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# COMPRESSION

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# Brazos' Midstream Strategy Includes Compression

*Pipeline & Gas Journal* Special Report


Jaggi

Fort Worth-based Brazos Midstream isn't your typical midstream company. Actually, in today's energy industry there is no typical midstream company. Few, if any, are identical, and their mixture of assets can change almost daily, depending on business conditions and the management team's strategy.

When Chief Executive Officer Brad Iles, Chief Financial Officer William Butler, Chief Commercial Officer Stephen Luskey and Chief Operating Officer Ryan Jaggi founded Brazos Midstream two years ago, their business plan was to focus on crude oil gathering, natural gas gathering and processing, compression, treating, water and condensate handling and stabilization.

Brazos's work is centered in the southern Delaware Basin in West Texas. Their assets include 35 miles of crude oil-gathering pipeline; two crude oil storage terminals with a combined capacity of 50,000 bbls; 240 miles of large-diameter, low- and high-pressure natural gas-gathering pipeline; field compression facilities initially designed for over 250 MMcf/d; two cryogenic natural gas processing plants, including Comanche I, a 60 MMcf/d plant in operation, and Comanche II, a 200 MMcf/d plant under construction with anticipated in-service date Q1 2018.

In this interview, Jaggi discusses the company's work as a compression service provider, one of the fundamental pieces of the natural gas business. Jaggi has over 16 years of experience in engineering, project management and operations. As Chief Operating Officer he oversees the company's operations and asset management. Prior to Brazos, Jaggi was Vice President of Engineering for Wildcat Midstream Partners, where he led project management and engineering responsibilities for the company's Permian and Caddo assets. He earned a BS degree in mechanical engineering from the University of Missouri-Rolla and an MBA from Texas Christian University.

**P&GJ:** Ryan, how did you get into the energy business?

**Jaggi:** My father has always worked in the oil and gas business, so I grew up around it. During college, I interned for a midstream company in Oklahoma and really enjoyed my time there. Unfortunately, when I graduated from college, the industry was in a downswing and no one was hiring in the midstream sector. A small Fort Worth-based company, XTO Energy, decided to take a risk and hire a green engineer right out of college. I worked in their gas operations group, enjoying the rapid pace of the business.

I traveled all over the country building pipelines, gas-processing plants and compression facilities. I learned a lot working in the field with operations and mechanical personnel. I believe those lessons have helped me better understand how to design midstream facilities in a prudent way that also meet the needs of our producer customers.

**P&GJ:** Brazos has grown quickly in the past two years. How does the compression segment fit in with Brazos' overall business strategy?

**Jaggi:** While many companies tout their plant and pipeline capacities, well-designed field compression is the first line of defense from having to curtail customers' production due to capacity constraints. At Brazos, a key to our success is making sure that our compressor packages are as flexible as possible while still running efficiently. Conditions can change quickly based on customer's preferences, volume fluctuations and downstream pressure constraints. Having the correct cylinder configurations and station design gives us confidence that we can continue to move gas in all types of scenarios.

**P&GJ:** How does compression design help you plan for future growth?

From left are CFO William Butler, CEO Brad Iles and COO Ryan Jaggi.

**Jaggi:** Now that producers are drilling multi-well pads and fracking them all at the same time, being flexible has become the new norm. Midstream operators must be able to handle spikes in volumes over a brief period. For example, Brazos is currently constructing infrastructure for an eight-well pad to be brought online toward the end of this year.

To accommodate production from these types of multi-well pads, compressor units need to be designed to allow for a range of operating conditions by simply adjusting setpoints or valve pockets to handle incremental volume. Understanding the relationship between the cylinder size, suction pressure, and full range of compression capability enables Brazos to maintain flexibility and strategically design for growth.

**P&GJ:** Have you planned for your current compression capabilities to be expanded? If so, what are some lessons learned?

**Jaggi:** Brazos designs all of our compressor stations to operate at the same design conditions so that we can easily move a unit from one station to another, based on demand. This allows us to quickly expand without having to redesign the entire station. We also build the headers at all of our stations to accommodate for future compression. Finally, identical station designs save on costs since the contractors can be more efficient with concrete crews, field fabrication and overall manpower. This standardization helps alleviate the dreaded change order battle and shortens the overall construction time, enabling Brazos to pivot quickly.

**P&GJ:** What are the greatest challenges you are seeing in the Delaware Basin related to compression?

**Jaggi:** The biggest challenge we face right now is predicting the future. There was a time equipment costs were competitive and lead times were reasonable, but the market has changed due to the rapid growth in the industry, especially in the Permian. We now see lead times on new compression packages ranging from eight to ten months in some cases, which puts pressure on project planning.

**P&GJ:** How have you overcome these challenges?

**Jaggi:** At Brazos, we try to address the challenges we see in the midstream sector in a few different ways. It starts with close coordination with our producer customers regarding their short- and long-term development plans and forecasting these compression needs relative to our physical capacity. This helps identify any capacity constraints before they occur. Secondly, we maintain a queue of "spare" units that allows us to be responsive to any changes in our producer-customer's plans. Lastly, at times we have relied on rental compression for projects that require expedited schedules. The rented packages are typically identical to our standardized purchased fleet. This ensures that we meet project schedules and that our mechanics can efficiently operate and maintain all our units. ***P&GJ***

# Reciprocating Compressor Pulsations Effect on Compressor Surge Margins

By **Klaus Brun,** Director, **Sarah Simons,** Scientist, **Southwest Research Institute (SwRI),** San Antonio, TX, and **Rainer Kurz,** Manager **Solar Turbines,** San Diego, CA

The mixed operation of centrifugal and reciprocating compressors in a single compression plant has become common design practice over the last 20 years, as this arrangement can provide benefits for highly cyclical process profiles.

Conventional thinking was that a centrifugal compressor may experience some pulsations from the reciprocating compressor when in series or from both the common suction and discharge headers, but good reciprocating compressor bottle and manifold designs would result in minimal impact on the operational stability of the centrifugal compressor.

This assumption held true for small-horsepower and low-speed applications and with older, high-pressure drop and often significantly oversized pulsation-control systems. However, recent experience with mixed compressor stations utilizing large power and high-speed modern separable reciprocating compressors with modern efficient pulsation control systems shows that the centrifugal compressor can be moved into pulsation-induced operational instability for both parallel or series arrangements. This clearly presents a station design challenge, operational range limitation, and a basic safety concern.

## Experimental Facility

Laboratory testing of reciprocating and centrifugal compressor mixed operation was performed in an air loop at the SwRI compressor laboratory. Figure 1 shows a schematic of the test arrangement and photos of the compressors. The testing was performed using a 50 hp single-stage, double acting reciprocating compressor mounted upstream of a two-stage, 700 hp centrifugal compressor.

The reciprocating compressor suction was open to atmosphere with an operating range of 300-1,000 rpm (5-17 Hz) using a variable frequency driver. Similarly, the centrifugal compressor was operating in a semi-open recycle loop with the loop's discharge throttled back to atmospheric pressure, a speed range of 2,000-14,000 rpm, and maximum pressure ratio of 3:1. However, for safety reasons, the centrifugal compressor's speed and discharge pressure were limited to 7,000 rpm and 2 bar (30 psi), respectively, for the subject test series.