Case study

NUCLEAR AMRC
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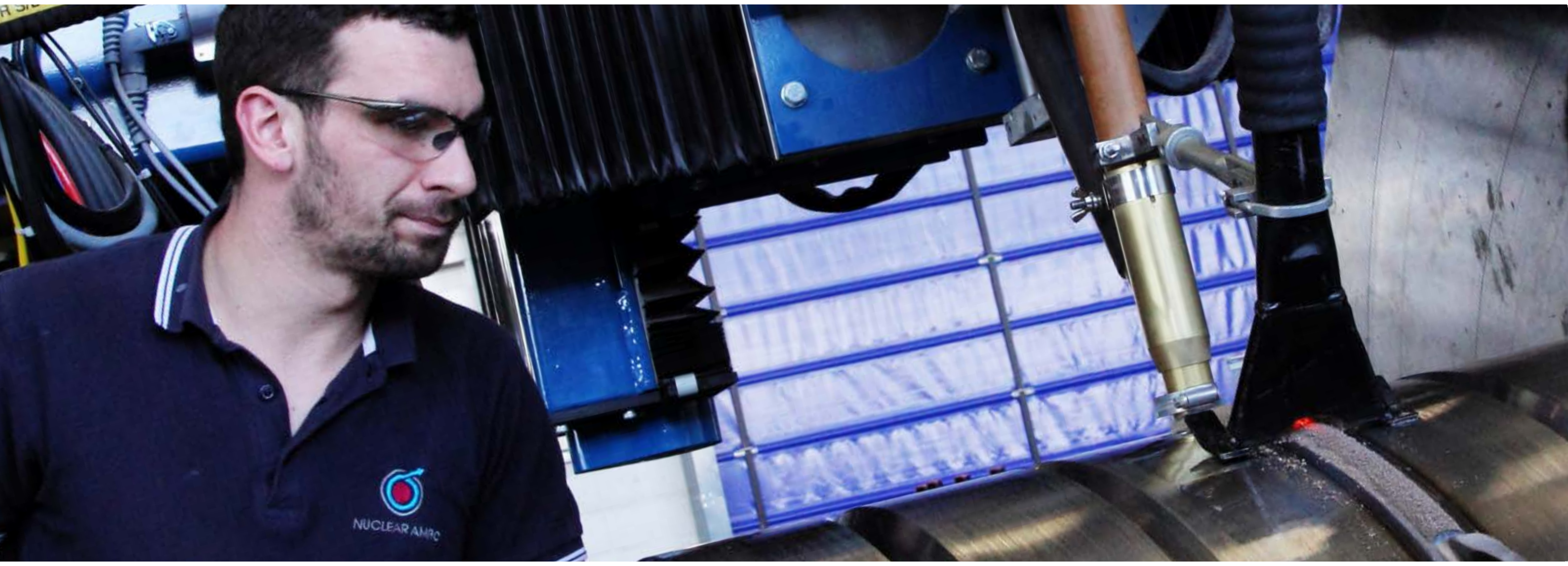

Sound benefits in welding for **Tata Steel** and **TÜV Rheinland**

The Nuclear AMRC helped members Tata Steel and TÜV Rheinland demonstrate a new real-time testing technique for high-performance welds.

The project, funded by Innovate UK, aimed to reduce welding and inspection time in the manufacture of offshore wind turbine towers.

Welding large sections together to construct turbine towers can take days. These thick section welds are typically made by welding the root at high temperatures, allowing the assembly to cool before testing for defects, then laying down more weld – and repeating dozens of times.

A typical offshore turbine tower is made up of 30 or more massive ring sections held together by over 25km of welding. Inspecting the welds and correcting any flaws is a slow and laborious process.

"Our only option is to grind flaws out and do big repair welds – not just unsightly, but costly and time-consuming," says Dr Alan Thompson, manager of welding technology for long products at Tata Steel Europe.

To tackle the problem, Tata Steel worked with inspection specialist TÜV Rheinland and the Nuclear AMRC to explore whether non-destructive testing (NDT) could be carried out during high temperature welding. The initial feasibility study was supported by Innovate UK through a competition to find improved manufacturing solutions for offshore wind energy structures.

The team integrated defect testing equipment, based on ultra-sonic transmitters and receivers, into a submerged arc welding rig at the Nuclear AMRC. The technology is based on the well-established time-of-flight diffraction technique, which bounces soundwaves across the weld, with any defects showing up in the reflected waveform.

"The beauty of this technique is that flaws show up immediately in the image," says John Crossley, NDT lead at the Nuclear AMRC. **"You can see the length and height very accurately, enabling depth to be easily calculated."**

The team created a prototype featuring heat-resistant probes and a cooling system to allow it to work at high temperatures (up to 450°C), as well as adaptive controls to adjust the speed and feed of welding.

In trials on a large steel cylinder, the system successfully identified deliberately induced defects. The system's adaptive controls also allowed welds to be filled uniformly and at greater speed despite variations in size.

"We get a high completion rate, so we don't need to add partial weld runs," says Thompson. **"Non-destructive, real-time testing is a true breakthrough. It will save companies considerable amounts of time and money correcting flaws."**

A proven NDT procedure for high temperature welding can also play an important role in assuring build safety and integrity.

"We need to be doing more to reassure people that the structures we build are subject to stringent measures to ensure their quality and safety," notes Bjorn Snijders, TÜV Rheinland's lead engineer on the project.

These initial results are a significant move towards real-time testing of welds at high temperatures. One particularly exciting finding was that the adaptive controls on the new equipment could increase the speed of the welding process five-fold, although realising these gains in a production environment will require significant further development.

"We wouldn't have been in a position to do this research without Innovate UK support and the facilities of the Nuclear AMRC," Thompson concludes. **"They make it possible for companies like us to work on projects that deliver real benefits but that aren't central to our manufacturing base."**

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