SPOTLIGHT ON TECHNOLOGY

Increasing Shareholder Value with Subsea Electric Actuation Systems

Mark Perry
Global Business Development
WITTENSTEIN motion control GmbH
WITTENSTEIN Innovation Factory

Wide Portfolio

Mechanical & Mechatronic Drive Solutions

WITTENSTEIN alpha

WITTENSTEIN electronics

WITTENSTEIN bastian

WITTENSTEIN cyber motor

WITTENSTEIN intens

WITTENSTEIN motion control

WITTENSTEIN aerospace & simulation

attocube systems
Wide Portfolio

Mechatronic Solutions – from the Sea Bed to Aerospace
Technology Challenges

Key Drivers for Electric Actuation

Environmental risk
Deeper waters
Longer step-outs

Increased Oil Recovery
On existing fields with Processing & Compression

Increase reliability to Reduce marginal field expenditure
Electrical Subsea Valve Actuator

Safety – Reliability - Competence

Modular
Electrical
Redundant
Technology Challenges

New Projects & Retrofit

Condition Monitoring

better than Hydraulics

Safety

Usability

Reliability

Controllability

Originator Mark Perry

Proprietary Information
Technology Program

- In-house
- Modular components
- TRL 6 & 7
- ISO 13628-6
- Subsea qualified
- Key program supplier
- Quality
- Fast prototyping

Specialty Technologies
Proprietary Information
Technology Program

Integrated Systems from a Single Source

Planetary Gearheads

Electronic Modules

Brushless DC-Servo Motors
## Technology Program

### Subsea SSEAC applications

<table>
<thead>
<tr>
<th>Nm Range</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Nm</td>
<td>Small Ball Valves 90 Degree Turn, Spring return/Failsafe</td>
</tr>
<tr>
<td>600 Nm</td>
<td>General Purpose Choke Valves and Rotary Gate Valves</td>
</tr>
<tr>
<td>2700 Nm</td>
<td>Multi Turn Larger Control Valves / Chokes   Fail Safe</td>
</tr>
<tr>
<td>1000 KN</td>
<td>HIPPS Valves Slow Opening SLAM shut 8” Gate Valves</td>
</tr>
<tr>
<td>40 KN</td>
<td>Linear movement actuators</td>
</tr>
</tbody>
</table>

Originator Mark Perry

Proprietary information
Technology Program

SSEAC subsea electric actuator: Dual & Single channel

- 3000 m operation
  - Retrofit or Direct mounted.
- MTBF 30,000 hours
  - Tested to 1 Million op.cycles
- Vibration, Shock, EMC, Temperature & Pressure resistant ISO 13628-6
- Battery or spring return.
- Powered from Surface or SCM (1000v AC to 24v DC)
## History & Deployment

Deployments with Global clients since 2001 > 200 units

<table>
<thead>
<tr>
<th>Project</th>
<th>Value €</th>
<th>Year</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statfjord</td>
<td></td>
<td>2001</td>
<td>Valve actuation</td>
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<tr>
<td>Elvis</td>
<td></td>
<td>2002</td>
<td>Valve actuation</td>
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<tr>
<td>Orman Lange</td>
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<td>2004</td>
<td>Valve actuation</td>
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<tr>
<td>Norne</td>
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<td>2006</td>
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<td>Gjoa</td>
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<td>2007</td>
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<tr>
<td>Pluto</td>
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<td>2007</td>
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<tr>
<td>Tyrians</td>
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<td>2008</td>
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<tr>
<td>Albacora</td>
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<tr>
<td>Aasgard</td>
<td>2011-13</td>
<td></td>
<td>Valve actuation</td>
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<tr>
<td>Siemens</td>
<td>2012</td>
<td></td>
<td>HPU (Pump Drive)</td>
</tr>
</tbody>
</table>

Originator – M. Perry
The sea bed

Operator Benefits:

**RETROFIT & GREENFIELD**

**REDUCED MAINTENANCE**
CONDITION MONITORING

**OPERATIONAL EFFICIENCY**
MODULATING CONTROL

**SAFETY & RELIABILITY**
SIL available
Long MTBF

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**Processor / Compressor**
- Subsea Processing of oil/compression of gas enhances field economics by maximizing recovery, increasing production and reducing costs
- WITTENSTEIN delivers 80-100 valve system components for Aasgard

**Xmas Tree**
- Assembly of valves, spools, and fittings used for an oil, gas, water injection, water disposal, gas injection, condensate and other wells
- ~8-10 valves .Choke, Gates ,Ball.

**Manifold**
- Structure consisting of pipes and valves and designed to transfer oil / gas from wellheads into a pipeline
- ~2-5% manifolds on the NCS are electrical
- ~18-20 valves per manifold

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*Originator Mark Perry*
SHAREHOLDER VALUE

Increased functionality:
Operational efficiency:
Environmental safety:

• OPEX:
  No hydraulic fluids and maintenance of it.

• RELIABILITY:
  Facilitates condition monitoring

• CAPEX:
  Reduces the size and weight of the umbilical

• ENABLING:
  Longer step-outs and deeper water

• OPERATIONAL EFFICIENCY:
  Closer control of EOR schemes

• SUSTAINABILITY:
  Environmentally safe - zero discharge