Real-Time Monitoring of Offshore Oil and Gas Operations Workshop

Responses to Third-Party Real-time Monitoring Providers panel
Chuck Salminen

- 6 years experience with Weatherford in various roles (domestic and international)
- Current position: Sr. Drilling Optimization Engineer
- Responsible for remote operations monitoring and development of automated hazard detection capabilities
- B.S. Petroleum Engineering, U. of Texas – Austin (2009)
What services do you provide?

- Real-time Data and Expert Services
  - Drilling & Completions
  - Production
- Managed Pressure Drilling (MPD)
- Mud Logging (SLS)
- Directional Drilling, M/LWD & Geosteering
- Tubing Running Services (TRS)
- Fishing & Re-entry (Sidetrack)
- Drilling With Casing (DWC)
- Consulting Services:
  - Reservoir Characterization
  - Well Engineering & Project Management
  - Production Optimization
How do the services lend themselves toward operational decision making?

- RTM integrates formation evaluation and all relevant drilling data across a common platform
- Real-time data provides key information to make accurate, time-critical decisions to avoid potential hazards and manage costs effectively while optimizing performance
- RTM environment leverages knowledge of highly-skilled personnel across all rig operations
- Remote, secure, real-time monitoring & quality control of data, optimization of, operations
- Auditable communications trail between RTM & Rig Site
What are your suggested protocols for remote oversight and the established chain of command?

• RTM exists to provide rig site personnel with support & advice to enable safe operations
• Ultimate authority resides at the rig site
• Auditable communications trail between RTM & rig determined in Well Construction Interface Document, (WCID), developed according to project requirements as part of HAZOPs planning. May include:
  • Direct communication with Operator Supervisor
  • Direct communication with Weatherford Supervisor(s), including MPD, DD, M/LWD, SLS etc
  • Indirect communication with Operator Supervisor via Drilling Team
  • Email, SMS etc...
• Tends to be Customer / Rig / Project specific
What are the critical operations and specific parameters that are typically monitored?

- Drilling, Tripping (including casing & completions), Well Control, Leak-off tests; all operations - potential for safety critical events are always present
- All rig & 3rd party sensors should be monitored by RTM
- Redundant sensors should be in place for:
  - Pit levels
  - Total Gas (mandatory) Delta Gas (preferred)
  - Flow, SPP, Casing Pressure, Choke & Kill Line Pressures
  - H₂S, CO₂ (Field specific)
- Survey (for anti-collision)
- MPD
  - Critical alerts
  - Rig status
  - Drilling fluid tracking
  - System diagnostics
Does your company rely on any automation and predictive software in real-time monitoring?

- Predictive (RTM & Rig Site):
  - Hydraulics
  - Kick
  - Torque & Drag
  - Drillstring Analysis
  - Pore / Frac Pressures
  - Wellbore Stability
- Intelligent Agents (IAs) & Expert Services (ES)
- Rotary Steerable Tool (RSS)
- **Automated Capability** (Optional at Rig Site):
  - Kick & Loss Detection & Control
  - Annular Pressure Control
  - PID Controls (Chokes)
Condition-based monitoring is viewed by BSEE as monitoring the operating condition of critical equipment and using any generated data to predict and proactively intervene when needed. As such, what role could condition-based monitoring play in real-time monitoring? Describe how operating equipment using condition-based monitoring could be tailored and/or used for real-time monitoring.

- Equipment Health Monitoring (Diagnostic)
  - ICU (Instrumentation & control Unit)
  - Flow meter
  - HMI (Human Machine Interface) Health
- Equipment Performance Monitoring
  - Rotating Control Device (RCD)
    - Rubber life (Fluid type, temperature, alignment)
  - Chokes (Total mass flow, working hours, cuttings size & temperature)
  - Piping (Erosion, corrosion & similar)
  - Valves (Total usage, open/close, Erosion, corrosion etc)
- GWD (Gas While Drilling) Standard provides QC of gas detection system
- Cross checking critical parameters derived from multiple sources
- Critical parameters for downhole tools; e.g. Vibration, temperature, pressure, etc, internal service quality & reliability