U.S. Department of Transportation

Innovative Welding Processes for Small to Medium Diameter Gas Transmission Pipelines
DTRS56-05-T-0001

November 2005

OPS ACCOMPLISHMENTS

Pipeline Safety Research and Development for Focus area

Improved Materials Performance

Challenge

A major challenge in high strength pipeline construction is producing small to medium diameter girth welds that have high quality and integrity. Manual shielded metal arc welding is currently used on these pipeline applications where the resulting weld deposit has marginal properties, high hydrogen content, and high defect propensity. This process is not suitable for higher strength materials used in high integrity applications. This project will develop innovative gas metal arc welding (GMAW) and hybrid laser-GMAW processes and technologies for single-sided pipeline girth welding of small to medium diameter pipe (24-inch and less). A key requirement is the welding from a single-side with no internal backing tools or internal welding machine.

Serimer-Dasa mechanized pipe welding system. Modifications will be made to include automated torch-tilt, on-board high speed data acquisition to facilitate real-time quality monitoring, and adaptive welding control for CTWD.

Technology Description

The project aims to develop innovative welding processes and technologies for single-sided pipeline girth welding. Root pass welding techniques will be emphasized since they have the greatest potential to improve pipeline integrity and facilitate the use of new and existing GMAW fill pass techniques. Advanced automation techniques will be used to improve weld quality, process control, seam tracking, and robustness.

Accomplishments

- **Evaluated GMAW-RE, GMAW-VP, and GMAW-CSC for root pass quality and productivity.**
- **Selected GMAW-RE as the process providing the best results, and developed further in conjunction with process automation.**
- **Added torch-tilt to Serimer-Dasa welding system**
- **Automated work angle motion**
- **Developed control software for path planning**
- **Developed software and system for real-time weld quality monitoring**
- **Completed initial development of automated voltage control**

Contact

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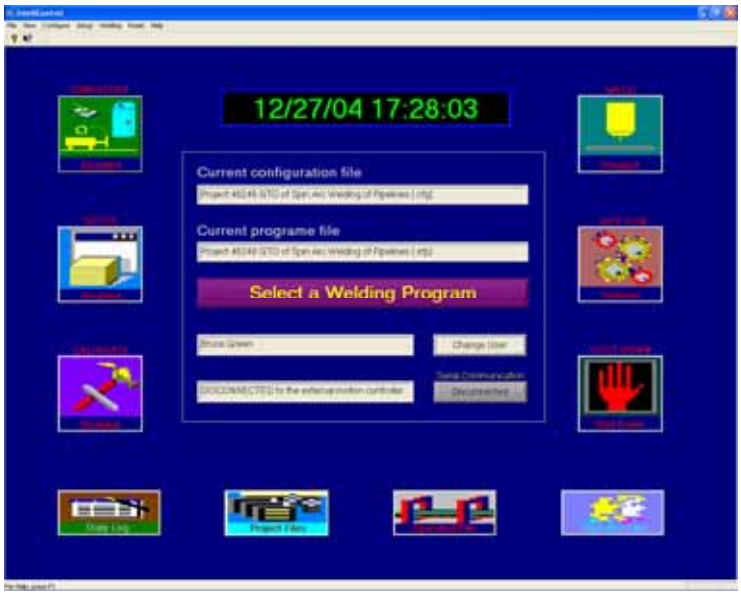

User-friendly Intelllicontrol Software Main Panel for Real-Time Quality Monitoring

Benefits

This research will advance pipeline safety by providing advanced automated welding processes coupled with automation techniques which have the potential to improve the robustness, quality, productivity, and integrity of single-sided pipeline root passes, and assure resistance to flaws through the use of monitoring and adaptive control techniques.

Future Activities

- **Integrate additional adaptive control algorithms**
- **Complete contact tip to work distance control software and hardware**
- **Add high-speed seam-tracking capability by way of spin-arc torch signals**
- **Develop and integrate QA/QC system**

Partners in Success

- **Edison Welding Institute Inc. (EWI) - Lead Organization www.ewi.org**
- **Pipeline Research Council International, Inc. (PRCI) www.prci.com**
- **Serimer-Dasa Automated Pipe Welding www.serimerdasa.com**
- **TransCanada www.transcanada.com**
- **BP www.bp.com**

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