

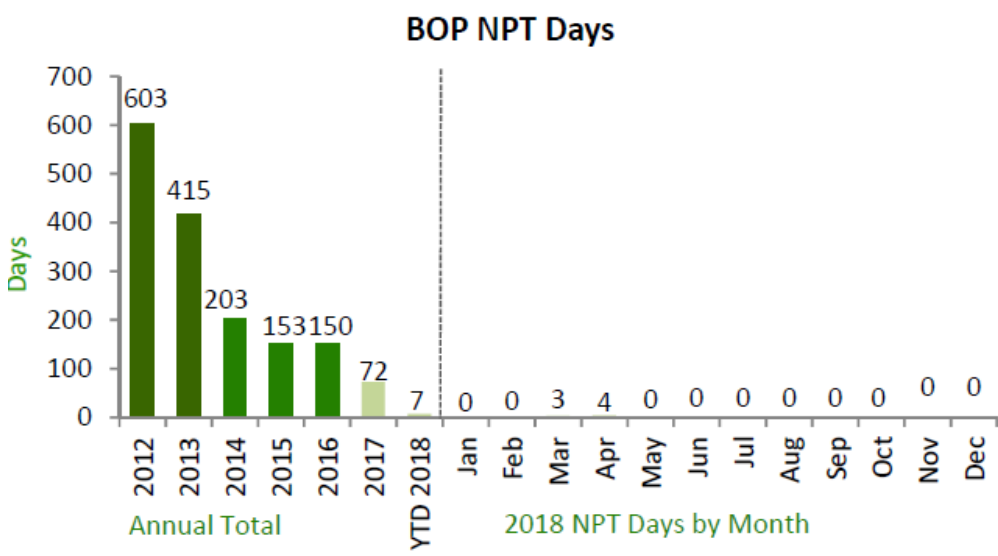
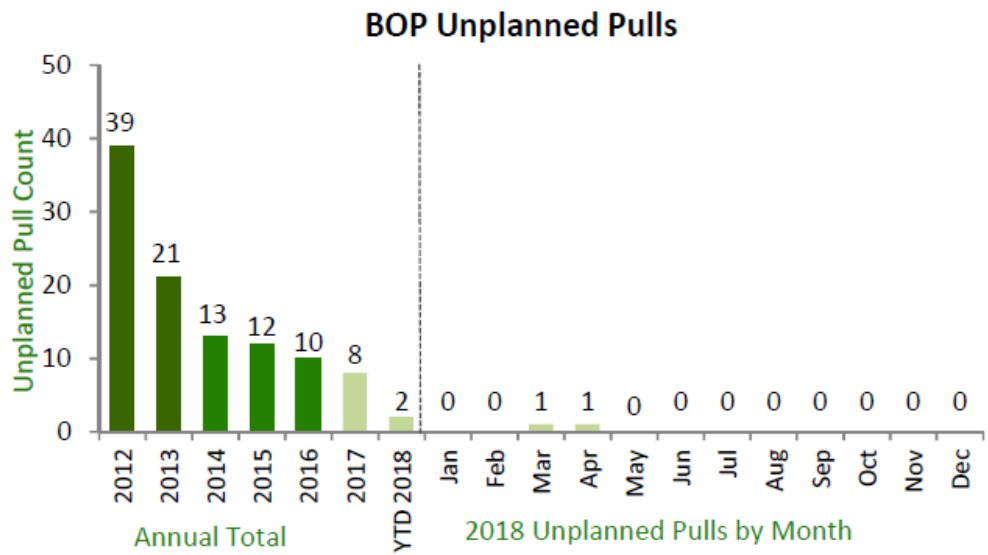


BOP reliability – an operator's journey



Trent Fleece, BOP Operations Team Lead
Safety 30 Conference, Aberdeen, UK
Wednesday, 6 June 2018

BP global BOP reliability improvements



- BP BOP global data over last 6 years
- 88% reduction in BOP non-productive time (NPT) over timeframe
- Significant decline in BOP defects over the last 6 years
- Data driven work – BP BOP defect database, Industry database (IOGP/IADC S53)

BOP reliability challenges

- During the last cycle, shipyard's built 80+ new mobile offshore drilling units (MODUs), most with dual BOPs
- Drilling contractors (DCs) typically bought the rig after the vessel (and well control equipment) had been specified by the shipyard
- Operators typically signed rig contracts after the rig (and BOPs) had started construction
- Inter-related challenges of capital efficiency, cost of maintenance and equipment reliability
- Industry downturn has caused reduction of personnel at DCs and BOP original equipment manufacturers (OEMs)
 - Several major DCs have declared bankruptcy

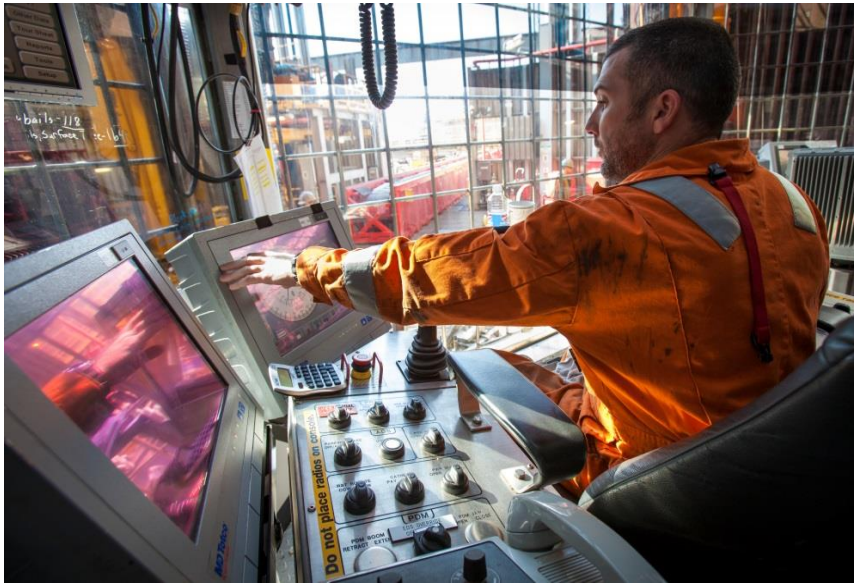
BP working collaboratively to enhance BOP reliability



- Defect elimination
 - Root Cause Failure Analysis (RCFA)
 - Work with OEMs and DCs to publish engineering bulletins/product improvement bulletins (EB/PIB) to industry
- BOP maintenance
 - Procedures, rigor, preservation and testing
 - Optimization – human error vs wear and tear
 - *Future – condition based maintenance – Real time monitoring (RTM) Phase 3
- Implement best practice and engineered improvements
 - BOP health monitoring
 - Implementing OEM PIB/EB on rigs
 - Led industry bolting upgrade initiative
 - Led industry RCFA on blind shear ram blade failures



BP's approach to BOP real time monitoring



- **Phase 1 – Health Monitoring**
 - Allows viewing of the data logger at Operator, DC and OEM locations
 - Alarm status – red/green
- **Phase 2 – Condition based Maintenance**
 - Monitor cycles on BOP components vs time based
 - Run analytics on failures and perform maintenance prior to expected failure
- **Phase 3 – Predictive Maintenance**
 - Monitor BOP data – i.e. solenoid electrical readback, regulator readback
 - Perform maintenance prior to component failure based on real time data from the BOP system



RTM enhances BOP reliability

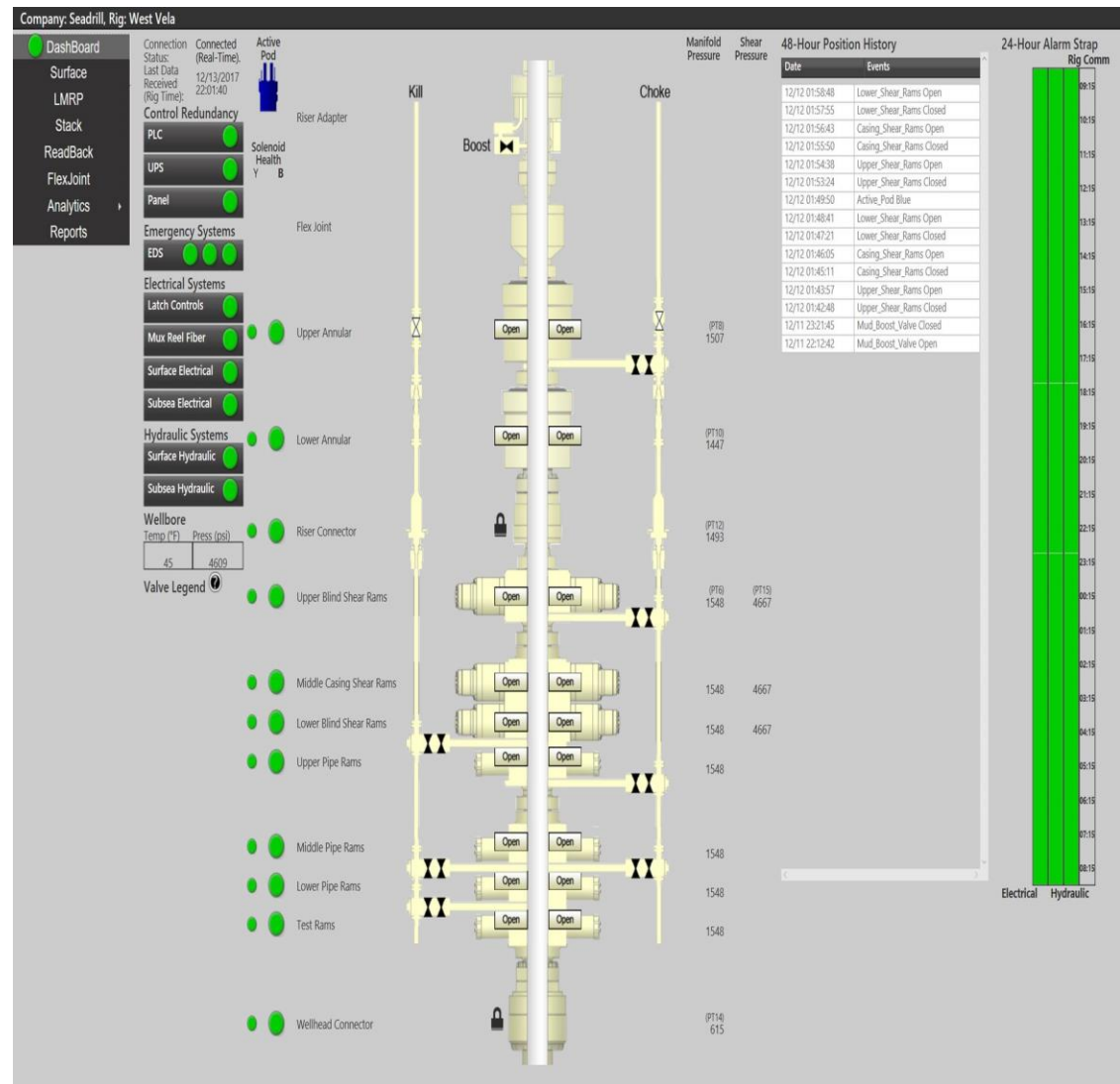


Smart Notifications

1. System monitors data
2. Compares trends against 'what good likes'
3. Compares trends against what failure looks like
4. Alerts users trending towards failure signature

Monitoring

- Regulator pressure
- Open under pressure
- HPU pump
- Leak detection
- Annular BOP
- Accumulator precharge
- BOP closing time



BOP reliability overview

Component design

BP focus area – RT monitoring Ph 3

Component qualification

Component burn-in

Maintenance

BP focus area – RT monitoring Ph 2

Usage

BOP defect

RT monitoring Ph 1

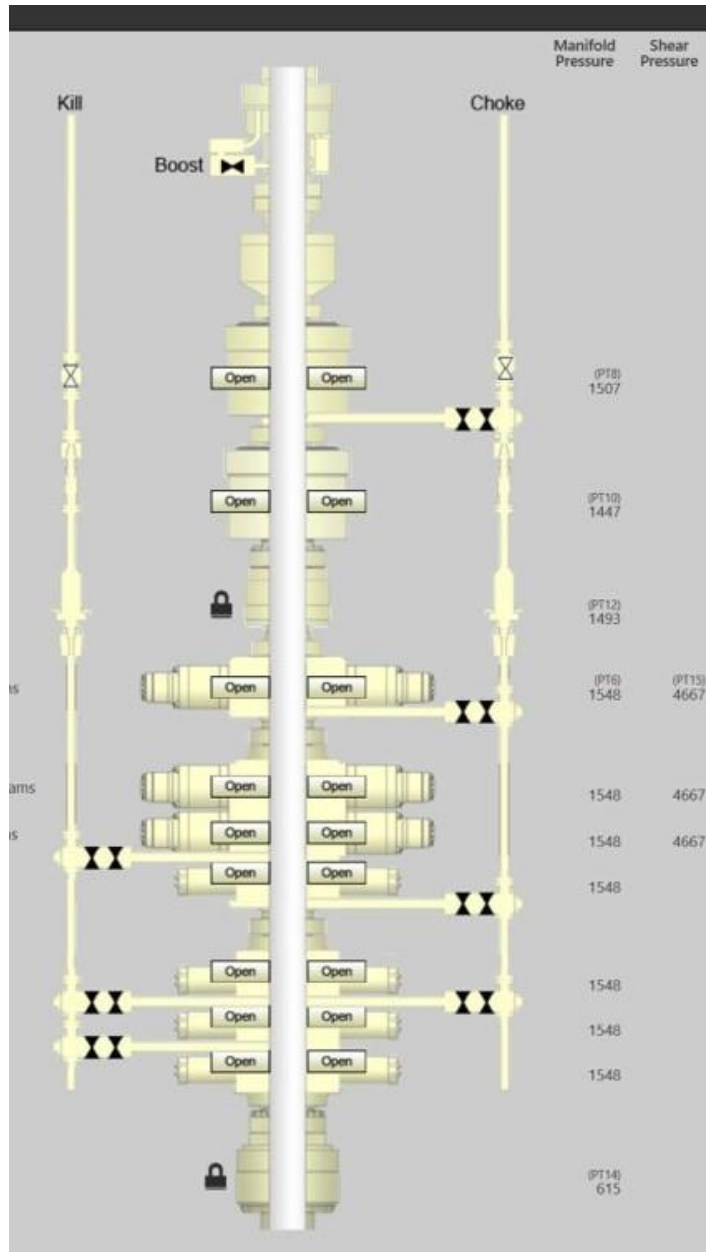
Risk Assessment

Repair

RCFA

BP focus area – RT monitoring Ph1,2,3

- Standardization of BOP requirements across regions
 - API Standard 53 – configuration and testing
 - Involvement in Standards development
- Risk Assessment on BOP defects that don't impact primary or secondary well control
- Innovative approaches to complex challenges
 - Industry response to bolting failures
 - Industry working in collaboration with regulator
 - Original equipment manufacturer, drilling contractor and operator workgroup
 - Voluntary upgrades to BOP equipment
 - Development of new standards to address root causes
- BOP reliability is a win-win-win proposition
 - Good for the DC and OEM
 - Good for the Operator
 - Good for the Regulator



- Real time monitoring to further enhance BOP reliability
- Continue defect elimination work fronts
- Progressing towards condition based and ultimately predictive maintenance
- Working collaboratively with OEMs and DCs to publish engineering bulletins and product improvement bulletins (EBs/PIBs) to Industry from RCFA work

Questions

