



Figure 1. Petrobras' GASTAU pipeline spans 97 km, running from the Caraguatatuba Gas Treatment Plant to the Taubaté Custody Transfer Station and São José dos Campos Refinery to transport natural gas produced in Brazil's Mexilhão gas field.

Scott Funderburk, Lincoln Electric, USA, describes how a Brazil pipeline project overcame timetable and rejection rate challenges using heavy-duty GMAW consumables and an automated welding process.

Automated welding on GASTAU

Brazilian integrated energy supplier Petrobras was working on its GASTAU project when production slowed due to a high rejection rate on its welds, which was affecting the overall project schedule. It quickly became apparent that automated welding would be needed to complete the job on time to open in 2011.

The project

Running 97 km from the Caraguatatuba Gas Treatment Plant to the Taubaté Custody Transfer Station and São José dos Campos Refinery, the pipeline – upon completion – will transport natural gas produced in the

Mexilhão gas field, located in the offshore Santos Basin. It is expected to carry up to 15 million m³/d of gas and yield 20 000 bpd of natural gas condensate. The project is of strategic importance to Brazil in that it will feed the industrial, domestic and automobile natural gas consumption in the country's major metropolitan areas.

Its latest expansion in the pipeline market, the GASTAU project, runs through a highly developed region that includes industrial plants, large metropolitan areas of more than two million inhabitants, large farms, a major highway network and even a Federal Environmental Preservation Area, with strict

environmental restrictions. With this in mind, pipe integrity and durability – and lasting, quality welds – were a must on this project.

The GASTAU pipeline features 34 in. diameter (863 mm), 0.748 in. thick (19 mm) X80-grade pipe. The pipe was initially welded manually and semi-automatically. However, as the job progressed, Petrobras officials began seeking solutions to streamline the project's welding process and still achieve the highest level of quality. The combined forces of Dyna Torque Technologies Inc. and The Lincoln Electric Company provided the answer.

"It takes a certain skill set to weld this pipe with a semi-automatic welder or by hand," says Dyna Torque President Andrew Scherfenberg. "They were experiencing a high rejection rate. For example, they would make four



Figure 2. The GASTAU pipeline features 34 in. diameter (863 mm), 0.748 in. thick (19 mm) X80-grade pipe and is the first of this grade to be welded robotically in Brazil and the first to use Lincoln Electric's new Pipeliner® 80Ni1 welding wire.



Figure 3. Because the pipeline runs through a highly developed region that includes industrial plants and large metropolitan areas of more than two million inhabitants, pipe integrity and durability – and lasting, quality welds – were a must on this project.

welds, and three would have to be redone. They weren't progressing as quickly as they needed to be to get the job done on schedule."

Dyna Torque, an international, full-service welding company, offers automated welding solutions for the global oil, gas and water pipeline industry by planning, managing and delivering fully integrated welding solutions onshore and offshore, in the most demanding environments and extreme conditions around the world. Its advanced orbital pipe welder, the LONESTAR Automated Welding System, is designed to modernise traditional welding techniques and processes. Introduced in 2003, the system offers the latest in software development and microprocessor technologies with innovative device design to deliver reliable digital welding.

For the challenging Petrobras project, the company combined this technology with Lincoln's innovative Pipeliner® 80Ni1, a gas metal arc welding (GMAW) wire developed specifically to meet the rigorous demands of the global pipe welding industry.

"It is the first X80-grade project in Brazil to be done on an automated system, and the first one in that country also to use Lincoln's new Pipeliner product," Scherfenberg notes. "The wire met our requirements and is an excellent match for the application."

The testing

Petrobras performed additional testing of Lincoln's Pipeliner 80Ni1 consumable – as it does with all consumables in order to verify the mechanical properties before their use on a project.

This verification included welding a similar joint prescribed in the AWS A5.28 - Specification for Low Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding and then checking to ensure the soundness, mechanical properties and chemical analysis meet the requirements.

As a part of the qualification process, a welding inspector certified by FBTS (Fundação Brasileira de Tecnologia de Soldagem) was required to witness all the welding and testing. Monitoring was also conducted by Petrobras' engineering team.

The welding was performed at Lincoln Electric's Weld Tech Center in Brazil, and the tests were performed in an approved laboratory. All welding and test followed the applicable standards. The all-weld metal results were as follows:

Tension test

- UTS: 700 MPa (101.5 ksi).
- YS: 625 MPa (90.6 ksi).
- Elong.: 20%.

Impact test

- Charpy V notch: Average 146 joules at 0 °C.

Chemical analysis

- C - 0.08%

- ➔ Mn - 1.29%
- ➔ Si - 0.66%
- ➔ Ni - 0.80%
- ➔ S - 0.009%
- ➔ P - 0.006%
- ➔ Cu - 0.16%.

The consumable

Designed for semi-automatic or automated welding of root, hot, fill and cap passes on up to X80-grade pipe and root passes on up to X100-grade pipe, Pipeliner 80Ni1 is capable of producing high toughness CVN and CTOD properties down to very low temperatures to meet the demands of tough pipeline applications. It is manufactured to lot control standards and tested per AWS A5.01 Class S4 Schedule H.

“This wire increases productivity with enhanced arc characteristics and provides optimal wire placement in the narrow-groove joint configurations commonly used for automatic pipeline welding,” notes Scott Funderburk, Lincoln’s Global Business Segment Director. “It meets the demands of higher strength pipe and also those of severe environmental conditions – both factors on the GASTAU pipeline project.”

The combination of the LONESTAR system and the Pipeliner consumable helped bring the GASTAU construction timetable back up to speed, Scherfenberg says.

“The automated welder picked up the production pace, and the consumable helped deliver the durable, quality weld required for the job,” he notes. “Before they switched to automated welding, they were doing two welds a day manually and were facing a high rejection rate. With this combination of products, we were doing two an hour – and both were good welds. Both the fatigue life and quality have been increased.

GASTAU at a glance

- ➔ It is the latest expansion in the gas pipeline market and brainchild of Brazilian integrated energy supplier Petrobras.
- ➔ The pipeline runs 97 km inland from the Brazilian coastline, through a highly developed region that includes major metropolitan areas, farms, a highway network and a Federal Environmental Protection Area.
- ➔ The line connects the Caraguatatuba Natural Gas Treatment Unit (UTGCA) with the Campinas-Rio gas pipeline in Taubate, Brazil, making it possible to use gas in the Mexilhão field in the Santos Basin to meet the market demands in Rio de Janeiro and São Paulo.
- ➔ The pipeline carries up to 15 million m³/d of natural gas, yielding 20 000 bpd of gas condensate.
- ➔ A tight construction timetable prompted Petrobras to seek a faster solution than manual and semi-automatic pipe welding on the 34 in. X80-grade pipe.

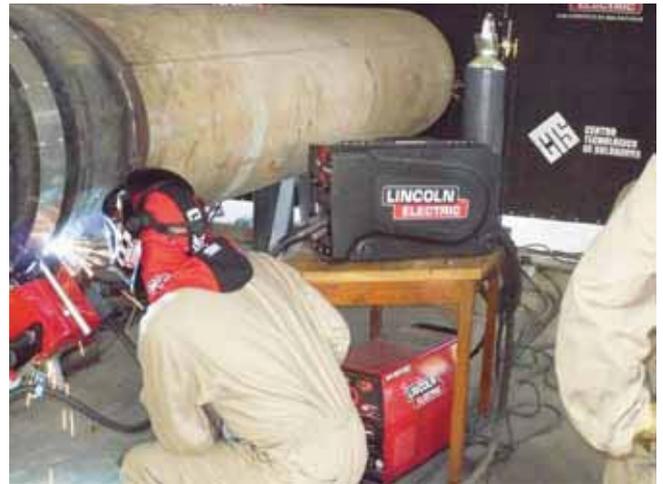


Figure 4. The welding team combined an orbital pipe welder, the Dyna Torque LONESTAR Automated Welding System, with Lincoln Electric’s innovative Pipeliner® 80Ni1, a gas metal arc welding (GMAW) wire developed specifically for the global pipe welding industry.

- ➔ Dyna Torque, an international full-service welding company, and Lincoln Electric, a world leader in the design, development and manufacture of welding systems and related products, teamed up to provide an automated orbital welding solution.
- ➔ The answer: Dyna Torque’s LONESTAR Automated Welding System combined with Lincoln Electric’s innovative Pipeliner® 80Ni1, a gas metal arc welding (GMAW) wire developed specifically for the global pipe welding industry.
- ➔ GASTAU is the first X80-grade project in Brazil to be completed with digital automated welding and the first to use Lincoln Electric’s new Pipeliner® 80Ni1 consumable.
- ➔ The combined power of the orbital welder and the Lincoln Electric consumable completed two welded joints per hour vs. two joints per day with manual welding.
- ➔ According to those involved on the project, the switch to automatic orbital welding picked up the production pace, while the new consumable provided the durable, quality welds required for this type of job.

A closer look at Pipeliner® 80Ni1

Designed for semi-automatic or automatic welding of root, hot, fill and cap passes on up to X80-grade pipe and root passes on up to X100-grade pipe, Pipeliner® 80Ni1 MIG (GMAW) wire from Lincoln Electric was developed to meet the rigorous demands of the pipe welding industry.

Capable of producing high toughness CVN and CTOD properties down to very low temperatures, this wire increases productivity with enhanced arc characteristic, providing optimal wire placement for narrow groove joint configurations. It is manufactured to lot control standards and tested per AWS A5.01 Class S4 Schedule H. **WP**