



Draugen Subsea Boosting

Shell @ FFU 2017

Jan-Olav Hallset

Team Lead - Subsea Controls & Umbilicals
A/S Norske Shell



Jan-Olav Hallset, CV

1992: PhD, NTNU, Dept. of Engineering Cybernetics.

1993 - 2014: Oceaneering, Hitec, Poseidon, Siemens

2014 - now: Norske Shell - Team Lead for Subsea
Controls & Umbilicals.



Shell Operated Assets in Norway



Knarr FPSO,
Norwegian
North Sea

4



1 Draugen – Norwegian Sea

Draugen Subsea Boosting



Ormen Lange and Nyhamna

2

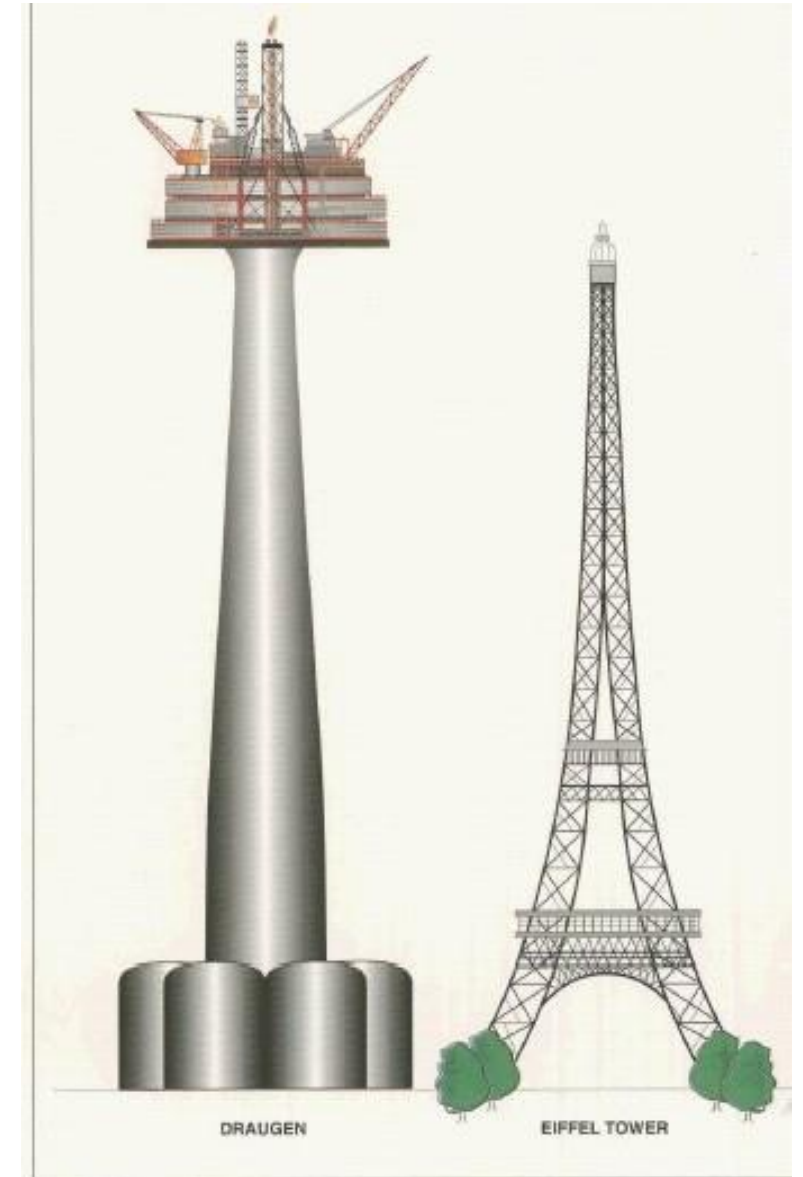
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Draugen Field



- Haltenbanken area, 140km North of Kristiansund
- Discovered in 1984 and production start 1993
- First and only Single-leg GBS platform
- Water Depth ~ 250-280 m
- Peak Production 225 000 bbl/day

- Continuous project activity and investments underway to make Draugen a high integrity producer

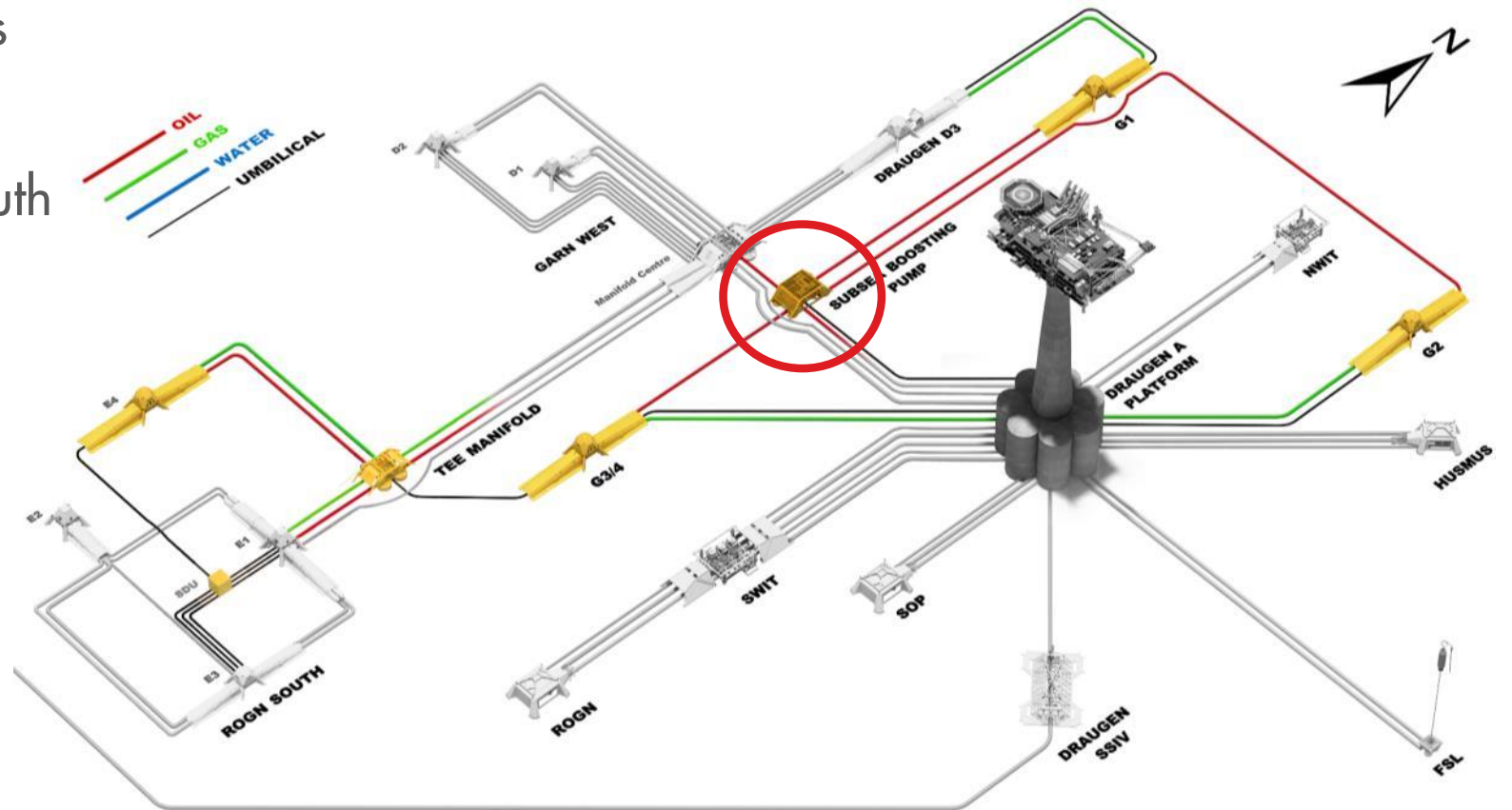


Partners



Draugen Infill Drilling Campaign

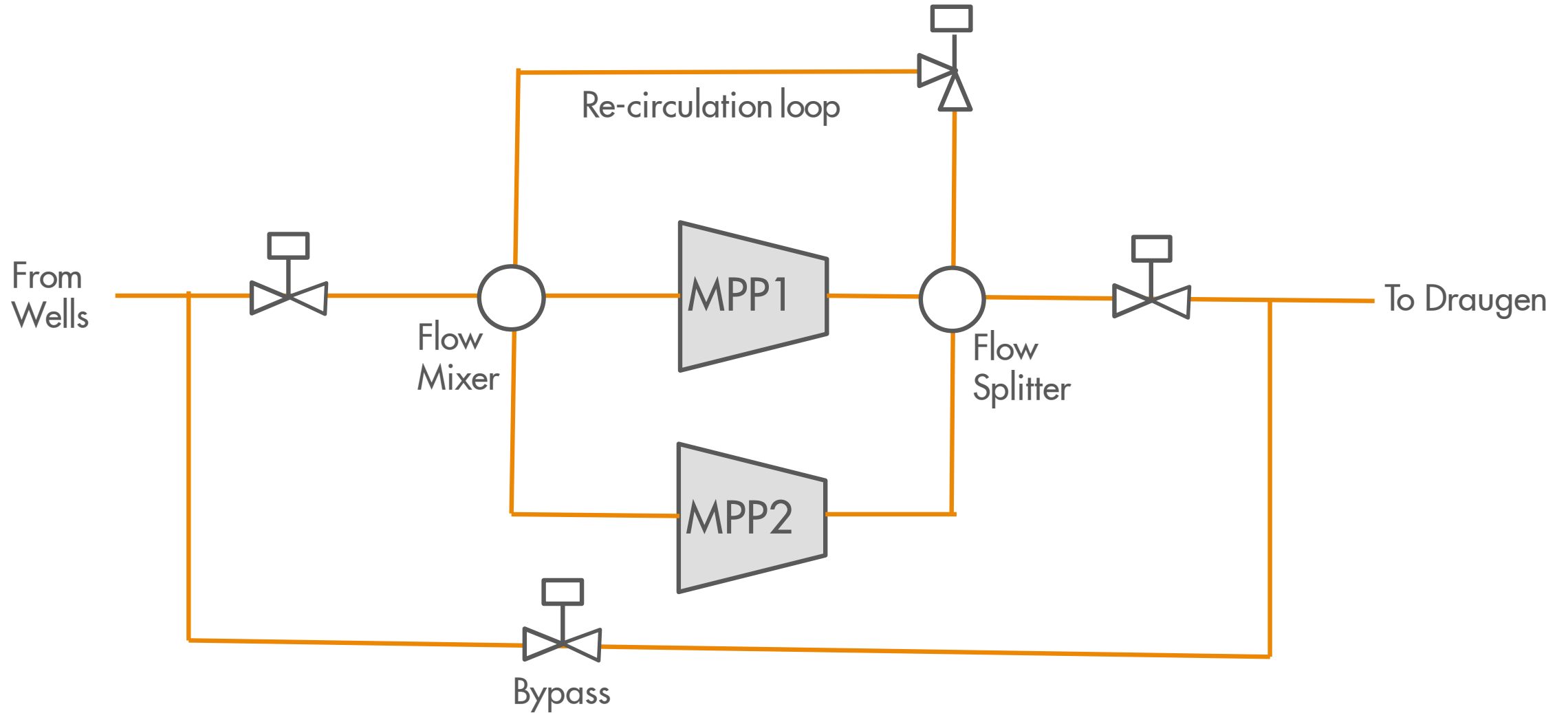
- 4x New Subsea Production Wells
- Subsea Boosting Pump
- Subsea Tee Manifold @ Rogn South
- 19 km of New Flowlines
- 11 km of New Umbilicals
- 52 tie-ins
- 113 GRP Covers
- 245 000 m³ Rock Installation



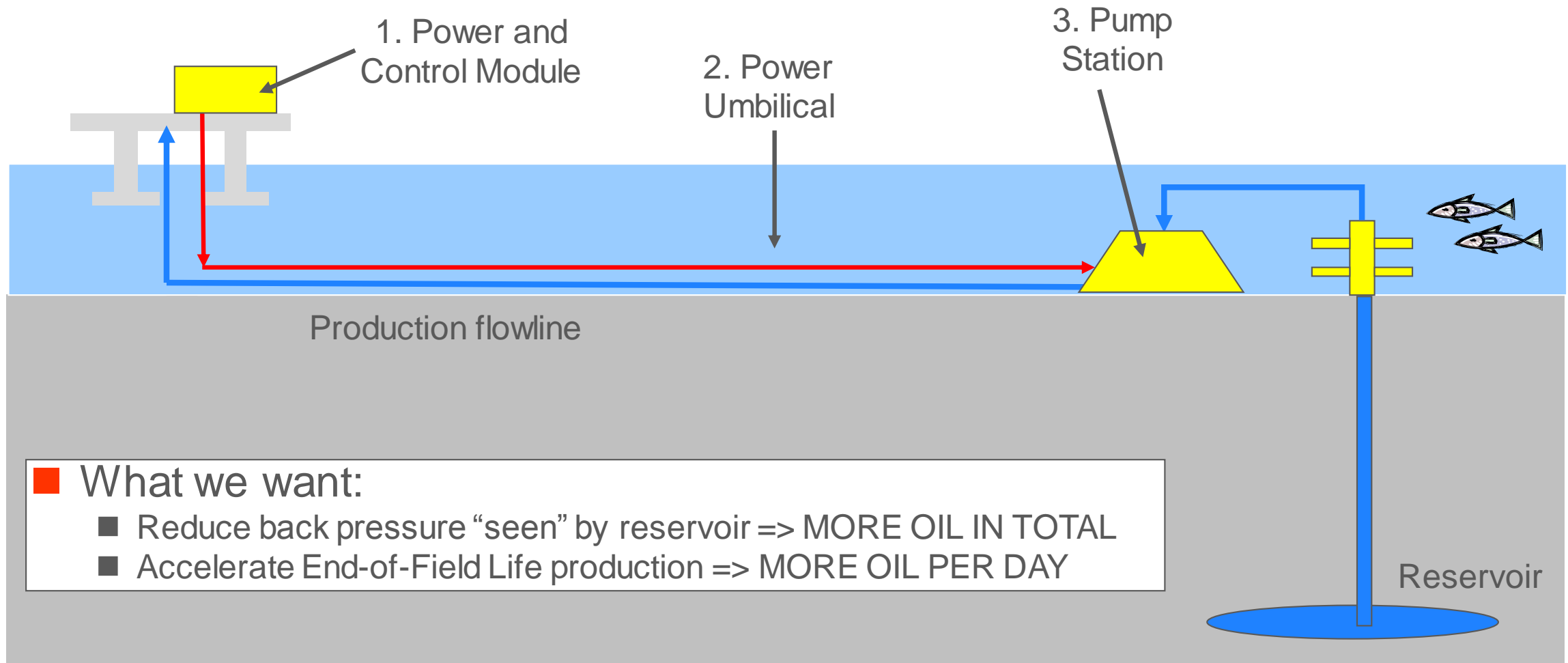
Vision, Mermaid and Clipper



Draugen Pump System - Simplified



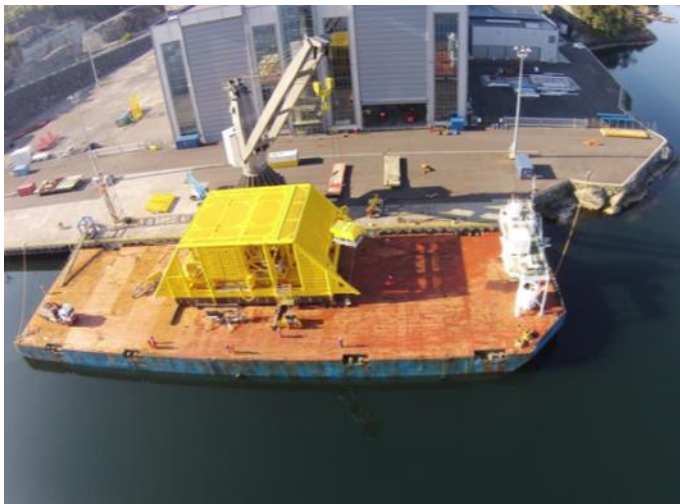
Subsea Pump System and Purpose



Draugen Pump Manifold installed – July 2014

- Size Protection Structure: 15m x 33m x 11m
- Size Pump Manifold: 13m x 16m x 8m
- Weight Protection Structure: 294 MT
- Pump Station Weight: 301 MT
- 2 year after contract award

Safe and on schedule



Topside – Power & Control Module (PCM)



- 2 Siemens Variable Speed Drives
- Barrier Fluid System
- Control Fluid System
- Pump Controls
- Air cooling unit and other utilities



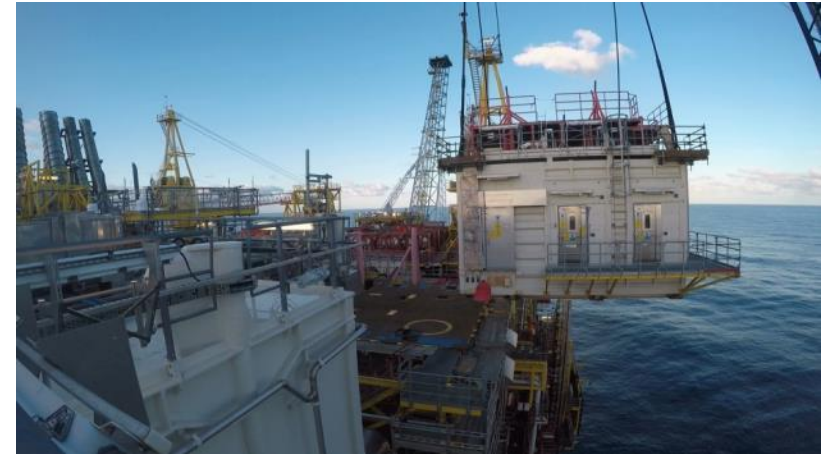
Name	Dim (WxLx H) [m]	Weight
Power Control Module	12x9x7	200 MT

PCM Installed – May 2016

- Size of Power and Control Module: 9m x 12m x 7m
- Weight: 200 MT
- After 2 years in storage

Successfully lifted onto Draugen

From Horsøy – to Draugen



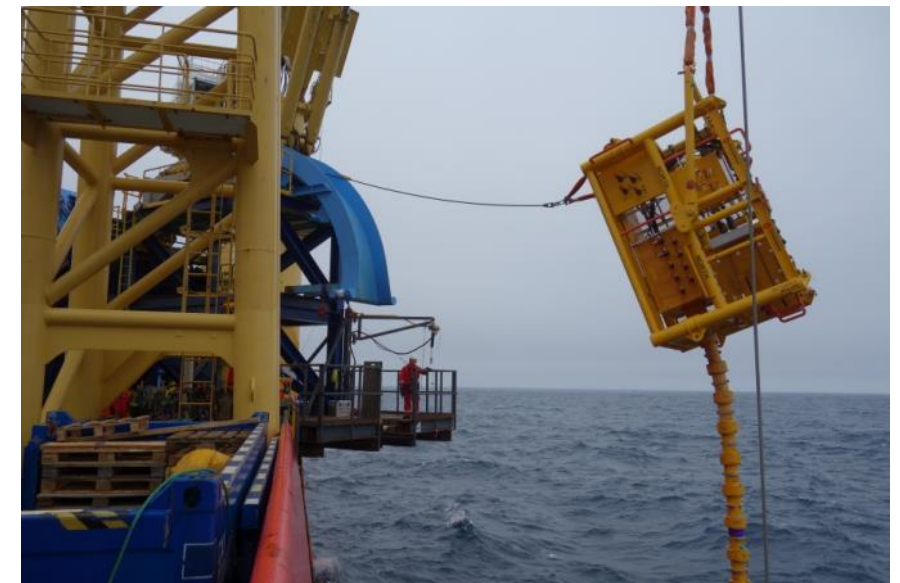
Pump Umbilical installed – July 2016

- Length ~4km; Diameter 169 mm
- Termination Assembly ~20MT
- Services: Medium Voltage, Low Voltage, Fiber optic, Hydraulics, Chemicals

Successfully tested & installed after 2 years in storage



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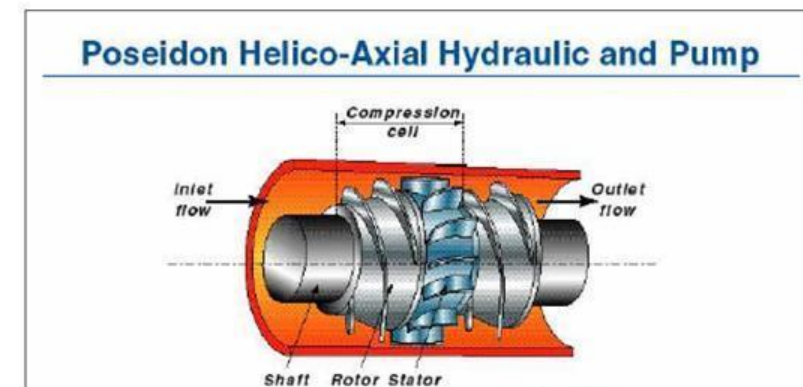
Draugen Subsea Boosting

February 2017

Helico-Axial Multiphase Pumps

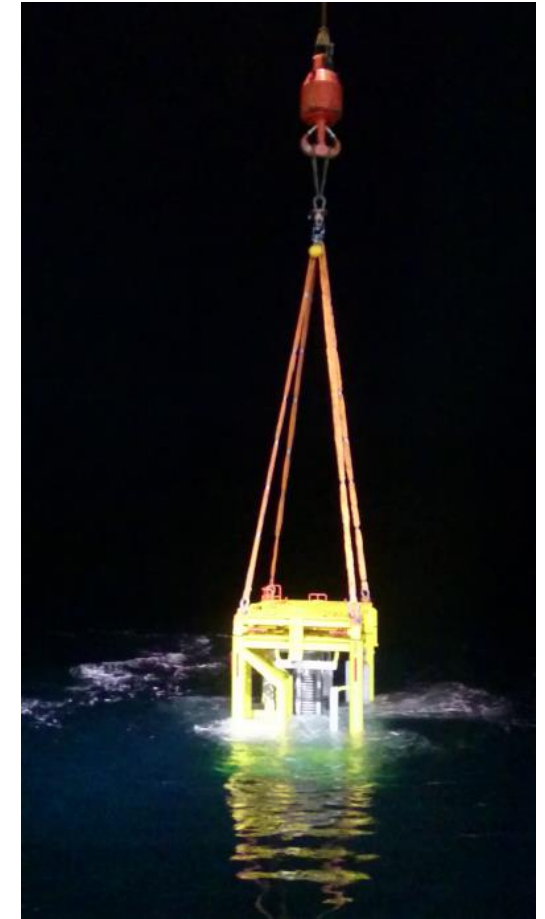
- 2 x Subsea Pump Modules
- Size: ~4,3m x 3,3m x 6,3 m
- Weight ~43 MT

Design pressure:	220 barg
Process operating temperature:	4 to 75 °C
Max pump differential pressure:	50 bar
Pump suction pressure:	21 - 29 bara
Pump suction GVF:	10 - 32% (75%)
Pump flow rate:	643 - 855 Am ³ /h
Pump speed:	1500 – 4200 rpm
Pump motor shaft power:	2300 kW
Water Depth:	268 m

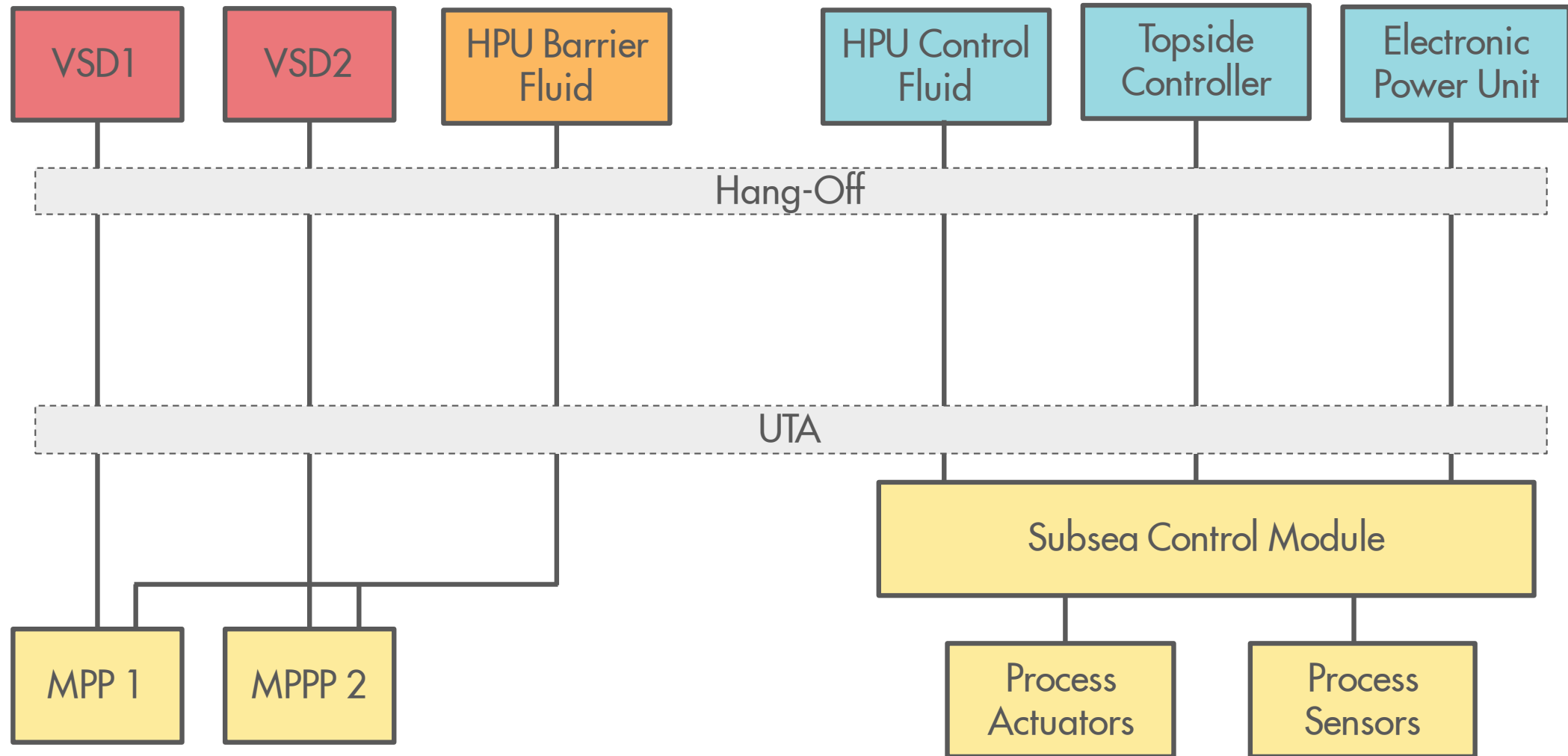


Vision 2nd Campaign – Pump Modules

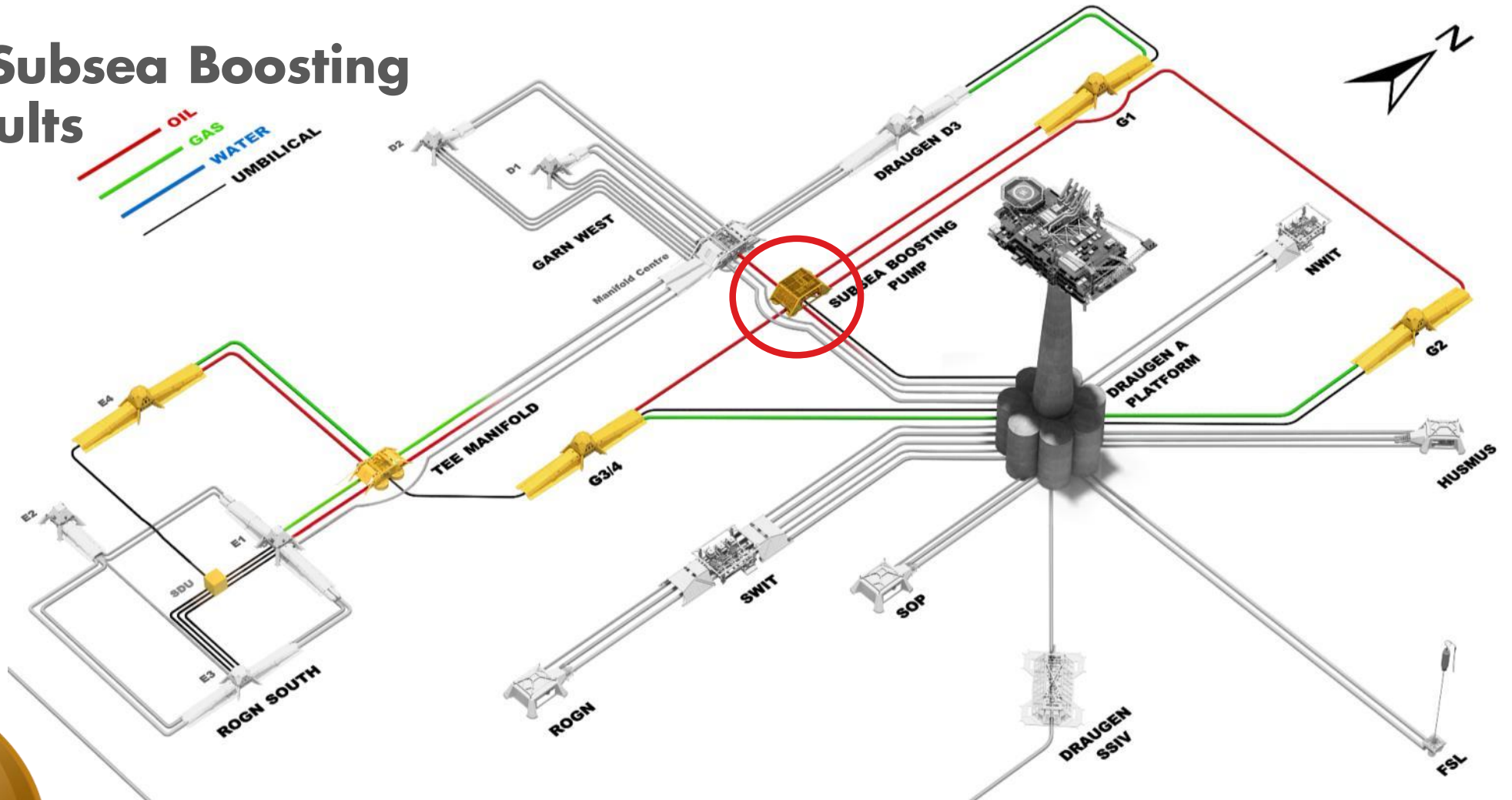
- 2 x Subsea Pump Modules
- Size: ~4,3m x 3,3m x 6,3 m
- Weight ~43 MT



Extensive Hook-up & Testing, Example: Control & Power



Draugen Subsea Boosting - First Results



- Results per 2017:
 - MORE OIL IN TOTAL => YES, we have reduced back pressure a lot
 - MORE OIL PER DAY => YES, we are producing significantly more

Shell Subsea Processing - A Global Activity

Operating Fields:

BC-10 – ESP Caisson Pumps since 2009
Perdido – ESP Caisson Pumps since 2010

Execution phase:

Draugen – Mudline Pump (MLP)
BC 10 MLP Pilot
Stones MLP

Assess Phase: Ormen Lange Late Life Compression

