Fra PID til Integreerte Operasjoner
1982

PID for ASEA MASTERPIECE
Automation and Control Evolution
1992 – Compressor Control
InTEGRerte Operasjoner
Digital Oilfield

Source: Society of Petroleum Engineers, 2001
Integrated operations
Safe, better and faster decisions

Before

<table>
<thead>
<tr>
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<th>Now</th>
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<tbody>
<tr>
<td>Serial</td>
<td>Parallel</td>
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<tr>
<td>Single discipline</td>
<td>Multidiscipline teams</td>
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<tr>
<td>Dependent of physical location</td>
<td>Independent of location</td>
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<td>Decisions based on experience data</td>
<td>Decisions also based on real-time data</td>
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<td>Reactive</td>
<td>Proactive</td>
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<tr>
<td>Classic Startup</td>
<td>Operational readiness</td>
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Technology

Work

Processes

People
Digital Oilfield: Value Potential

- Increased production (3-5%)
- Reduced production losses (20-40%)
- Reduced operation and maintenance costs (15-30%)

Source: NPD IO Potential Study for NCS
EICT Life-cycle service
The target

- Accelerated startup & Ready for Operation
- Increased overall benefits from system
- Maintain system performance
- Continuous Improvement

Traditional Benefit Curve
- Typical Performance Degradation
- Failures

Economic Return

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| Slide 10
How remote condition monitoring improve availability
FPU Gjøa
Operational flexibility

Case: GDF SUEZ, Compressor tripping on high vibration

High vibration suppressed due to startup conditions

Compressor trips due to high vibration in gearbox-compressor connection

Sequence of analyses

Mechanical discipline

Resonances frequencies for the compressor train provided

Indications of excitations on resonant frequencies 14-15 Hz, however this mismatch with compressor RPM (3900)

VSD monitoring reveals torque fluctuations on 14-15 Hz in motor when motor RPM is 800-900, Drive excluded as possible cause

Performance Monitoring (Turbowatch) excludes surge as an issue
Operational flexibility

Case: GDF SUEZ, Compressor tripping on high vibration

Root cause and solution

- Trip caused by vibrations in 14-15 Hz regime
- Resonance frequency of the compressor train in 14-15 Hz domain
- Resonance frequency exited when motor RPM is 800-900
- Detection of critical rotation speed via the VSD monitoring analyzing torque fluctuations
- Solution:
  - Fast acceleration through the critical rotation speed interval
  - Trip-multiply implemented from onshore location
- Result
  - Minor changes in the protection system eliminate the problem. The platform can continue operating with minimal downtime

Enablers

  - "Based on criticality classification, all equipment and systems shall be designed for real time condition monitoring."
  - "The data shall be made available both onshore and offshore using high quality data/information transfer ...."
- GFD SUEZ Operational philosophy
- Access to information for internal and external users and extensive use of service partners
- Instrumentation to cater for condition based maintenance as a part of the project delivery
- All relevant parameters for the compressor was monitored:
  - The process conditions and performance
  - Vibration analyzes
  - The electrical parts of the system monitored as a part of the compressor solution.
- ABB service Environment™ provided easy access to experts for discussions, analyzes, data collection and problem solving.
Lifecycle simulator

Design & Engineering Simulator
- Control System Test
- Operator Training Simulator
  - Training of new operators, hazard training
  - Process optimization and modification studies
The wells at Ormen Lange are completed with a gravel pack. An increase in the gas rate must be slow and controlled in order to avoid disturbances in the natural pack.

**Design objective:**

*Protect the integrity of the wells:*
- Keep pressure drops less than 4 bar/h
- Keep drawdown less than 25 bar
- Keep flow rate less than 10 MSm³/d

This was previously solved by: Assuming worst-case conditions and opening the valve with a predefined, fixed speed.
Problem description
Instrumentation and valves

Who
Where
What
How
Results
Conclusion
Solution details
Implemented control solution

- One controller per restriction
- Duplicates of the downhole transmitters and controllers
- All controllers enters a low-select
- On/off-switch
Solution details
Tuning of controllers

- We created a model that estimates the process behavior, based on:
  - The opening of the choke valve
  - The pressure-drop over the valve

- We implemented Skogestad’s tuning-rules in the control system
  - The tuning of the controllers are dynamically updated, based on the estimated process behavior
Customer value
A side-effect of the solution: Much quicker startup

- Ramp-up of well B3, with aggressive tuning
- ACC used 1 hour and 40 minutes to ramp-up the well
- Previously would have used 9 hours
Comparison of flow rates
Difference is approx. 10 MSm³
Comparison of flow rates
Difference is approx. 5 MSm³
Customer value
What is this worth for Shell?

Production loss:
- All the wells have to be shut down 2 times per year, due to integrity testing
- If the onshore facility goes down, the wells have to be shut down within 30-60 minutes

Customer value:
- Previously, a ramp-up of a high-pressure well took 15-20 hours (up to 30 for some new wells)
- With ACC, the same well takes 4.5 hours
- The gained production is 5-10 MSm³, per plant startup
- For high-pressure wells: Can be as high as 1MSm³ per well per startup
ABB Integrated Operations
From technical to operational integration
**Integrated Operations**

**Structured Safety and Alarm Management**

**Performance Level**

- **Top 10 List:** 50.93%
- **Average time to resolve:** 71 alarms/month
- **Time in unstable condition:** 12%

**Frequent Alarms**

- **G138E_116A**
- **G138E_116B**
- **G158E_116B**
- **L869E_116A**
- **L869E_116B**
- **L064E_116A**
- **L064E_116B**
- **W119E_117E**
- **W119E_117F**
- **W119E_117G**

**Alarm Manager**

Successful alarm management ensures optimal working conditions for operators while ensuring safe and predictable alarm and safety system behavior.

The Alarm Manager provides a complete toolset for operators and alarm experts, ensuring plant integrity and meeting government requirements and industry guidelines. This product is part of the Integrated Operations portfolio.

An alarm system should release an alarm only when the plant condition requires operator action. However, most alarm systems are not optimally configured which leads to both insufficient alarming and a high number of nuisance alarms. As a result, the operator stress and workload increases significantly.

The Alarm Manager is the ideal tool for day-to-day follow-up of an alarm system as well as being a toolset well suited for alarm system improvement projects.

Government regulations as well as company internal alarm philosophy require documentation of current alarm system status and fully documented alarm system design. The Alarm Manager helps keeping track of the alarm system status, improving performance, and automating mandatory reports.

The Alarm Manager is compliant with the standards IEC/IA 191, YA-711, and ISA 18.02.
An active maintenance strategy with structured work process and modern tools enables early fault detections, reduces costs and avoids expensive breakdowns.
Digital Oilfield Topology

- Supply vessel & Tankers
- Drilling rig
- Goliat FPSO
- Hammerfest
- Subsea
- Stavanger

Connections:
- Wireless
- Radiolink
- Fiber
- Remote access
Power and productivity for a better world™