New welding technique to save industry billions

INTERNATIONAL accreditation of a ground-breaking South African sampling and welding technique based on a little-known welding process will save South Africa's local power generation and petro-chemical industries billions of rands.

Approval for industry application of WeldCore®, a friction taper hydro-pillar welding and repair process was granted by the world's leading engineering body, ASME (The American Society of Mechanical Engineers) earlier this month. This will allow unconditional application of the technology on high integrity plants and equipment designed in accordance with the ASME Boiler and Pressure Vessel Code (BPVC).

The accreditation follows 15 years of research by Nelson Mandela Metropolitan University's engineering technology station, eNtsa, which has spearheaded a number of innovative engineering solutions. Some of the inventions include the design and development of one of the smallest remote controlled Friction Stir Welding Platform for performing partial penetration repair welds for the nuclear industry. This was enabled by developing a ground breaking "low force" welding strategy.

"Acceptance into the ASME BPVC is like conquering one of the highest mountains in engineering terms for us. It's a major step forward as this is proof that the local welding solution survived international scrutiny at the highest level," says eNtsa director Prof Danie Hattingh of the successful technology transfer by his team of engineers.

The "big deal" has already seen the country's main energy supplier Eskom making substantial savings through more than a billion rand in deferred expenditure since the WeldCore® process offers reliable feedback on its aging power stations.

eNtsa spent the last two years preparing for the rigorous ASME Section IX code case.

The ASME code approval places the process on the international front as an accepted procedure, and removes some of the "legal compliance risk" for users world-wide. By all indications, this is the first approval by ASME BPVC for a South African institution. Over the next three years industrial experience in the application of the process will be evaluated, ultimately determining whether the process will be adopted as a new solid state welding process in ASME BPVC – Section IX.

A R32-million investment from Eskom, THRIP (Department of Trade and Industry), and the Technology Innovation Agency (Department of Science and Technology) over a 12-year period, in support of contract research and commercialization strategy, involving a number of PhD and Masters students at NMMU, will change the way engineers look at the life extension of high value engineering components as it allows engineers to make informed decisions on the materials state of equipment in a very short time frame.

"The ROI for one particular study case example proved to be significant. For an input of R30m facilitated more that R1bn in deferred expenditure," says Dr Mark Newby, a senior consultant for Eskom.

Since 2001 Eskom has been conducting several pilot studies, prior to ASME approval, using the new WeldCore® technique on turbine rotor discs and live steam high pressure turbine inlet pipes, testing the industrial application in the process in which they have invested funding since 2006.

Several other leading companies have not been allowed to do so because of internal certification rulings but were literally waiting in the wings for the much-anticipated ASME BPVC approval.

According to Eskom's chief welding engineer Phillip Doubell the journey towards "less guessing" when dealing with creep and fatigue damage in high value, rotating components in turbine assemblies and steam-containing components is over as the new process allows engineers to extract relevant data of the material status for more accurate and less conservative remnant life or life extension analysis.

"We're now able to core the material and repair it within hours. Depending on the analysis, we're able to save companies millions of rands in deferred maintenance by providing accurate data on the actual creep condition.

"This process allows companies to be better informed of actual material conditions while managing their high end equipment more cost effective," says Prof Hattingh.

Eskom turned to NMMU in 2004 after initially approaching The Welding Institute (TWI) in the United Kingdom.

"In South Africa we have a competitive edge. We are multi-skilled and that's what makes us world class from a success point of view - and at NMMU we had a partner committed to technology transfer and not just research," says Doubell.

And so the journey that began with findings from a PhD study and a subsequent feasibility study in 2004 gained momentum as Eskom invested research funding of R12m in 2009 - and presented proof of concept to industry.

TIA invested further funding in preparing the process for commercialisation in 2012. It was the same year that the eNtsa /Eskom team received the Eskom's Chairman's Award for Innovation. The previous year, the eNtsa team also won the National Science & Technology Forum (NSTF) BHP Billiton award for research leading to an innovation by a team in 2011. In 2010, they took first prize in the National Innovation Competition.

Caption
PROBLEM SOLVED … Eskom's (from left) Phillip Doubell and Mark Newby congratulate Prof Danie Hattingh and Dr Ossie Franks of Nelson Mandela Metropolitan University (NMMU) on receiving accreditation for a ground-breaking South African sampling and welding technique that will benefit the country's power industry.