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Innovative 3-D Implementation of Riser Wake Interference Assessment

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ABSTRACT

As the water depth of field developments increases, the risers systems (SCR's, Flexibles, single HRT's or bundle-HRT's) follow parallel courses. Several recent experimental works (Blevins, et al., 2006 & 2007) have shown the significant length over which the lift and drag on a downstream cylinder is influenced by the wake of an upstream cylinder. However, current industry practice does not include the lift force contribution when assessing the riser wake interference. Both effects are considered – the drag reduction on a downstream riser due to it being in the wake of an upstream riser, and the lift force on the downstream riser towards the center of the wake of the upstream riser.

Several phases of model tests have been performed at the Scripps Institution of Oceanography. The paper provides details of the experimental set-up and main results. The tests were conducted at a Reynolds number of about 80 000. Conclusions are drawn on the possibility of extending the theoretical model (to include both the lift and drag) to cover VIV.

The paper also presents work to implement numerical models of wake interference in a riser analysis program. This work generalizes 2D theoretical models and test results to 3D modeling of real riser systems.

KEY WORDS

Riser Wake Interference, HRT, SCR, Lift Force, VIV, FPSO.

INTRODUCTION

As the water depth of oil & gas exploration is getting deeper and deeper, production risers become a critical component of field developments. Parallel risers are attached to these deepwater floating production units, such as Semi-submersible (Semi), Tension Leg Platform (TLP), Spars as well as Floating Production Storage and Offloading (FPSO). FPSOs are increasing popular worldwide; there will be two Turreted-Moored FPSO systems installed in the Gulf of Mexico (GOM) in the next few years.

The major types of deepwater risers are flexibles, Hybrid Riser Towers (HRTs) and Steel Catenary Risers (SCRs). Three HRT's (Figure 1) have been successfully in service with spread moored FPSO vessels in West Africa (WA) since 2001 on the Girassol Project. Two more HRTs have been also installed in WA lately. Besides being field proven, Hybrid Riser Towers offer the below specific advantages:

- Large diameter risers can be accommodated
- In-place riser fatigue is low
- Field layout is simplified and allows future expansion
- Demanding flow assurance requirements can be met
- Riser hang-off loads on the Floating Production Unit are drastically reduced

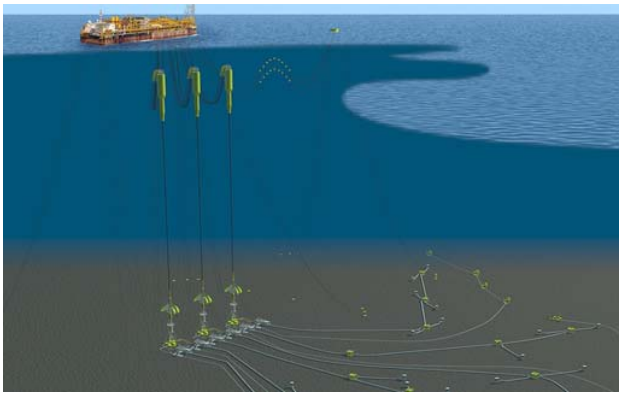

Figure 1: Riser Tower Systems installed at West Africa