Long Tie-back Controls Technology in the Barents Sea

Subsea Controls Down Under 2018

Perth, 24th October 2018
Rodrigo Lima, Specialist Engineer
Agenda

- Industry trends
- NCS2017+ project
- Johan Castberg
- Askeladd
- Technical details
Subsea Power Delivery Industry Trends

- Long step-outs are becoming more common

- Power consumption is increasing
  - More instrumentation
  - Instrumentation more complex

- Higher load + longer step-out
  - Less efficient power distribution

- Move towards
  - Higher voltages and/or
  - DC distribution

Low Voltage AC (<1kV 1-ph.)
Low Voltage DC (<1.2kV)
AC Highway (3kV 3-ph.)
DC/FO (3-10kV)
## SPS NCS 2017+ project

<table>
<thead>
<tr>
<th>Project</th>
<th>Equipment</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johan Castberg</td>
<td>31 off 7”x5” VXT / 10 off Templates+manifolds</td>
<td></td>
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<tr>
<td>Askeladd</td>
<td>4 off 7”x7” VXT / 2 off Templates+manifolds</td>
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<tr>
<td>Troll Phase 3</td>
<td>9 off 7”x7” VXT / 2 off Templates+manifolds</td>
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<tr>
<td><strong>Total</strong></td>
<td>44 off VXT / 14 off Templates+manifolds</td>
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Our involvement on NCS2017+

2013
Skrugard/ Havis Concept Study

2014
Johan Castberg Pre-FEED extension

2015
Concept and cost optimisation study

2016
Johan Castberg – Cost Out Pre-FEED Per Well Target 100 MNOK

2017
ITT Received 3rd of April 2017

NCS2017+ FEED Maturing of concepts/ Tender Preparations Started Oct 2016

Askeladd Pre-FEED

Askeladd FEED

Askeladd tender

Tender submitted 1st of June 2017

TP3 Pre-FEED

TP3 FEED

TP3 tender
SPS Package Specification implications

- Clarifies requirements and makes them more accessible
- Reduces documentation with duplicated requirements
- An engineering team more engaged with contractual requirements

- New way of distribute requirements to discipline engineers
  - Some will always prefer the way it “used to be”
  - Challenging with new team members joining as new way of thinking requires closer project induction
- Development: New FPSO
- Oil field
- Design life: 25 years
- Design water depth: 500m
- Actual water depth: 344 – 398m
- Design pressure: 345/345/690bar
- Design temp: -18°C +121°C
- Manifold header/branch: 10" ID/6"
- Max. step-out: 14 km
Johan Castberg  – Controls Highlights

- **Scope of Supply**
  - Topside cabinets prepared for and equipped with hardware for **70 wells**
  - **87 Vectus™ SEMs** (33 SCMs & 21 SRMs)
  - ~550 instruments
  - ~500 EFLs and OFLs
  - 84 RIMS

- **New interface to SAS**
  - MDIS - ABB as interface party

- **New and extensive Cyber security and Network specifications**
  - External consultants part of execution team

- **Interface to Alcatel DCFO**

- **Aker Solutions has EPma contract (FPSO)**
  - Aker synergies continuously exploited
  - Agreed on shared Functional Safety approach to remove duplication of work
  - EPma, SPS and ABB located in the same building
Askeladd

- Development: Tie-back to Snøhvit PLEM and CDU
- Gas condensate field
- Design life: 25 years
- Design water depth: 500m
- Actual water depth: 250 - 330m
- Design pressure: 345/430/690bar
- Design temp: -18°C +121°C
- Total step-out: 194 km
Askeladd – Controls Highlights

- **Scope of Supply**
  - Topside cabinets inc SCU, topside copy for Melkøya test system and input to production simulator
  - 14 Vectus™ SEMs (4 SCMs & 6 SRMs)
  - 12 ELDRIVE™; AKSO Electric Actuators
  - ~50 instruments
  - ~70 EFLs and OFLs, inc HV electrical distribution
  - ~17 RIMS

- **New AC Highway™** 3kV 3-phase AC power transmission
  - Expansion from Snøhvit
  - New 3kV/500V Subsea Trafo Unit (STU)

- **Limited fibre optic cores available**
  - Expansion from Snøhvit
  - Fibre multiplexer in Subsea Router Module (SRM)
Johan Castberg SPCS

Topside

HPU
DCFO P&C
COMMS RACK
Subsea Gateway
IMS
Metering
SCU
RISER BASE
DCFO NODE
UTH
SRM
SCM 1
SCM n

Subsea

RISER BASE
Askeladd SPCS

Topside
- Subsea Gateway
  - IMS
  - Metering
  - SCU

Subsea
- UTH
  - Trafo
  - SRM
  - SCM 1
  - SCM n
  - UTH
  - Template
  - UTH

- CDU
- EPU
- COMMS RACK
- HPU
Scalable System Architecture

- Subsea Gateway Server 1
- Subsea Gateway Server N
- Data Processing Server 1
- Data Processing Server N

Core Network
(Scalable design based on project needs)

- Communication
- Template 1
- Template 2
- Template 3
- Template N
Scalable System Architecture

- Goal is to have a functional split of the system to cater for a scalable architecture.
- Each domain can be scaled and/or duplicated based on the functional design
- E.g. Subsea template structure is duplicated for the number of templates, while the core network is scaled to support the required connections and throughput.
- Clear interfaces is kept between the functional domains to be able to keep the overall architecture the same.
- Scalable between small and big projects.
- Duplicated domains can be managed with minimal configuration and testing effort.
- Scaling simplifies documentation and testing. Flexibility in terms of HW used during testing
Power systems

**DCFO Power Feed Equipment**

- DCFO Power
- 12kV DC

**Topside**

- DCFO NODE
- 400V DC

**Subsea**

- SRM
- 400V DC

- SCM

**Askeladd**

- EPU
- 3kV AC – 3 phase

**Topside**

- TRAFO
- 600V AC

**Subsea**

- SRM
- 600V AC

- SCM

- SRM
- 500V AC

- SCM
Comms systems

Ethernet Switch

Subsea Gateway

Topside

Optical Ethernet
Single fibre

DCFO NODE

Optical Ethernet
Single fibre

SRM

Subsea

Ethernet

SCM

Optical Ethernet
Single fibre

DCFO NODE

Optical Ethernet
Single fibre

SRM

Subsea

Ethernet

SCM

Optical Ethernet
Single fibre

SRM (M)

Subsea

Ethernet

SCM

Optical Ethernet
Single fibre

SRM

Subsea

Ethernet

SCM

Optical Ethernet
Single fibre

SRM

Subsea

Ethernet

SCM

Dual fibre

Ethernet Switch

Subsea Gateway

Topside

Optical Ethernet
Single fibre

SRM

Subsea

Ethernet

SCM

Optical Ethernet
Single fibre

SRM (M)

Subsea

Ethernet

SCM

Optical Ethernet
Single fibre

SRM

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Optical Ethernet
Single fibre

SRM

Subsea

Ethernet

SCM
**Vectus Power & Communications**

**Power Supply Module**
- Wide Range Input power
- 200 to 900V AC / 280 to 1200V DC

**Power Filter Module**
- Contains the power filters for CPS
- 600V AC Rated

**Electronics Module**
- Contains modems & communications routing electronics
- Multiple modem options/configurations including Optical & Copper
**Vertical XT Standardization**

### Johan Castberg (5in x 7in)
- Oil Production
  - FCM
  - MPFM
  - PT/TTs
  - Erosion probe
  - SPFM
  - Sand detector
  - Chokes position
- Water Injection
  - FCM
  - SPFM
  - PT/TT
  - Choke position
- Gas Injection
  - FCM
  - SPFM
  - PT/TT
  - Choke position

### Askeladd (7in x 7in)
- Gas Production
  - CBM
  - WFGM
  - PT/TT
  - Corrosion-erosion monitor
  - Sand detector
  - Choke position
  - El. actuators

### Standard XT with well specific configuration in FCM
- Standard SCM with SIIS L1, SIIS L2, SIIS L3 and IWIS interfaces to cater for different needs
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