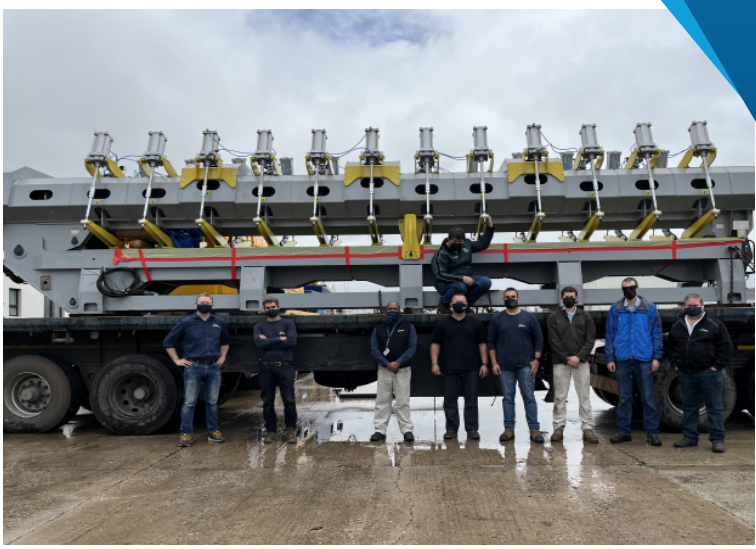
eNtsa

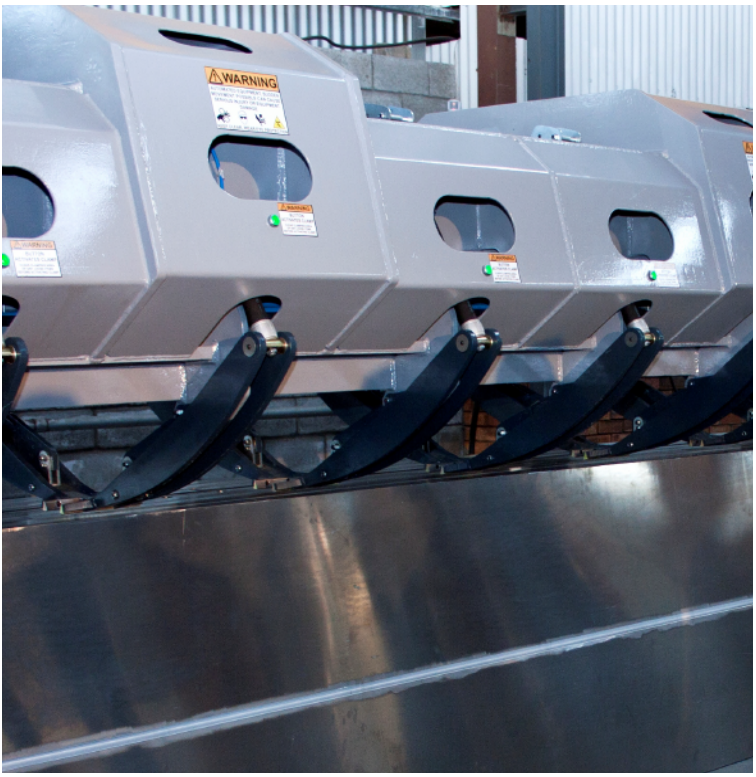
INNOVATION THROUGH ENGINEERING

THOUGHT LEADERSHIP ARTICLE

MATURING TECHNOLOGY: TRANSITIONING FROM THE RESEARCH LABORATORY TO THE PRODUCTION FLOOR.

As research engineers we are passionate about developing new innovative technologies. The process of learning, adapting and ultimately succeeding in delivering innovative "engineering" solutions is our contribution towards creating a sustainable future. However, it is easy to lose sight of the "final intended solution" during the research phase and it takes a lot of planning and focused approach to ensure research solutions are successfully integrated into a production environment. At eNtsa, the research and engineering teams make every effort to complete the "technology readiness lifecycle", ultimately integrating the technology into the appropriate market. Along the development and implementation phase we are often reminded that the end of research and development phase is not the end of the product development phase.





EVER SO OFTEN A TRULY NOVEL TECHNOLOGY MAKES ITS WAY INTO THE ENGINEERING RESEARCH ENVIRONMENT, and in 1991 a new solid state joining technique, namely friction stir welding (FSW), was invented by TWI (The Welding Institute). TWI is a welding research facility in the UK. The term "solid state" refers to the fact that there is no bulk melting of the base metal, and no molten weld pool is created, but rather that the material remains in a softened but still solid phase. A third body, non-consumable tool is rotated and plunged into a joint line, and then traversed along the joint line, extruding plasticized material around a pin and forging the material to create a fully consolidated joint. FSW was adopted as a main research area at the Automotive Components Technology Station (now eNtsa) in the early 2000's, which led to several academic papers. Eleven years later, during 2011 the research and engineering knowledge culminated into the design and build of a production ready prototype FSW platform for GRW engineering. GRW being a leading South Africa based manufacturer of tankers and trailers. It soon became apparent after delivery of the platform to the client, that this was not the end of our involvement, rather the beginning of a technology support phase, critical for ensuring adoption of the new technology within a complex manufacturing space.

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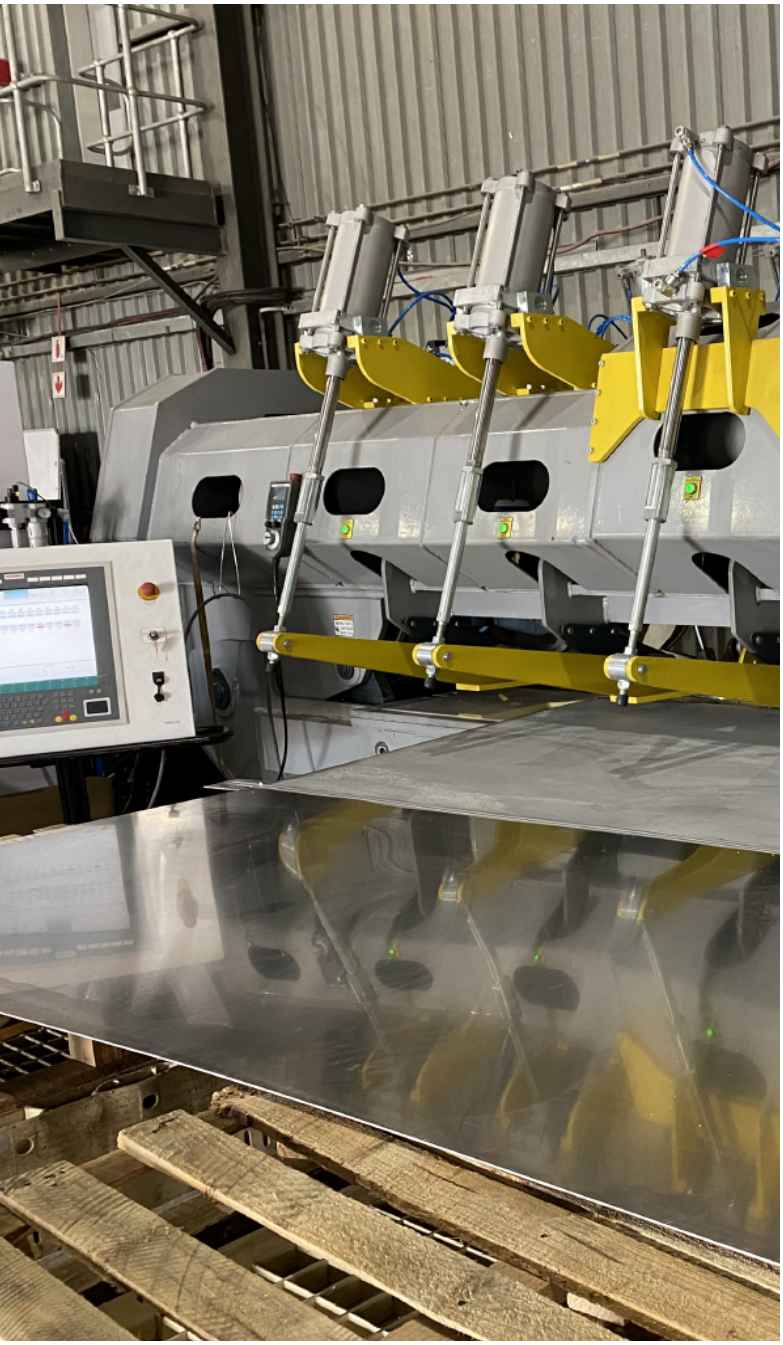

WORKING CLOSELY WITH OUR CLIENTS, WE ARE NOW REALIZING THE CHALLENGES POSED BY A PRODUCTION ENVIRONMENT.

Cycle times and product delivery are a top priority, and although we could produce welds, which far exceeded the design requirements or performance of existing fusion welds, it was not economically feasible. Furthermore, we realized very quickly that the integration of a new technology via a production ready prototype is no simple task and if not done with great care it potentially could nullify all the technological gains to result in a less favorable experience. The knowledge transfer process during the initial phase is critical towards ensuring a successful integration of a new technology into a production environment.

RESEARCH ON THE FSW OF ALUMINUM CONTINUED POST THE INTRODUCTION OF THE TECHNOLOGY.

The approach was more focused towards improved welding speeds. The aim of this work was to increase the welding speed to a point where the process could compete, or even exceed that of conventional fusion welding. Ten years after the initial commissioning, applying the newly sourced knowledge to perform the necessary upgrades to the platform, the platform was recommissioned at GRW Engineering in December 2021. This led to the start of a new chapter in introducing this technology in the modern manufacturing space, proper online quality control of the production items now posed “exciting” new challenges.

The initial conundrum was to manage process integration and late-stage research and development on a production platform within a production environment. Away from the research laboratory the team now had to deal with 3m long wrought alloy sheet, far from a 0.2 m long milled plate used during development. Proper fit-up, alignment and preparation is key to producing high quality welds, getting many of these properly implemented in a production environment required innovative engineering and changing the way we think about and approach the process.

FOLLOWING A SHORT AND INTENSE FEW DAYS OF TRAINING, THE PLATFORM WAS HANDED OVER TO PRODUCTION AND WAS IMMEDIATELY USED FOR MANUFACTURING TANKER SHEETS.

A new process does not go without teething problems, but once attended to it was used for daily production. Having started production with a prototype platform, there has been a continuous need for improvements. Ultimately maintaining a productive working relationship with GRW production staff became a priority for successful implementation. After a year of production, the platform has made more than 3000m of weld and the welding process is being tested in the most demanding applications, on the road, delivering product to clients. eNtsa is continuously working at improving the technology together with GRW, in an attempt of promoting FSW as a joining technology in our local manufacturing economy.