Committee on the Application of Real-Time Monitoring of Offshore Oil & Gas Operations

Large / Independent Production Operations Panel

SHELL’S APPROACH TO REAL-TIME MONITORING IN THE PRODUCE PHASE FOR ITS DEEPWATER ASSETS

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Deepwater GOM presents unique operational challenges.
Collaboration Centers supporting the Asset Lifecycle

Explore & Develop
SEPCoVE

Drill & Complete
WVRO
(WellVantage Remote Operations)

Surveil / Diagnose
Bridge

Operate / Control
IOC

Collaboration Centers supporting the Asset Lifecycle
Operational Control/Monitor & Engineering Surveillance

Real-time Operations
Control & Operate

Production System
Surveillance & Diagnostics

Asset Performance
Analysis & Optimization

ALARM
- An operational notification that requires immediate attention [IMMEDIATE & URGENT]

ALERT
- An engineering notification that indicates a parameter is trending outside of desired range [DEVELOPING & THREATENING]

EVENT
- A single or combination of ALERTS that indicate a defined production anomaly

SERVICE
- The step-wise remediation steps to ‘treat’ an event [SOP]

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Early detection methods – “before problems occur”

- Operating Windows
- Deviation from “normal”

Expected System Capacity

Minimizing the deferment wedge

System Optimization

Threshold Alarms

Exception-Based Multi-Variant Alert
BRIDGE / EBS SURVEILLANCE PROCESS MAP

Operational Data
- X, Y, Thrust
- Speed
- LO Pressure / Temp

Equipment Condition Monitor:
- Online
- Data Gathering & Pre Processing
- Algorithms / Event Generation

EBS Alert:
- Date / Time Stamp
- Equip Type / Location
- Condition Status

Alarm Validation

Service Analysis

Engineering Analysis

Operational Data: ECM Analysis
- Near / Real Time

Analytics
- Bridge Portal

EBS Alerts
- (~2000)* Detected Alerts
- (~1000)* Initiated Services
- (~400)* Completed Services
- (~250)* Actions Carried Out

Advice/Plan
- Specialist

Action
- Engineer
EBS ALERT USE CASES

- EBS Alert Console
- Visual aids and Related Technical Info
- Alert verification
- Escalate to SharePoint workflow
- Workflow based on SOP
## BRIDGE ALERTS

<table>
<thead>
<tr>
<th>Surveillance Category</th>
<th>Surveillance Group</th>
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<tbody>
<tr>
<td><strong>Surface Engineering</strong></td>
<td>Chemical Performance Surveillance</td>
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<td>Compressor Optimization Surveillance</td>
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<td>Compressor Reliability Surveillance</td>
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<td>Instrumentation System Surveillance</td>
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<td>Process System Surveillance</td>
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<td>Water Separation Surveillance</td>
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<td><strong>Subsea Engineering</strong></td>
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<td>Choke Performance Surveillance</td>
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<td>Christmas Tree Surveillance</td>
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<td>Electric Submersible Pump Surveillance</td>
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<td>EPU Surveillance</td>
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<td>POD Electrical and Hydraulic Surveillance</td>
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<td>Valve Surveillance</td>
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<td><strong>Subsurface Engineering</strong></td>
<td>Annulus Pressure Surveillance</td>
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<td>Choke Performance Surveillance</td>
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<td>Gas Lift Surveillance</td>
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<td>Operating Guidelines Surveillance</td>
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<td>Rate and Phase Surveillance</td>
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<td>Sand Management Surveillance</td>
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<td>Shut In Well Surveillance</td>
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13,800 individual EBS Alerts

+225,000 daily executed anomaly detections
An Integrated Operations Center has been deployed to producing assets in the Mars Basin

The Bridge, Subsea Collaborative Work Environment – performance monitoring, optimization

**Integrated Operations Center (IOC):** 24x7 Remote Control Rooms, co-located with off-asset operations staff, dedicated asset technical support staff (& reservoir teams where appropriate). Includes robust IT infrastructure and collaboration capabilities supporting efficient remote execution of work.

The on-asset staff strives to ensure that only activities mandatory to be performed on the asset are actually done there.
The IOC layout is process driven, consisting of a Control Room and Work Zones equipped with collaboration enablers.

Operations Work Zones
- Asset support grouped into Zones delineated by work process
- Zone placement is based on frequency of interaction with offshore and between Zones, with the RCR acting as the operational center
- Olympus & Mars sides are mirror images of one another

Development Work Zones
- Development support grouped into Zones delineated by project-centric and discipline-centric activity

Key:
- Mars
- Olympus
- Development
In addition to production/deferment impact, we have significant PoB avoided, reduced non-productive time and avoided flight costs.
OUR FUTURE ANALYTICS PORTFOLIO

Event Stream Processing (ESP)

Spectral Analysis

In-Well Sensing (Fiber, Electrical)

3D Graphics

EBS Alert

- Displayed on equipment operating with a performance anomaly, hydrate
- Displays relevant measurements

NLG

- Event Stream Processing (ESP)
- Spectral Analysis
- In-Well Sensing (Fiber, Electrical)
- 3D Graphics
- EBS Alert
WRAPPING IT UP

- Does your company use real-time monitoring for its offshore operations? If not, why? **YES**
- If your company does use real-time monitoring, what are the critical operations and specific parameters that your company monitors? **ALREADY DISCUSSED**
- Do you believe there are specific types of wells or operations and parameters (for drilling, completions or workovers, or production operations) that always should be monitored with real-time monitoring? **YES**
- Are there specific criteria or risk thresholds that your company uses to prompt real-time monitoring requirements (e.g. factors such as well or water depth, frontier area, HP/HT wells, or well complexity)? **PERHAPS**
- Does your company rely on any automation and predictive software in real-time monitoring? **YES**
- What role could automation and predictive software tools play in real-time monitoring? **SURVEILLANCE**
- Condition-based monitoring is viewed by BSEE as monitoring the operating condition of critical equipment and using any generated data to predict and proactively intervene when needed. As such, what role could condition-based monitoring play in real-time monitoring? Describe how operating equipment using condition-based monitoring could be tailored and/or used for real-time monitoring. **DRAW YOUR OWN CONCLUSIONS**
- How could BSEE leverage such technologies? **NOT CERTAIN THERE ARE SPECIFIC TECHNOLOGIES TO LEVERAGE**
- Which activities could real-time monitoring supplement or replace? **TO BE DEBATED**
- What opportunities do you see for BSEE to use real-time monitoring to provide timely, functional, and value-added inspection? **THERE COULD BE OPPORTUNITIES**
- What would you recommend that BSEE do in the real-time monitoring area? **DON’T PRESCRIBE, SET PERFORMANCE OBJECTIVES**