Integrated Solution for Ultra Deep-Water Offshore Drilling in Challenging Regions

Subsea & Drilling Brazil Conference

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Wood Integrated Solution Overview
- Pre-Operations Global Drilling Riser Analysis;
- Forecast Analysis;
- Real-Time Analysis;
- Post-Operations Assessment & Analysis.

Real Case Study – Offshore Drilling French Guiana
Wood Integrated Solution for Offshore Drilling
Integrated Solutions for Offshore Drilling

- Statistical Metocean Data
- Forecast Metocean Conditions
- Actual Metocean Conditions
- Measured Operational Data

Pre-Operations Global Drilling Riser Analysis → Forecast Analysis → Real-Time Analysis → Data Integration

WSOG → Operational Decision-Making

DeepRiser, Optima-Offline, Optima-Online, Optima

Increasing Realism / Reducing Conservatism and Cost
Integrated Solutions for Offshore Drilling

- **Pre-Operations Global Drilling Riser Analysis**
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**Forecast Analysis** → **Real-Time Analysis** → **Data Integration** → **Operational Decision-Making**

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**WSOG**

**DeepRiser**

**Optima-Offline**

**Optima-Online**

**Optima**

**Increasing Realism / Reducing Conservatism and Cost**
Pre-Operational - Traditional Approach

- Analysis conducted prior to the operation and drilling program;
- Defines limits to vessel and riser operations;
- Metocean based on statistical data;
- Well Specific Operating Guidelines (WSOG);
- Field proven approach, but can be too conservative for harsh environmental conditions;
- Wait on weather is a significant cost during operation.
Integrated Solutions for Offshore Drilling

- **Pre-Operations Global Drilling Riser Analysis**
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**Operational Decision-Making**

- **Statistical Metocean Data**
- **Forecast Analysis**
- **Real-Time Analysis**
- **Data Integration**

**Increasing Realism / Reducing Conservatism and Cost**

**DeepRiser**

**Optima-Offline**

**Optima-Online**

**Optima**

**DataTrac**
Forecast Analysis

• Operational phase;
• Combine metocean forecasts with riser simulation;
• Confirm feasibility of planned operations;
• Eliminates conservatism of fixed WSOG;
• Continuous process – 24/7;
• 12-hr, 24-hr, 2-day, 3-day, 1-week look ahead;
• Informs critical decision-making;
• “What if” scenario planning.
Integrated Solutions for Offshore Drilling

Pre-Operations
Global Drilling Riser Analysis

Forecast Metocean Conditions

Forecast Analysis

Actual Metocean Conditions

Real-Time Analysis

Measured Operational Data

Data Integration

WSOG

Operational Decision-Making

DeepRiser

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Optima-Onlie

Optima

Increasing Realism / Reducing Conservatism and Cost
Real-Time Analysis

- Real-time simulation can provide:
  - Optimum vessel position advice;
  - Alert offsets for DP power-loss scenario;
  - Envelope of rig operation (drilling/standby);
  - Min & max top tension limits;
  - Optimum top tension;
  - ... And more
Real-Time Analysis

➢ Offshore Engineering Support

• Dedicated engineer available to perform spot checks analysis onboard;

• Able to combine/interpretate all the information produced for decision making.

• 24h operational support.
Integrated Solutions for Offshore Drilling

- **Pre-Operations Global Drilling Riser Analysis**
- **Forecast Metocean Conditions**
- **Actual Metocean Conditions**
- **Measurement Operational Data**

**Operational Decision-Making**

- **Statistical Metocean Data**
- **Forecast Analysis**
- **Real-Time Analysis**
- **Data Integration**

Increasing Realism / Reducing Conservatism and Cost
• Wealth of measured operational data

• Post-operations analytics enables:
  • Wellhead fatigue tracking;
  • Incident investigation.
  • Review / assessment of operational strategy;
  • Feedback to operational procedures;
  • Riser equipment usage tracking;

○ Single Database
○ Highly Interactive
○ Event time-lining
○ Operational Assessment
○ Black-Box recorder
○ Post-incident analysis

Data collection, analysis and reporting made easy
French Guiana Offshore Drilling Operation

Recent Experience
French Guiana – Recent Experience

➢ The Operation

- Offshore French Guiana;
- Water depth of 2120m;
- DP Drill Ship Drilling;
Scope of Work – Pre-operational

- Open Water Operations (Deployments)
- Connected Operations
- Pre-Operations Global Drilling Riser Analysis
  - Statistical Metocean Data
  - WSOG
- Emergency Disconnection Analysis
- Fatigue Analysis (VIV and FOF)

Scope of Work – During Operation

- Forecast Metocean Conditions
- Actual Metocean Conditions
- Measured Operational Data

Forecast Analysis → Offshore Engineering Support → Data Integration → Operational Decision-Making

Optima-Offline

DataTrac
The Challenge

➢ Currents

• Area of influence of the North Brazilian Current (NBC);

• Flows along the cost of northern Brazil and Guianas;

• Major contribution from Amazon river plume;

• Large internal waves responsible for a very rapid changes in current speed and direction.

[Image: https://oceancurrents.rsmas.miami.edu/atlantic/north-brazil_2.html]
Integrated Solutions for Offshore Drilling

**Integrated Solution for Ultra Deep Water Offshore Drilling in Challenging Regions**

- **Pre-Operations Global Drilling Riser Analysis**
- **Forecast Metocean Data**
- **Actual Metocean Conditions**
- **Measured Operational Data**
- **Forecast Analysis**
- **Offshore Engineering Support**
- **Data Integration**
- **Operational Decision-Making**

**Statistical Metocean Data**

**Forecast Metocean Conditions**

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**Measured Operational Data**

**WSOG**

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**Increasing Realism / Reducing Conservatism and Cost**
BOP Deployment Analysis

- Conducted prior to the operation;
- A range of current and waves combined based on metocean historical data;
- Four stages covered: splash, 50% and 75% of the riser deployed and BOP latch.
Results - Pre-operational Assessment (Static WSOG)

➢ **Static Deployment**
  • Deployment can be conducted with surface current speed of up to 1.4m/s (70% non-exceedance)
January

Static Deployment

- 66% NEXC current = 1.40m/s
- Predicted 34% of non-permit weather

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Drift-running – Mitigation Measure

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**Pros:**
- Reduced relative speed.

**Cons:**
- Upstream navigation;
- BOP latch needs to be static.
- Counter/loop current
Results - Pre-operational Assessment (Static WSOG)

Drift Running

- Deployment Can be Conducted With Surface Current Speed of up to 1.8m/s (90% Non-exceedance);
- Day of connection current needs to be under 1.4m/s;
Deployment Up-time Assessment

➢ January Drift-running
   • 90% NEXC Current = 1.73m/s;
   • Predicted 10% of Non-permit Weather;

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Static Deployment

• Deployment can be conducted with surface current Speed of up to 1.4m/s (70% Non-exceedance);

• Predicted 34% of Non-permit Weather;

Drift-running – 0.5knots

• Deployment can be conducted with surface current speed of up to 1.8m/s (90% Non-exceedance);

• Predicted 10% of Non-permit Weather.
Integrated Solutions for Offshore Drilling

Pre-Operations Global Drilling Riser Analysis

Forecast Metocean Conditions

Actual Metocean Conditions

Measured Operational Data

Statistical Metocean Data

Forecast Analysis

Offshore Engineering Support

Data Integration

WSOG

Operational Decision-Making

DeepRiser

Optima-Offline

Optima

Increasing Realism / Reducing Conservatism and Cost
BOP Deployment Operation

- Takes at Least Four Days to Complete;
- BOP Pressure Test Conducted in Four Water Depths;
- Fairing Installation.
### Current Forecast

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*80% of the Allowable
Above Allowable*
On-Board Decision-Making Tool

Drift-running

- Analysis shows drift-running could be a solution;
- Vessel would have to travel sufficient distance for 4 days of deployment;
- Weather Would have to Improve for BOP Latch;
- Pessimistic Weather Forecast for Connection Day.
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Increasing Realism / Reducing Conservatism and Cost
Prior to Deployment ADCP

- ADCP Readings Showing Current Below the Limit

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On-Board Decision-Making Tool

➢ Support Vessel Drift Test

Vessel Trajectory for Drift Test
On-Board Decision-Making Tool

Static Deployment

• NBC vortex location mistakenly predicted by forecast;

• Risk Assessment for Decision Making;

• Successful Static Deployment.
Main Conclusions
Case Study Main Conclusions

Ultra-deepwater (>2,000m), harsh environment location

BOP Deployment could not be conducted based on fixed WSOG

Wait On Weather as per fixed WSOG

Wait on Weather (WoW) would take up to 4 days Based on Weather Forecast

Approx. 4 days WoW + upstream navigation at a considerable daily cost

Multiple $M in savings

Perform riser simulations using actual forecast metocean conditions

Offshore Engineering support for decision making: ADCP reading and support vessel drift test

Outcome: deployment conducted statically: no drift-running required
1. Pre-operational global riser analysis to cover a wide range of environmental scenarios to provide inputs for the WSOG

2. Onshore based support for tracking and optimization of offshore operations

3. Engineering Tool Package to reduce conservatism through real-time on-board simulation (offshore support)

4. Enhances safety by real-time monitoring & analysis

5. Reduce operational down-time and costs