Subsea Control, Safety & Digital Oilfield

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Agenda

1. Rockwell in the Oil & Gas Subsea Industry
2. The Digital Oilfield & FT Innovation Suite
3. The Digital Oilfield – Augmented Reality
4. The Digital Oilfield – Subsea Process Optimization Application
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Rockwell in The Oil & Gas Subsea Industry

Onshore

Pipeline/Transportation

Refining and Petrochemical

Gas Processing

Offshore

Liquefied Natural Gas
Industry challenges

OIL & GAS
Maximize uptime, speed exploration & well development, help enable safe operations, optimize asset utilization - and reduce operational costs.

APPLICATION EXPERTISE
- ConnectedProduction™ (Digital Oil Field)
- Emergency Shutdown / Fire & Gas
- FEED Studies
- Integrated Control & Safety
- Main Automation Contractor
- Packaged Process & Power
- Process Safety
- Subsea Control & Safety

OIL PRICES
Deflated / Stabilizing

-30% CAPEX SPENDING

2.2% GLOBAL NATURAL GAS DEMAND

Project Cancellations & Production Performance

Regulatory Requirements

Remote Locations

Costs
## Subsea Control & Safety Solutions

### Supply of Subsea Control System for Compressor Anti-Surge and Process Shutdown

<table>
<thead>
<tr>
<th>CUSTOMER CHALLENGES</th>
<th>DELIVERED SOLUTION</th>
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<tbody>
<tr>
<td>New engineering concept – subsea compression.</td>
<td>- Functional Safety Review of the Basis of Design</td>
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<td>Timescales – Finite amount of time available to develop the solution as the field was losing pressure and if it dropped too low it would have been unrecoverable.</td>
<td>- Rockwell’s Redundant AADvance Eurocard Solution</td>
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<tr>
<td>Integrating Aker ModSAFE (Safety serial communication protocol) into AADvance</td>
<td>- Anti Surge system and Process Shutdown system and Simulation Test Rig</td>
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- Rockwell Automation were a critical part in the delivery of the world’s first subsea compression system. This is also considered to be the world’s largest underwater machine.

- Rockwell Automation’s highly technical project scopes were delivered within the project KPI’s (Safety, schedule and cost).

- As a result of this project Rockwell Automation’s Eurocard AADvance system has been approved and specified for future SEM Subsea deployment.
Global Solutions O&G – Upstream Offshore

- **Drill Rigs & Drill Ships**
  - Integrated Information, Control, Power and Safety (ICPS)
  - Emergency Shutdown (ESD) / F&G Gas Detection
  - Process Shutdown (PSD) / High Integrity Pressure Protection Systems (HIPPS) / Subsea control
  - Skid package control systems / TMC and compressor control systems / Vibration monitoring systems
  - Marine propulsion systems / Ballast control systems

- **Production Platforms**
  - Integrated Information, Control, Power and Safety (ICPS)
  - Emergency Shutdown (ESD) / Fire and Gas detection (F&G) / Process Shutdown (PSD)
  - High Integrity Pressure Protection Systems (HIPPS)
  - Burner management systems (BMS)
  - Subsea control and shutdown systems
  - Subsea control / Skid package control systems
  - TMC Vibration monitoring systems
  - Compressor control systems

- **Subsea**
  - Integrated Control and Safety Systems (ICSS)
  - Subsea control systems including compressor control
  - Emergency Shutdown (ESD) / Process Shutdown (PSD)
  - High Integrity Pressure Protection Systems (HIPPS)
  - Subsea Blowout Preventers (BOP’s)
  - Technologies for OEM skid packages
  - The Digital Oilfield

- **FPSO**
  - Integrated Control and Safety Systems (ICSS)
  - Emergency Shutdown (ESD) / Process Shutdown (PSD) / Fire and Gas detection (F&G)
  - High Integrity Pressure Protection Systems (HIPPS)
  - Burner Management Systems (BMS)
  - Subsea control and shutdown systems
  - Monitoring and Control
    - Marine propulsion systems and Ballast control
    - Skid package control systems / TMC and compressor control systems / Vibration monitoring systems
    - Thruster control Medium Voltage Drives
    - Pump control Medium Voltage / Low Voltage Drives, Smart Motor Controllers (SMC) or ACL
    - Generator monitoring / Equipment monitoring and reporting / Tank level monitoring and control
  - Power solutions
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The Digital Oilfield – Big Data?

Analytics Value
Increasing Intelligence & Improving Performance
The Digital Oilfield – How It’s Done
The Digital Oilfield – FT Innovation Suite

What does that mean?
We have produced a software suite called FT Innovation Suite that truly lives where IT meets OT. It’s a convergence of:

- Connectivity of disparate systems
- Augmented & Virtual Reality
- Artificial Intelligence
- Automation
- Basic & Advanced Analytics
- Internet of Things
- MES

All working together in one integrated suite!

There are two main applications I see for the O&G Industry:
1. Augmented Reality
2. Production Optimisation
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Augmented Reality

Maintenance Repair – C.Valve seal

- Recognition of plant & equipment by GPS location or an Outline view based on the digital model (twin) of the plant.

(Note = Ruggedized tablets or Class 1 / Div 1 Monolens are available now)

- The Augmented Reality environment synchronises with data feeds from the IOT to augment the information to the user.

- As the engineer approaches, additional information is augmented and prompts the engineer to the Task Integration Area.

- Next a short video will explain the next steps in Augmented Reality aided maintenance.
The Digital Oilfield – FT Innovation Suite
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The Digital Oilfield – Typical Subsea Well Tie Back
The Digital Oilfield – Subsea Modelling (Ref Case)

Production Optimization – What more can be done?
- We can Model the Flow Assurance Report – Technical
- We can Model the Well Start-Ups – Actual
- Data mine the Descriptive & Diagnostic Real Time Operations
- Use Data Analytics to Predict what is about to occur and Prescribe optimal production settings, within the operational plant constraints.

Typical Start-Up and Production Issues & Constraints
- Well Dynamics (Closed In Head Press & Thermo Dyn’cs)
- Normal Operating Conditions
- Flowline Pressure Drops
- Wellhead Choke Valve Pressure Drops
- Hydrate Formation (Turndown & Ramp Up Rates)
- Chemical Inhibitor injection rates
- Well Operational Lifecycle – Managing Change
The Digital Oilfield – Subsea Modelling (Ref Case)

**Production Benefits**

- Re-Validation of ‘One-Shot’ Flow Assurance is redundant, due to **Real-Time** Basic and Advanced Analytical Verification.
- Shutdown Start-Ups enhanced with ‘Tuned’ Choke Ramp Rates specific to your Well Dynamics utilising the **Predictive** and **Prescriptive** Analytical tools.
- Analytically **Predict** and **Prescribe** Slugs to avert shutdowns and production interruptions.
- Minimise Hydrate mitigation and blow down on Start-Ups by mapping Hydrate curve in Real-Time and using the Analytics Value available.

**Analytics Value**

Increasing Intelligence & Improving Performance
Questions?

Thank You!
Thank you