



IN DEPTH: Subsea 7's corrosion resistant alloy-lined BuBi pipe, shown here being deployed at Statoil's Aasta Hansteen development, will be combined with a direct electrical heating system for Wintershall's Maria project.

### Focus areas

The exercise led the company to focus technology development in five strategic programmes — riser systems, flowline systems, bundles, subsea processing, and life-of-field and remote intervention.

Subsea 7's deepwater riser portfolio includes decoupled systems such as the single hybrid riser (SHR) and hybrid riser tower (HRT) systems, both deployed at Total's Clov development off Angola, and the buoyancy-supported riser (BSR) system, four of which were installed at the Petrobras-operated Guara-Lula NE project in Brazil (see Upstream Technology 04/2013). The company's coupled systems include flexibles, steel catenary risers (SCRs) and steel lazy-wave riser (SLWR) systems.

Recent developments in the riser programme have focused on the tethered catenary riser (TCR) concept, which consists of several SCRs supported by a subsurface buoy tethered to the seabed by a single pipe

tendon connected to a suction pile. The company has also developed new engineering tools, including software that screens a large number of SLWR configurations to determine the optimal solution for a deepwater project. New components include the Plastic Stopper, a polymer structural anchoring point used to secure buoyancy modules on HRT bundles.

For the flowline strategic technology programme, Sunde says, "we set out to make a portfolio of different flowline systems, have them prequalified, have them optimised, so when we then look at the early engagement, the conceptual stages, it allows us to try out different solutions over a tabletop exercise and see what works — what meets the criteria, what has the functionality and what is the best overall cost solution."

Subsea 7's industry partnerships provide crucial help, he says — KBR and Granherne on the conceptual FEED aspects, and OneSubsea for

the subsea production and processing systems expertise needed to create a "vertical integration" of subsea services.

"What we're doing is taking the different challenges and developing, individually, the different types of solutions that we have. It allows our design teams, when we look at conceptual work, together with OneSubsea or with KBR and Granherne, to use new technology when developing a field. The main gain here is changing the subsea architecture, simplifying it. There are huge commercial advantages to be gained from that."

On the technology front, Subsea 7 has put a lot of resources into enhancing the performance of both wet-coating flowline insulation systems, dry insulation (as in pipe-in-pipe flowlines) and active heating technologies such as direct electrical heating (DEH) and hot water heating for longer tie-backs.

Recent R&D has focused on

electrically heat traced flowline (EHTF) technology. "We've used water heating in bundles before. We've used DEH," Sunde says. "The next step is going toward electrically heat traced flowlines. With a partner, ITP InTerPipe, we've designed a pipe-in-pipe system that has the best thermal performance of any system."

The technology combines high-performance flowline insulation with EHTF to reduce the electrical power required for heating and the associated topside equipment. "The energy consumption is about 10% of DEH," he says. "It cuts a significant amount of cost from the topside point of view, but also from an opex point of view."

The system offers other cost benefits by changing the field architecture.

"In some of the West African jobs we studied, we looked at a typical field layout that involved a loop production flow and glycol injection plant," Sunde says. "The theory and methodology

**"The adoption of new technology is accelerating — there's an openness far beyond what we saw before."**

*Thomas Sunde,  
Subsea 7*

of any hydrate mitigation was, if you have a shutdown, you'll circulate the flow and inject glycol into it, which is standard and proven.

"In this system, you have a single line, so it removes the loop production. You halve the number of risers, and you also take away the glycol injection plant specifically for that production line. That's where an understanding of the field architecture, the design and conceptual part comes in. That's one of the systems we're developing which I think is a big game changer, even in conventional tieback lengths, and it expands the distances you can achieve."

Subsea 7 has also recently rolled out a mechanically lined reeled pipe, branded BuBi and developed in collaboration with German company Butting. The clad pipe, used at Guara-Lula NE and Statoil's Aasta Hansteen development, will be deployed at Wintershall's Maria project offshore Norway, where the pipe will be combined with a direct

electrical heating system (see page 35). The project will mark the first application of reeled corrosion resistant alloy-lined carbon steel pipe with a DEH system.

### Pushing limits

Subsea 7 is working on a next generation of its proven pipeline bundle technology, which has been widely deployed over the past 30 years. The technology packages multiple flowlines inside a carrier pipe, which is towed out for installation.

"It's a very impressive system, and it has shown huge value, especially in the UK and the type of infrastructure and challenges we have there," Sunde says. "Now we are taking it to a new level, adapting it for high-pressure, high-temperature (applications) and we are looking into the feasibility of providing bundle solutions in other locations apart from the North Sea."

The company is finalising a test programme for a bundle rated to 220 degrees Celsius (428



AGILE SWIMMER: Subsea 7 has reorganised its life-of-field business line and increased investment in related R&D, which includes the company's autonomous inspection vehicle.

degrees Fahrenheit) and pressure up to 20,000psi.

Additionally, "we've looked at extending the length of individual bundles," he says. "The longest we've towed is about 7.5 kilometres long. We're looking at extending that to 15 kilometres on a single tow. That's a big step."

The alliance with OneSubsea, announced in summer 2015, created an opportunity to

combine the Schlumberger company's subsea production systems expertise with Subsea 7's subsea umbilicals, risers and flowlines capabilities to create value, Sunde says. Technology development has been concentrated in three early focus areas — integrating subsea processing and boosting within a bundle system, extending the technical limits of long