Advanced Dynamic Training Simulator for Drilling as well as Related Experience from Training of Drilling Teams with Focus on Realistic Downhole Feedback

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  – Market
  – Technology
• Simulator capabilities
  – Top-side
  – Dynamic down-hole
• Operations
  – HPHT, TTRD, ERD, MPD
• Future perspective
• Drilling simulator training
  – Application
  – Experience
Background

• Market
  – Not available in 2010
  – Customer encourage suppliers to cooperate

• Technology
  – Dynamic models verified
    RealTime in MPD and Decision
    support systems

  – State of the Art Topside Drilling
    equipment simulator
Downhole

- Advanced integrated hydraulics and temperature model
  - Realistic transient calculations
  - Realistic dynamic effects
  - Multi-phase capabilities
    - Realistic gas behavior in oil- and water based muds
- Dynamic torque and drag calculations integrated with topside simulator
  - Realistic feedback from draw works
- ROP model for realistic WOB

= Realistic feedback from virtual well
Topside

- Modern offshore drilling rig containing standard generic equipment that can be configured to operate like an actual rig’s equipment
  - Drawworks
  - Heave compensator
  - Topdrive
  - Iron Roughneck
  - Mud pumps
  - Active mud system
  - Pipe handling machinery including racking machine and fingerboard
  - Trip tank system (pump and tank)
  - Valves, surface lines, kelly line, slip-joint, Chokes, BOP, etc
Simulator configuration

- **Topside**
  - Surface lines
  - Valves
  - Pumps
  - Tanks and fluids
  - BOP stack
  - Chokes
  - Fluid properties

- **Downhole**
  - Drill string and BHA components
  - Well path
  - Formation properties
  - Formation “Hardness”
  - Reservoirs
  - Loss zones
Simulator infrastructure

- Topside simulator
- Flow model (P, T)
- T/D Model w/ ROP
Simulator infrastructure
User interface
Operations

The dynamic training simulator will enable realistic training on the following:

- Drilling and tripping operations
- Stripping operations
- Connections
- Multi fluid operations
- Well control (kick and losses)
- TTRD (Through Tubing Rotary Drilling)
- MPD (Managed Pressure Drilling)
- HPHT (High Pressure High Temperature)
- ERD (Extended Reach Drilling)

Relevant feedback from well in all operations due to dynamic response…….
MPD training

- Complex operation
- Sub contractors
- Procedure testing
- Extra equipment
  - MPD choke
  - Backpressure pump
- Testing 3rd part control system

- Experience
  - Improvement on 3rd part system due to new challenging TTRD configuration
Future perspective

• Education/learning
• Customize for Drill Well On Paper Exercises
• Test and train on new drilling methods/concepts
• Seamless integration with RealTime operation
• Use Simulator models and virtual well as a planning / design verification tool. (Coupling T/D, hydraulics & temperatures in one system)
Training Philosophy

Statoil's ambition is to raise company-wide performance and thus reduce the likelihood of loss due to deficient quality and precision in our activities.

Our objectives are thus **improved risk handling**, more **effective work processes** and continued **development of leadership skills** in order to provide the foundations for a value-based performance culture.

To ensure quality in all aspects of Statoil’s activities, we have decided to introduce a generic work form for use in all delivery processes.

**The Compliance & Leadership model**

This model applies to any task and is the way we work in Statoil, also when performing training at the Drilling Simulator.
The goal is to provide **realistic team training** on common and **critical drilling and well operations** according to the **Compliance and Leadership** model.
Training Preparations

PROJECT DEFINED CHALLENGES

- Pore Pressure ramp
- Geological uncertainty
- Fracture/Loss/Ballooning
- Collapse / Pack-off
- Small operational window
- Underground blow-out
- Operational procedures
- Contingency procedures
- Emergency systems

SIMULATOR CAPABILITIES

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CONFIGURATION

Input data for Training Simulator

(Provide input data to "green" cells depending on type of cases for simulator, or if pre-defined cases should be used)

1. Survey
2. Wellbore Geometry
3. Formation
4. Stability & Temperature
5. Cases & Parameters
6. Drilstring
7. Fluids
8. Rig data

9. In addition Project need to submit input data on Geological layers according to specifications
1. Compliance & Leadership
2. Focus points (Project)
3. The Task (SimTeam/Project)
4. Driller’s Handover (Instructor)
5. Instructions (Leaders)
6. Assessment (Group)
7. Execution (Group)
8. Event
   - Detect, React, Recover
9. Evaluation (All)
10. Lessons learned (All)
11. Feedback (Group)
Experience

DW100 – Well Construction Process

**BENEFITS FROM THE SIMULATOR**

Verification of plans and procedures.

Enhanced risk assessment and planning.

Focus on down-hole conditions and limitations, including key drilling parameters and best practices.

Realistic application of skills and competence.

Confidence with critical events and well control situations.

Team approach to handling of well specific challenges (CRM).

Verification of emergency systems and relevant procedures.

Understanding of the Compliance and Leadership model.

A **team** that is better prepared to execute tasks, handle critical situations and to ensure safe and efficient drilling operations.
Thank you for the attention, any questions?