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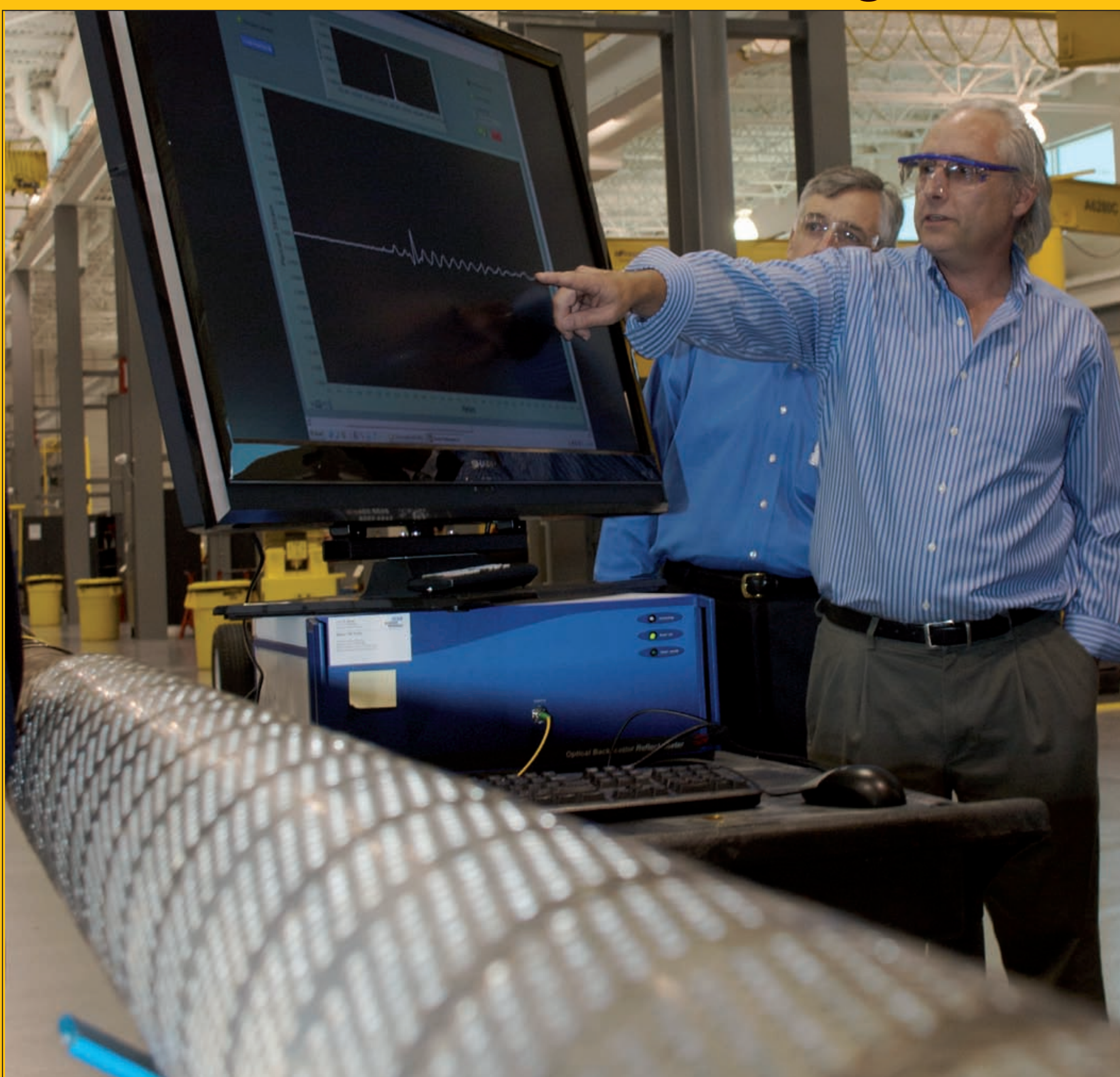

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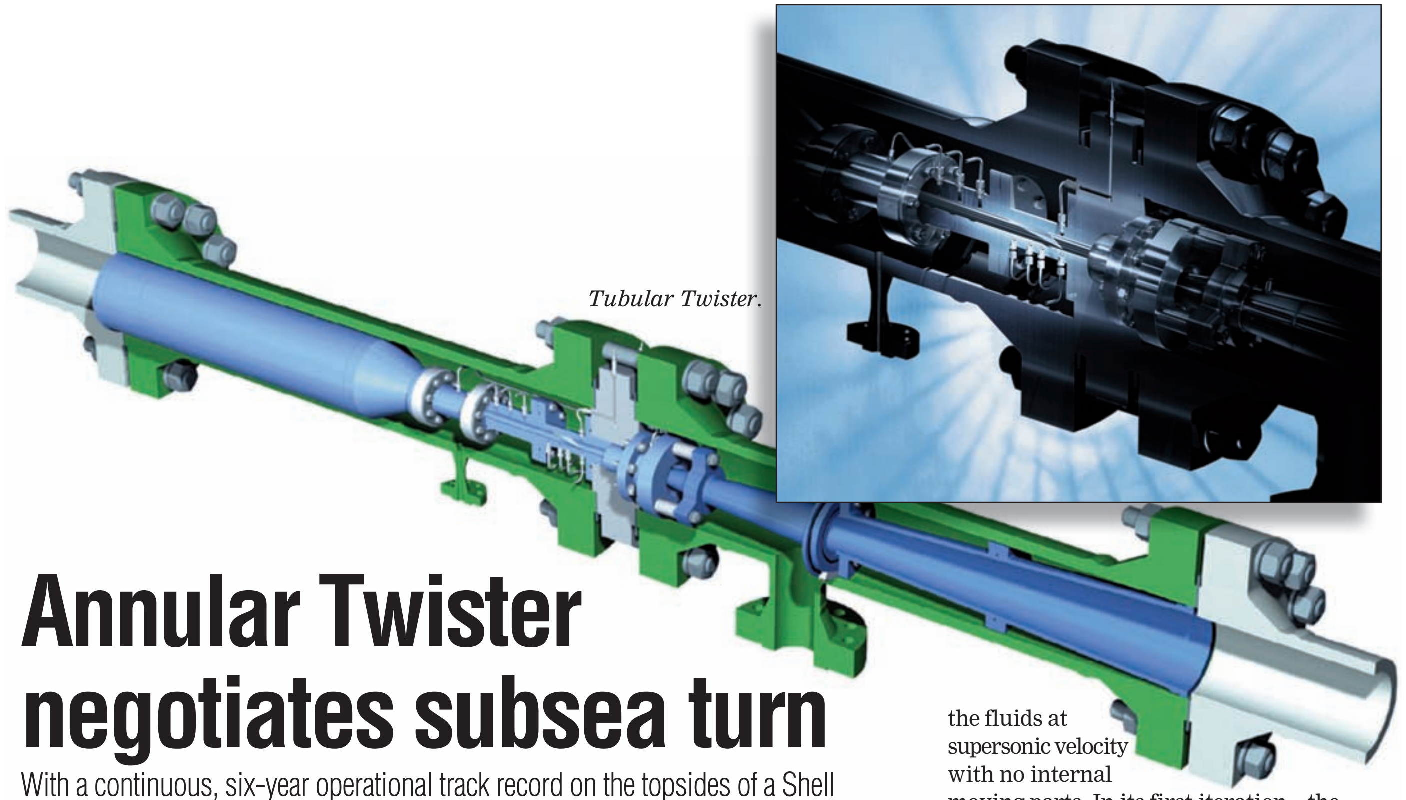

Tubular Twister.

Annular Twister negotiates subsea turn

With a continuous, six-year operational track record on the topsides of a Shell Sarawak sour gas field off East Malaysia, Twister Supersonic Gas Solutions is now looking to move a new generation of its offshore gas conditioning plant into the subsea arena courtesy of an offshore Brazil operator. **Jennifer Pallanich** reports.

The Twister low-temperature separation technology uses supersonic velocity to dewpoint water and hydrocarbon vapors in natural gas. Twister Supersonic Gas Solutions won a contract in 2006 to place an Annular Twister unit onshore for Petrobras and is now commissioning the unit for startup this month. The operator is expected to make a decision later this year about whether to move forward with a subsea installation as part of an existing research program begun in 2004.

'It's very exciting for us – a no brainer,' says Hugh Epsom, Twister sales director. If Petrobras orders a subsea Twister tube, it is expected to be placed in a well in 1600m of water in the Canapu field, he adds. The unit would dehydrate the gas at the wellhead and remove liquids to an FPSO via an umbilical for processing at the topside.

According to Epsom, the subsea appeal of the system lies in its unmanned ability to simultaneously separate three phases without relying on chemicals or moving parts. Additionally, the technology could further enable the development of marginal and stranded fields, the company says. The units are compact. For example the two 3m x 3m modules, each with a 300mmcf/d capacity, serve Shell's Sarawak B11 platform.

Twister completed a feasibility study in 2002 on a subsea processing system and in 2004 began carrying out a four-year project funded by the EU to design, construct, install and test the first pilot subsea gas processing installation. In 2006, Petrobras signed on to participate in further development with an onshore test planned for 2009 and the subsea test next year, if the operator opts to move forward with the project.

The subsea template will likely feature four suction anchors that support the interfaces for the manifold module and the other retrievable modules. The manifold structure would include the manifold piping with tie-ins, the inlet cooler and the inlet separator. The Twister unit itself contains the low temperature separator including electric heater, Twister tube(s) and related piping and valves. A seawater cooling pump unit has an electric motor installed on top of a transformer unit. Finally, a control valve unit includes the control system and battery backup. The module would be adapted for subsea use, and the final design, according to the company, will vary depending on the design requirements of each application.

By 2015, Epsom says, the company hopes to have a viable subsea gas conditioning design commercially viable.

Designed in 1998, the original system works by combining aero-dynamics, thermo-dynamics and fluid-dynamics to condition the gas (*OE* July 2000). The resulting gas dehydration and hydrocarbon dewpointing helps operators meet gas specifications while the NGL extraction increases revenue, Epsom notes. Twister condensates and separates the fluids at supersonic velocity with no internal moving parts. In its first iteration – the style in use at the Shell Sarawak field – the design features a Laval nozzle, an aerofoil section (wing), the cyclone separator, a diffuser, and outlets for the separated products. A fixed actual volumetric flow device, the system is intended for water dewpointing, hydrocarbon dewpointing and natural gas liquids recovery. The system working off East Malaysia, however, has an 85% separation efficiency rating, a dew point suppression of ≤15°C, and a 30% pressure loss. Droplets were re-evaporating, he notes.

'The original Twister was not very efficient,' Epsom says. 'The higher pressure drop was the penalty we pay for the good stuff Twister gives you.' The goal was to improve the separation efficiency and reduce the pressure loss. 'The lower we could get this pressure drop, the better.'

The Annular Twister, another design with no moving internal parts but using a vortex generator upstream of the nozzle, emerged in 2004. This design removed the opportunity for droplets to re-evaporate, Epsom says. It has a separation efficiency of 98%, a dew point suppression of 30°C and a 25% pressure drop. This design was prototyped in 2005, qualified in 2007 and put on the market in 2008. One unit started up onshore Nigeria in April 2009 and other units have been ordered for installation onshore Brazil and Colombia. The Brazilian unit is being commissioned for startup this month and the latter unit is slated to start up next year. While the supersonic velocity may drop the temperature by 50°C, Epsom says, 'there's no time for hydrates to form'. The fluid is only in that portion of the system for 2 milliseconds. Droplets formed by

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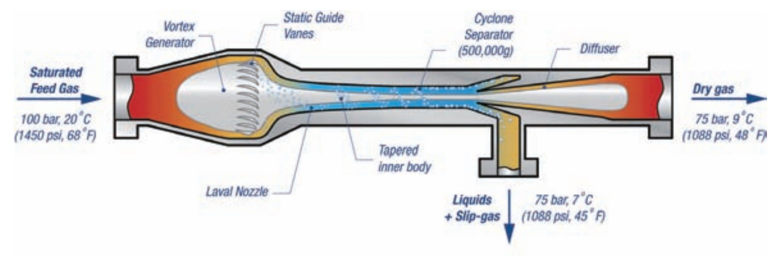
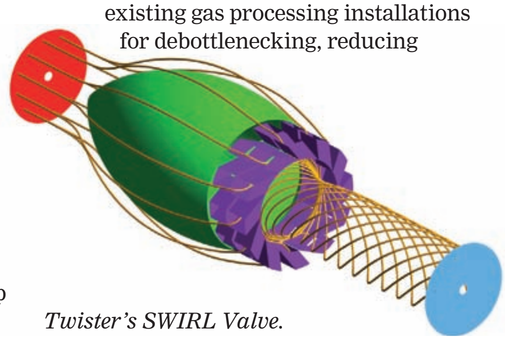


Annular Twister.

the supersonic vortex exit through the annulus while dry gas exits through the center. The slip gas, which exits the Twister tube with the liquids, is separated in the downstream chemical-free Twister Hydrate Separator, or in a normal Low Temperature Separator, operating with chemicals, and is recombined with the processed gas stream.

Twister is nearing the qualification phase for a next-generation prototype called the Reflux Twister. This system, in prototype since last year, does away with the inner body and replaces it with a virtual inner body. The design, Epsom says, achieves the same effect as a true inner body while reducing pressure drop and length. ‘The high pressure gas system acts in the same way as that inner body,’ he says. The new design is slated to undergo qualification testing in a test loop in The Netherlands in October. Twister is building one unit now that it hopes to introduce to the market in March 2010. It is expected to have a separation efficiency of 98%, a better dew point suppression of over 35°C and a reduced 20% pressure drop. Recovered gas from the condensate stabilization unit will be ‘spiked back to the Twister’, Epsom says.

He says new SWIRL Valve technology developed by Twister can be installed in existing gas processing installations for debottlenecking, reducing pressure drop, improving dewpointing, reducing liquid carryover, and reducing chemical loss. Previous valves had relied on a conventional radial flow cage design while the Twister SWIRL Valve uses a tangential flow cage to generate swirl. The swirl in turn promotes faster droplet growth on the inside surface by coalescence.



Twister’s SWIRL Valve.

Introduced earlier this year, Twister has two onshore contracts with NAM for the valve technology.

According to the company, when expanded through a Twister tube, H_2S and CO_2 condensate can be removed from the gases in the liquid phase, making the system viable for pre-treatment of sour gas.

Another design, referred to as the 2-Stage Twister, is expected to begin the prototype process in 2010 to target the deep LPG extraction market. **OE**