



Emergency Disconnect Procedures: Industry Approaches to DP Drift-Off Analysis

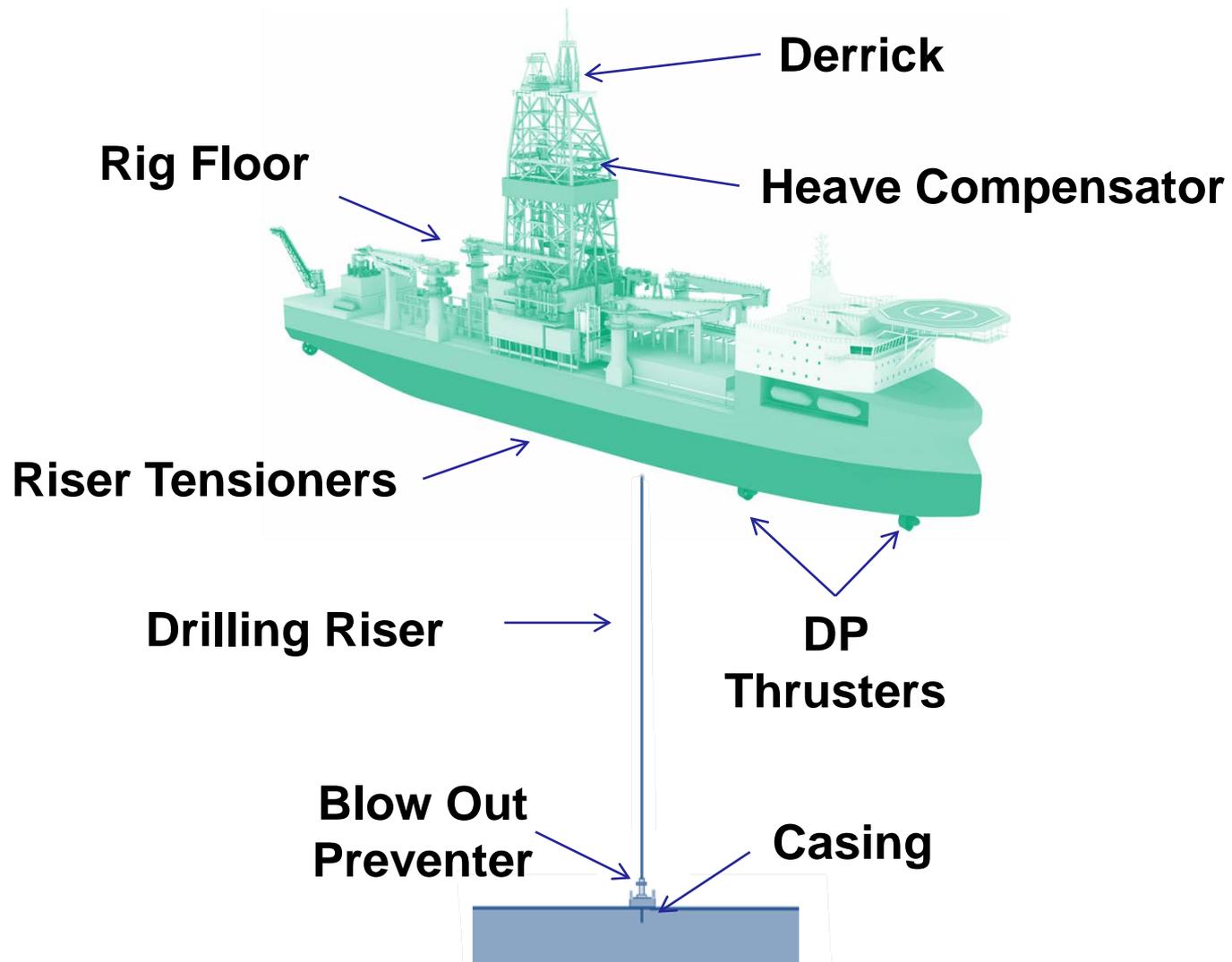
James N. Brekke, P.E.
Account Manager, Offshore
Energy Project Development
American Bureau of Shipping

Preview

- Background on DP Drillship Operations
- DP Watch Circles – Emergency Disconnect
- Drift-off Analysis Techniques
- Operations
- Conclusions



Drillship Operations



Drilling Riser Management

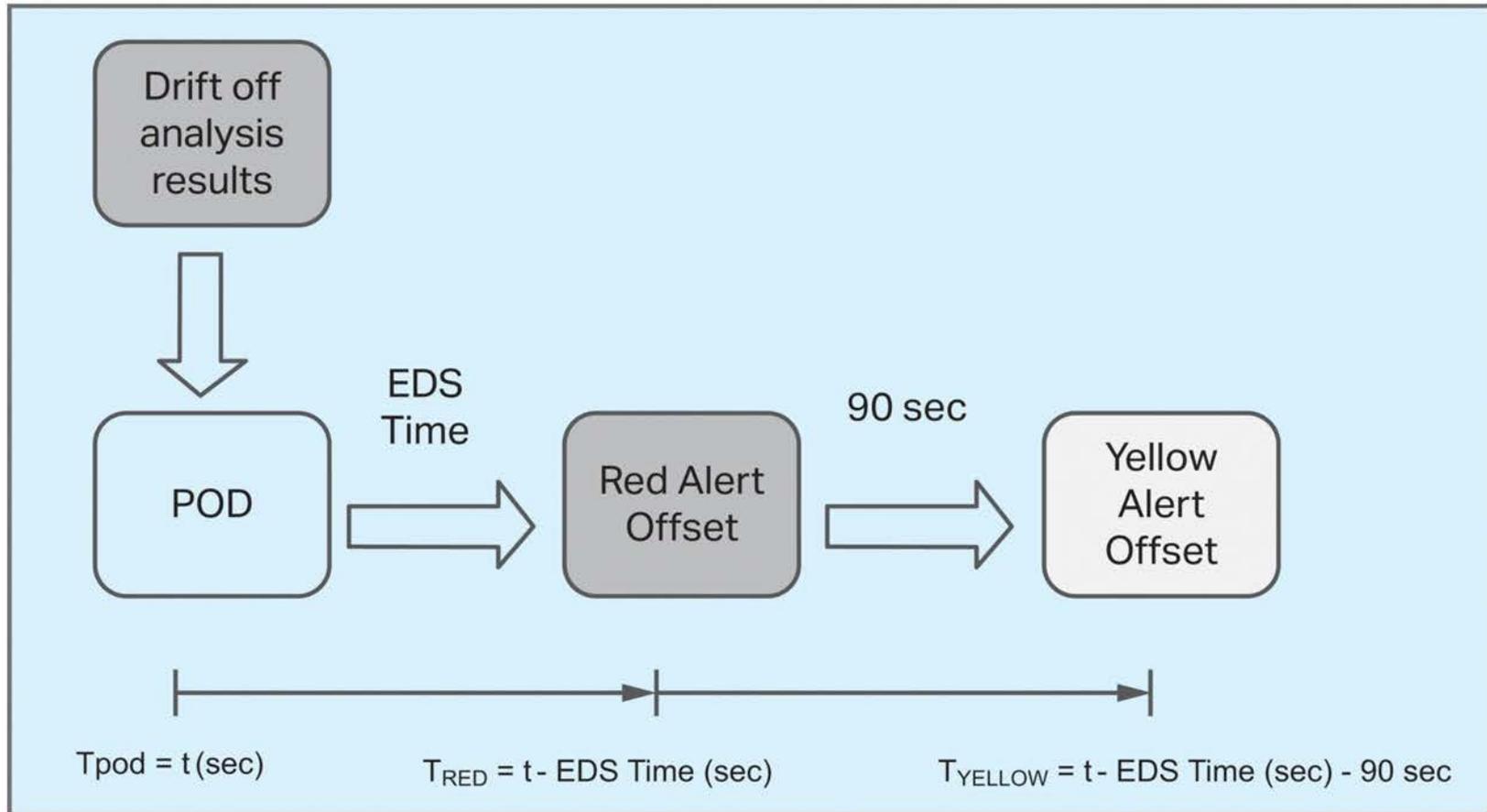
- Objective:
 - Protect the vessel, riser and well
 - Establish limits on operations
- Scope:
 - Riser deployment
 - Riser tensioning
 - Emergency disconnect
 - Riser recoil
 - Storm hang-off



Emergency Disconnect

- What is emergency disconnect?
- How often does it happen?
- Allowable limits:
 - Conductor pipe – bending stress
 - Wellhead – bending moment
 - Riser bottom flex joint – limiting angle
 - Riser top flex joint – limiting angle, moonpool contact
 - Riser slip joint – stroke limits
 - Riser tensioners – stroke limits
- How are these managed? **Watch Circles and Drift-Off Analysis.**

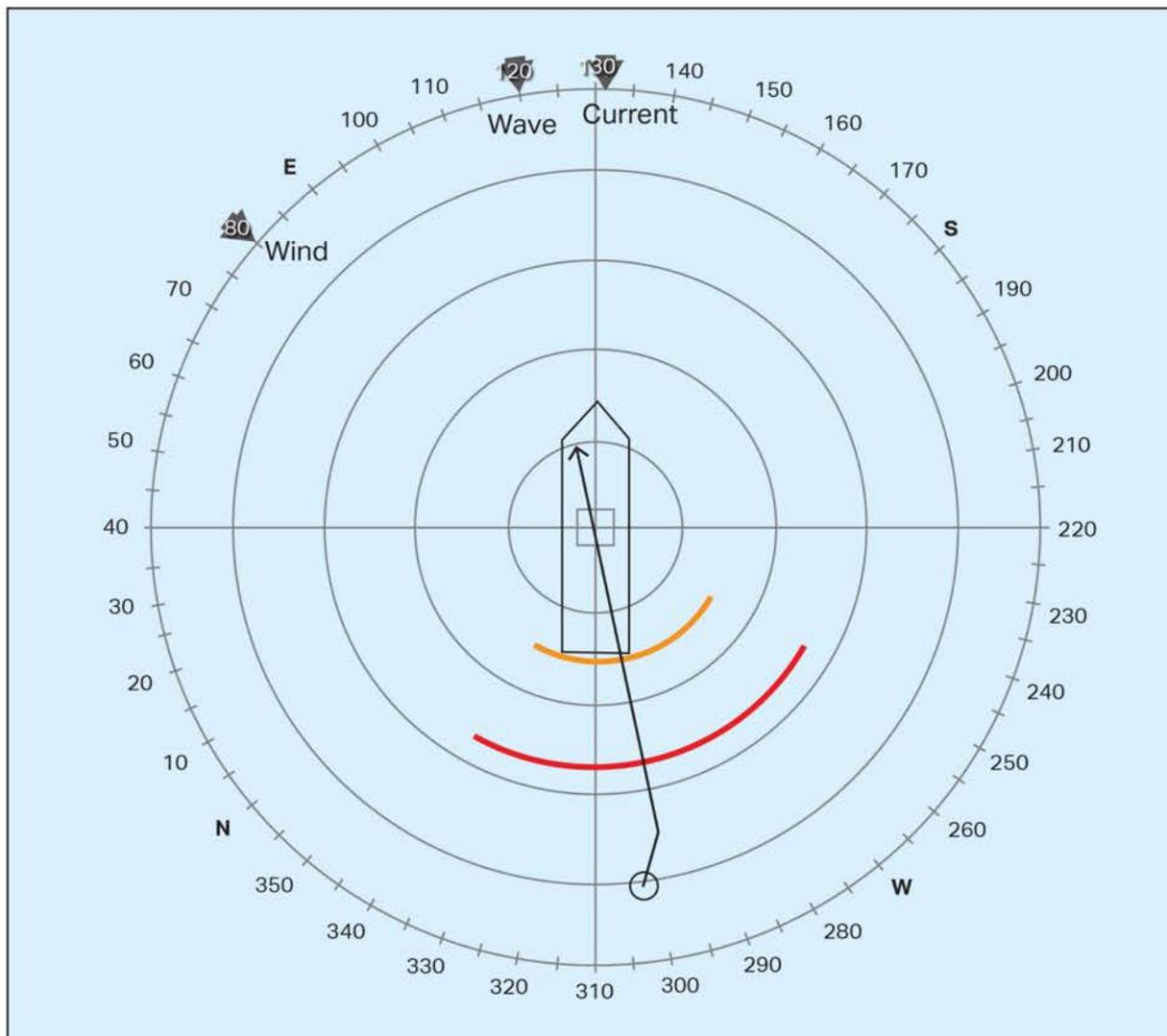
Watch Circles: Concept



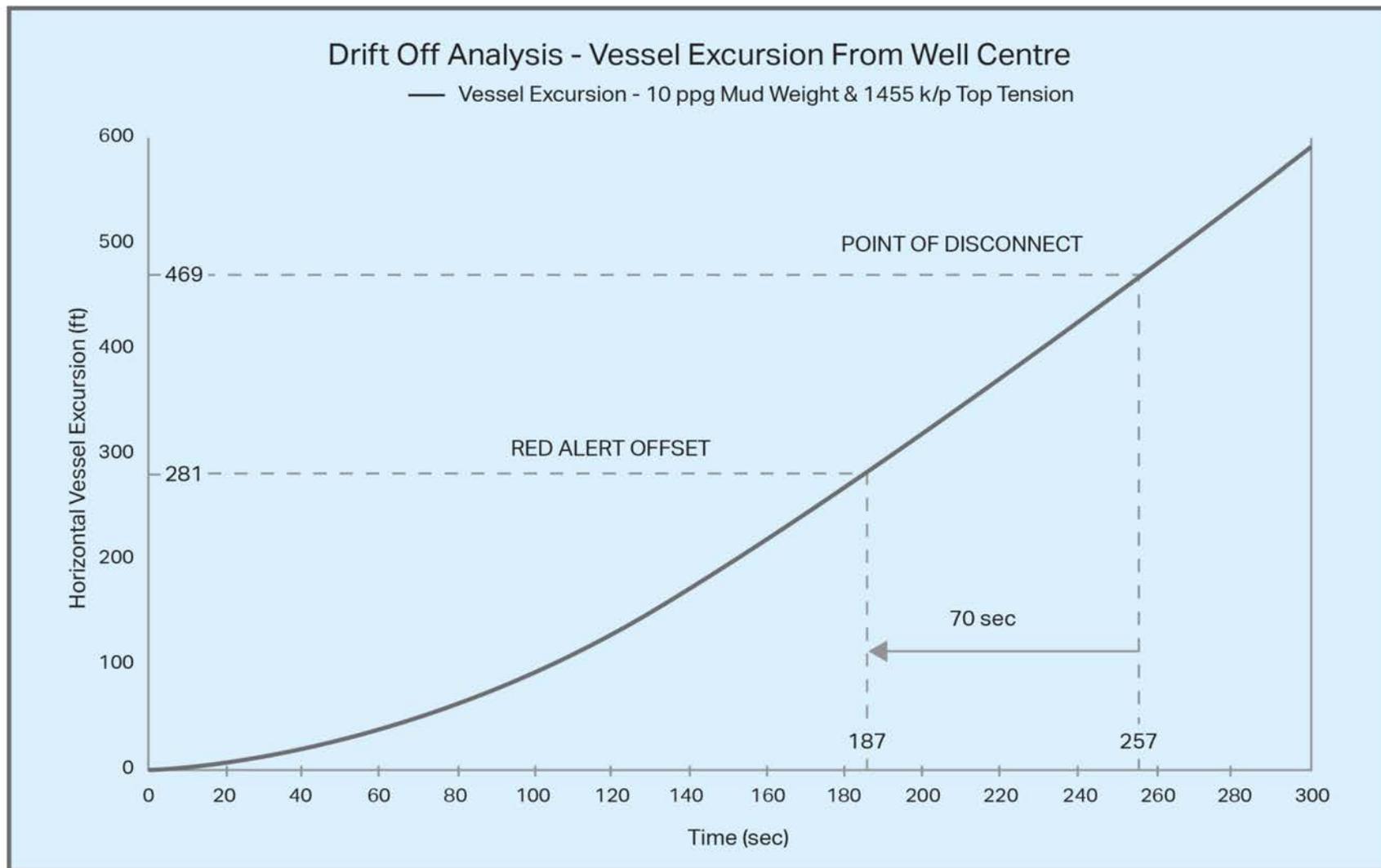
Watch Circles

- Thresholds that are color-coded yellow and red
- Established using drift-off analysis
- Based on scenarios of drift-off under total loss of power, drive-off, degraded thrusters, or other events
- Offset definitions:
 - Point of disconnect (POD) – offset at which any allowable limit is first exceeded
 - Red – offset at which the emergency disconnect sequence (EDS) must be activated. Drillpipe would be sheared during EDS.
 - Yellow – offset at which preparations begin prior to EDS

Watch Circles: Compass View



Drift-Off Analysis Results



Drift-Off Analysis Techniques

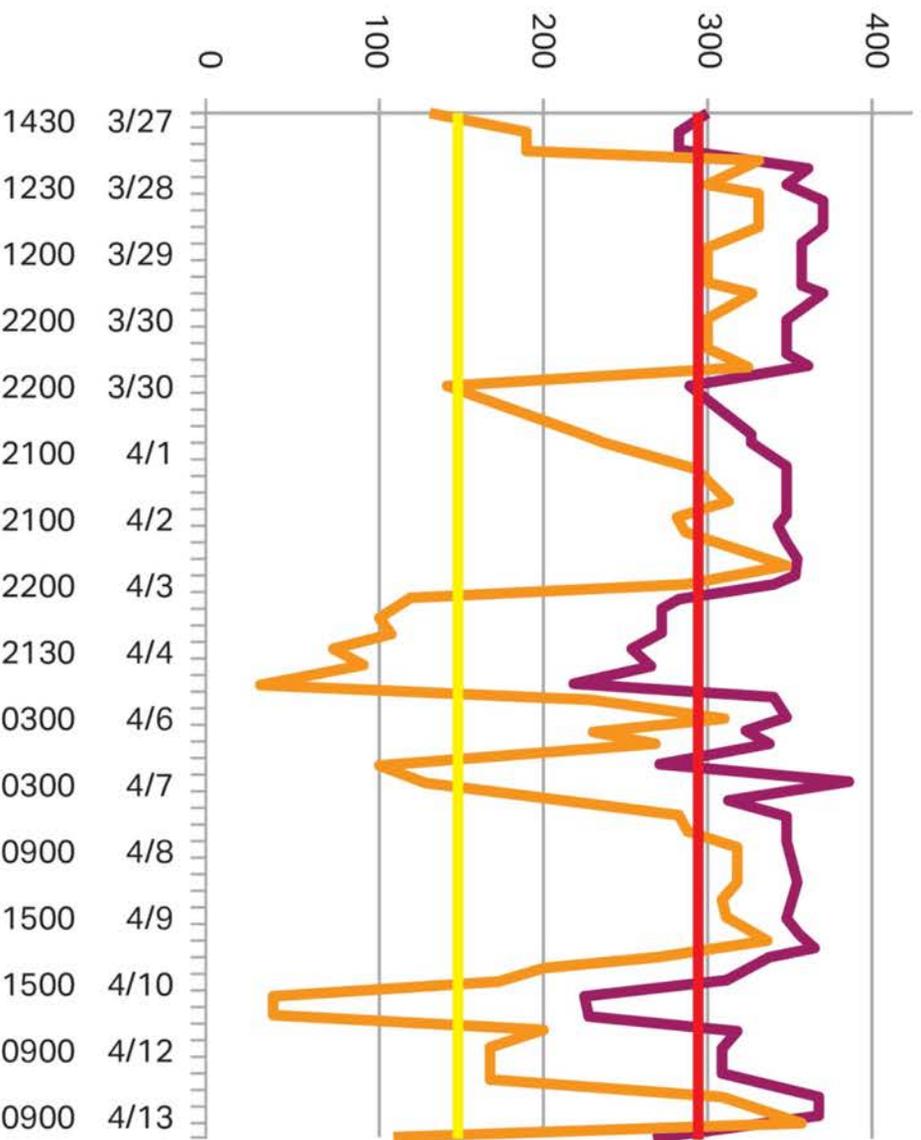
- Fully coupled analysis (state-of-the-art)
 - Riser analysis fully coupled with vessel analysis
 - Includes riser restoring force, riser dynamics
 - Ref: O’Sullivan, Soles, Dib, “Fully Coupled EDS/Drift-off Analysis for a Harsh Environment Deepwater Site” OMAE 2004 – 51631
- Uncoupled techniques
 - Vessel drift-off analysis without riser, static riser analysis
 - Vessel drift-off analysis without riser, dynamic riser analysis
- Fixed offset
 - Constant watch circle sizes, typically based on % water depth

Operations

- Dynamic Watch Circles (updates on the rig every 6 hours)
 - Prevailing or forecast weather
 - Changes in riser top tension or drilling mud weight
 - Can use coupled or uncoupled drift-off analysis



Fixed vs. Dynamic (Fully Coupled)



- Fully Coupled Yellow Limit
- Fully Coupled Red Limit
- Yellow Limit Fixed
- Red Limit Fixed

Conclusions

- Use of fully-coupled drift-off analysis makes a difference; providing a more realistic solution
- Regular updates of watch circles also make a difference, accounting for:
 - Prevailing weather
 - “What-if” forecast weather
 - Changes in top tension and mud weight
- Fully-coupled drift-off analysis is referenced as part of marine drilling riser assessments in ISO 13624-1 and ISO 13624-2.



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