesses that support and use standards. State governments have also expressed concern about this situation.

Standards Australia was not the only body let go by the State and Federal Governments. The privatisation of power companies has severely impacted on support for activities such as writing standards. Worse still, Governments did not just let Standards go: an agreement is still in place that Standards Australia will not specify anything that can be construed as a restriction on trade. Hence, for example, competencies cannot be specified.

Strategy for Development of Pressure Vessel Standards

I acknowledge the input of Rob West, Chairman of Committee ME01, in this section.

Despite the current situation, development of Standards still continues, slowly.

AS1210 Pressure Vessels

Amendments will continue to be made to this Standard, but these will not be serious changes—error fixes, clarifications that arise, and incorporating published rulings.

AS1548 Steel Plates for Pressure Equipment

ME-001 (Standards Australia Pressure Equipment Committee) has been endorsed to undertake work on AS1548 but there’s no movement at present. There is still a need to address the issue of Boron content in steel, and casting methods. Revisions are likely once the review of AS/NZS 3788 is underway.

AS-NZS 3788 Pressure Equipment In-service Inspection

This was last revised 2006. Recently, several submissions for revision have been rejected. This year, a new proposal was submitted, which would see the Standard reviewed, with an unrestricted document produced and published by the WTIA. The WTIA will also create a separate pressure vessel repair code. Standards Australia have provisionally agreed to this approach, with the project yet to commence.

In addition, there are a number of Standards that ME-001 recognises need revision (although there are currently no plans in place), including: AS2593 Boilers Safety Management and Supervision Systems; AS4041 Pressure Piping; and AS4458 Pressure Equipment Manufacture.

Conclusion

The situation faced by Australian industry may seem parlous, but many companies are surviving and thriving by innovative response to the changing environment. Poor quality fabrication may have dire consequences, not just for public safety, but for industry as a whole. The bi-partisan attitude of government has not helped. The WTIA, through the good work of its CEO, Geoff Crittenden, is working to promote the advantages of a strong local industry and strong Standards, and the need for enlightened government policy in this regard.

This article is an extract from a presentation to HERA (New Zealand). In many ways it seems the New Zealand Government has a good understanding of these matters.

Roger Griffiths, President of the WTIA and Chairman of the AS/NZS 3788 Revision Committee

Roger managed the Refinery Inspection department for 28 years at BP Refinery, initiating and leading the development of a number of world-class innovations, including systems for digital recording and download of thickness data, and the development of a 3D plant design model into an inspection tool operated by the plant inspectors. Roger has been associated with the WTIA for over 30 years, including as a member of the Pressure Vessel Panel (as Chairman since 1992), and the Pressure Equipment SMART Group. Roger joined the WTIA Council in 2008.
In April, the Government announced the build locations of the Offshore Patrol Vessels, Future Frigates and Pacific Patrol Boats, all of which form an important part of Australia’s continuous naval shipbuilding program. The program also includes the $50 billion Future Submarine program. The commitment to an Australian build will create a sustainable Australian naval shipbuilding industry and provide the certainty that industry requires to invest in innovation and technology and grow its workforce.

Designed to ensure a sustainable long-term Australian naval shipbuilding industry, the plan includes 12 Offshore Patrol Vessels up to 21 Pacific Patrol Boats, and nine Future Frigates, in addition to the 12 Future Submarines.

These announcements provide for two shipyards to implement the Government’s commitment to a continuous build of naval surface ships in Australia. Major warships will be built in Adelaide, at Techport Australia’s state-of-the-art facilities, while minor vessels will be built in Henderson, Western Australia.

Combined, these shipbuilding projects will directly secure more than 2,500 jobs for decades to come. They will also generate thousands of additional jobs with suppliers throughout Defence industry supply chains.

While state governments have advocated for maximum Australian industry content in Defence programs over a number of years (particularly the South Australian Government, as many of the programs will be undertaken in the state), local suppliers are being urged to be proactive in securing Defence contract work, or risk missing out.

According to the South Australian Defence Industries Minister Martin Hamilton-Smith supply chain work is not gifted, it has to be won. “Now is not the time to rest on our laurels. There is a significant body of work on the near, medium and far horizons for our state’s industries,” said Hamilton-Smith.

“The Government is doing everything possible to maximise South Australian industry involvement in the programs. Our role is to support companies who are already in South Australia and encourage others to invest here. There’s every reason to be excited about these projects and plenty of opportunity to get involved in the supply chain. But the opportunities won’t just fall into the laps of firms; they’re going to have to compete for it. If we sit back and wait, we’ll miss out,” said Hamilton-Smith.

Offshore Patrol Vessels
The competitive evaluation process for Australia’s Offshore Patrol Vessels (OPVs) commenced in December 2015. In April 2016, the Commonwealth Government confirmed construction of the OPVs would commence in Adelaide in 2018 and transfer to Western Australia when Future Frigate construction begins in 2020.

Three designers have been shortlisted to refine their designs, Damen of the Netherlands, and Fassmer and Lurssen, both from Germany. The $3 billion program is expected to create more than 400 jobs, plus supply chain opportunities.

Twelve vessels will be built in total to replace the 13 existing Armidale Class patrol boats. The OPVs will enhance the Australian Defence Forces’ capacity to support border security, maritime resource protection and military patrol and response operations.

Future Frigates
The Future Frigates program includes a fleet of nine vessels to replace the in-service ANZAC class frigates. Three companies have been
shortlisted to refine their designs for the program through a competitive evaluation process, including BAE Systems with the Type 26 frigate, Fincantieri with the FREMM frigate and Navantia with a redesigned F100.

The new frigates will be larger and more capable than the ANZACs, with a heavy emphasis on anti-submarine warfare. They will be installed with the Australian-developed CEA Phased-Array Radar and will be built in Adelaide. Subject to second pass approval in 2018, the construction of Future Frigates is expected to commence in 2020. Valued at more than $35 billion, the program is expected to create 2,000 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.

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**About Techport Australia**

Techport Australia is the centre of naval shipbuilding in Australia, home to two major, long-term defence projects and the confirmed build location for Australia’s next generation Future Submarines and Future Frigates. Current projects include sustainment of the Collins class submarine fleet and construction of the Air Warfare Destroyers.

Techport Australia’s fully serviced wharf is 213m long and 25m wide. It can support heavy load equipment and is capable of servicing an Air Warfare Destroyer through: final outfitting, test and activation, harbour trials, sea trials, and maintenance and repair activities.

The world-class Syncrolift® shiplift raises and lowers large naval and commercial vessels out of and into the water for dry-docking ashore. The shiplift is the largest in the southern hemisphere, at 156m long and 34m wide, and with a maximum net lifting capacity of 13,500 tonnes.

The runway connects the shiplift with the 250m dry berth, which can support multiple vessels and projects concurrently. The runway and dry berth are supported by a rail-based transfer system that moves vessels around the site, including to and from the shiplift.
SEA1000: The Future Submarine Program

The Future Submarine Program will be the largest Defence procurement program in Australia’s history, representing a $50 billion investment in Australia’s security. The program will deliver an affordable, regionally dominant, conventional submarine capability, sustainable into the foreseeable future.

Submarines are the most complex, sensitive and expensive Defence capability acquisition Government can make. They are of strategic importance to Australia and a critical element in the nation’s maritime security planning, with Australia’s national security and $1.6 trillion economy depending on secure sea lanes. As such, Australia needs the best possible submarine to protect trade and support maritime security.

At its conclusion, the Future Submarine Program will provide Australia with similar range and superior sensor performance, stealth and endurance to the Collins class submarines. There are, however, no off-the-shelf submarine options that meet Australia’s unique submarine capability requirements. As a consequence, the Australian Government undertook a competitive evaluation process to select an international partner to design and build the next generation of submarines. DCNS of France, TKMS of Germany and the Government of Japan were all involved in the evaluation process.

DCNS

In April, the Turnbull Government announced that DCNS had been selected as the preferred international partner for the design of the 12 Future Submarines.

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.”

“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,” said DCNS Chairman and CEO, Mr Herve Guillou.

Australia’s next generation of submarines will be constructed at the Adelaide shipyard, directly sustaining around 1,100 Australian jobs and creating a further 1,700 jobs throughout the supply chain.

In preparation for the Future Submarines Program, DCNS has signed a Memorandum of Understanding (MoU) with Quickstep (an Australian listed company at the forefront of advanced composites manufacturing and technology development) for cooperation in the field of components and assemblies. Through the MoU, Quickstep will produce representative demonstrator components to validate their technology for naval applications with DCNS.

“DCNS has commenced building a supply chain in Australia that will support the submarine capability on a sustainable basis,” said Sean Costello, CEO DCNS Australia. “Ultimately, this supply chain will comprise several hundred companies across Australia and form the Future Submarine Enterprise.”
In addition, DCNS and the University of New South Wales (UNSW) have signed an MoU that will see the two organisations collaborate more closely on engineering and marine technologies.

“The signing of this MoU maps to our Australian Industry Capability Plan which aims to cultivate an innovation environment around our scientific, education and industrial community,” said Costello.

ASC
Australian submarine builder and maintainer ASC, congratulated DCNS on being selected as the Government’s design partner for Australia’s Future Submarine project.

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,” said Whiley.

“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.

“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.”

What’s Needed in an Australian Submarine?
Australia’s geography is the key to defining submarine operational capability. Our comparatively remote location requires naval operations at great distances from Australian bases and support facilities. Australia’s submarines have to travel long distances to carry out their missions and must be able to stay for weeks on end to attack the enemy in times of war, to inform on developments in times of tension, and to provide intelligence in times of peace.

Existing off-the-shelf submarine designs cannot perform effective operations that comply with these requirements. Even at very slow speed for best fuel consumption, they can barely reach pivotal operational areas in the South China Sea and the areas between the Pacific and Indian Oceans. Even then, they can stay for only a day or two. These existing submarine designs can travel to distant bases only with extensive pre-planned logistics support. For example, the recent deployment of a German submarine over the 8,500km from its home base to the east coast of the US could only be undertaken with an accompanying logistic ship in support.

In contrast, the larger Australian Collins class submarines regularly deploy the 12,000km from Fremantle to Hawaii as a routine training operation. Last year, HMAS Sheean completed a 37,000km deployment that included high tempo multi-national exercises off Hawaii.

Optimum operational performance under these conditions can be provided only by a submarine design considerably larger than the off-the-shelf designs. Crew must be large to ensure performance over long, intensive missions. As a rule of thumb, each crew member represents one day of mission endurance – the Collins crew is around 60.

Unsurprisingly, the off-the-shelf designs, with crews of around 30, are usually sent by their operating navies on deployments of less than 30 days. To sustain larger crews, Australian submarines need the ability to provide, without replenishment, larger outputs of power, food, water and fresh air over long periods. Performing roles such as intelligence, surveillance and reconnaissance requires equipment, for which there is not enough space in the off-the-shelf designs. For all these reasons, Australia’s new submarines must rely on a design that is larger and operationally more capable and versatile than any of existing off-the-shelf designs.
LAND 400: Armoured Fighting Vehicles Program

LAND 400 will involve the acquisition and support of the next generation of Armoured Fighting Vehicles (AFV). These vehicles will have the firepower, protection and mobility to defeat increasingly lethal and adaptive adversaries well into the future.

The program will deliver enhanced levels of survivability to the Joint Land Force including sensors, weapons and information systems, which will be networked to strategic intelligence platforms.

The project will deliver replacements for the Australian Light Armoured Vehicle (ASLAV) and M113 Armoured Personnel Carrier (APC) fleets. The project will also provide specialist Manoeuvre Support Vehicles (MSV) to properly enable Army’s combat brigades to undertake joint land combat.

LAND 400 has four distinct phases:

- **Phase 1**: Project Definition Study (now complete)
- **Phase 2**: Mounted Combat Reconnaissance Capability, primarily enabled by the Combat Reconnaissance Vehicle (CRV) mission system (the ASLAV replacement)
- **Phase 3**: Mounted Close Combat Capability, primarily enabled by the Infantry Fighting Vehicle (the M113 APC replacement) and MSV mission systems
- **Phase 4**: Integrated Training System

In August, the Minister for Defence Industry, the Hon Christopher Pyne MP, announced that the Defence Department had signed contracts with BAE Systems Australia and Rheinmetall for LAND 400 Phase 2.

Minister Pyne said the Defence Department had signed contracts with both companies ensuring Australian industry involvement, which will create jobs and drive economic growth.

“These are exciting times for Australian Defence industry. Both vehicle options are world class and offer a quantum leap in protection for our soldiers and our military’s operational capability,” Payne said.

“The contract signings formally start the next stage of the evaluation process, known as the Risk Mitigation Activity.”

“The Risk Mitigation Activity involves a one year test and evaluation program of the vehicles, including against improvised explosive devices. The tests will be done at a range of sites within Australia including Defence’s world class facility at Monegeetta, Victoria.”

“I am pleased to announce that following the recently completed review of the Australian industry involvement in this project, a significant focus of the Risk Mitigation Activity will be to improve opportunities for Australian industry participation.”

“This will include showcasing Australian industry capabilities to BAE Systems Australia and Rheinmetall to ensure they have every opportunity to get involved in the project,” Mr Pyne said.

Rheinmetall Defence

Rheinmetall Defence has offered the Commonwealth the latest version of the BOXER 8X8 vehicle that is fitted with the in-service LANCE turret and a growth path that includes a 35 mm main gun and the Northrop Grumman command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) architecture.

Ben Hudson, Head of Rheinmetall’s Vehicle Systems Division, said: “We are delighted to have been selected in Australia for the next phase of this important program. BOXER is combat proven and offers the highest levels of survivability and..."
INSIDE THE INDUSTRY: DEFENCE INDUSTRY PROJECTS

LAND 400 aims to enhance the mounted close combat capability of the Land Force by providing armoured fighting vehicles with improved firepower, protection, mobility and communication characteristics to enable tactical success in the future operational environment. LAND 400 will deliver a Combat Reconnaissance Vehicle, an Infantry Fighting Vehicle, a Manoeuvre Support Vehicle and an Integrated Training System. LAND 400 will allow a staged retirement of the in-service Australian Light Armoured Vehicle and the M113AS4 Armoured Personnel Carrier fleets.

mobilisation, that when combined with the in-service Lance turret, will deliver the capabilities that allow Army to fight, survive and win on the battlefields of today and tomorrow.”

Rheinmetall Defence will establish an Australian Industry Capability program for Land 400 that strengthens existing industrial capability in Australia and creates high technology enduring jobs for hundreds of Australians by localising design and manufacturing expertise in electro-optics, weapon systems, fire control and sensor systems, turret manufacturing, variant design and manufacture, integration, armour systems, simulation, training and fleet sustainment.

BAE Systems Australia

BAE Systems Australia, along with their bid partner Patria, has offered the AMV35 – Patria’s modern, agile, highly protected military-off-the-shelf Armoured Modular Vehicle integrated with the combat-proven E35 turret from BAE Systems Hägglunds.

BAE Systems Australia Chief Executive Glynn Phillips said, “BAE Systems will produce the AMV35 in Australia if we are selected as the successful tender. This will secure and retain in-country capability and contribute significantly to the Australian economy throughout the expected 30-plus year life and sustainment of the vehicles.”

“Our three test vehicles are built and ready for the Australian Defence Force’s test and evaluation program. Our team is now focused on maturing our in-country manufacturing plans to ensure we provide the Australian Army with the best capability while also delivering the maximum economic benefit across our Australian supply chains.”

Mika Kari, President of Patria’s Land business said: “BAE Systems and Patria have together developed a great solution for Australian soldiers and the Australian economy. We are now in a position for the AMV35 to be evaluated, continue our partnership with BAE Systems and forge stronger links with Australian industry.”

BAE Systems is committed to embedding as much Australian industry content in this vehicle as possible and to helping grow local industrial capability, with the manufacturing, technology and intellectual capability transitioning to an Australian production line. Both Patria and BAE Systems Hägglunds have transferred technology involved in the production of the AMV and the E35 turret to several other countries, successfully demonstrating capability transfer and the in-country economic advantages this brings, including long term sustainment, upgrade and maintenance activities.

SAAB defence products feature as sub-systems in the AMV35 vehicle and weapon system. In July 2015, SAAB Australia and BAE Systems Australia signed a Memorandum of Understanding committing both organisations to collaborate to maximise Australian industry involvement and further develop Australian capability through the Land 400 project.

Patria’s modern, agile, highly protected military-off-the-shelf AMV35 will be integrated with the combat-proven E35 turret from BAE Systems Hägglunds.
State Focus: Queensland’s Major Projects Challenge

With falling commodity prices continuing to put new resources projects on hold and government funding for public infrastructure projects constrained, the outlook for major project work in Queensland remains uncertain and volatile. From a peak of over 240,000 persons employed in the Queensland construction industry in early 2013, employment slumped to approximately 204,000 persons (as at the end of 2015). On major projects, the decline has been even more severe, with employment already down around 50% from the 2012-2013 peak. Further declines in construction employment are expected over the next few years, presenting challenges for the sustainability of industry in Queensland.

An upswing in major project work is expected from 2017-2018. However, even this recovery is predicated on currently unfunded projects proceeding, including large public sector road and rail projects, as well as another (much smaller) round of resources investment.

There will be significant shifts in the regional location of major projects and labour demand over the next five years. This reflects not just investment in different types of infrastructure compared to the recent past (such as regional airports and ports, water storage and public transport) but also very different regional investment profiles where the investment will occur (focused on tourism regions, urban centres, agricultural areas and transport hubs).

In particular, major project work is expected to pick up strongly (and be more targeted) in south east and northern Queensland.

Challenges

According to Doug Hawkes, Managing Director of Structural Integrity Engineering, while the major challenge in Queensland is the obvious lack of major projects, there are other issues at play.

“From an engineering sense, achieving the necessary quality that is expected is one of the greatest challenges for industry that has arisen over last decade. This is characterised by poor quality engineering and imports that have fundamentally lowered the expectations of both the industry, and of purchasers,” said Hawkes.

“To provide a simple example, we’re involved in a project that requires repairs and remedial strengthening, including on weldments where a new weld needs to join with an existing weld. The contractor is validly concerned with the quality of the existing weld—not only will he be judged on his repair work, but on the existing weld, which is of poor quality. It is these small issues that create both technical and commercial issues.”

“The owners will need to make a decision as to where liability lies. What are the technical issues of leaving the existing weldment there, or take it out and start again? The legacy of poor quality fabrication...
is now having to be addressed, with more and more remedial work being undertaken. This is particularly prevalent in the mining sector because of the relatively large amount of imported structural steel work over the last decade.”

“With the significant amount of offshore fabrication that has occurred in recent times, it has reduced both capability and, in some circumstances, the underlying quality in the Australian market; because the demand hasn’t been there, it hasn’t been satisfied by quality operators, particularly when the primary purchasing driver has been price. This situation has been made worse when a low commodity, low price environment exists,” said Hawkes.

“There is also a distinct lack of basic knowledge, appreciation, and exposure to welding of structural steel by younger engineers. The engineering industry now has people sitting in front of computers who never see what they design being built. This is a major concern in terms of the ability of engineers to efficiently design and fabricate infrastructure in a high cost country. Just in my own experience, there are hundreds of examples of structural engineers who are unable to place the correct weld symbol on a drawing.”

Opportunities

Despite these challenges, there is a way forward: quality engineering and fabrication services. “The primary opportunity, in a high cost country, is doing things properly that add value, both in the short and the longer term. There is no point in doing things poorly at a high price. Poor quality at a high price is a simple driver for purchasers to get poor quality at a low price. If poor quality is the outcome, it has associated whole of life legacy issues,” said Hawkes.

“Delivering quality engineering and products will provide impetus to the industry and avoid longer term legacy issues. Our company believes that owners, suppliers, engineers and fabricators will benefit from the right people making the right technical and purchasing decisions.”

Building Queensland’s Infrastructure Pipeline

With the Queensland Government’s expert infrastructure panel recommending it move ahead with $6.5 billion in projects, the importance of high-quality welded structural steel and other products is paramount. Building Queensland Board Chair Alan Millhouse said the Building Queensland’s Infrastructure Pipeline Report identified 16 priority infrastructure proposals—four of which are ready for government investment consideration. The four proposals which Building Queensland has assessed as being ready for a government investment decision include: Cross River Rail; European Train Control System (ETCS–Inner City); Cunningham Highway (Yamanto Interchange to Ebenezer Creek); and Pacific Motorway (Mudgeeraba to Varsity Lakes).

A proposal’s inclusion in the Infrastructure Pipeline is a clear recommendation to government to progress the proposal. “We are pleased to see the government has committed to progress the ETCS–Inner City project having received the business case from Building Queensland last month,” said Millhouse. “We have also submitted the Cross River Rail Business Case to the Queensland Government this month and this reflects its readiness for a funding decision in our report.”

Reinforcing Steel Coordinator Course

Reinforcing steel provides strength and stability in concrete infrastructure, including buildings, tunnels and bridges. The failure of reinforcing steel due to poor weld quality can pose serious problems for industry and safety, necessitating major repairs, or significantly reducing the usable ‘life’ of a structure. With a spike in major infrastructure projects around the country, industry requires properly trained and skilled personnel to supervise and inspect the welding of all reinforcing steel structures, in the interests of both public safety and structural integrity.

In response to industry concerns, the WTIA has developed a brand new course: the Reinforcing Steel Welding Coordinator Course.

The course includes training with practical application and case studies to provide attendees with the skills and knowledge required to undertake the supervision and coordination of welding of reinforcing steel to the requirements of AS/NZS 1554.3 — Welding of Reinforcing Steel.

Specifically designed following consultation with industry, the course is just a week long (including the exam), and certification is awarded immediately upon (successful) completion—it really is a fast-tracked certification process.

Who Should Attend the Course?
This course will be of enormous benefit for welders and supervisors in companies fabricating reinforcing steel cages and components for reinforced concrete structures (such as bridges, tunnels and buildings), both within workshops and on-site.

Why Complete the Course?
The Reinforcing Steel Welding Coordinator course offers a range of benefits for welders:
• Higher salary potential
• Stronger employment demand
• Better job stability
• Demonstrate capability
• Win more work
• Meet client specifications

The course also offers benefits for employers:
• The ability to work with various state-based roads authorities, all of which support and recognise this new course
• A building block towards certification to ISO3834 in line with road authority specifications
• Peace of mind that projects are being delivered in accordance with welding specifications, ensuring client satisfaction
• End user comfort for state road authorities, government bodies and the general public, particularly in relation to safety

About the Course
The course covers a wide range of topics:
• Duties of a welding supervisor or coordinator
• Metallurgy, weldability and manufacture of reinforcing steel
• Function, safety and maintenance of welding equipment, technology and power sources
• Interpretation of fabrication requirements, drawings and symbols
• Procedure, specification and welder qualification
• Quality assurance and reporting, including templates and examples of quality documentation

Further Information
For further information, or to enrol:
• Visit: www.wtia.com.au
• Email: training@wtia.com.au
Under the Australian Welder Certification Register (AWCR) system, welders are invited to complete a test that qualifies them to a welding procedure as set out in ISO 9606-1 (AS/NZS 2980). Once qualified, the welder is certified to that procedure, becoming a Registered Welder, and the information recorded in the AWCR.

**BENEFITS TO EMPLOYERS**

1. **Reduced Costs:** Check the competence level of any Registered Welder against an internationally recognised standard, minimising welder testing.
2. **Minimised Risk:** By having a recognised and certified competency level, the risk of a welder failing a weld procedure is significantly reduced.
3. **Currency of Certification:** Assess welders against current, rather than past, performance.
4. **Improved Record Keeping:** Independent records of welder qualification simplify record keeping for quality management.
5. **Unparalleled Access to Skills Base:** Quickly and easily identify and contact Registered Welders for employment.

**BENEFITS TO WELDERS**

1. **Improved Employability:** Welders will be able to present third-party verified qualifications to prospective employers.
2. **International Qualification Recognition:** Work overseas, with ISO 9606-1 certification recognised in Australia, Europe and North America.
3. **Continuous Upskilling:** In line with the AWCR’s testing framework, short training courses will be offered to upskill Registered Welders.
4. **Recognised Career Path:** Test yourself on more complex weld procedures for more satisfying and rewarding career opportunities.

Q&A With a WTIA Member: Jack Donaldson

Impressive young pipe and hull welder, Jack Donaldson works at ASC (formerly the Australian Submarine Corporation), the company responsible for building and maintaining Australia’s Collins Class Submarines, which are a vital part of our navy’s defence.

ASC is Australia’s largest specialised defence shipbuilding organisation, with naval design and engineering resources unparalleled within Australia’s defence industry.

Employing over 2,600 permanent personnel across three facilities in South Australia and Western Australia, ASC is one of the largest employers of apprentices in South Australia.

On the back of his great work at ASC, Jack won the 2015 Allan Saunders Apprentice of the Year award, which ASC awards annually to their most outstanding apprentice.

Edging out a number of fellow graduates, Jack was found to be the apprentice who had consistently demonstrated an outstanding level of initiative, while applying a high level of safety awareness and a commitment to ASC’s values.

“I was honoured to be chosen as the 2015 Alan Saunders Apprentice of the Year and look forward to contributing to the ongoing maintenance of the Collins Class Submarines as a qualified tradesperson,” Jack said.

Jack was also awarded the South Australian Apprentice of the Year Award and will be representing both ASC and South Australia at the national training awards, which will be held in Darwin.

Describe your job.
I’m a pipe welder at ASC, working on Collins Class submarines. This job requires me to weld a number of different materials such as carbon steel, SMO and copper-nickels, just to name a few. The metals are all different sizes and I have to weld both on and off the submarines. I also work on CNC plasma cutting machines, and boiler make and pipe fit when required.

What inspired you to choose a career in the welding industry?
As a child, I can recall spending many hours in the shed, asking my grandfather a never ending array of questions. This was definitely what sparked my interest in the heavy engineering industry.

What are the biggest challenge and opportunity for the industry at the moment?
I believe the biggest challenge for our industry at this moment is a constant flow of challenging work. We need to continually invest back into the Australian economy. By doing this, it will allow us not only to build more projects but also allow the people working within industry to grow the industry. This will bring with it innovation and sustainment.

I believe the biggest opportunity for the industry at the moment is
in technology development. We need to continue to strive for new, innovative methods and processes. With Australia’s diverse culture and commitment to apprentices the ideas for technology development shall be there. This will allow us to continue to be industry leaders and stay ahead in an ever globalising market.

What is the most interesting project you’ve worked on? Why?
The most interesting project I have worked on so far would have to be the Collins Class submarine hull cuts. The hull cut is a significant step to reduce the amount of time the submarines are in planned long term maintenance. It enables equipment to be removed from within the submarine so that maintenance can be performed more efficiently.

Who or what has inspired you the most professionally?
I feel very privileged that I have had the opportunities I have, to be able to work on the most complex naval maintenance project in Australia. I am surrounded by people that all excel in their chosen fields, from the engineers to the senior trades people. I am inspired by our collective endeavors to continuously innovate and succeed as a team.

What gives you the most satisfaction at work?
Satisfaction at work for me comes in a couple of forms. Seeing a submarine glide down the Port River under its own propulsion, and knowing I was a part of the team that made this happen is very satisfying.

I also perform a lot of work in confined spaces, restricted welding and mirror welding. This level of work requires a high level of sustained concentration. There is also no better satisfaction than passing the X-rays after you have put all that hard work and effort into a weld.
Can you provide some details on the need for delay in Non-Destructive Testing (NDT) after the completion of welds in a bridge girder?

The reason for the delay in NDT is to ensure the weldments are free from Hydrogen Assisted Cold Cracking (HACC).

HACC in carbon steel becomes an issue with:

- Atomic hydrogen entering the weld during arc welding
- High residual stresses in the weld particularly when welding thick sections
- Development of a susceptible microstructure in the HAZ due to inadequate preheat

In many cases, HACC has occurred by the time the weld has cooled to atmospheric temperature. But in thick sections or with high strength steels, HACC has been known to occur up to 48 hours after welding. Fortunately, HACC is rare in Australian steels due to our good steel making practices and use of high quality coal and iron ore in the steel making process.

Bridge girders are safety critical structures, so their structural integrity must be assured by carrying out NDT on the welds (particularly butt welds), generally 24 hours after welding. This delay must be incorporated into the Fabricator’s manufacturing plan when required by the purchaser.

Delivering NDT by 48 hours will provide confidence of the desired weld quality.
Can you provide some detail on the requirements for ‘smoothing’ of weld bead during Submerged Arc Welding (SAW) and its effect on the mechanical properties?

Smoothing in this context refers to how well the weld bead blends into the parent metal. It is a function of weld reinforcement height and the angle between the weld bead and parent metal measured at the weld toe. This parameter is important for structures subject to fatigue loading and also for painting, epoxy coating or galvanising in some instances.

The Submerged Arc Welding (SAW) process is capable of giving a ‘smooth’ finish in the as-welded condition if correct welding parameters are adhered to, particularly the optimising of welding current, voltage and travel speed during the capping runs.

Purchasers that need specific performance requirements may specify a maximum weld reinforcement as well as the angle between the weld reinforcement and parent metal. Where a suitably smooth finish cannot be achieved in the as-welded condition, post weld grinding or milling will need to be carried out. These operations will not affect the mechanical properties of the joint as measured by tensile, bend or fracture toughness tests but they will improve fatigue performance.

References
- AS/NZS 1554.5:2014 - Welding of steel structures subject to high levels of fatigue loading
- AWS D1.1:2015 – Structural Welding Code - Steel

About the WTIA Hotline

Corporate Members have access to the WTIA Hotline, which is manned by WTIA 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.
An Update from: SMART Industry Groups

About SMART Industry Groups

WTIA’s SMART (Save Money and Re-engineer with Technology) Industry Groups provide a facilitated private forum where industry-specific members can discuss welding-related challenges and issues, and source solutions. For further information, please contact info@wtia.com.au.

SMART Defence Group

Hosted by TAFE SA, the Defence SMART Group meeting in late September was attended by representatives from ASC, ANSTO, DMTC, Defence SA, TAFE SA, Austal, BAE, Bisalloy, Rheinmetall, and ATTAR.

Attendees were treated to a number of highly engaging presentations. David Eyre (Director of Maritime, Defence SA) spoke about the Future Naval Defence program and its expected timeframe, highlighting the advantages of using local companies, including cultural alignment, better responsiveness to change, shorter lead times, and face-to-face communication. David also outlined the challenges that these local companies are likely to face: breaking into Defence is hard, and once there, safety management, financial security, and process control are paramount.

Given these challenges, David emphasised the importance (for local suppliers) of building relationships within the Defence industry now.

Shafick Elsayed (Project Manager Global Access Program, BAE Systems) provided an overview of BAE Systems. In 2011, BAE signed a Global Supply Deed to assist Australian suppliers with entry into global supply markets, as part of a Global Supply Chain Program launched by the Australian Government in 2009. As part of this program, BAE promotes the export of local supply across the world.

Professor John Norrish (Director, Defence Materials Technology Centre) presented on the topic of robotic welding, covering titanium machining, welding benchmark capabilities, programming welding arms, and additive manufacturing. Professor Norrish also spoke about a program he is facilitating (in conjunction with the CSIRO and Flinders University) for robotic inspection in confined spaces.

Anna Paradowska (Industrial Liaison Manager and Senior Research Scientist, ANSTO) provided an overview of ANSTO’s extensive range of capabilities. These capabilities include measurement of residual stress using neutron diffraction, the application of neutron diffraction in the shipbuilding industry, including application on different materials, and research into residual stresses on components produced through advanced manufacturing.

David Price (Production Superintendent, ASC) presented on capability development for the welding industry, contending that South Australia is facing the ‘valley of death’. According to David, the pool of skilled welders is diminishing quite quickly.

Dean Gagnon (Technical Director, Rheinmetall) provided an update on the program for the Land 400 vehicle. The contract is likely to include over 200 vehicles of different variants, with a life of 30 years. A major component of the contract is adherence to specific levels of Australian Industry Content. As such, Rheinmetall is talking with Sydney-based Bisalloy for steel supply, and is currently engaging with local SMEs to explore the best supply chain available in Australia.

David Lake (Managing Director, ATTAR) provided an overview of ATTAR, the leading non-destructive testing training organisation in Australia, and Geoff Crittenden (CEO, WTIA) provided an overview of the Australian Welder Certification Register (AWCR).
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 sure to be an industry event for you. For further information on any of the events listed below, or any WTIA courses or state division events, please email events@wtia.com.au or phone +61 (0)2 8748 0100.

January 2017
Joining Advanced Materials for the Automotive Industry
23 January, Ohio, USA
www.aws.org

Manufacturing & Materials Joining Innovation Center's (Ma2JIC) Annual Meeting
24 to 25 January, Ohio, USA
www.aws.org

February 2017
AXAA 2017 Australian X-ray Analytical Association Conference and Exhibition
5 to 9 February, Melbourne, Australia
www.axaa.org

Australian Microbeam Analysis Society (AMAS) 14th Australian Microbeam Biennial Symposium
6 to 10 February, Brisbane, Australia
www.amas2017.org

March 2017
CSSCE 2017: 19th International Conference on Steel Structures and Construction Engineering
11 March, Dubai, UAE
www.waset.org

4th IEBW International Electron Beam Welding Conference
21 to 22 March, Halle, Germany
www.dvs-ev.de/iebw2017

May 2017
FABTECH Mexico
2 to 4 May, Monterrey, Mexico
www.mexico.fabtechexpo.com

National Manufacturing Week
9 to 12 May, Melbourne, Australia
nationalmanufacturingweek.com.au

Stainless 2017: 9th International Stainless Steel Exhibition
17 to 18 May, Brno, Czech Republic
www.stainless2017.com

ICWAM 2017 - The first IIW International Congress on Welding, Additive Manufacturing and Associated Non-Destructive Testing
17 to 19 May, Metz, France
www.icwam.com

June 2017
70th IIW Annual Assembly and International Conference
25 to 30 June, Shanghai, China
www.iiw2017.com

August 2017
YPIC 2017: 3rd Young Welding Professionals International Conference
17 to 18 August, Halle, Germany
www.slv-halle.de
KEY AREAS OF ADVISORY EXPERTISE

- Welding procedure development – pWPS, WPQR, WPS
- Welding coordination and management systems
- Material performance and weldability
- Welding processes and related equipment
- Welding health and safety
- Failure investigation
- Expert witness in welding and related matters
- On-site welding technology assistance
- On-site auditing of welding quality systems
- Welding codes and standards
- Inspection and testing
- Non-destructive testing
- Mechanical testing
- Heat treatment in welding
- Welding quality management to ISO 3834
- Provision of welding specialists (IWE, IWT, IWS) for site work
- Pipelines-in-service welding, repairs and hot tapping

SERVICES AVAILABLE THROUGH OUR NATIONAL & INTERNATIONAL TECHNOLOGY SUPPORT CENTRE NETWORK

- Specialised welding and associated technologies (such as laser, ultrasonic peening, underwater welding)
- R&D – Application of technology
- Engineering critical assessment fracture mechanics
- Structural and pressure equipment design
- Finite element analysis
- Weld cost estimating
- Life estimation

TRAINING

- Training leading to formal International Institute of Welding (IIW) Qualification and Certification
- Training leading to WTIA qualification and certification
- Informal training courses