Overview

Drilling Automation
- Why automate with examples
- Industry Groups
DSA-TS Architecture
Opportunities for WITSML
What is an Automated Rig?

Conventional

Automated
RSS PowerDrive Activity US Land 2004

Number of Runs on Automated rigs versus conventional rigs

- 220 Conventional
- 115 Automated

Footage Drilled on Automated rigs versus conventional rigs

- 295,707 Conventional
- 254,600 Automated

- 34% of all PD runs in USL to date are on Automated rigs
- 46% of PD footage has been drilled on Automated rigs
- Average run length of 2,213 ft on Automated compared to 1,344 ft on any other rig
- Automated rigs used on difficult well
- RSS predominantly used on ‘good’ land rigs
RSS Performance US Land

Cost/Ft

Automated
Conventional

Mean Footage to Failure

Automated
Conventional

Conventional
Gen 1&2
Gen 3

Increasing Technology

Welcome to productive drilling
Automated Steering

Predict RSS Tool settings and then advise and/or control the RSS via downlinks to tool.
Automatic Downlinking

Manual method

Automatic method

Welcome to productive drilling
Shell Clifdale Asset, Peace River

In 2009, a Shell-engineered SCADA system was installed on a hydraulic rack-and-pinion rig. It integrated the control and data acquisition systems of:

- Top Drive
- Mud Pumps
- Electronic Data Recorder
- MWD (un-manned)
- Flow Meters

“Two multi-lateral oil production wells were drilled in closed-loop autonomous fashion, with the SCADA system controlling the entire rotary and slide-drilling process from slips-out to slips-in, without driller intervention. This included automatically generated trajectory steering commands.”
@Balance MPD

Welcome to productive drilling

Schlumberger
Industry Committees

IADC ART - Advanced Rig Technology
- Reliability
- Future Technology
- Drilling CS
- Technology Value Guide

SPE DSA-TS – Drilling System Automation Technical Section
- Communication Sub-Team
**Phase I**
- Identify and define key interface points to equipment on rig
- Agree upon a list of tag names for the key interface points for use in communication protocols
- Agree upon at least one open communication protocol between components

**Phase II**
- Define components of architecture
- Define high levels roles and responsibilities of each component
  - Security
  - Heartbeat – Protocol and methodology
  - Etc.

**Phase III**
- Identify and define industry terminology necessary to enable process automation for drilling of oil and gas wells
- Define interface for components (e.g. limits management, authorization, alarm & events, etc.)

**Phase IV**
- Define commissioning tests (starting conditions, procedure, and expected results) for DSATs Comms Box control system.
DSA-TS
Automation Architecture

Communication Protocols
- OPC UA
- Proprietary

DCD
- Isolates Rig Equipment
  - Security / Authorization
  - Standard Interface
    - Equipment Interfaces
    - External Interfaces
OPC UA (Unified Architecture)

- Moves from COM to Web Services
- Easier to implement on non-Microsoft OS.
- Single set of services to expose all OPC Services (DA, HDA, A&E, …)
- Organizations need efficient method to expose and move high level structured data

Protocols that support:
- Security & Authentication
- Binary data transfer
- Publish / Subscribe
- RT Data Access
- Historical Data Access
- Alarms & Events
- Discovery
WITSML Opportunities / Directions

OPC UA

MIMOSA - An Operations and Maintenance Information Open System Alliance
ISA – International Society of Automation
IEC – International Electrotechnical Commission

Lay schema on top of services to get access to data.
- Integrate with off-the-shelf OPC UA data servers / client
WITSML Opportunities / Directions
Automation Metadata

Surface Equipment
- Description
- Tags
  - RT Values
  - Set Points
  - Limits / Capacities

Top Drive
FDS 150 portable direct drive patented Top Drives for Service Rigs and shallow to medium depth drilling rigs.

Features:
- Integrated Swivel and Traveling Block
- Back Torque Track and Bushing
- Integrated Backup Leg
- Integrated Thread Saver
- Top Drive Extend, c/w Back Torque Track
- Front Torque Track Available, no extend

Specifications:
- Rated Capacity = 150 Ton
- API Dynamic Capacity = 100 Ton
- Pull Down Capacity = 15 Ton
- Breakout Torque = 15,000 ft-lb
- Makeup Torque = 13,000 ft-lb

Top Drive Running range:
@ 40 RPM max 23,500 ft-lb (Intermittent)
@ 100 RPM max 19,000 ft-lb
@ 180 RPM max 13,000 ft-lb
Maximum Speed = 200 RPM

Torque / Hookload Sensor Sub
Mud Pump

Schlumberger
WITSML Opportunities / Directions
Automation Metadata

Surface Equipment

- **Description**
- Tags
  - RT Values
  - Set Points
- Limits / Capacities

Manufacturer
- FDS

Firmware Version
- V5.6.3

Owner
- Saxon

Type
- Top Drive Controller

Etc.

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WITSML Opportunities / Directions
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Real-Time Values
- RPM (TD_SPEED_REF)
- Angular Position (TD_POS_DEGR)
- Torque (TD_TORQUE_REF)
- Bail Position (TD_BAILS_POS_REF)
- Brake On (TD_BRAKE_ON_OFF)
- Etc.

Set Points
- Enable (REM_DRILL_ON_CMD)
- RPM (TD_RPM_SP)
- Max Torque (TD_MAX_DRILL_TORQUE_SP)
- Angular Position (TD_POS_DEGR_SP)
- Gear (TD_GEAR_SP)
- Etc.
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WITSML Opportunities / Directions
Automation Metadata

Network Topology
- Agent Description
- Company
- Users
- Status
- Versions
- Services
- Etc.
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Questions?