

## DETAILED DESCRIPTION OF ENTRY

### Cranfield Automated Pipewelding System

In 2001, Cranfield developed the concept of dual-tandem GMAW for pipewelding and received funding from BP Exploration Operating Company and TransCanada Pipelines to develop the Cranfield Automated Pipewelding System (CAPS).

Tandem GMAW differs from conventional GMAW as two welding wires are passed through the same welding torch. A single torch with two contact tips is used to feed both wires into a single weld pool. The Cranfield Automated Pipewelding System (CAPS) uses two tandem torches spaced 75mm apart on a single carriage (dual-tandem welding) Figure 1. The tandem GMAW allows high welding speeds (1.4m/min) and two passes are deposited simultaneously which further reduces welding times. This results in a significant reduction in the number of welding stations required to achieve a given number of weld's per day and this leads to major savings in labour and equipment costs. In comparing welding systems for a recent project estimate, CAPS resulted in a 25% saving in girth welding costs when compared with conventional mechanised GMAW systems. The system is currently using a welding head designed and supplied by RMS Welding Systems of Edmonton, Alberta but it can be fitted to most pipeline welding bugs.

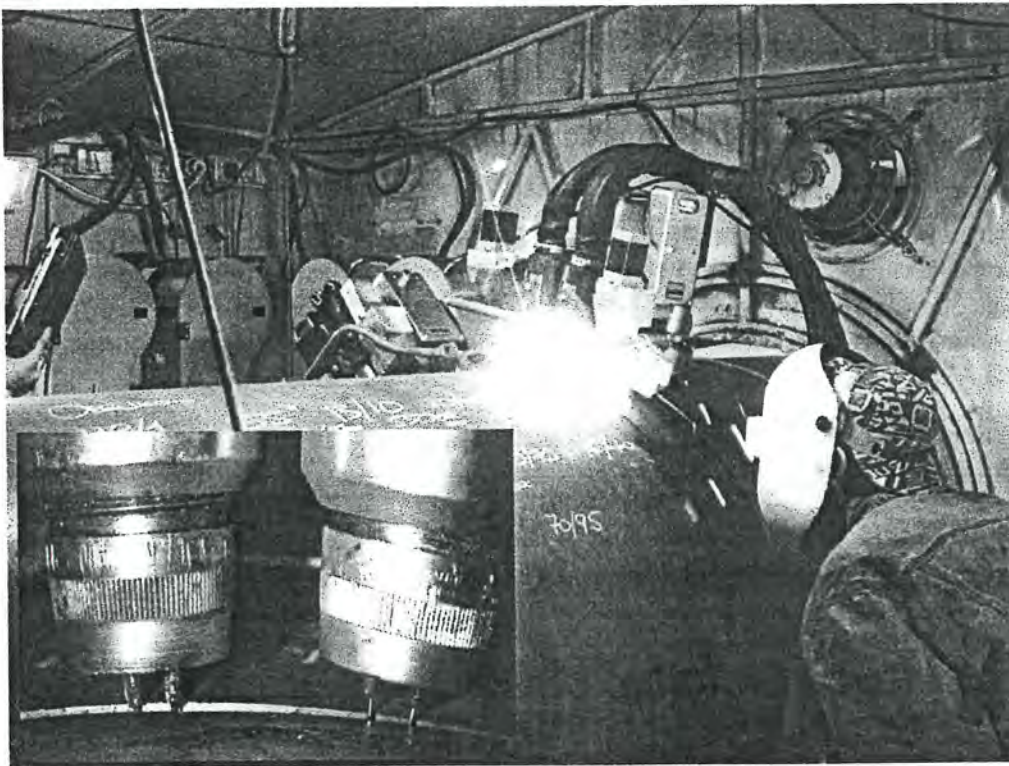
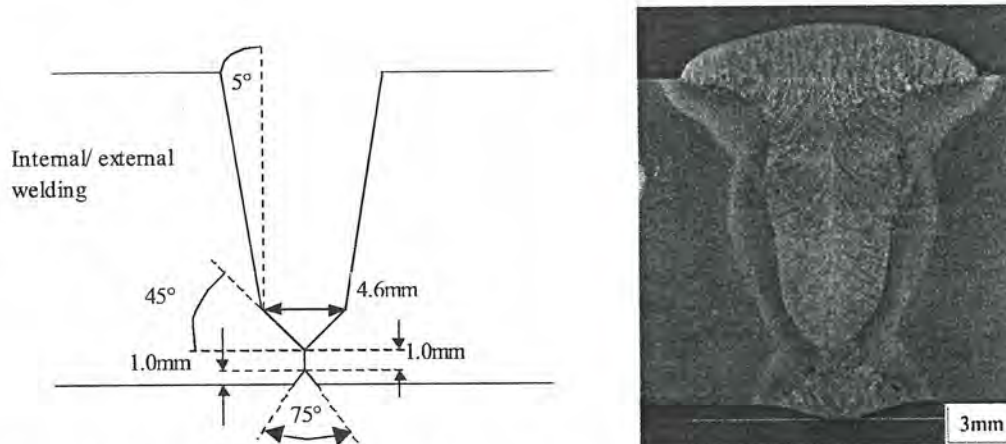


Figure 1: Arrangement of CAPS welding torches and system mounted on RMS Welding Systems mechanised welding bug

From 3-13<sup>th</sup> March 2003, the CAPS equipment was field tested in Edmonton, Alberta, Canada. BP Exploration provided funding and Cranfield worked with RMS Welding Systems to complete the field trials. These were performed on 40"x19.1mm X80 linepipe. The procedures was qualified with a 1%Ni, 0.3%Mo welding consumable to ensure overmatching criteria was satisfied. Despite the high strength levels, excellent Charpy Impact and CTOD properties were obtained.



**Figure 2: CAPS Weld Bevel and Macro-Section From Weld in 14.9 mm Wall X100 Linepipe**

A major benefit of CAPS is that it has evolved from existing technology. As seen in Figure 2, the completed weld has a similar weld bevel and profile to conventional mechanised pipeline welds so conventional radiography and automated ultrasonic testing can be used for defect detection. The suitability of automated ultrasonic testing was demonstrated during the CAPS field trials. The weld metal microstructure and metallurgical properties are also similar to conventional mechanised pipeline welds. CAPS is therefore suitable for use on all linepipe materials including X80 and X100 steels and the system does not therefore require any regulatory approval and can be implemented under normal codes and standards.

Following the field trials at RMS Welding Systems in March 2003, the process is now being tested by CRC-Evans Automatic Welding and Serimer-Dasa and it is hoped that these welding contractors will shortly be implementing the system on a pipeline project.