Conductor and Riser Design Challenges for Deepwater Jackup Rigs

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Challenges of ‘Deep’ Water To Jackup Conductors And Risers

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Overview

- What is ‘deep’ water for jackup rigs?
- Jackup conductor/riser arrangements
- What are the limitations in ‘deep’ water?
- How do we overcome the limitations in ‘deep’ water?
Jackup Conductor/ Riser Arrangements

- Jackup
- Access/tensioning deck
- Conductor
- Surface wellhead
- Surface casing
- Surface BOP
- Overshot
- Diverter
- Casings
- Pull-up tensioner
- Push-up tensioner
- Template
- Mudline suspension (MLS)
- Subsea housing/wellhead
- Full-bore HP drilling riser

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What Are The Limitations In 'Deep' Water?

- System doesn’t scale well – increased jackup & riser deflections
- Limited ‘deep’ water experience in harsh environments
- High pressure typically requires large BOP – very stiff

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Conductor and Riser Design Issues

- Conductor/riser joints through tensioner (>1.0 $\sigma_y$, fatigue, >connection capacity)
- Conductor/riser joints above subsea wellhead (>1.0 $\sigma_y$, fatigue, >connection capacity)
- Connections to wellhead, tree and BOP (> capacity)
- Conductor joints below subsea wellhead (>1.0 $\sigma_y$, connection capacity)*
- Overshot lateral load (~40-60Te)
- Lateral load on tensioner and/or tension deck (~80-120Te)
- Overshot rotational lockup (0.5-5deg) induced load

* Generally improved compared with semi-submersible for subsea well with HP riser

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How Do We Overcome The Limitations In ‘Deep’ Water?

- Reduce conservatism in analysis methodologies
- Riser operational procedures
- Design changes to riser and vessel
- Integrity Management

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Reduce Analysis Conservatisms

- >30% improvement in response achievable

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Riser Operational Procedures

- De-pressurise (plug/water fill) – improve system capacity
- Disconnection of overshot mandrel

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Design Changes

- **Riser**
  - VLV suppression – strakes, fairings
  - Secondary tensioner systems
  - Flanged riser connections
  - Flange bolt material grade and preload increase
  - Localised wall thickness and material grade
  - Integrally forged joints
  - Flexible overshot mandrel

- **Vessel**
  - Increase rig load capacities
    - Vertical - cantilever/tension deck
    - Lateral - tension deck/overshot
  - Floating diverter

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Integrity Management

- Instrument riser
- Define integrity management plan
- Define key performance indicators (KPI) to assess response against
  - Green = no action required
  - Orange = evaluate responses further
  - Red = inform operator immediately
- Determine if measured responses match predicted responses
  - Validate analysis models
  - Calibrate riser models if required
  - Redefine KPI's if required

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Conclusions

- Conventional jackup conductor and riser arrangements do not scale well to ‘deep’ water (>>80m)
  - Large dynamic jackup motions
  - High dynamic loading on riser
  - Limited flexibility in riser components

- Jackups in depths of ~130m with 7000psi pressures are possible through
  - Improved analysis methodologies
  - Operational procedures
  - Design changes to riser and vessel
  - Integrity management of installed riser

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