Digital Blowout Preventer with the PI System

Presented by
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Resources: Our use of the term “resources” in this presentation includes quantities of oil and gas not yet classified as SEC proved oil and gas reserves. Resources are consistent with the Society of Petroleum Engineers 2P and 2C definitions.

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COMPANY PROFILE

- Shell is an innovation-driven global group of energy and petrochemical companies
- We are active in more than 70 countries
- Worldwide, we employ 93,000 full-time employees
- Our fuel retail network has around 43,000 service stations
- On average, we produce 3 million barrels of oil equivalent per day (crude oil and natural gas).
- In 2015, we:
  - generated earnings* of $3.8 billion
  - had $28.9 billion of capital investment
  - spent $1.1 billion on R&D
- Royal Dutch Shell plc is a UK company, with its headquarters in the Netherlands
- We are listed on the stock exchanges of Amsterdam, London and New York

*On a current cost of supplies basis attributable to Royal Dutch Shell plc shareholders
Source: 2015 Annual Report and Form 20-F
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Agenda

Business Case
- Domain
- Business Approach
- Case for Change

Solution Overview
- Data
- Displays

Methodology
- Data Engineering
Digital BOP at Shell

COMPANY and GOAL
Shell provides well delivery support and wanted to improve the **reliability of blowout preventers** in their drilling contractor fleet.

CHALLENGE
Manual data reporting provided an incomplete understanding of BOP health and usage.

- Pressures and Temperatures available only via daily readings.
- Usage information limited to best-guess based on time.
- Failures not detected until they exhibited functional symptoms.

SOLUTION
Using the PI System as a data engineering toolkit, Shell implemented a BOP monitoring application.

- Three custom dashboards
- PI Coresight™ screens for ad-hoc trending
- Significant data processing to derive information from data

RESULTS
First instance of onshore detection of a control fluid leak in the industry.

- Onshore monitoring of regulatory testing
- Collection of previously unavailable usage information
- Organizational awareness of BOP health
What is a Subsea Blowout Preventer (BOP)

- Pressure Control Safety Equipment
- Used for Deepwater Drilling and Completion
- Installed on the Subsea Wellhead
- Operational Uses (Well Control)
- Emergency Uses (Shear and Seal)

Digital BOP - Case for Action

BOP is a Major Cause of Non-Productive Time (NPT)

- Testing & Certification
- Unplanned Maintenance
- Component Failures
- Stack Pull Decisions

Digital BOP Objectives

- Continuously Understand the BOP Condition
Digital BOP – BOP Reliability Team

Mission statement
The BOP RELIABILITY TEAM supports Shell’s deep-water drilling operations globally by increasing BOP reliability through engineering & operations support, and analysis of BOP performance data.

Operations
- Troubleshooting and Maintenance Support
- Regulatory Compliance Support
- Fleet Failure Tracking
- Real-time Operating Center (RTOC)

Engineering
- Shear Testing Support
- Accumulator Sizing
- Future Designs / Special Projects

Technology & Data
- Real-time Analytics
- Monitoring Dashboards
- Expert Systems
Digital BOP – Real-Time Operating Center (RTOC)
Digital BOP – Opportunities

Remote Certification
- Reduce trips offshore
- Lower cost for third-party surveyors

Failure Detection
- Leaks
- Seal failures
- Regulator failures
- Valve failures

Organizational Awareness
- Drilling Superintendents
- BOP Operations Team
- Regulatory

Reliability Statistics
- Cycle counts
- Pressure exposure
- Temperature exposure
- Time subsea

Operational Guidance
- Function selection
- Maintenance
- Testing Exceptions

Operational Guidance
- Reliability Statistics
- Organizational Awareness
- Failure Detection
- Remote Certification
Digital BOP – Leak Detected

- RTOC monitoring detected anomaly
- Rig investigated with ROV
- Leak was confirmed
- Operational guidance - MOC
Digital BOP – Available Data

Digital BOP uses available data from equipment and sensors to improve BOP performance and reliability.

Data sources include:

- 150 individual values
- 2 redundant electronic modules
- 2 redundant control pods
- 20 surface readings
Digital BOP – Custom Dashboards

Current state of valves and preventers

Valve state history bar chart

Headline readback pressures

* Note: Dashboard image does not represent actual readings.
Digital BOP – Custom Dashboards

HPU Boost Unit

Surface Accumulator

Subsea Accumulators

HPU Unit and reservoir

Shear Pressure Notifications

* Note: Dashboard image does not represent actual readings.
Digital BOP – PI Coresight Dashboards

- Pressure Trend Display
- Valve State Display
- Adhoc Trending

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Methodology
# Digital BOP – Data Engineering

**Data engineering** is the multi-disciplinary practice of **engineering** computing systems and algorithms to derive **information** from **data**.

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Digital BOP – Data Engineering Example

“Active” BOP

- Each rig has 2 BOP’s
- Only one BOP is connected to the control system at a time
- Data must be segregated by connected, or “active”, BOP
- Use cases:
  - Cycle counting
  - Failure detection
Digital BOP – Data Engineering for Time-series Data

Consumption
- AF SDK
- PI Coresight™

Processing
- Asset Analytics
- PI OLEDB Enterprise

Modeling
- Asset Framework

Storage
- Data Archive
- Event Frames

Ingestion
- PI Interfaces
- AF SDK

The PI System® provides an integrated suite of software tools that implement a data transformation layer for operational data.
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Thank You

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Merci
Gracias
ありがとう
Спасибо
Obrigado