

# Light Well Intervention Vessel Operations for Phase 1 Subsea Well Abandonment

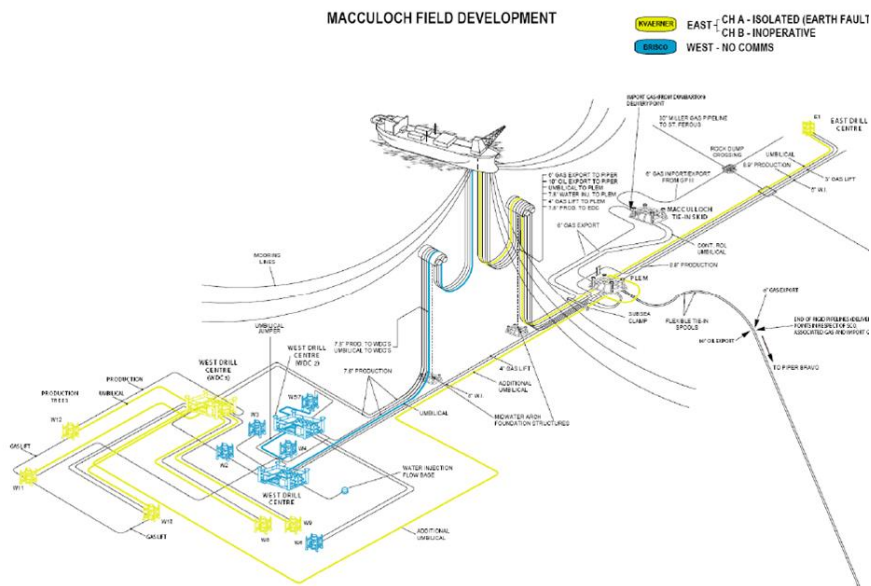
MacCulloch Field Abandonment

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# MacCulloch Field Background



- Black oil reservoir located 140miles NE of Aberdeen in 490ft WD
- Eleven subsea producers in two centres, with strong natural aquifer
  - Produced 119MMbbls since first production in 1997
  - Production to leased FPSO - North Sea Producer, flowlines disconnected from wells and vessel removed by August 2015
  - Field in LRP for full abandonment 2019 earliest





# Optimised P&A Strategy

## Wells Suspended at the Tree Valves

2015

2016

2017

2018

2019

+

### Previous Strategy



### Why change strategy?

Diver operations to reinstate barriers for tree cap recovery and subsequent well access

De-risk wells thru suspension phase

Reduce overall project cost – reduced rig days and weather exposure

Better define and de-risk rig based P&A scope

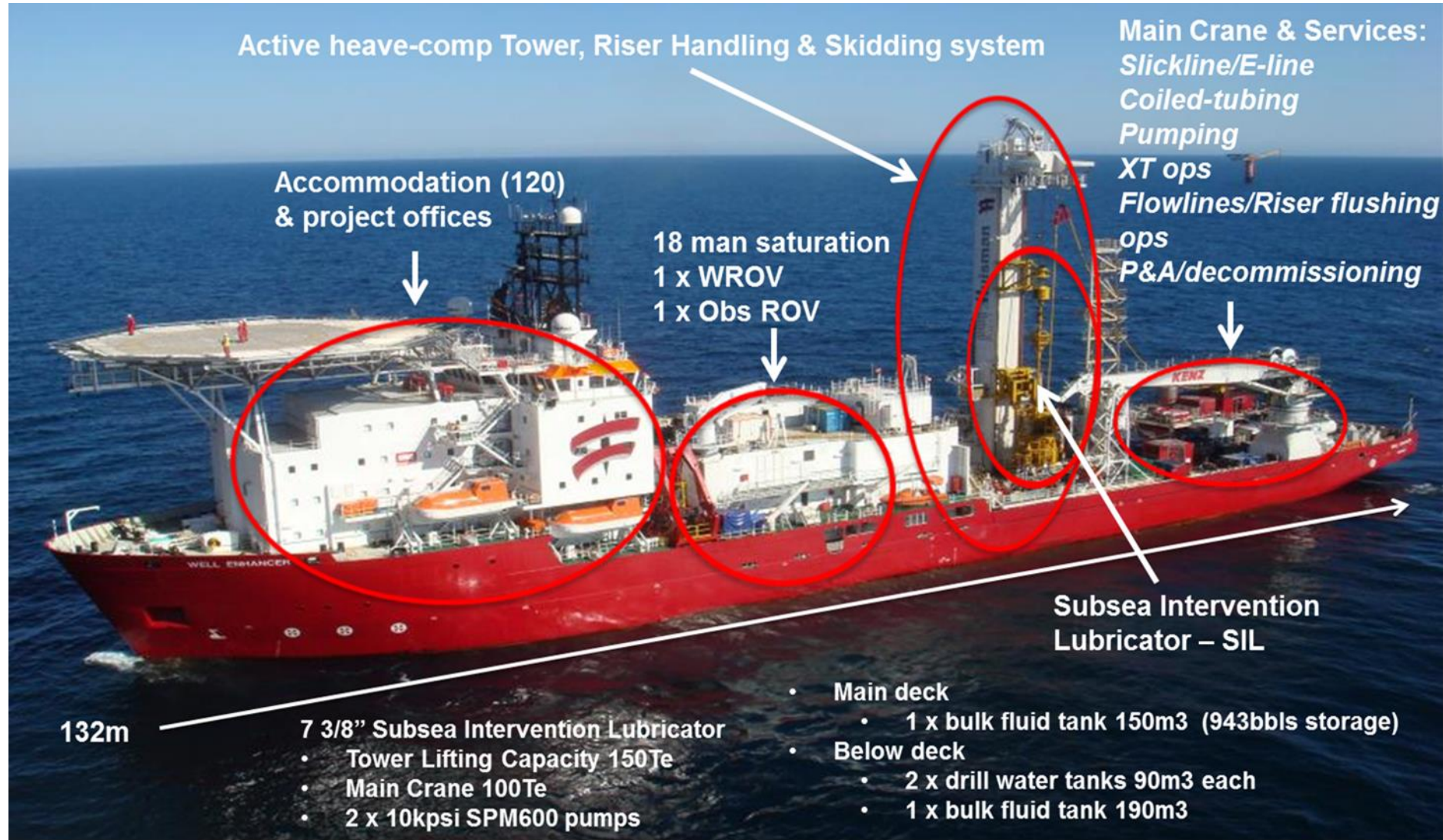
Defer P&A whilst optimising P&A design (Technology and GGRE options)

Maximise collaboration/campaigns

### Optimised Strategy

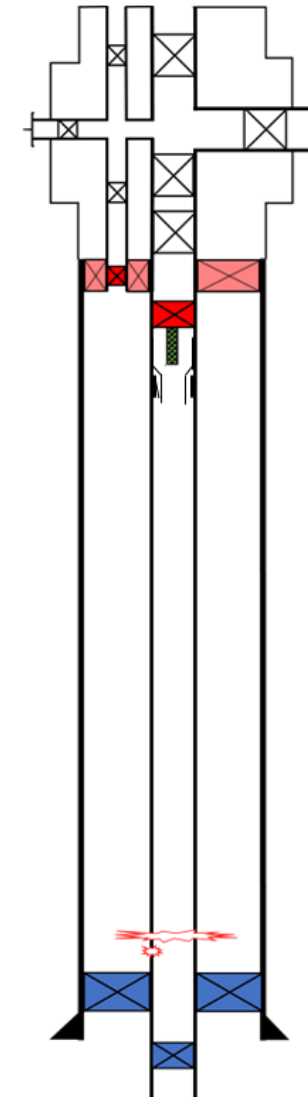


# Helix Well Enhancer





1	Transit to Field, DP trials & enter the 500m zone
2	Recover debris cap, pressure wash tree and establish guidewires
3	Deploy tree cap running tool (TCRT), lock and overpull
4	Divers pressure test barriers for tree cap recovery
5	Unlock and recover tree cap to vessel
6	Deploy Subsea Intervention Lubricator (SIL), lock and test interfaces
7	Rig up Digital Slickline (DSL)
8	Run a drift to the completion tailpipe
9	Punch tubing just above production packer
10	Rig down DSL & deploy 2" subsea hose to SIL
11	Bullhead the tubing and annulus contents to reservoir
12	Recover 2" subsea hose & rig up DSL
13	Set a deep plug in tubing tailpipe, top up well and pressure test plug and production packer (primary suspension barriers)
14	Cut tubing above production packer
15	Set a hold-open sleeve across the DHSV
16	Set a shallow plug c/w wireless acoustic gauges in the completion tubing below the tubing hanger. Pressure test the plug (secondary suspension barrier)
17	Recover SIL, reconfigure for annulus operations, deploy SIL and test interfaces
18	Set a plug in the tubing hanger annulus profile and pressure test (secondary suspension barrier)
19	Recover SIL and install debris cover



# What did we get done?



## HSE Stats

- 1 incident – minor dropped object
  - No risk to personnel or assets
  - Recovered to surface and re-deployed with enhanced rigging
- Safety Management System Stats

TYPE	Total Project
TRAC (Task Risk Assessment Cards) – Doghouse, deck, SIL, ROV, Diving, Marine, Catering, 3 <sup>rd</sup> Party	3,876
Observation Reporting – At Risk Observations, Improvement Suggestions, Positive Observations	797
MOCs (Management of Change)	20
Level 2 Risk Assessment	4
Doghouse Drills (Inc Subsea)	172
ROV Drills	7
Diving Drills	212
Marine Drills	58
TOSs (Time Out For Safety)	223

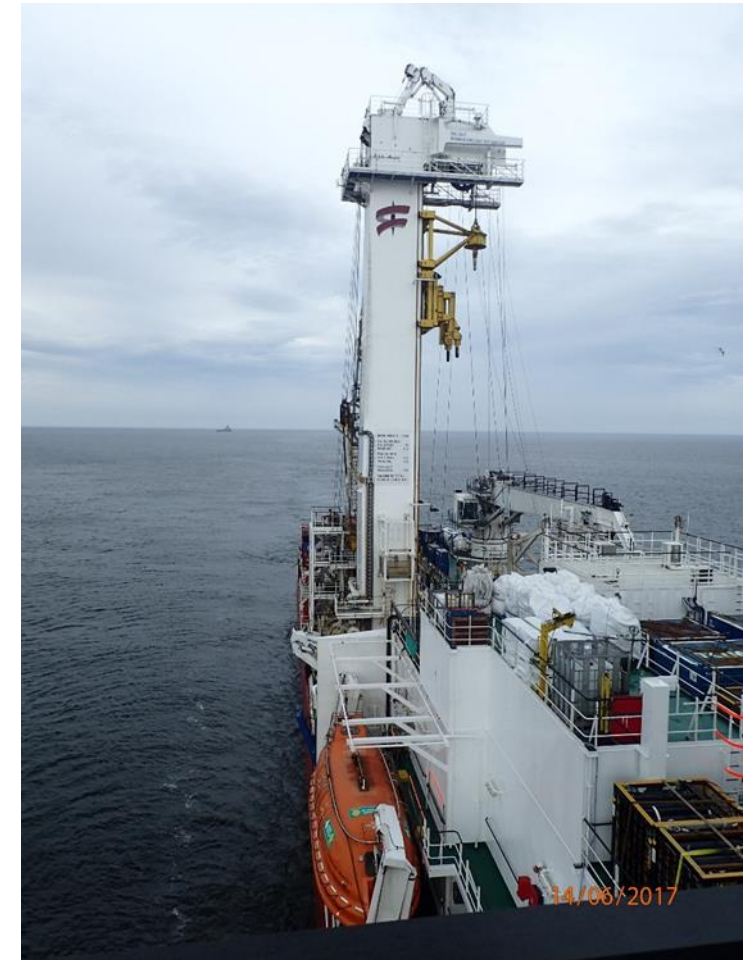
- Average POB: 122
- Total Man Hours: 142,634
- Total Dives: 92
- Total Diver in Water Time: 579 hours and 32 minutes (over 24 days)



# What did we get done?



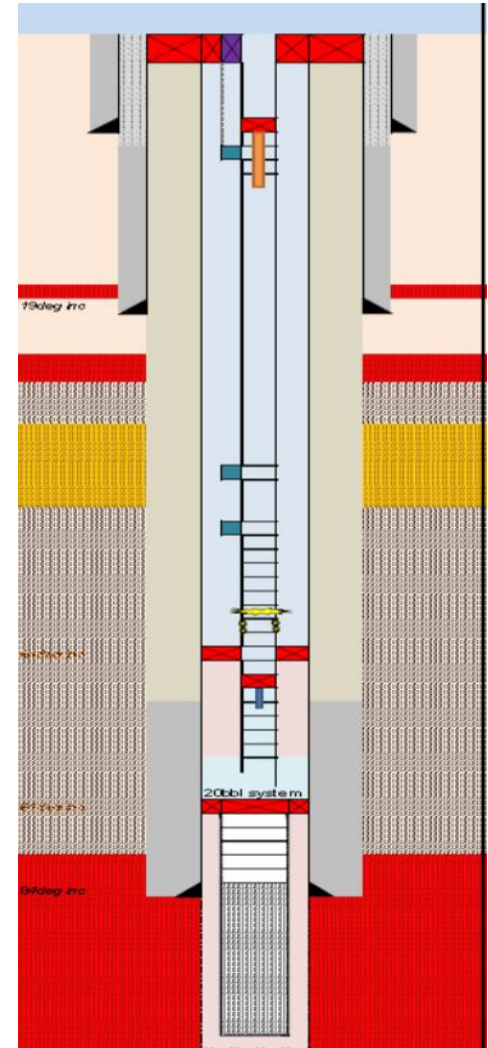
- Everything!
  - Two reservoir barriers set on every well
  - Wells displaced to inhibited SW or brine
  - Tubing cut
  - DHSV's sleeved
  - Metrol gauges hung below shallow tubing bridge plugs – all 22 of them working
  - All tree caps and debris caps brought onshore
- Challenges
  - Managing preparation of old intervention equipment
  - Completed well integrity diagnostic program on W4
  - Failed Interwell BVS on first run on W4
  - Problems with annulus plugs on W3
  - Unable to function DHSV on W2
  - Stuck toolstring on W2
  - 7 miss-runs due to tools or human error
  - Trees with control system issues
  - Wells would not hold a fluid column – additional time to top up after deep plug set
  - Deviation on W9 & W7





# New Technologies/Approaches

- Interwell Barrier Verification System (BVS)
  - Failed first run
  - Proved deep plug when working

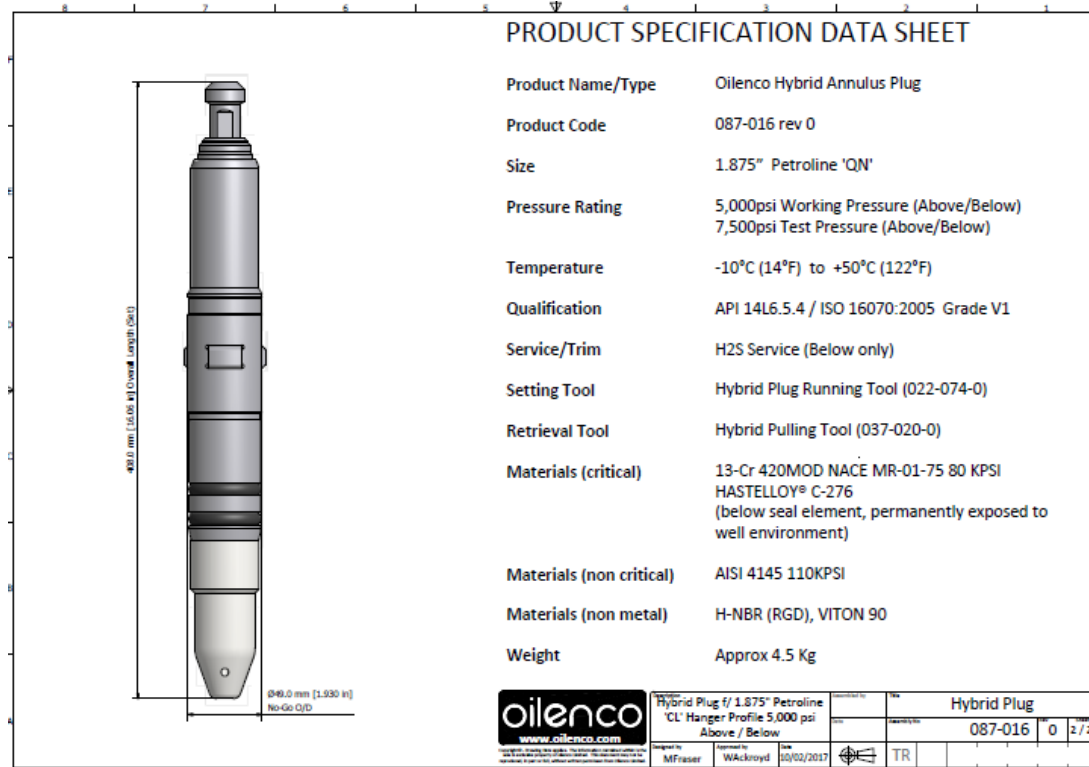






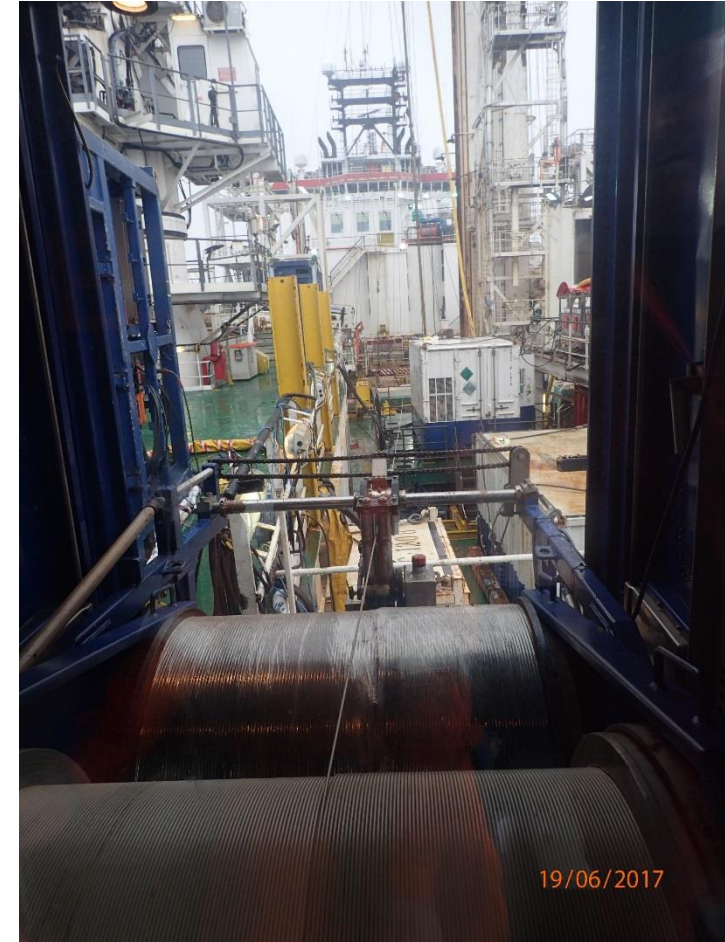
# New Technologies/Approaches

- Oilenco Hybrid Annulus Plugs
  - One run plug with integral prong
  - Worked perfectly 9 times
  - Geometry makes it easier to run
  - A third of the cost of OEM plug & prong, 3-5 weeks lead



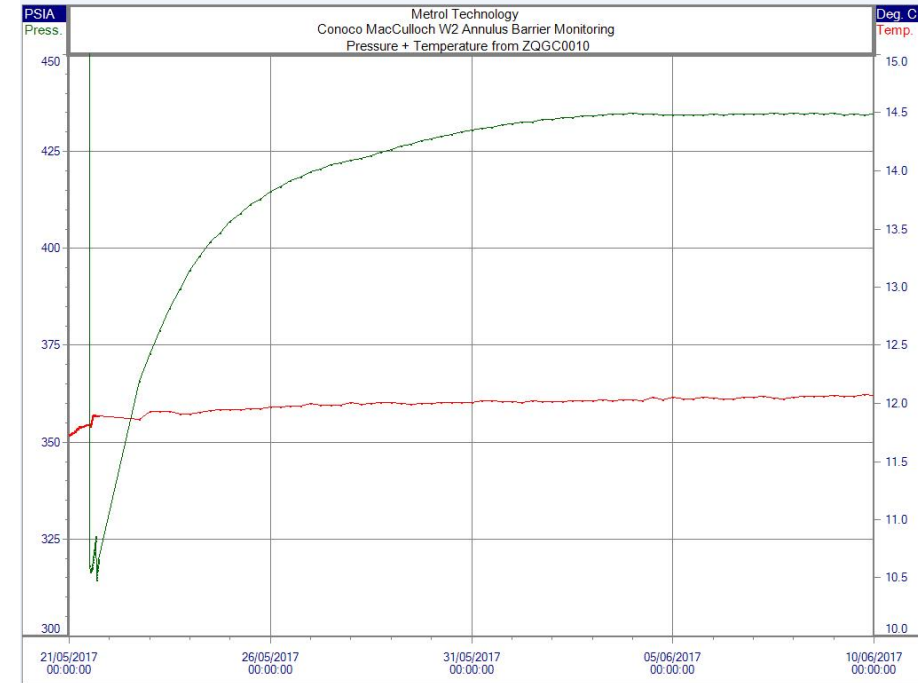
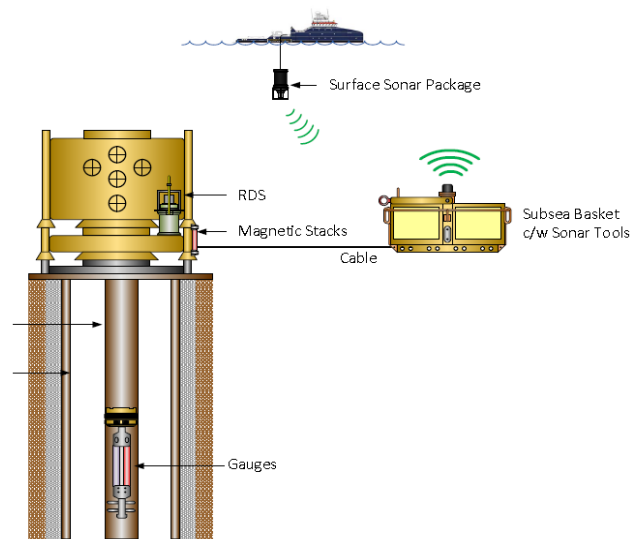


- Digital Slickline – pro's
  - Ability to send signals to setting tools/firing cutters etc
  - Immediately recovered from stuck toolstring via disconnect
  - Same strength as normal Slickline
  - CCL data leads to more accurate setting etc
- Con's
  - Unable to transmit logging data
  - Signal dependent on earth on the tubing – some issues with weak signal in places





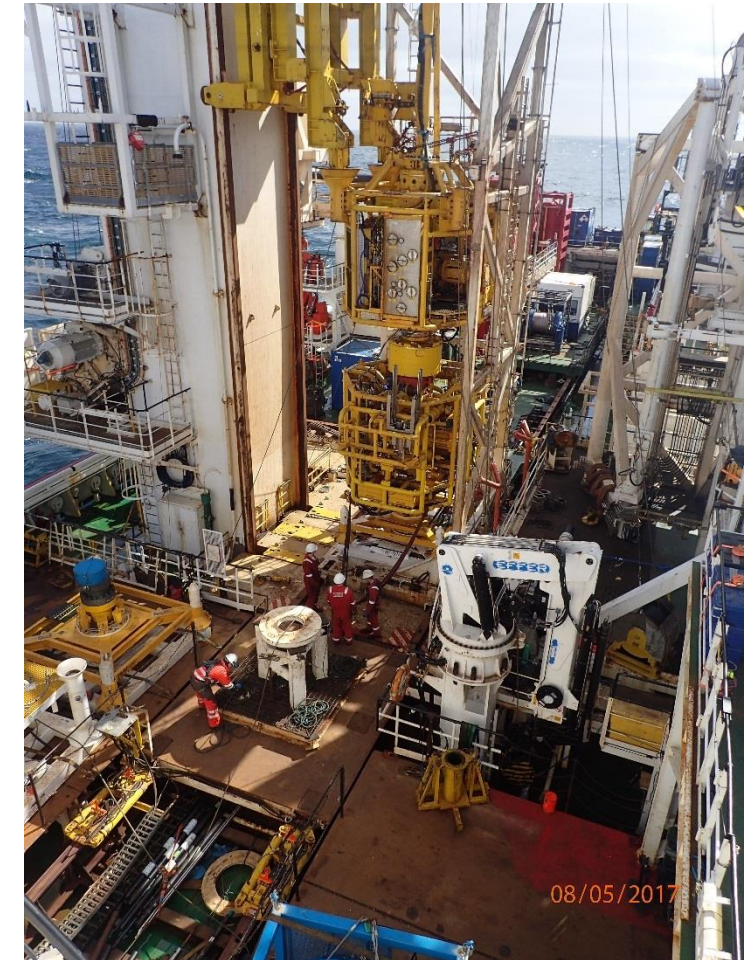
- Metrol Acoustic Wireless Gauges
  - Set 22 gauges – all working
  - 1 failure identified as tool was picked up



Well	E1	W2	W3	W4	W6	W7	W8	W9	W10	W11	W12
SITHP on arrival (psi)	1026	1763	1070	1791	2073	1400	1500	2190	1580	1070	850
Gauge installed?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Most recent pressure (psi)	297	438	390	742	390	309	478	295	528	433	370



- Don't have to use OEM for intervention equipment preparation
- The vessel is efficient, but has one speed
- Divers were indispensable
  - Barrier testing offline – only tested 2 wells on critical path
  - Reconfiguring subsea control systems
  - Tree coupler shroud removals post tree cap recovery– most wells
  - Tree cleaning
- Digital slickline
- Plan for success on bullheading – unlikely to block 3,000ft screens
- Metrol gauges very effective for monitoring and diagnostics
- Consider alternatives to OEM nipple plugs
- Listen to the Cerberus modelling
- The Interwell BVS is an excellent tool



# Summary



- Average POB: 122
- Total Man Hours: 142,634
- Total Dives: 92
- Total Diver in Water Time: 579 hours and 32 minutes (over 24 days)
- 36 mechanical plugs were set over the course of the campaign
- The 73MT Subsea Well Control package was deployed and recovered 23 times
- Total Wireline runs: 99
- Total footage of Wireline: 555,488ft (105.2 miles – about the same as the direct distance between Aberdeen and Stirling)

