First Digital Drilling Analytic and Advisory Service in **Pertamina**:
The Journey to Reduce Invisible Lost Time on Pertamina Hulu Kalimantan Timur Offshore Drilling Campaign

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Background

New Focus

- ILT (Invisible Lost Time)
- NPT (Non Productive Time)
- Technical Limit

Drilling campaign acceleration for 2019 – 2022

Necessity to apply quick learning curve in drilling

East Kal Block handover from Chevron to Pertamina in 2018

Limited drilling personnel and resources

- NPT : Non Productive Time
- PT : Productive Time
- ILT : Invisible Lost Time / Hidden Downtime
STA Phase 1 campaign (STA-27 to STA-31) was drilled and completed in 2020 using AE-1 Rig: many issues encountered related to equipment & personnel performance.

STA Phase 2 campaign (STA-32 to STA-36) planned to be drilled using same rig in 2022.
Digital Enablement – RigHour + Advisory

Multi well drilling performance analysis tool to compute and compare drilling KPIs.

Surface sensor data is transformed into valuable performance information.

Google Chrome and mobile browser

ASCII Time and DDR processing and analysis

Daily Report, Section Report, End of Well Report
Operational Efficiency Methodology

**Analyze and identify the problem**
- Analyze entire well construction data

**Set the benchmark**
- Estimate best composite time per activity and well
- Capture lesson learnt & set target for campaign

**Performance Monitoring**
- Measure, quantify and monitor improvements
- Prioritize operations to focus

**Continuous Improvement**
- Evaluate entire rig fleet and transfer lessons learned for next well

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**Planning** | **Execution**
### Planning – KPI

<table>
<thead>
<tr>
<th>Surface Operation</th>
<th>BHA Handling</th>
<th>Tripping</th>
<th>Drilling</th>
<th>Running Casing</th>
<th>Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>• N/U Diverter</td>
<td>• M/U Drilling BHA</td>
<td>• Average Speed Tripping in cased hole</td>
<td>• Drilling Weight to Weight (Pre-connection, Connection and Post Connection)</td>
<td>• Casing Average Speed Tripping in cased hole</td>
<td>• Tubing Average Speed Tripping in cased hole</td>
</tr>
<tr>
<td>• N/U Wellhead</td>
<td>• Racking back BHA</td>
<td>• Average Speed Tripping in open hole</td>
<td>• Average ROP</td>
<td>• Casing Average Speed Tripping in open hole</td>
<td>• Tubing Average Speed Tripping in open hole</td>
</tr>
<tr>
<td>• N/U BOP</td>
<td>• L/D Drilling BHA</td>
<td>• Average Speed Tripping out open hole</td>
<td></td>
<td>• On Bottom ROP</td>
<td>• Tubing cementing job</td>
</tr>
<tr>
<td>• Pressure test BOP</td>
<td></td>
<td>• Average Speed Tripping out cased hole</td>
<td>• Average Speed</td>
<td>• Casing job Casing/Liner</td>
<td>• Wellbore clean out</td>
</tr>
<tr>
<td>• N/D BOP</td>
<td></td>
<td></td>
<td>Tripping out cased hole</td>
<td></td>
<td>• N/D BOP in completion</td>
</tr>
</tbody>
</table>

- Pressure test BOP
- N/D BOP
Planning – Data Gathering & BCT Analysis

Data Gathering and Upload

BCT and ILT

- Rig Preparation
- PU, MU & RIH BHA to TD
- POOH, LD BHA
- RIH CSS to TD
- Test BOP
- RIH Maintenance
- Pooh Liner Running Tool
- Cementing Plug

- Diverter Work
- DOC/Drill Out Shoe
- Wellhead works
- Cement CSSLNR
- LOT/FIT
- Wireline Logging
- Press Test Casing
- Cement TBG

- Diverter Test
- Drilling to CSG Point
- Wellhead
- BOP Works
- Logging Pipe
- Run Liner
- RIH Tbg
- Well Monitor and Slickline

Hours:
- STA-27: 100.52
- STA-28: 220.91
- STA-30: 77.98
- STA-29: 148.19
- STA-31: 171.53
Execution - Current Journey
Execution – 17-1/2” Hole Section Drilling W2W

Improvement STA-35:
295 mins / 4.91 hrs / 0.20days
Execution – 8-1/2” Hole Section Trip Out OH

Composite Stand Time, POOH, 8.5”, min
- Average: 7.9
- Connection time per stand
- Run time per stand
- Circulation time per stand
- Reaming time per stand
- Stationary time per stand

Average (Minutes)

Average (Stand/hr)

Inc.: 62.97 deg
Inc.: 19.83 deg
Inc.: 21.9 deg
Inc.: ?? deg
Inc.: 46.99 deg
Inc.: 32.62 deg
Inc.: 10.44 deg
Inc.: 19.85 deg
Inc.: 41.66 deg
Inc.: 44.21 deg
Execution – 6-1/8” Hole Section Trip In CH (with Crew Comparison)

- Day crew starts from 12:00 hrs – 00:00 hrs
- Night crew starts from 00:00 – 12:00 hrs
Execution – BCT Well Opportunity Analysis

Well: STA-34, Best, ILT, NPT

- Rig Preparation – 17.5
- Diverter Test – 17.5
- Drilling to CSG Point – 17.5
- Wellhead works – 17.5
- RIH CSG to TD – 17.5
- Rig Preparation – 12.25
- DOC/Drill Out Shoe – 12.25
- Drilling to CSG Point – 12.25
- RIH CSG to TD – 12.25
- Wellhead works – 12.25
- Cement CSG/LNR – 12.25
- Test BOP – 12.25
- P/U, M/U & RIH BHA to TD – 8.5
- LOT/RT – 8.5
- POOH, L/D BHA – 8.5
- Run Liner – 8.5
- Pooh Liner Running Tool – 8.5
- Rig Maintenance – 8.5
- Test BOP – 8.5
- DOC/Drill Out Shoe – 6.125
- Drilling to CSG Point – 6.125
- Wireline Logging – 6.125
- Wellhead – 6.125
- Wellhead Tubing – 6.125

Total productive time hours: 632.2

- Best time, h
- ILT, h
- New Record, h
- NPT, h
- ILT %
- NPT %
Execution – Monitoring and Advisory

### Monitoring

- **Footage per day per borehole:** Spud to TD & Spud to Rig Release, ft/day
- **Footage per day per borehole:** Spud to TD

### Advisory

- **Execution**: Monitoring and Advisory
- **Phase 1**: Monitoring
- **Phase 2**: Advisory

- **Performance Highlight**: P/U, M/U & RIH BHA to TD 6.33 hrs (-42%)
- **Performance Highlight**: POOH, L/D BHA to 11.15 hrs (-24%)
Results

DVD Chart

PHKT Drilling Performance (Phase 1 vs Phase 2)

-18%
Continuous Improvement to Reduce ILT – Phase 1 vs Phase 2

**Average Target - Moderate**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Before RH in hrs</th>
<th>After RH in hrs</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diverter Work</td>
<td>32</td>
<td>75</td>
<td>-47%</td>
</tr>
<tr>
<td>Diverter Test</td>
<td>16</td>
<td>16</td>
<td>-18%</td>
</tr>
<tr>
<td>Tripping In</td>
<td>260</td>
<td>437</td>
<td>-41%</td>
</tr>
<tr>
<td>Tripping out</td>
<td>502</td>
<td>778</td>
<td>-35%</td>
</tr>
<tr>
<td>Wellhead</td>
<td>102</td>
<td>145</td>
<td>-30%</td>
</tr>
<tr>
<td>RIH Casing/Liner</td>
<td>228</td>
<td>228</td>
<td>-14%</td>
</tr>
<tr>
<td>Cement Job CSG/LNR</td>
<td>126</td>
<td>123</td>
<td>-2%</td>
</tr>
<tr>
<td>N/U BOP</td>
<td>32</td>
<td>98</td>
<td>-67%</td>
</tr>
<tr>
<td>Wireline Logging</td>
<td>118</td>
<td>135</td>
<td>-13%</td>
</tr>
<tr>
<td>RIH Tubing</td>
<td>150</td>
<td>128</td>
<td>-43%</td>
</tr>
<tr>
<td>Cement Tubing</td>
<td>70.5</td>
<td>73</td>
<td>-44%</td>
</tr>
<tr>
<td>Wellhead Tubing</td>
<td>31</td>
<td>165</td>
<td>-44%</td>
</tr>
<tr>
<td>Completion BOP</td>
<td>41</td>
<td>10</td>
<td>-24%</td>
</tr>
</tbody>
</table>

~ 30 days savings

~ $ USD 9.2 Million savings

Next journey: STA Phase 3 Drilling Campaign
Summary

- **RigHour** performance analysis + advisory service, combined with frequent performance review with Engineers, Superintendent, & Field personnel successfully reduce drilling days & cost on STA Phase 2 drilling campaign compared to Phase 1 drilling results.

- Reduction on well days and cost accomplished through identification of BCT (Best Composite Time) and ILT (Invisible Lost Time) in planning and monitoring phase.

- Room for improvement on some drilling KPI remains and requires commitment from all parties for better output – to be applied on next phase of STA drilling campaign (end of 2023).