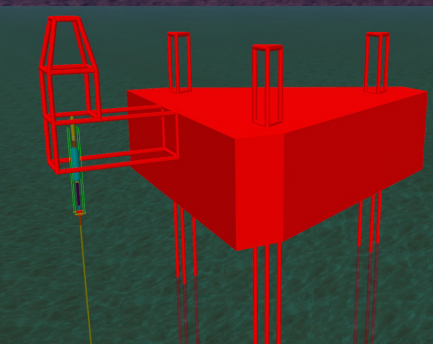


# HP DRILLING RISER ANALYSIS IN SHALLOW WATER FOR ABANDONMENT OPERATIONS FROM A JACKUP ON ARTEMIS

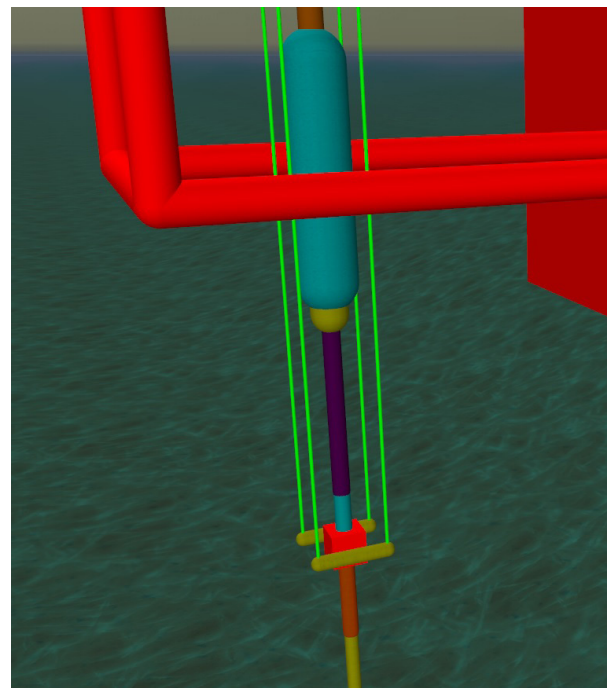


## BACKGROUND

The Artemis well to be plugged and abandoned was located in the Southern North Sea in 45m water depth. The well used a 13<sup>5</sup>/<sub>8</sub>" horizontal subsea tree on a 13<sup>5</sup>/<sub>8</sub>" subsea wellhead system. The subsea wellhead system was originally installed in 2002 from a jackup rig through the 30" conductor. The well, with horizontal subsea tree, was completed from a jackup rig using a 5000psi, 16" outside diameter high pressure rental riser system for 13<sup>5</sup>/<sub>8</sub>" equipment, with the jackup 13<sup>5</sup>/<sub>8</sub>" surface BOP.

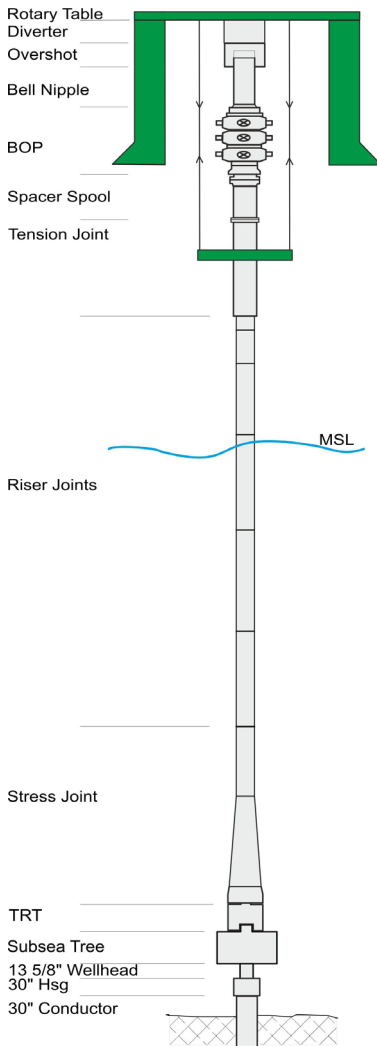
## CHALLENGE

AS Mosley was contracted by BP in 2012 to investigate the usage of the 16" high pressure (HP) rental riser system originally used for completion, but now for abandonment operations. An objective of the global riser analysis was to minimise riser top tension which would minimise loads on the proposed jackup rig whilst maximising compressive loading on the 13<sup>5</sup>/<sub>8</sub>" subsea wellhead system to improve wellhead performance. Also to be investigated was possible vortex induced vibration (VIV) on the 16" diameter riser from the relatively strong currents that may occur at the Artemis location, offshore Humberside.



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## SOLUTION



The global riser analysis with jackup and HP riser system, performed by AS Mosley, identified that the 16" riser system was susceptible to VIV in the strongest currents and recommended a suppression system be fitted to the riser. The analysis showed best riser performance was achieved by high riser top tensions, however a low top tension was recommended to improve subsea wellhead fatigue performance and reduce jackup pull-type riser tension loads.

Both fatigue performance and strength utilisation, with the 16" riser, was found to be acceptable throughout the system under extreme environmental loads with no riser disconnection. However, further investigation into the long rental life of the 16" riser system revealed that the history of riser usage was incomplete and the early seal verification testing was now considered obsolete. Enquires were made to check on the availability of other rental riser systems with better recorded history and testing, and although 24" diameter systems were available for 18 3/4" equipment, no other 16" system was available for 13 5/8" equipment.

## RESULTS

AS Mosley performed the global riser analysis for abandonment operations using a 16" HP rental riser system, and a top tension was identified that satisfied:

- Acceptable strength utilisation throughout the system under extreme environmental loads with no riser disconnection.
- Acceptable fatigue life for both riser system and 13 5/8" subsea equipment.
- Acceptable jackup rig tension loads that account for possible individual tension system failure.

Unfortunately, use of the readily available 16" rental riser system was no longer acceptable due to incomplete riser rental history and obsolete seal verification testing.

Even though initial load estimations did not look promising, it was decided that AS Mosley should investigate the possibility of performing Artemis abandonment operations using one of the available 24" high pressure rental riser systems.

Global riser analysis found that the available 24" riser system was less susceptible to VIV than the 16" riser and may only require VIV suppression in extreme current profiles. However, although strength utilisation of the 24" riser system was found to be perfectly acceptable, utilisation of the 13 5/8" subsea equipment, including wellhead, was found to be excessive even in moderate sea states. Fatigue life of the 24" riser system was also found to be acceptable, but life predictions for the 13 5/8" subsea equipment were found to be unacceptably short. Riser top tension optimisation also failed to deliver acceptable strength and fatigue results for the 13 5/8" subsea equipment. Usage of the available 24" HP riser system for the abandonment operations was therefore unacceptable.

Global riser analysis performed by AS Mosley on an available, but larger, 24" HP riser system for the abandonment operations gave unacceptable strength and fatigue results for the 13 5/8" subsea equipment. Therefore, it was necessary for BP to postpone the Artemis abandonment operation until a suitable riser system designed to pass 13 5/8" equipment, but with minimal outside diameter, could be sourced.

Being involved early in the process, AS Mosley was able to confirm the viability of the intended abandonment plan. Also, being truly independent of hardware manufacturers, AS Mosley was able to perform analysis on different hardware, from different manufactures, to an identical standard, which allowed direct performance comparisons to be made.