2014-11-07 Håvard Devold, ABB

Fra PID til Integrerte Operasjoner

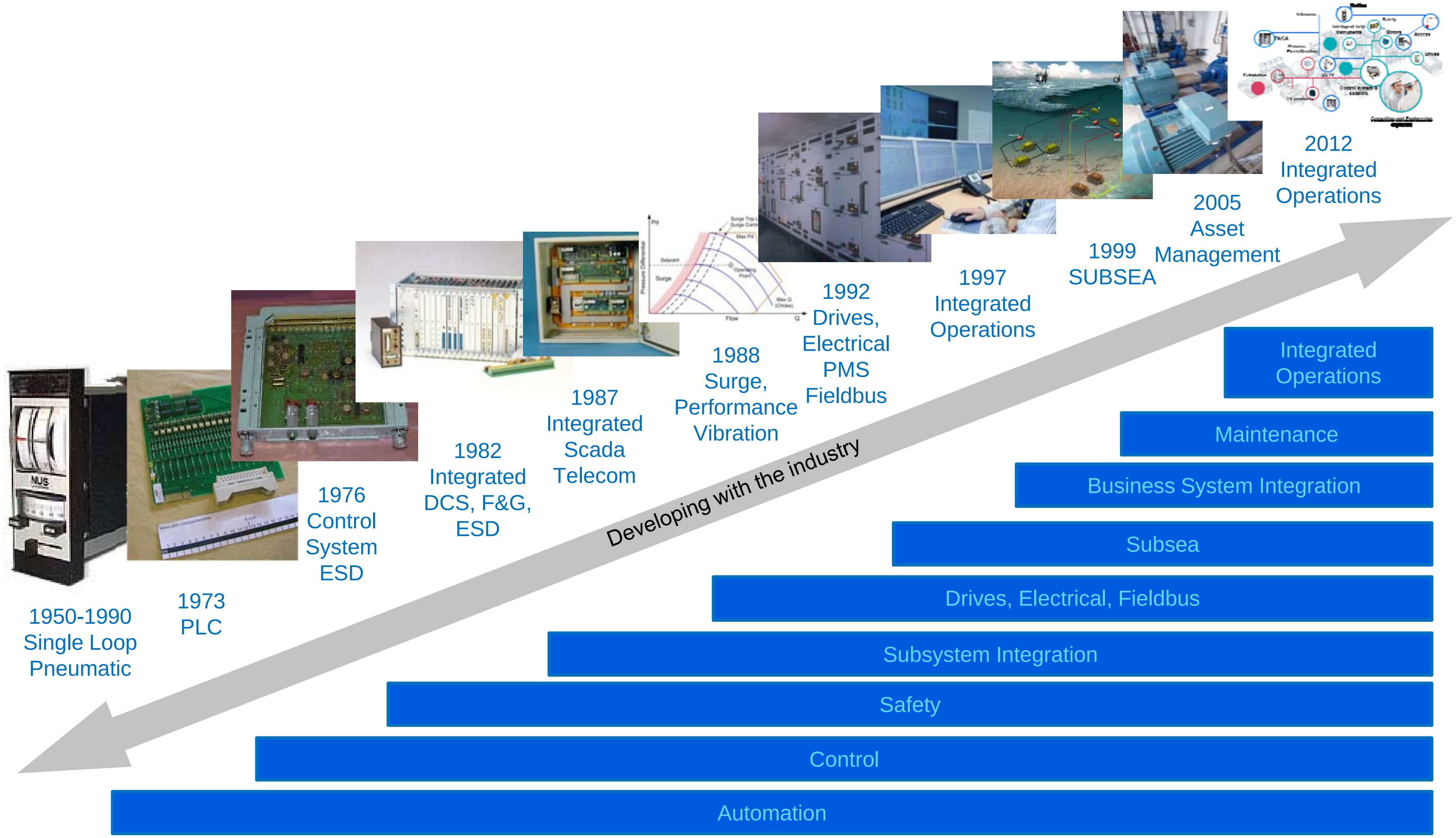
60 år Kybernetikk 1954-2014 NTNU

Power and productivity for a better world™ ABB

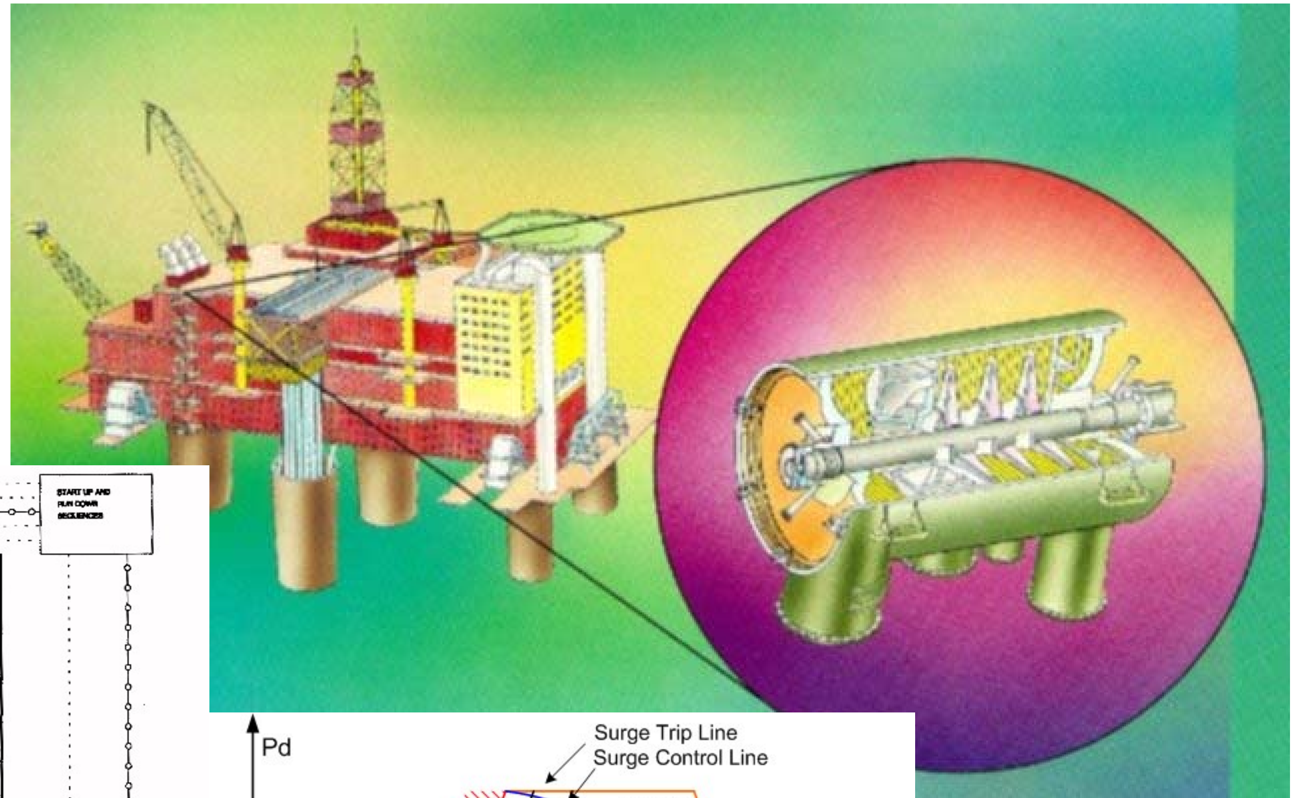
1982

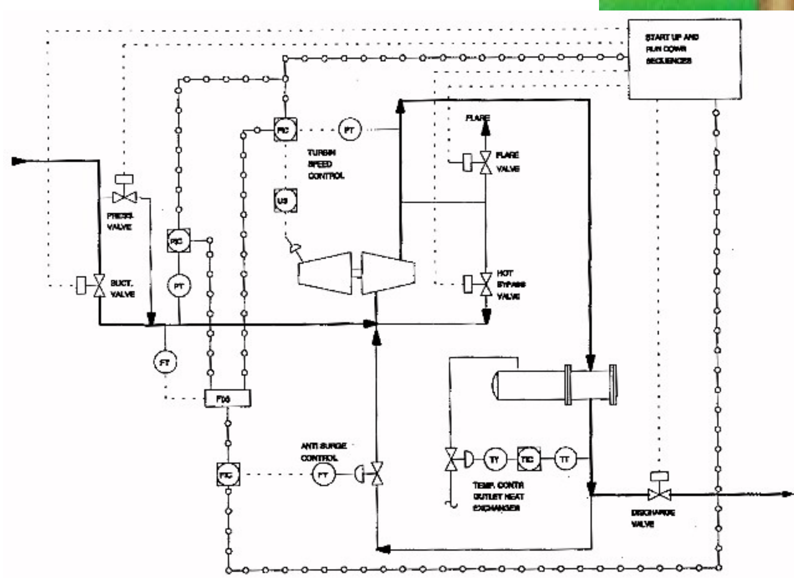
PID for ASEA MASTER PIECE

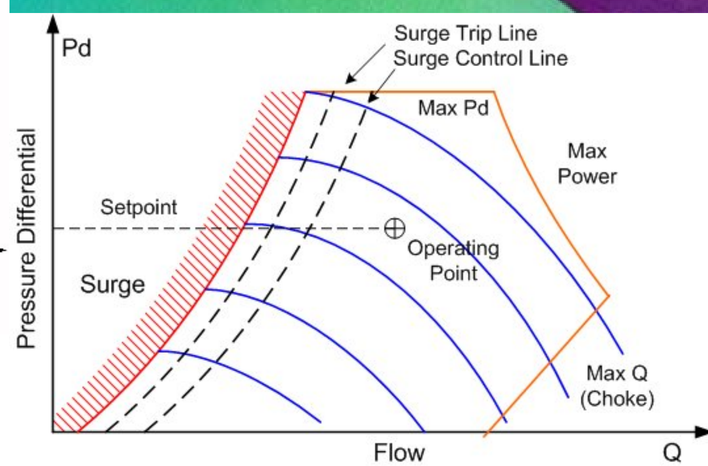
Automation and Control Evolution



1992 – Compressor Control

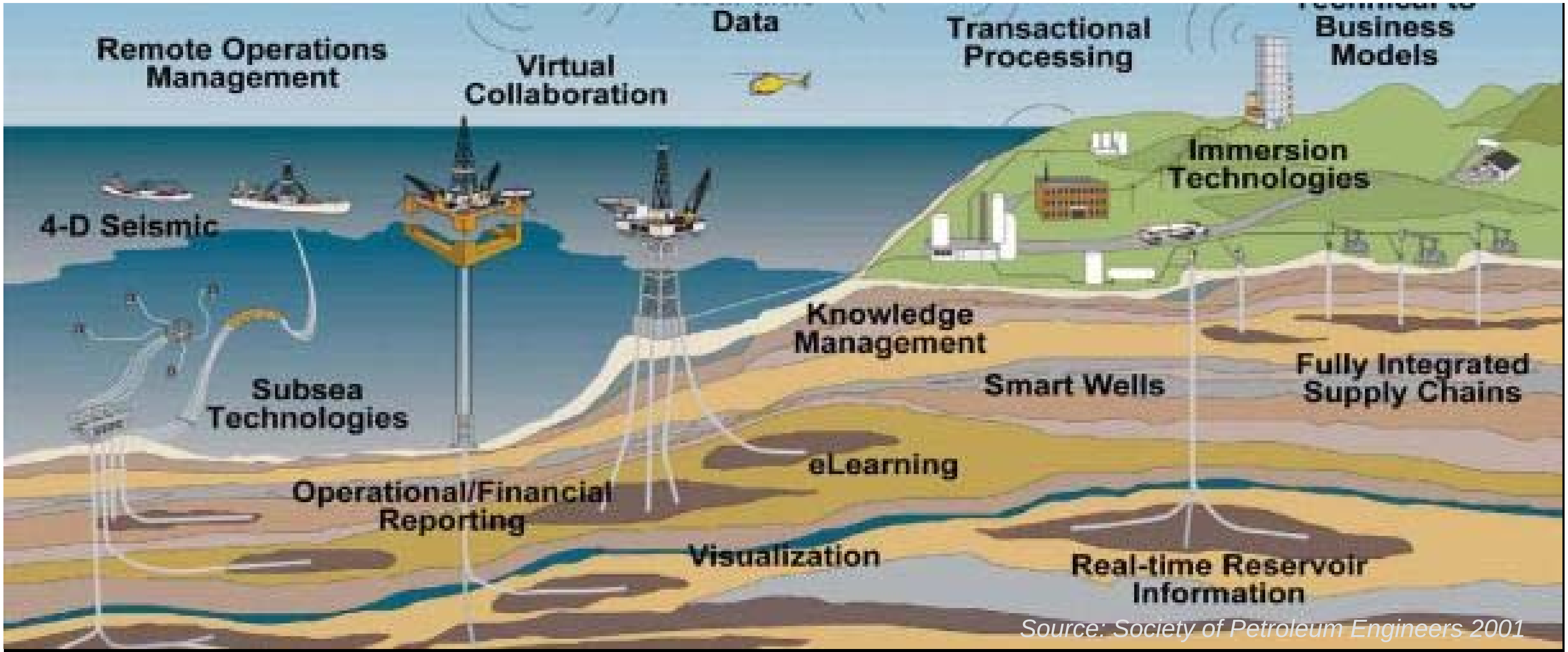






2002

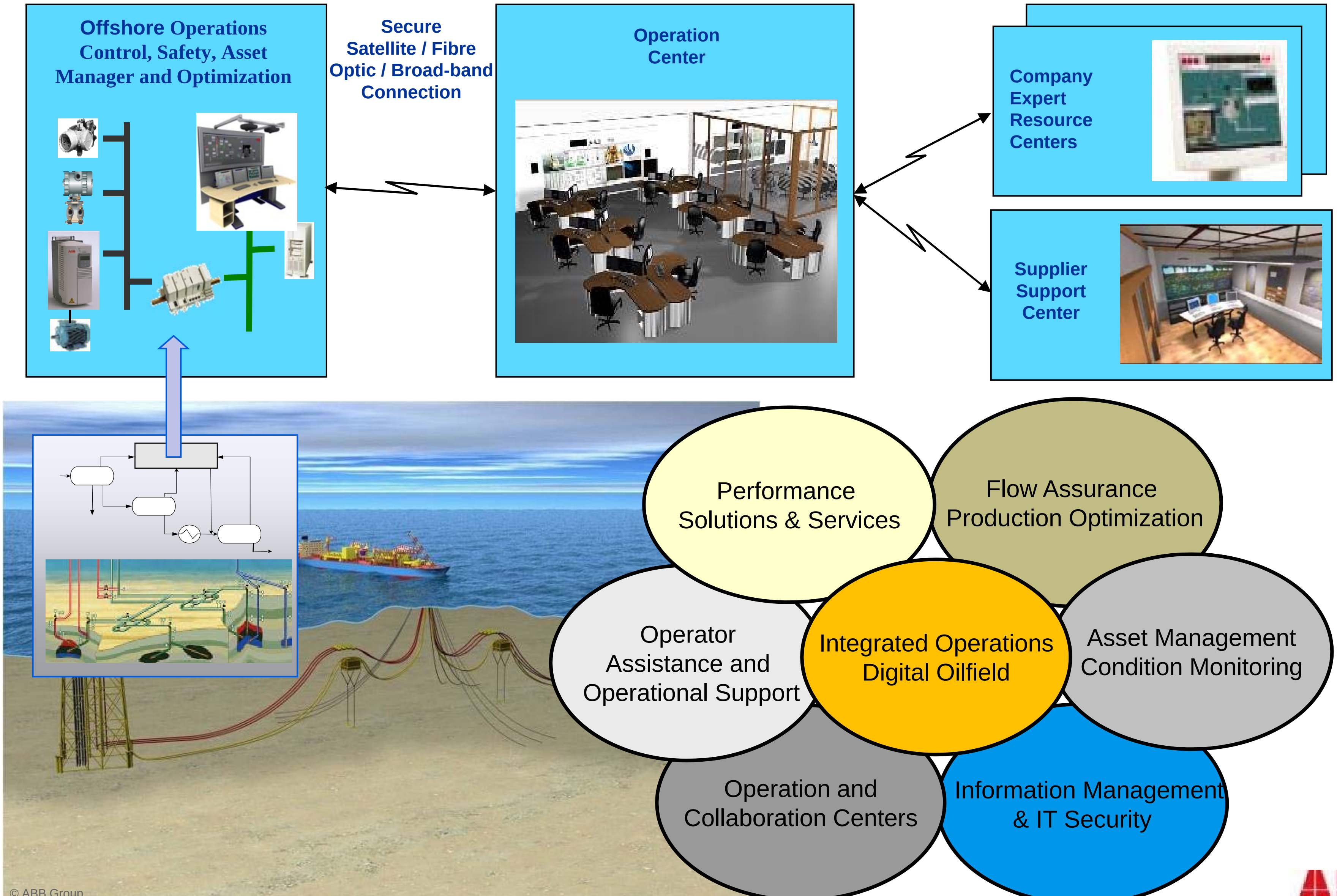
60 år Kybernetikk 1954-2014 NTNU



In5egrerte Operasjoner

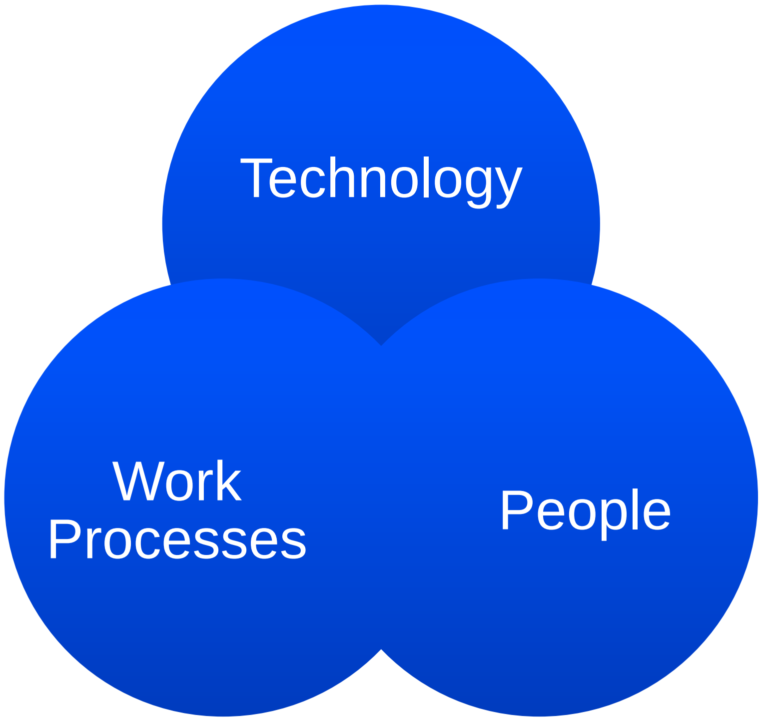
Digital Oilfield

Digital Oilfield Structure



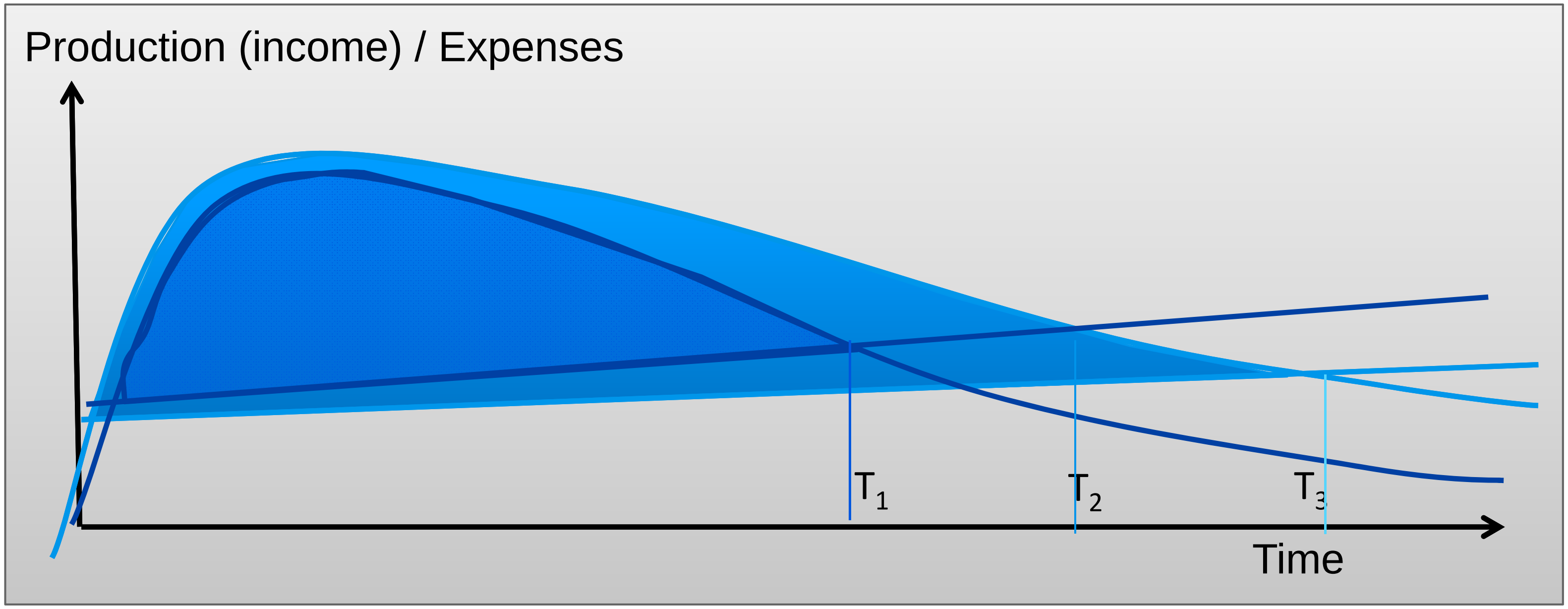
Integrated operations

Safe, better and faster decisions



Before	Now
Serial	Parallel
Single discipline	Multidiscipline teams
Dependent of physical location	Independent of location
Decisions based on experience data	Decisions also based on real-time data
Reactive	Proactive
Classic Startup	Operational readiness

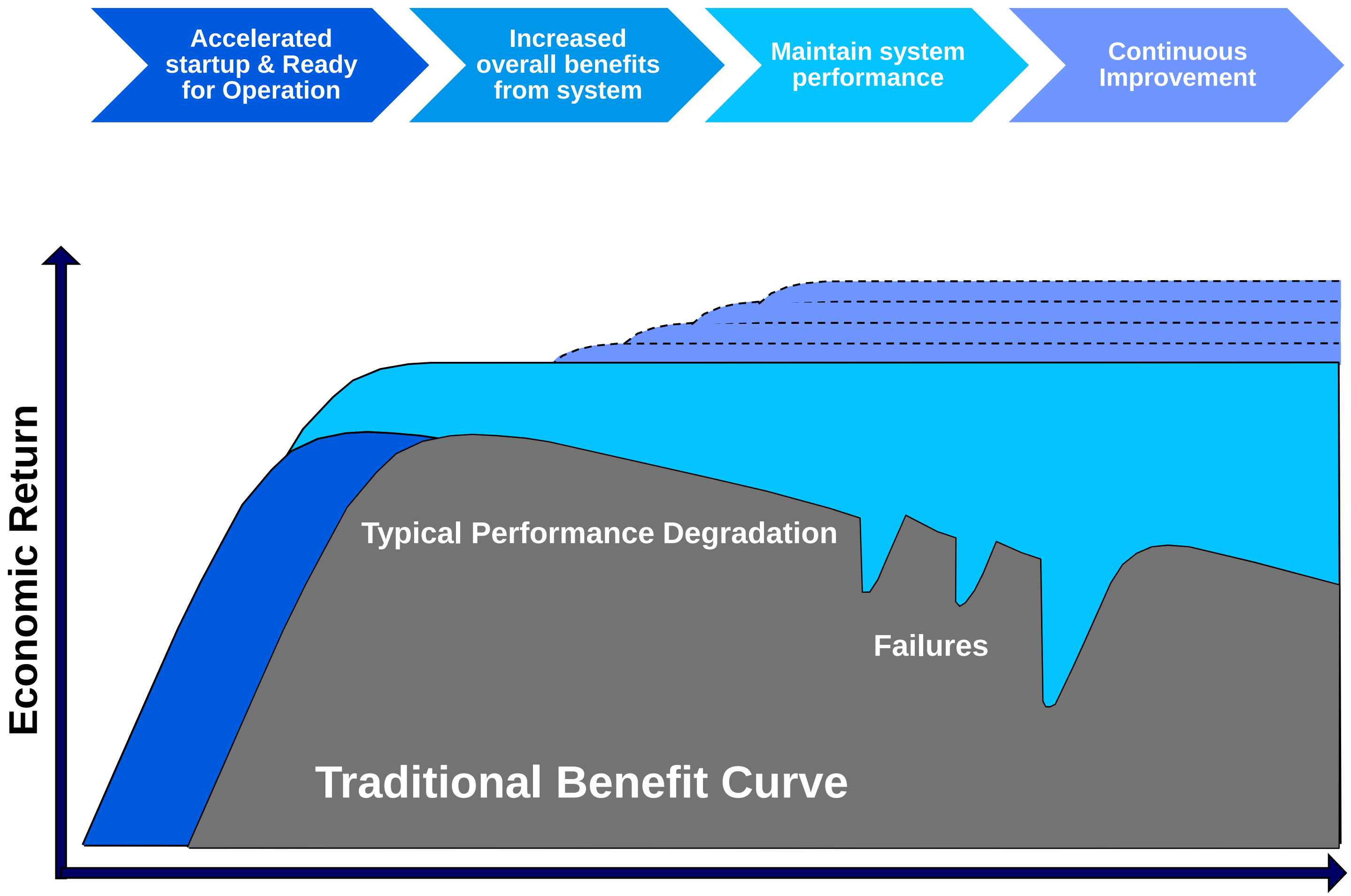
Digital Oilfield: Value Potential



- 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



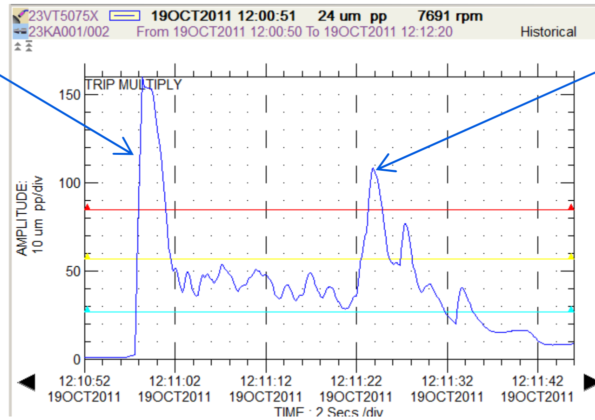
How remote condition monitoring improve availability FPU Gjøa

Operational flexibility

Case: GDF SUEZ, Compressor tripping on high vibration

Case

High vibration suppressed due to startup conditions



Compressor trips due to high vibration in gearbox-compressor connection

Sequence of analyses

GDF SUEZ – Mechanical dicipline: Performance Monitoring (Turbowatch) excludes surge as an issue

DRESSER-RAND – Compressor Specialists: Resonans frequencies for the compressor train provided

GE Bently Nevada – Vibration Monitoring: Indications of exitations on resonans frequency 14-15 Hz, however this mismatches with compressor RPM (3900)

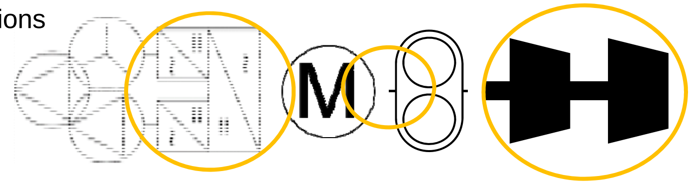
ABB – Drive / Electrical Monitoring: VSD monitoring reveals tourque torque fluctuations on 14-15 Hz in motor when motor RPM is 800-900, Drive excluded as possible cause

Operational flexibility

Case: GDF SUEZ, Compressor tripping on high vibration

Root cause and solution

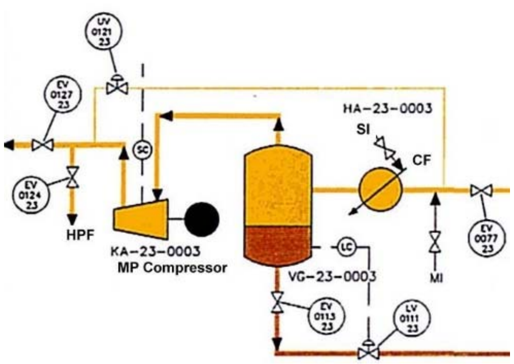
- Trip caused by vibrations in 14-15 Hz regime
- Resonance frequency of the compressor train in 14-15 Hz domain
- Resonance frequency exited when motor RPM is 800-900
- Detection of critical rotation speed via the VSD monitoring analyzing torque fluctuations
- Solution:
  - Fast acceleration through 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

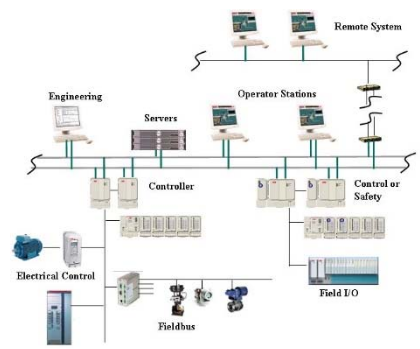


Enablers

- GFD SUEZ strategy for Integrated Operations, **C097-AKE-A-FD-0013, Integrated Operation Strategy:**
  - ”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 accsess to experts for discussions, analyzes, data collection and problem solving.

Lifecycle simulator





Planning **Design** **Engineering** **Production start** **Operation** **Modifications**

Design & Engineering Simulator

Control System Test

Operator Training Simulator

Training of new operators, hazard training

Process optimization and modification studies

Process Perforamce Case: Problem description
Design objective

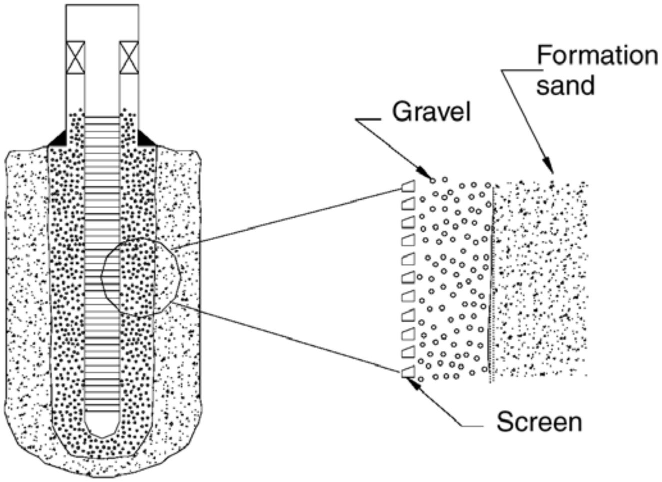
Who
Where
What
How
Results
Conclusion

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:

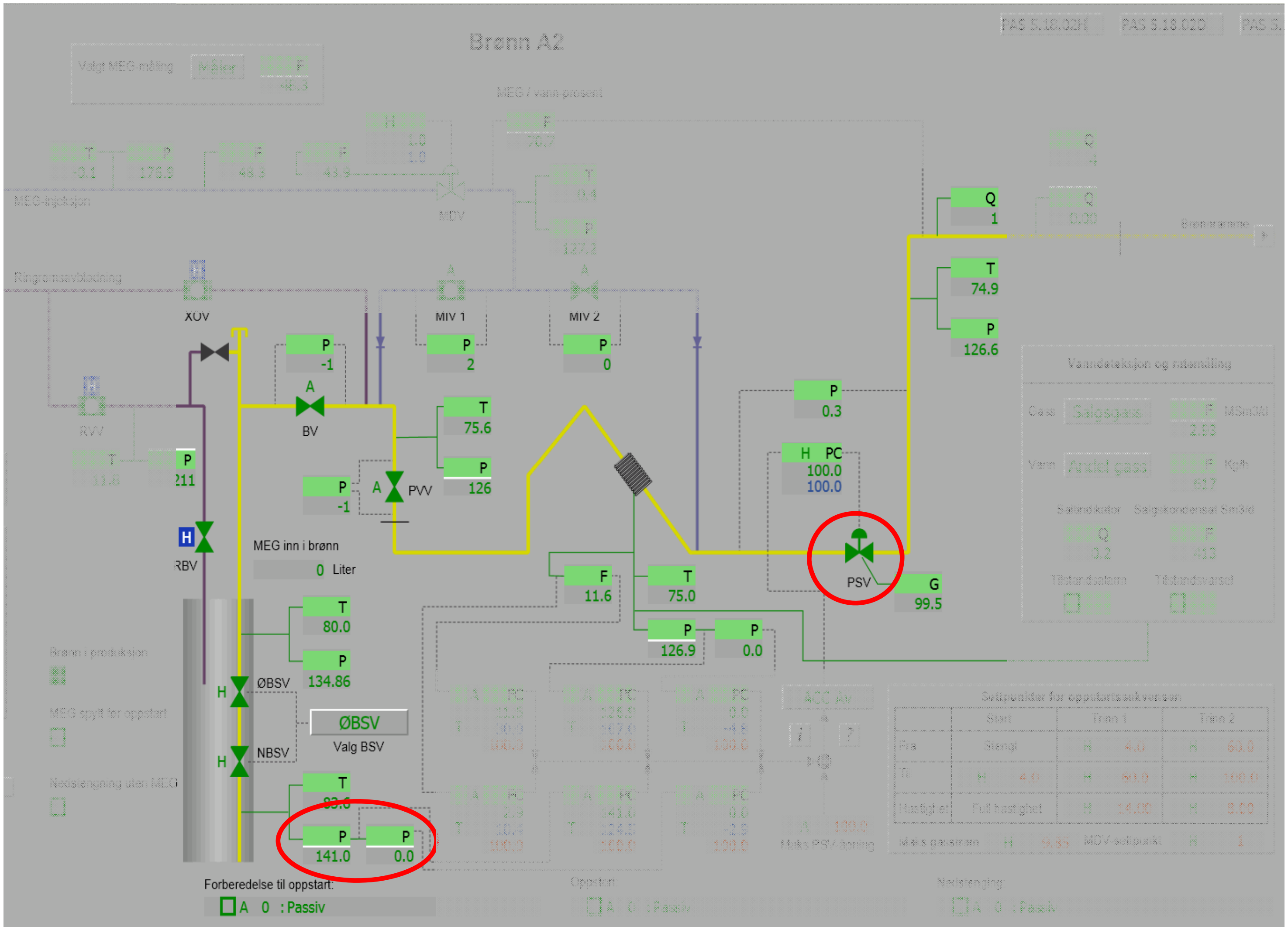
- Keep pressure drops less than 4 bar/h
- Keep drawdown less than 25 bar
- Keep flow rate less than 10 MSm3/d



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

Problem description
Instrumentation and valves

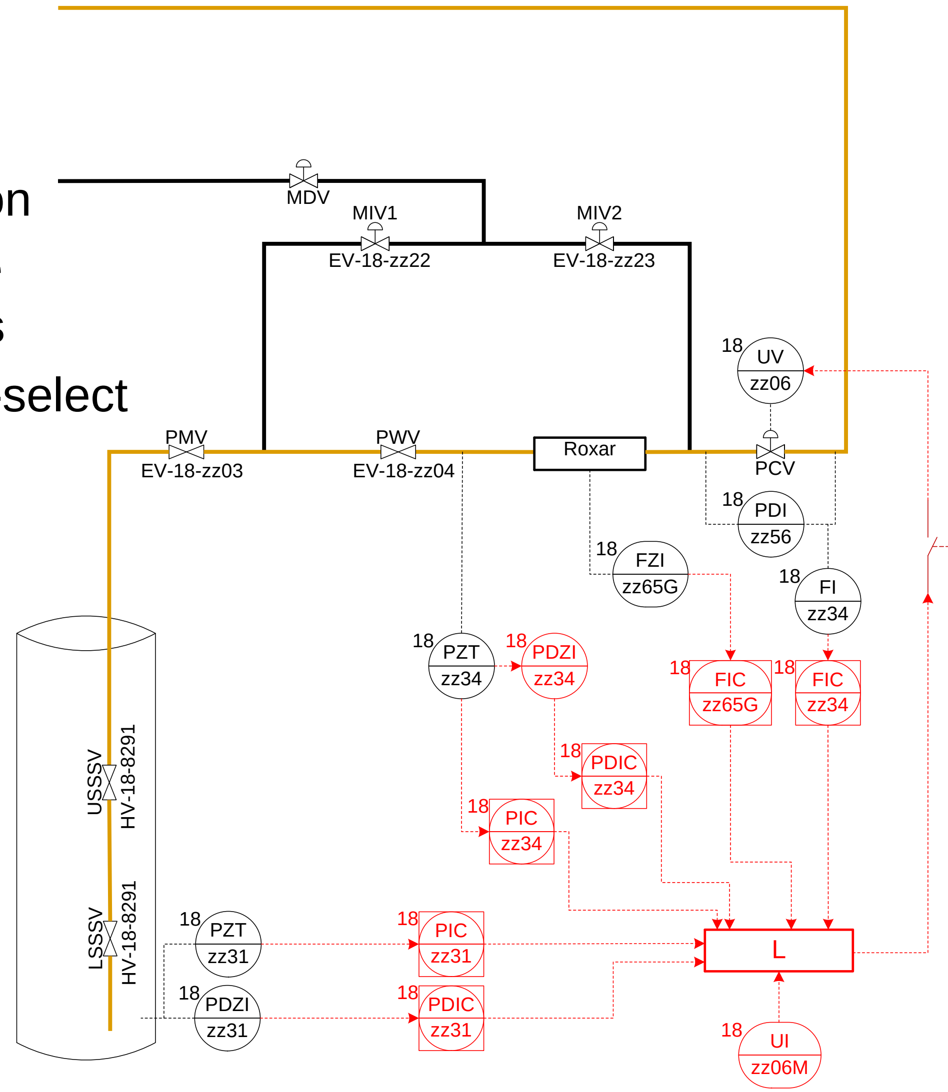
Who
Where
What
How
Results
Conclusion



Solution details
Implemented control solution

Who
Where
What
How
Results
Conclusion

- 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

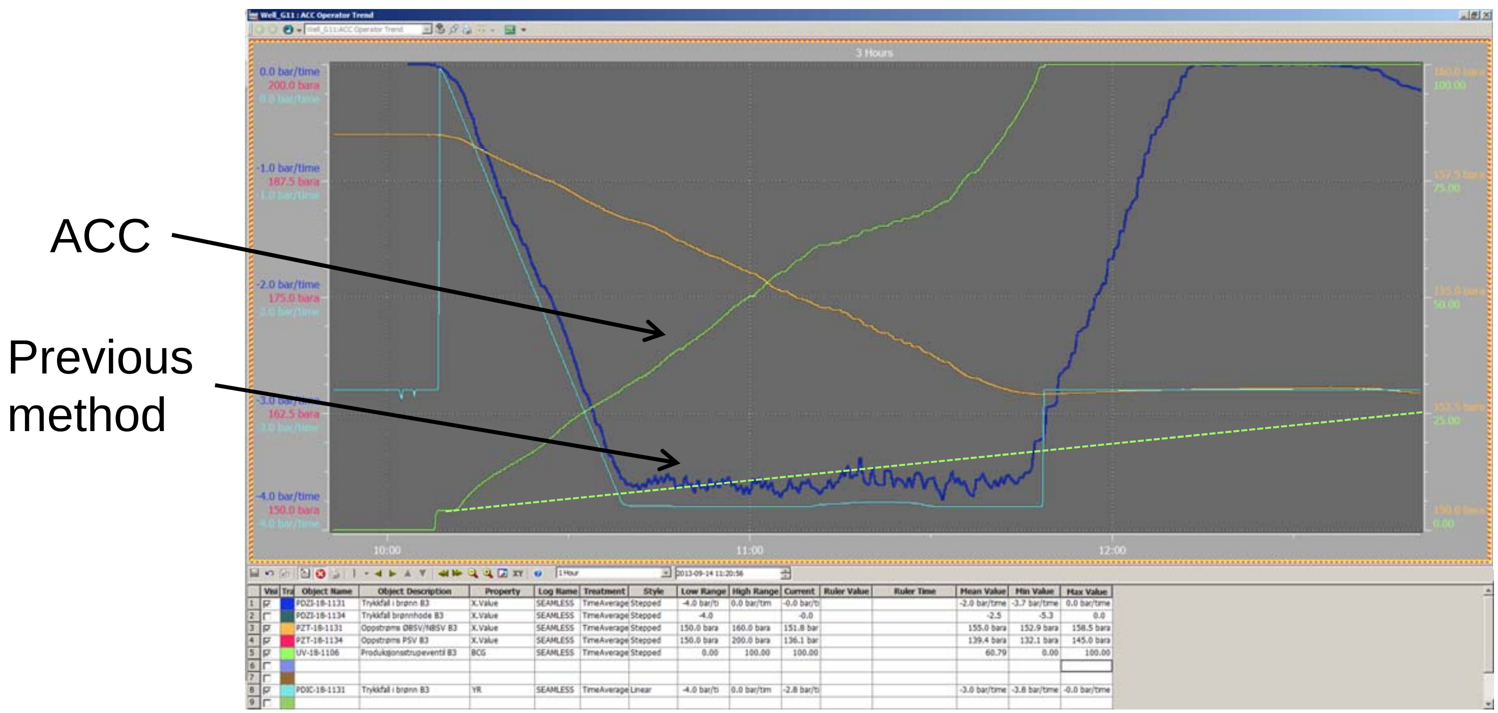
- We created a model that estimates the process behavior, based on:
  - The opening of the choke valve
  - The pressure-drop over the valve

- We implemented Skogestad's tuning-rules in the control system
  - The tuning of the controllers are dynamically updated, based on the estimated process behavior

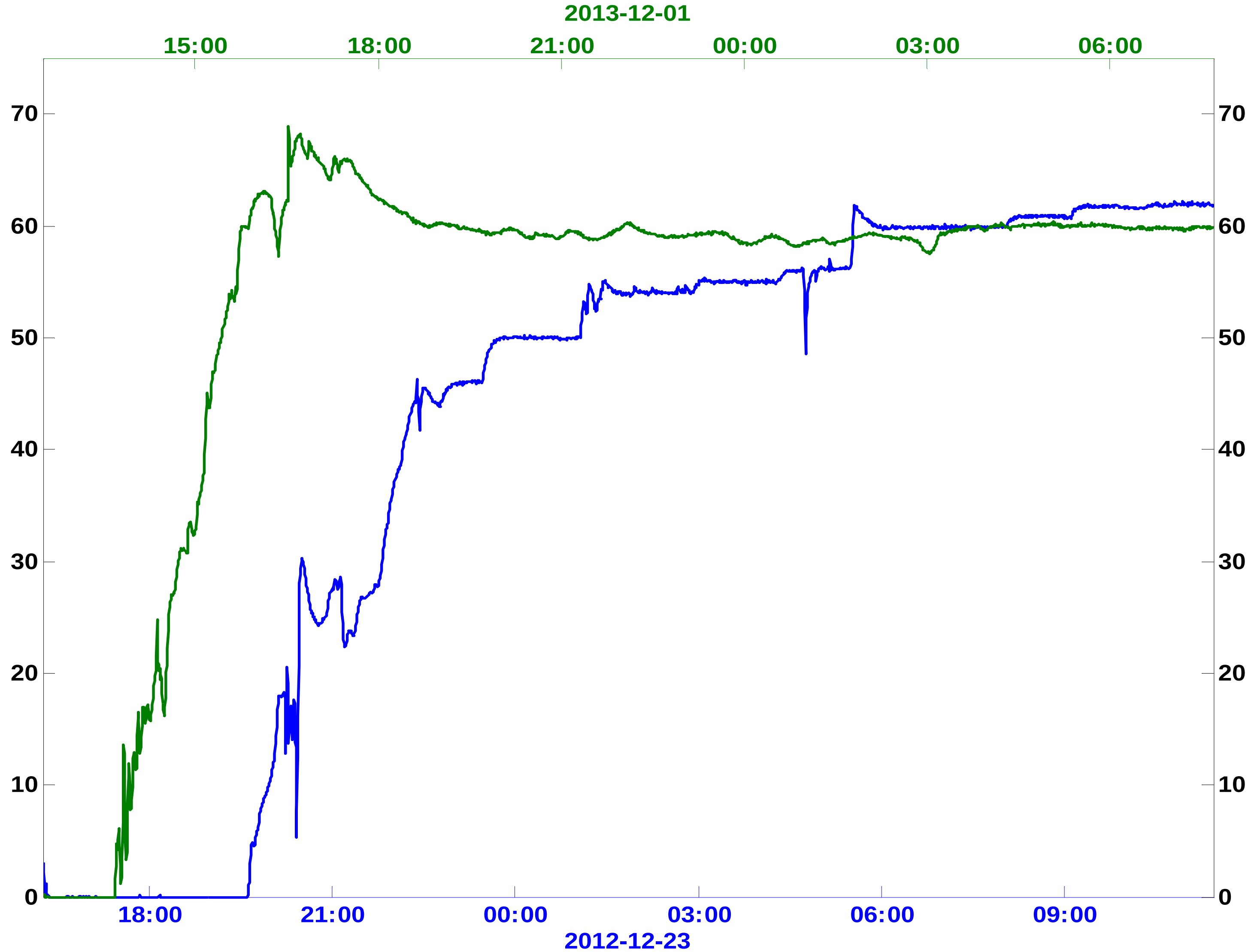
Customer value
A side-effect of the solution: Much quicker startup

Who
Where
What
How
Results
Conclusion

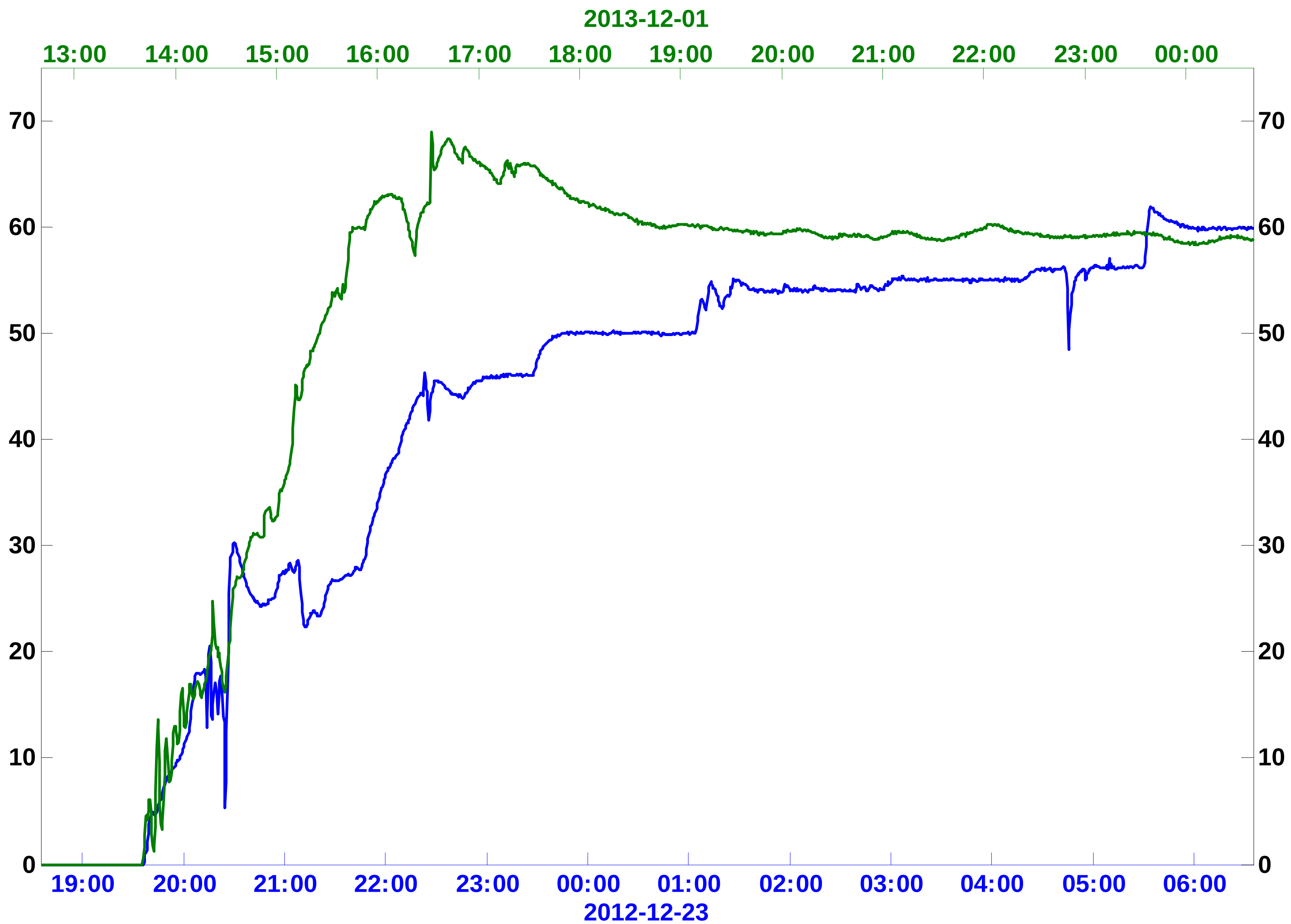
- Ramp-up of well B3, with aggressive tuning
- ACC used 1 hour and 40 minutes to ramp-up the well
- Previously would have used 9 hours



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?

Who
Where
What
How
Results
Conclusion

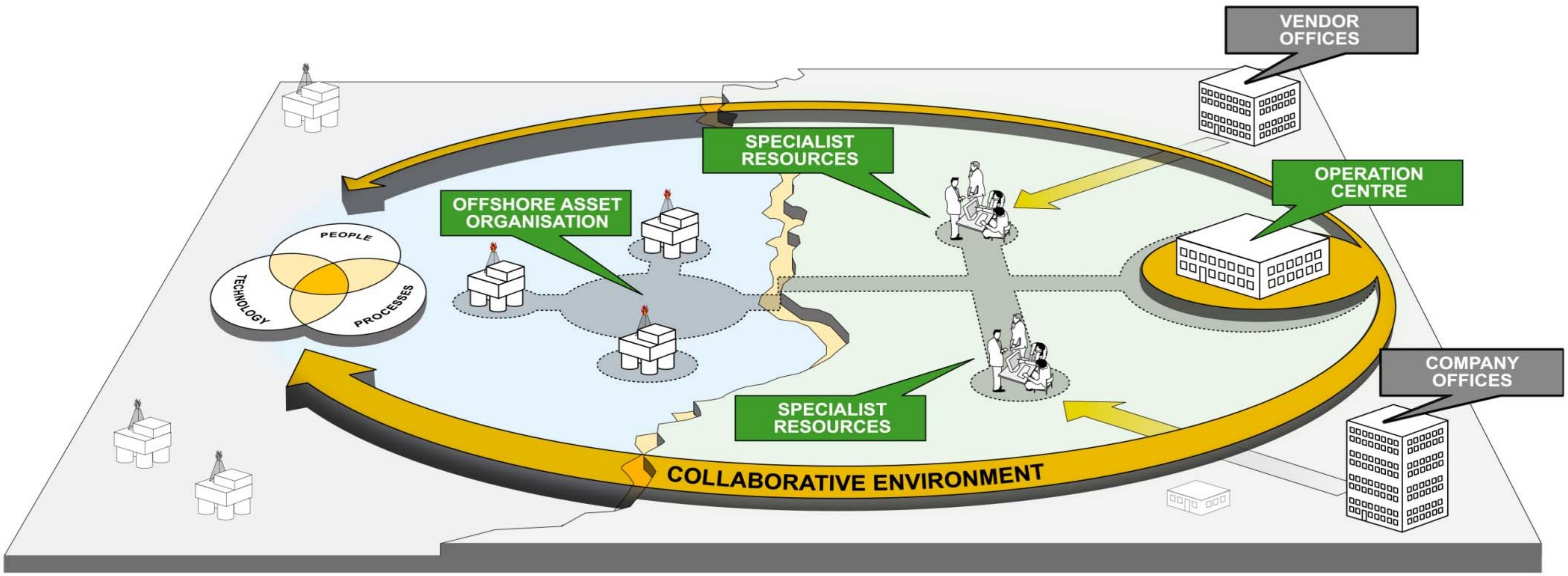
Production loss:

- 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

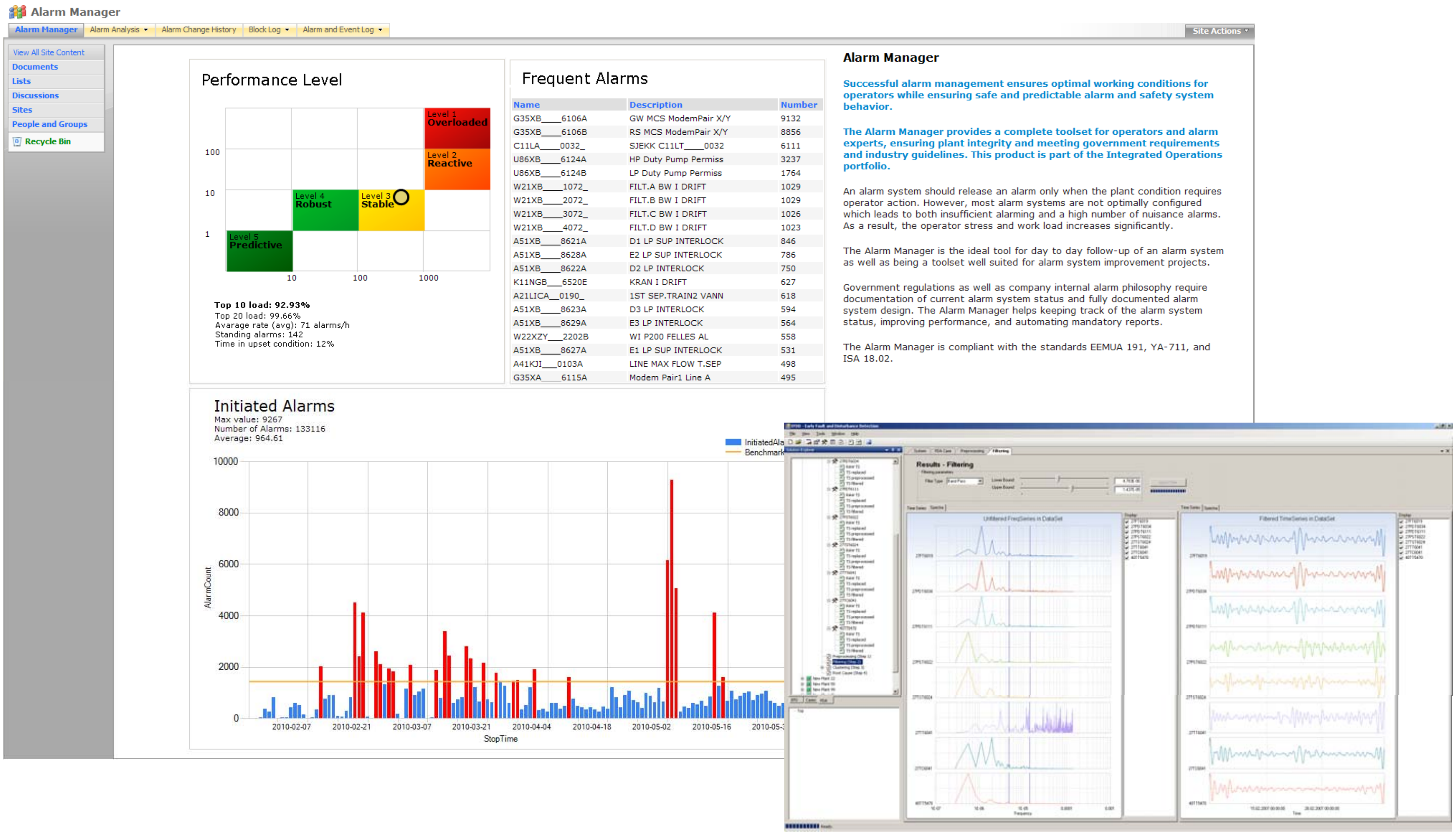
Customer value:

- 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 MSm^3, per plant startup
- For high-pressure wells: Can be as high as 1MSm^3 per well per startup

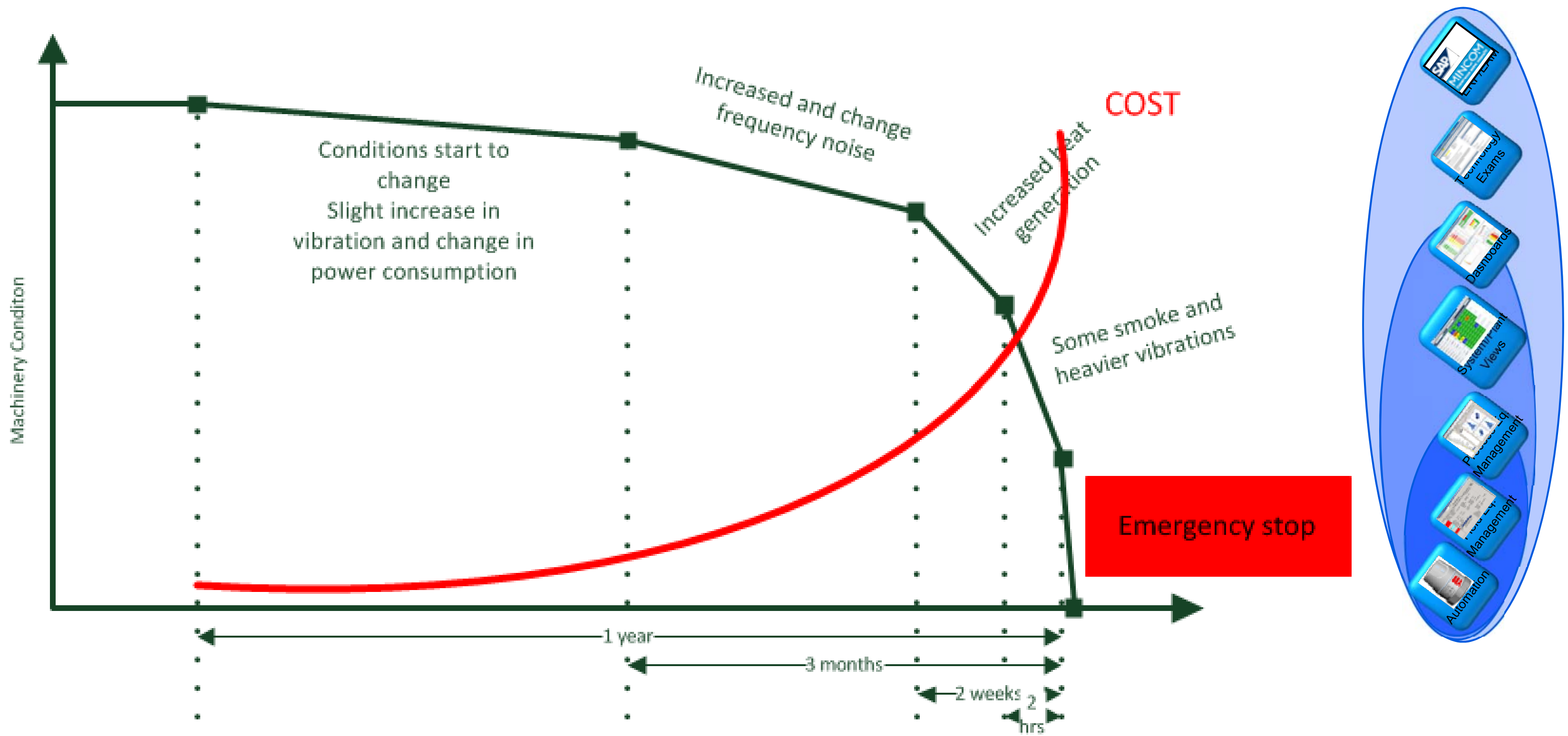
ABB Integrated Operations
From technical to operational integration



Integrated Operations
Structured Safety and Alarm Management

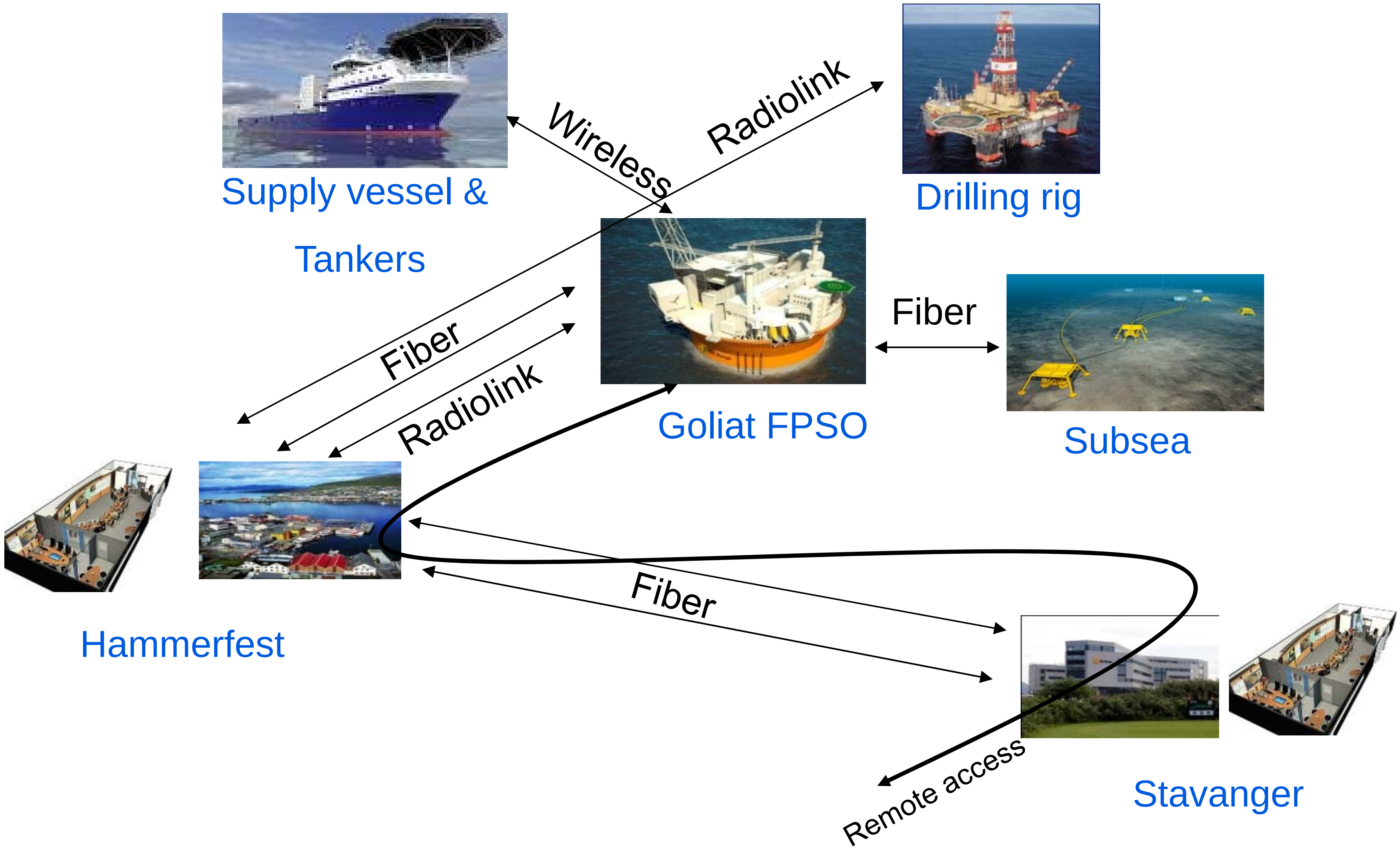


Integrated Operations
Realizing the value of a modern maintenance strategy



An active maintenance strategy with structured work process and modern tools enables early fault detections, reduces costs and avoids expensive breakdowns

Digital Oilfield Topology



Power and productivity
for a better world™

ABB