Transforming a Service Model: Break/Fix to Condition Based
GE APM ... powered by Predix

GET CONNECTED
Machine and Equipment Health
Local or remotely accessible, accurate, and centralized view of your assets state and health.

GET INSIGHTS
Reliability Management
Diagnose assets and predict issues to respond before assets fail.

GET OPTIMIZED
Maintenance Optimization
Maintenance strategies that balance reliability, performance, and cost.
From “Somewhere In This General Area…”
GE’s CBM Strategy Pillars – Smart BOP

Diagnostics
Digital Traceability for change detection

Monitoring
Measures health & detects deterioration

IIoT
RFID Asset Management, linking the physical & digital worlds for complete life cycle genealogy.

RTM/Analytics
Turning fleet data into knowledge
Annular Leak Case Study

During a routine test, leak detected and isolated to be “somewhere” in the LMRP. LMRP was pulled and the troubleshooting effort began.

Total Downtime: 604 Hrs

Source: 1) Reliability of Deepwater Subsea BOP Systems & Well Kicks, SINTEF & EXPROSOFT Unrestricted, 8/2012 & internal estimates
Diagnostics – Digital Fingerprinting

- Create a digital 3D model of interior part surfaces
- Original condition can be the “fingerprint” against which current can be compared
- Current state can be digitally “compared” to fingerprint
- Changes are highlighted

“If it ain’t broke (or doesn’t look different), don’t fix it!”
Remote Monitoring – SeaLytics BOP Advisor

- Cyber Secure Access to Datalogger
- Dashboard – Remote Visualization
  - Easy visualization (Health/Dashboard/Availability)
- Events – Historical Data Access
  - Access to data logger data
  - Searchable alarms & events
  - Trending
- Maintenance Optimization
  - Maintenance Optimization: Recommendations based on actual usage
## Actual Steps vs. CBM Alternative

<table>
<thead>
<tr>
<th>Actual Step</th>
<th>CBM Alternative</th>
<th>Actual HRS Required</th>
<th>CBM HRS Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pull LMRP</td>
<td></td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Replace Riser Adapter gasket</td>
<td>In-Situ Inspection/Digital Fingerprinting</td>
<td>216</td>
<td>36</td>
</tr>
<tr>
<td>Replace inner seals on annular</td>
<td>SeaLytics™ BOP Advisor</td>
<td>66</td>
<td>12</td>
</tr>
<tr>
<td>Clean/inspect annular head &amp; piston</td>
<td>Digital Asset Management engageDrilling.com</td>
<td>24</td>
<td>14</td>
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<tr>
<td>Install new annular packing element</td>
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<td>98</td>
<td>98</td>
</tr>
<tr>
<td>Run &amp; Latch LMRP</td>
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<td>100</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total HRS</strong></td>
<td></td>
<td>604</td>
<td>298</td>
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</table>
Real-world Results

- 604 non-productive hours
- Unnecessary parts replaced
- Multiple attempts to find the issue

CBM would have reduced NPT through:

- Advance warning of potential issue
- Targeted response, addressing only relevant parts
CBM Technologies

- Condition Based Maintenance
- Latest High Reliability Controls
- Improved Data Logging
- Asset Management
- Rig-based Re-certification
- Digitized Asset History

- Subsea Condition Monitoring
- SeaONYX / SeaPrime
- SeaLytics BOP Advisor
- RFID Tagging
- Traceability
- Digital Fingerprinting

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CSA includes personnel, management of parts, O&R, continuous certification, data monitoring and management of change.