KONGSBERG DIGITAL

Achieving well construction efficiency through an independent realtime data platform to enable ‘Monitor-By-Recommendation’ of critical operations.

Dismas Bismo Tjitrosoemarto
Technical-Sales Asia Pacific – Oil & Gas, Kongsberg Digital
From Deep Sea to Outer Space
SOLUTIONS TO PEOPLE AND COMPANIES OPERATING UNDER EXTREME CONDITIONS

Determination • Innovation • Collaboration • Reliable
PRESENTATION OVERVIEW

Achieving well construction efficiency through an independent real-time data platform to enable ‘Monitor-By-Recommendation’ of critical operations.

• THIS IS KONGSBERG

• REAL-TIME DATA MANAGEMENT STRATEGY FOR WELL CONSTRUCTION

• CASES STUDIES
WELL CONSTRUCTION
Well construction efficiency is key to achieve operators’ cost reduction targets. Reducing time spend in well construction has a major impact on total costs as ~80% of costs are time-driven.

Challenges in Well Construction
- Extraction is more challenging → well profiles are more demanding.
- Complex process. → Many steps and many companies involved.
- D&E technology is keeping up → volume and complexity of data is growing; making it difficult to get a holistic view of the operation.
- ‘The Big Crew Change’ - Dilution of in-house domain expertise

Operators’ five business objectives
- Drill CHEAPLY
- Drill ACCURATELY
- Drill CONSISTENTLY
- Drill SAFELY
- Drill QUICKLY

Operators’ five business objectives when planning, drilling, and delivering wells.
- Interlinked through cause and effect.

Inefficient well delivery can cause significant financial impact.
- Inefficient well delivery costs time and potentially safety, which means risk, which costs money; it also results in reduced production – which is the sole return on the investment of drilling a well.
- Damage company’s reputation!

Digital solutions and advanced analytics can help navigate the complexity, to make rapid and accurate decisions that improve efficiency and safety.
- An integrated realtime data solutions that help operators address the challenges associated with meeting these objectives will bring significant and immediate value.

“If a well is completed quickly and without any incident, then cost are saved, if the back-to-back wells are repeatedly and placed on target then production will be maximized.”

Ref. SPE 166686 • Matt Regan, Igland, J. K., & Andresen, P. A, KOGT.
INDEPENDENT REALTIME DATA MANAGEMENT PLATFORM: BUSINESS VALUE PROPOSITION

Optimizing Well Delivery in Realtime from Spud to Completion through Intelligent Use of Applied Data Management and Standards

BUSINESS VALUE

✓ Ensure successful critical operations

✓ Displaying complex information in an easily-consumable, integrated and standardised way

✓ Independent acquisition, checking, and provision of data.

✓ Standard-Based (WITSML).

✓ Full control of data.

A realtime data management strategy and infrastructure must be built on a solid foundation – a platform of trusted, standardized and robust data acquisition.
INDEPENDENT REALTIME DATA MANAGEMENT PLATFORM: BUSINESS VALUE PROPOSITION

Use your expertise to its full extent. Better expertise following up on wells optimizes the drilling operation.

Monitoring by Recommendation: Advisory Consoles

- Latest step in real-time data solution: predictive and advisory consoles
- Complex processing + automated problem detection + holistic presentation
- Driving standard workflows

Monitoring by Exception: Smart Agents

- ‘intelligent’ data management: no longer monitor logs, now monitor KPIs

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Key Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drilling data</td>
<td>MSE</td>
</tr>
<tr>
<td>Fluid data</td>
<td>Hydraulics/slip velocities/CC1</td>
</tr>
<tr>
<td>Surface data</td>
<td>Rig activity</td>
</tr>
<tr>
<td>Gas data</td>
<td>Gas ratios</td>
</tr>
</tbody>
</table>

Optimizing Well Delivery in Real-Time from Spud to Completion through Intelligent Use of Applied Data Management and Standards • Matt Regan, Kongsberg Oil & Gas Technologies
INDEPENDENT REALTIME DATA MANAGEMENT PLATFORM: OPERATOR D&E DATA MANAGEMENT PLATFORM

KONGSBERG suite of tools to build on to support you in your journey towards increasingly analytical decision making.

At Rig Site

Rig Site data providers supplying raw data in WITSML and/or WITS0

- LWD Provider (WITSML)
- Mudlogging Provider… (WITS0)
- Rig provider, etc… (OPC Profibus)

Operator IT Environment

Data management independent of rigsite service provider

Central D&E database for onward population of existing applications: modeling, reporting, benchmarking, etc

End-user using one interface (SiteCom Discovery™)

ONE central Client database (SiteCom®)

ALL data transmitted, hosted AND managed completely within Client domain

WITSML Feed

Client Applications

Discovery Mobile
End-users

Discovery Web
End-users

Central Data Repository

Client Hosting Facility

Rig Site data providers supplying raw data in WITSML and/or WITS0

(DD/MWD/LWD, Mudlogging, Cementing, MPD/UBD/CT, etc.)
INDEPENDENT REALTIME DATA MANAGEMENT PLATFORM: OPERATOR D&E DATA MANAGEMENT PLATFORM
Sophisticated visualization of realtime operations data across all well construction phases. Free flow of technical data across all applications and services needed to solve the efficiency issues.

Sophisticated Visualization of Realtime Operations Data
- One web-based interface.
- Integrated (across service companies).
- Static Data & Real-Time Data.
- Planned vs Real-Time Data.
- 3D Visualization.
- Across all well construction phases.
- Perform sophisticated realtime calculations.

Seamless Flow of Technical Data
- WITSML certified product.
- Recognized as the first software system that has been designed from the ground up as a real-time WITSML server. → Considerably faster and more efficient.
REALTIME DATA MANAGEMENT PLATFORM: NATIONAL D&E DATA MANAGEMENT PLATFORM

Lean automated and reporting. Accurate reporting based on actual time breakdown: Trusted KPIs → identify true NPT/ILT → design appropriate best practice

Commercial analytics with embedded IDS
Lean automated reporting and eliminate manual data collection through:

1. integration with existing systems f.ex. EDM (remove duplication of effort/entry)
2. driven by quality-checked realtime data
3. automatic rig state detection and fixed-test remarks (queriable, objective truth!)

Accurate reporting based on actual time breakdown → trusted KPIs → identify true NPT/ILT → design appropriate best practice
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• REAL-TIME DATA MANAGEMENT STRATEGY FOR WELL CONSTRUCTION

• CASES STUDIES
CASE STUDIES

Tapping into Corporate Domain Expertise Using a Standard Realtime Data Solution.
‘Data Highway’ - the de facto hub of the organization’s wider suite of tools, acting as a conduit through which rigsite data flow to, from, and between these tools.

- A holistic strategic approach to overcome: Technical Aspects and Human Aspects.
  - Build stakeholder confidence in a trusted solution
  - A solution was made available ‘to serve, not to supervise’, and users are encouraged to embrace the service ‘by invitation, not by imposition’.
- Now local offices retain authority, but are supported far more effectively, and timely, by expert peers in HQ and other locations incl. on the road (mobile).

From Dataflow to Workflow
Standard data platform now enables next-level value delivery:
→ Cherry-pick independent realtime data analysis providers/expertise.
→ Development of Standard Operating Practices.

CASE STUDIES
Tapping into Corporate Domain Expertise Using a Standard Realtime Data Solution
SPE/IADC 173058 • Case Study: Tapping into Corporate Domain Expertise Using a Standard Realtime Data Solution • Regan, M., & Kucs, R. (2015, March 17).

CASE STUDIES
A standardised independent self-managed realtime data management infrastructure to facilitate seamless flow of realtime technical data transparently throughout the organisation.

Real-time environment was fully managed by the service-company.
- Company has an in-house RTOC to support drilling operations globally, staffed entirely by service-company personnel.

Strategy to move towards an in-house and self-managed real-time operation service, unlock the potential for cost efficiency.
- The entire solution is entirely within the company’s IT environment and under the company’s IT department oversight.
- Capable to supported various types of well construction operations and integration of various systems; i.e. Well Testing, Gravel Pack, UBD, Soft Torque System, etc.

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SPE/IADC 173058 • Case Study: Tapping into Corporate Domain Expertise Using a Standard Realtime Data Solution • Regan, M., & Kucs, R. (2015, March 17).
CASE STUDIES
WellAdvisor build capability to integrate real-time data with predictive tools, processes, and expertise to enable timely and well-informed operational decisions.

**Mission:** To integrate advanced real-time data processing with oil company expertise, policies and guidelines to transform the safety and integrity of well operations, while improving well performance and reliability.

- Enhance operational safety
- Improve well construction efficiency
- Improve life of well reliability
- Consistency in application of company’s drilling know-how and expertise
- Business transformation – deployment of a solution
CASE STUDIES

WellAdvisor applications reduce downhole issues, and shows the analytics competence to build on for further analytics solutions

WellAdvisor consoles address important downhole issues

<table>
<thead>
<tr>
<th>Operational Safety</th>
<th>Well construction efficiency</th>
<th>Life of well reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 BOP monitoring</td>
<td>4 Casing running</td>
<td>8 Cementing</td>
</tr>
<tr>
<td>Monitoring of BOP health and valve positions, and simplified diagnostics information</td>
<td>Early warning of differential sticking in the wellbore and filters hook-load data plotted against modeled drag curves</td>
<td>Monitoring of cement jobs with key measured and calculated values to support verification of cement well barriers</td>
</tr>
<tr>
<td>2 Pressure testing</td>
<td>5 Rig site fluid management</td>
<td>9 Completions</td>
</tr>
<tr>
<td>Displays, interprets, and documents positive BOP and well barrier pressure tests in real time, assuring compliance with regulations</td>
<td>Early warning for lost circulation and well control issues and annular pressure display to detect wellbore ballooning</td>
<td>Monitoring of torque and drag to identify completion problems and provides real-time make-up torque performance for analysis</td>
</tr>
<tr>
<td>3 No drilling surprises</td>
<td>6 Drilling operations</td>
<td>8 Life of well reliability</td>
</tr>
<tr>
<td>Provides real-time early warning indicators of subsurface risks</td>
<td>Real time wellbore stability and hole cleaning information to understand the drilling envelope and driller to help subsequent operations</td>
<td>Monitoring of cement jobs with key measured and calculated values to support verification of cement well barriers</td>
</tr>
<tr>
<td>7 Rate of penetration</td>
<td>7 Drilling operations</td>
<td>5 Casing running</td>
</tr>
<tr>
<td>Improves ROP, drill-bit performance and reduces shock and vibration</td>
<td>Real time wellbore stability and hole cleaning information to understand the drilling envelope and driller to help subsequent operations</td>
<td>Early warning of differential sticking in the wellbore and filters hook-load data plotted against modeled drag curves</td>
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Take-aways

- The 9 downhole well construction analytics consoles have demonstrated great value for customers.
- Building on this with broader data and analytics can reduce well construction time spend
  - Expanding data platform to rig and topside data
  - Advanced analytics can further find root causes

Highlight:
The Casing Running Console was the first console to be developed. As of late 2014 deployed to 26 offshore rigs
- > 250 monitored runs.
- > 550 km of tubular has been driven.
- No stuck tubular incidents have occurred.
- Has identified 9 runs where the console was used to make an intervention or significantly influence an outcome.
CASE STUDIES
WellAdvisor applications reduce downhole issues, and shows the analytics competence to build on for further analytics solutions.
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Summary - Value Proposition

➢ **Single-source, one-stop real-time D&E data management solution**
  - Aggregate all data from all rig data providers in real time
  - Deliver all data to single central D&E data hub
  - All hosted within client IT environment; client retains complete ownership
  - All based on industry-standard WITSML
  - Single viewing package for all data, real time and historical
  - Drilling engineers and Geologists learn, use and administer only one data tool
  - Web-based, fastest data store/recall on the market
  - Seamless interface to existing applications: reporting, modeling, asset management

➢ **Vendor-neutral: technically and contractually independent**
  - Company now gets independent value from realtime Drilling and Geological data

➢ **Central integrated D&E knowledge store**
  - All D&E data, from all sources, from all rigs
  - Central repository of all Company’s historical/planned data as well as realtime
  - Secure and efficient: off-the-shelf, all within Company IT domain/oversight

➢ **Fully integrated ‘bigger picture’ of entire realtime operation**

➢ **Immediate, informed, collaborative operational decision making and support**
  - Available all the time, in realtime, to all who need it

➢ **Effective and efficient use of assets, expertise and experience**
  - Tangible ROI made in obtaining realtime data, becomes a useful, usable asset
  - Advanced visualization: Smart Agents, 3D, Mobile, Well Advisory modules
  - Onward population of existing Company applications: f.ex. Petrel, EDM/OpenSuite, etc.
Kongsberg Digital – world-leading independent provider

- Kongsberg Digital is the preferred partner for Oil & Gas supermajors that depend on **stable, scalable, high performance** systems for real-time data management.
WORLD CLASS
THROUGH PEOPLE, TECHNOLOGY AND DEDICATION