Next-generation drilling risers

IFP Energies nouvelles is extending the operational domain of drilling risers with new technologies

While current specifications for deepwater drilling risers frequently reach 10,000 ft WD and 15,000 psi working pressure on the C&K Lines (BOP rating), more severe specifications are now being seen that will be hard to meet with current technologies.
To satisfy these new requirements for next-generation drilling risers, IFP Energies nouvelles (IFPEN) is developing two complementary new technologies:

- Hybrid Steel/Composite Technology to lighten C&K Lines;
- HyperStatic Integration (axial load-sharing) to decrease the main pipe wall thickness and increase the axial stiffness.

IFPEN is now launching a new qualification project to bring these technologies to the market.

Hybrid Steel/Composite Pipes for Choke and Kill Lines

An IFPEN – Composites Aquitaine joint development

Composite layers are wrapped under tension around a steel pipe to increase its internal pressure resistance, while the steel body provides resistance to axial loads and water-tightness.

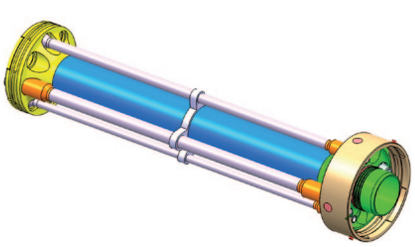
This hybrid technology is very beneficial to peripheral lines designed for high operating pressures (15,000 psi or more). It allows reducing the steel wall thickness by replacing a part of the steel with lighter composite material and by introducing a compressive prestress in the steel pipe. This leads to a 50% weight reduction on the C&K Lines and to 15 to 20% on the riser mass and buoyancy. The technology is especially well suited to riser upgrades. It has been extensively qualified in the lab and by a field test (**Field Testing of Hybrid Choke and Kill Lines,** Y. Poirette *et al.*, OTC 2009/SPE 20077).

HyperStatic Integration (axial load-sharing)

An IFPEN – Aker Drilling Risers joint development

HyperStatic Integration consists in fastening the peripheral lines to the main pipe at one or both ends of each riser joint to share the loads with the main pipe.

Field test of an hybrid line on the Pride Angola drillship.



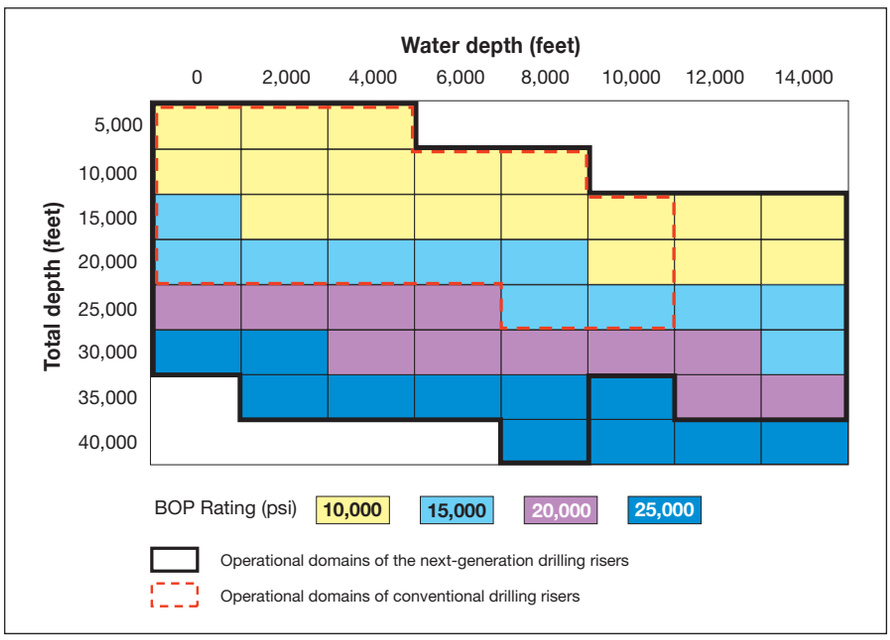
Principle of HSI (load-sharing).

The main advantage is the induced axial load-sharing that allows reducing significantly the wall thickness of the main pipe, and hence the riser mass by approximately 15%. This substantially decreases the amount of buoyancy required and improves the dynamic behavior of the riser when disconnected. The technology has been tested at small scale and is now going through a full-scale qualification program.

Benefits of the technologies

The conventional and next-generation riser technologies have been compared in terms of operational working envelopes. The operating envelopes are plotted according to water depth and total drilling depth. They are the result of a large parametric design study in which operational requirements such as riser mass, buoyancy diameter limitation, connector rating, dynamic hook load and axial natural period were taken into account (**New Riser Design and Technologies for Greater Water Depth and Deeper Drilling Operations,** E. Persent *et al.,* IADC2009/SPE 119519).

The benefits of the new IFPEN technologies can be clearly seen in the enclosed chart.



Operational domains of conventional and next-generation drilling risers.

Qualification of the technologies

Qualification of these technologies is now going on in order to bring them to market. It includes a phase of prototype manufacturing and testing, building on the experience of the conceptual and experimental studies already performed.
A field test of next-generation riser joints will also be considered to demonstrate the capability of the technologies to withstand environmental constraints and to prove their operational performance.

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