Case Study: Shell UK Subsea Wellhead Recovery Campaign 2017

SPE Late Well Life & Well Abandonment Conference
28th June 2018

Rafaella Madella
Wells Engineer

Cautionary Note

The companies in which Royal Dutch Shell plc directly and indirectly owns investments are separate legal entities. In this presentation "Shell", "Shell group" and "Royal Dutch Shell" are sometimes used for convenience where references are made to Royal Dutch Shell plc and its subsidiaries in general. Likewise, the words "we", "us" and "our" are also used to refer to Royal Dutch Shell plc and subsidiaries in general or to those who work for them. These terms are also used where no useful purpose is served by identifying the particular entity or entities. ''Subsidiaries'', "Shell subsidiaries" and "Shell companies" as used in this presentation refer to entities over which Royal Dutch Shell plc either directly or indirectly has control. Entities and unincorporated arrangements over which Shell has joint control are generally referred to as "joint ventures" and "joint operations", respectively. Entities over which Shell has significant influence but neither control nor joint control are referred to as "associates". The term "Shell interest" is used for convenience to indicate the direct and/or indirect ownership interest held by Shell in an entity or unincorporated joint arrangement, after exclusion of all third-party interest.

This presentation contains forward-looking statements (within the meaning of the U.S. Private Securities Litigation Reform Act of 1995) concerning the financial condition, results of operations and businesses of Royal Dutch Shell. All statements other than statements of historical fact are, or may be deemed to be, forward-looking statements. Forward-looking statements are statements of future expectations that are based on management's current expectations and assumptions and involve known and unknown risks and uncertainties that could cause actual results, performance or events to differ materially from those expressed or implied in these statements. Forward-looking statements include, among other things, statements concerning the potential exposure of Royal Dutch Shell to market risks and statements expressing management's expectations, beliefs, estimates, forecasts, projections and assumptions. These forward-looking statements are identified by their use of terms and phrases such as "aim", "ambition', ''anticipate'', ''believe'', ''could'', ''estimate'', ''expect'', ''goals'', ''intend'', ''may'', ''objectives'', ''outlook'', ''plan'', ''probably'', ''project'', ''risks'', "schedule", ''seek'', ''should'', ''target'', ''will'' and similar terms and phrases. There are a number of factors that could affect the future operations of Royal Dutch Shell and could cause those results to differ materially from those expressed in the forward-looking statements included in this [report], including (without limitation): (a) price fluctuations in crude oil and natural gas; (b) changes in demand for Shell's products; (c) currency fluctuations; (d) drilling and production results; (e) reserves estimates; (f) loss of market share and industry competition; (g) environmental and physical risks; (h) risks associated with the identification of suitable potential acquisition properties and targets, and successful negotiation and completion of such transactions; (i) the risk of doing business in developing countries and countries subject to international sanctions; (j) legislative, fiscal and regulatory developments including regulatory measures addressing climate change; (k) economic and financial market conditions in various countries and regions; (l) political risks, including the risks of expropriation and renegotiation of the terms of contracts with governmental entities, delays or advancements in the approval of projects and delays in the reimbursement for shared costs; and (m) changes in trading conditions. No assurance is provided that future dividend payments will match or exceed previous dividend payments. All forward-looking statements contained in this [report] are expressly qualified in their entirety by the cautionary statements contained or referred to in this section. Readers should not place undue reliance on forward-looking statements. Additional risk factors that may affect future results are contained in Royal Dutch Shell's 20-F for the year ended December 31, 2017 (available at www.shell.com/investor and www.sec.gov). These risk factors also expressly qualify all forward looking statements contained in this presentation and should be considered by the reader. Each forward-looking statement speaks only as of the date of this presentation, 28th June 2018. Neither Royal Dutch Shell plc nor any of its subsidiaries undertake any obligation to publicly update or revise any forward-looking statement as a result of new information, future events or other information. In light of these risks, results could differ materially from those stated, implied or inferred from the forward-looking statements contained in this presentation.

We may have used certain terms, such as resources, in this presentation that United States Securities and Exchange Commission (SEC) strictly prohibits us from including in our filings with the SEC. U.S. Investors are urged to consider closely the disclosure in our Form 20-F, File No 1-32575, available on the SEC website www.sec.gov.

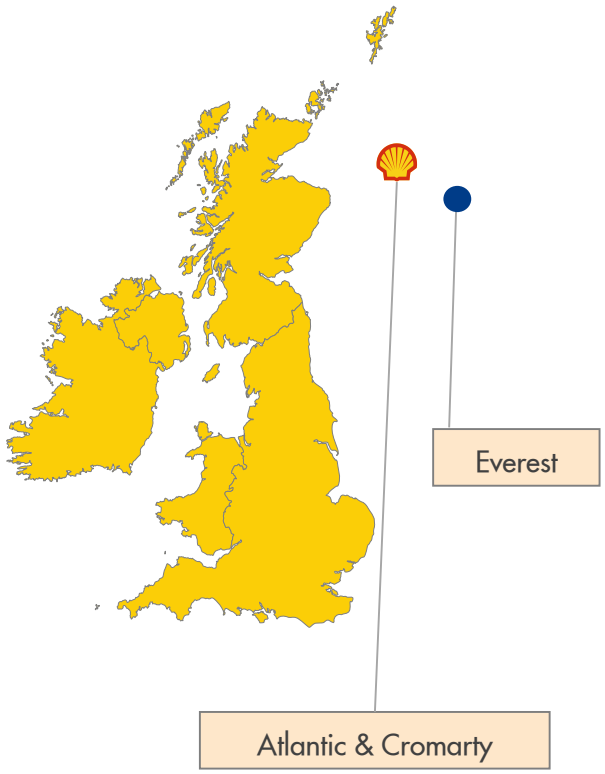
Agenda

- Setting the Scene
- Contracting Strategy
- Cost Savings & Realised Opportunities
- Overview of Operations
- Reducing HSE Exposure
- Looking Ahead

Setting the Scene: Decommissioning Strategy

Background

- Everest and Atlantic & Cromarty P&A Campaigns
  - 4x E&A Everest wells abandoned as part of a rig based P&A campaign completed in Q4 2016
  - 3x production Atlantic & Cromarty wells abandoned as part of a rig based P&A campaign completed in Q3 2017
  - Both campaigns included deep isolation against the reservoir to isolate all formations identified to be flowable
  - The shallow displacement of OBM from behind the casing strings and setting of environmental plug was undertaken using the Perforate, Circulate and Cement (PCC) method



Wellhead Recovery Campaign

What did we set out to do?

Cut and recover 4x Everest and 3x Atlantic & Cromarty wellheads and 3x subsea Xmas trees safely and efficiently

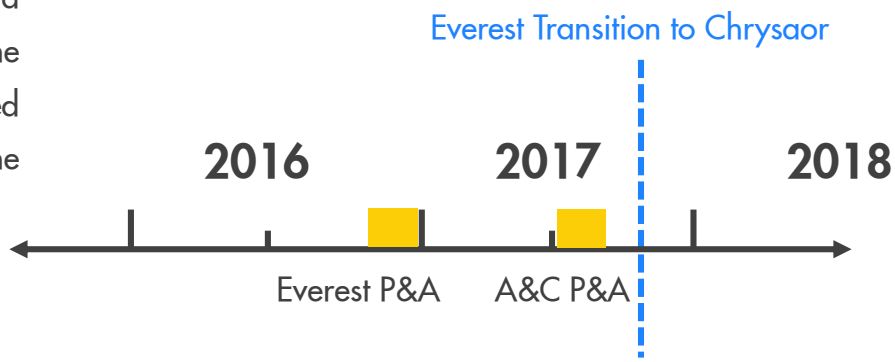
What did we achieve?

*Safe recovery of all 7x wellheads and 3x subsea Xmas trees in a total of **14 days** with no incidents or accidents. All wellheads severed at a minimum of 10ft below mudline as per OGUK guidelines (Issue 5, July 2015)*

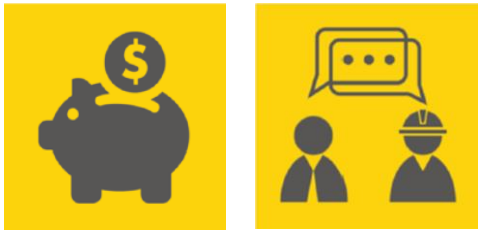
What did we do differently?

- Wellhead recovery was not new to Shell UK **but** had never been attempted before as part of a campaign using a work vessel
- Initial work focused on the clear definition of scope and a comparison between rig and vessel based options, after having confirmed sufficient number of wells to form a campaign
- Vessel option not only provided a cost saving opportunity but also helped minimise offshore HSE exposure
- As a result of this stand-alone piece of work, the decision was made to go out to market for a turn-key delivery on a lump sum basis
- Key consideration was to provide the vessel operator with maximum flexibility to execute the scope at an optimum time

The single constraint we had when completing the wellhead recovery campaign related to a time restriction for the Everest wellhead severance workscope to be completed prior to 31st October 2017, official transition date of the asset to Chrysaor.



Contracting Process



- As the project was part of decommissioning scope, the work was tendered to a wide range of companies and different commercial models were considered
- Out of a total of 14 candidates taking part in the tendering exercise, the contract was awarded to DeepOcean AS
- Key criteria included safety, ability to project manage scope and integration between the vessel operator and wellhead severance supplier

- Contracting process viewed as a pilot project and an opportunity to test the market's ability to deliver in advance of the upcoming 25 well subsea P&A campaign. This allowed us to try an alternative approach
- Drew on internal experience of C&P and Subsea Projects, working together as ***'Performance Partners'*** throughout the planning and execution phases. Although the Wells function planned the work, this was supervised by a Subsea Projects supervisor onboard the vessel

Performance Partnering and Goal Alignment between Wells, C&P and Subsea Projects was KEY!

Edda Freya Offshore Construction Vessel

- DP3
- Built in 2016
- 150m length
- Max POB: 140
- 600T AHC Offshore Crane
- 2300m^3 deck area
- 2x ROVs

First wellhead recovery campaign of this size for Shell and first time completing such workscope on an offshore construction vessel

Upfront Planning and Realising Opportunities

- The use of a vessel based wellhead severance campaign resulted in savings in the order of *£millions* compared to the same scope of work being completed with a rig straight after the abandonment of the wells.

- Risk based decision making

Example: Lump sum approach included all risk such that the impact of any inefficiencies from WOW / NPT was minimised

Example: Elimination of drift cleaning tool (DCT) run by replacing with simple check with ROV snake camera. Estimated time saving of 2hrs per well.

- Control of Work

Example: Authority to Work (ATW) obtained from nearby pipeline operator meaning less interfacing compared with previous experience using Permit to Work (PTW) system during rig P&A campaign.

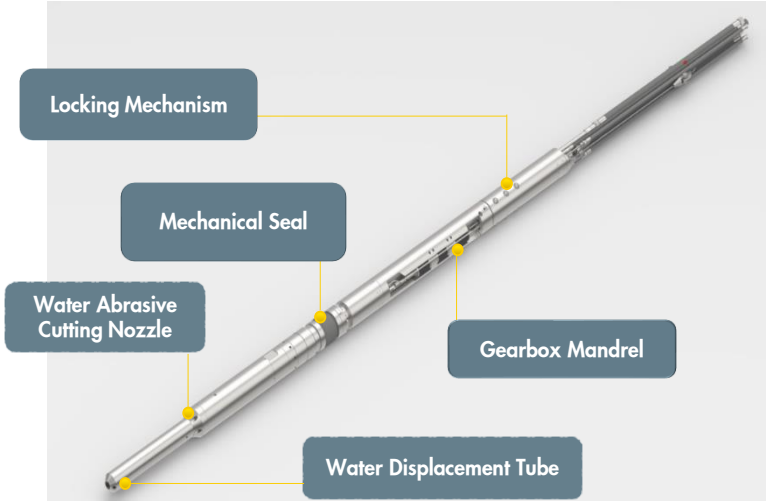
- Leveraging global Shell relationships

Example: Renting SXT lift caps from major oil operator in Norway

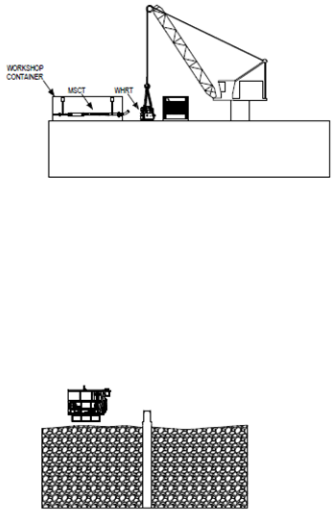
42%
Of Original budget Spent

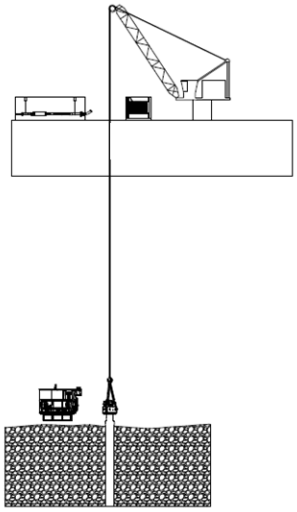
Abrasive Cutting Technology

- DeepOcean selected Proserv's abrasive technology to complete the wellhead severance campaign
- Multi string cutting tool (MSCT) allowed multiple 360° passes to achieve cut
- Multi Wellhead recovery tool (MWRT) to pull and recover the wellhead

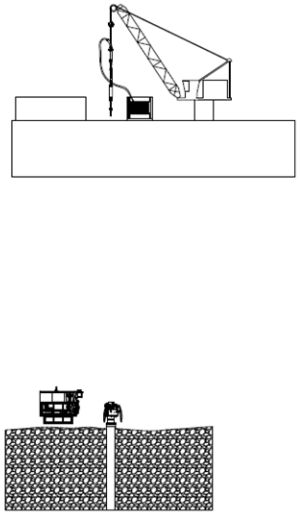


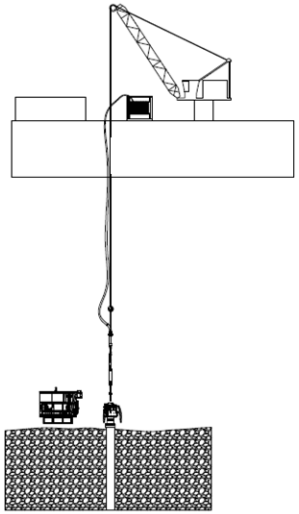
Operations Storyboard



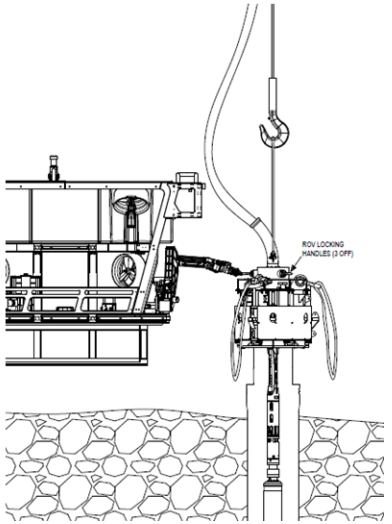


Crane deploys MWRT and ROV uses hotstabs to activate locking dogs and secure to wellhead



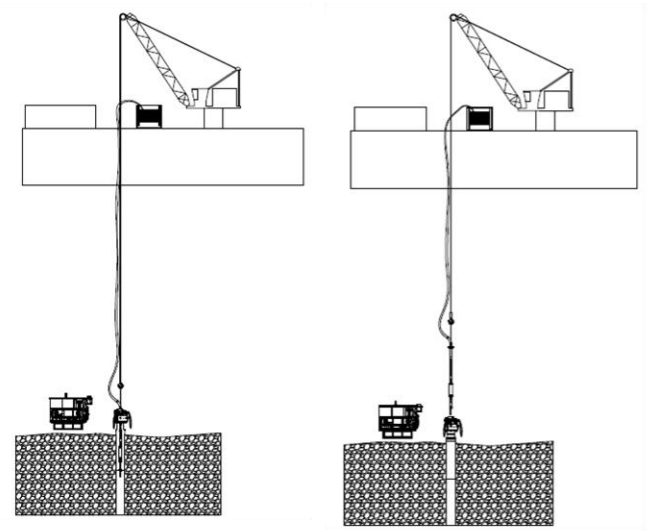


Crane deploys MSCT while ROV assists with securing it inside MWRT.
Umbilical secured to tugger wire

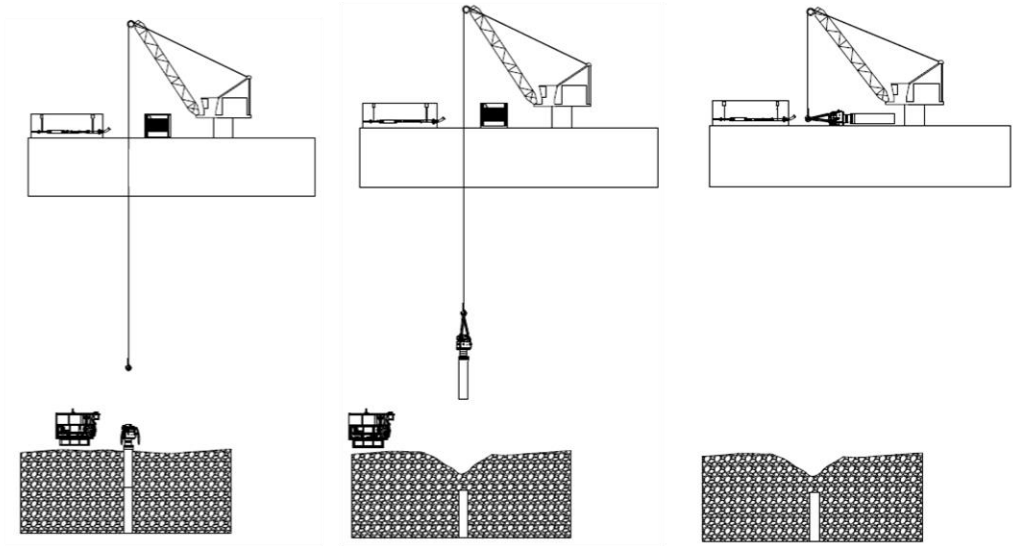


ROV manipulates locking handles to secure MSCT inside MWRT

Operations Storyboard

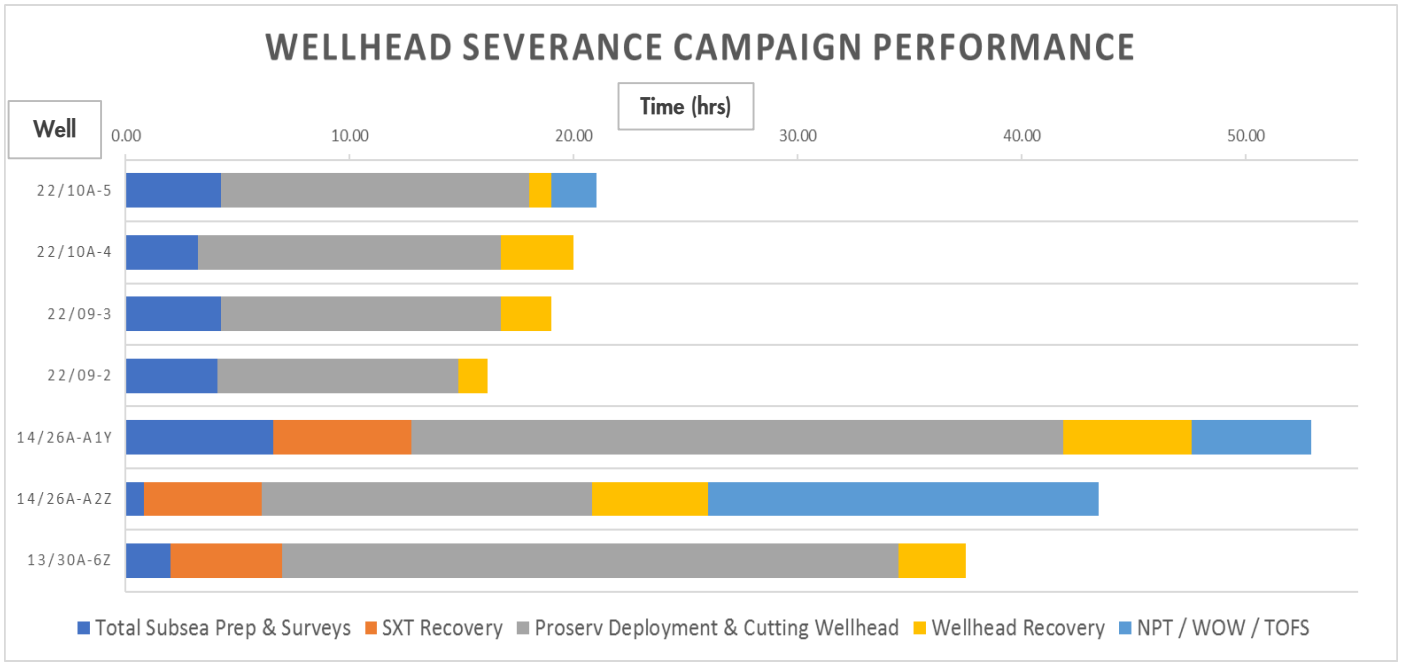


MSCT performs cut and is subsequently recovered. ROV manipulates locking handles to release tool from MWRT.



MWRT rigging re-attached to crane by ROV and wellhead pulled from seabed and recovered to vessel. On surface, MWRT is removed from wellhead before this is safely sea-fastened on deck.

Performance



Campaign duration incl. mob & de-mob: **14 days**

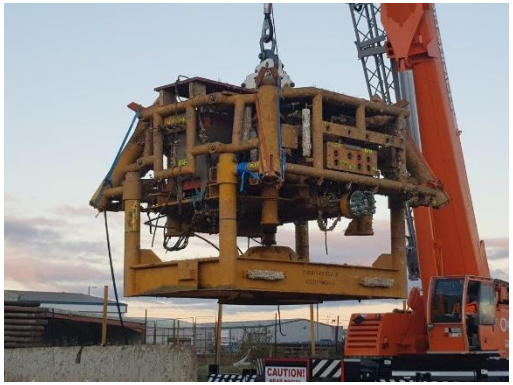
Fastest Everest WH severance completed in just **16.8 hrs**

Everest Wellhead Recovery

- Debris / netting removal completed prior to start of wellhead severance operations
- Proximity agreement with nearby pipeline operator and Everest platform liaison
- All 4 wellheads c/w guidebases recovered without any issues
- 4 strings (30″, 20″, 13-3/8″, 9-5/8″) severed with a single cut
- Maximum pull required for wellhead recovery ~30T
- Wellhead c/w guidebase ~20T lift in air

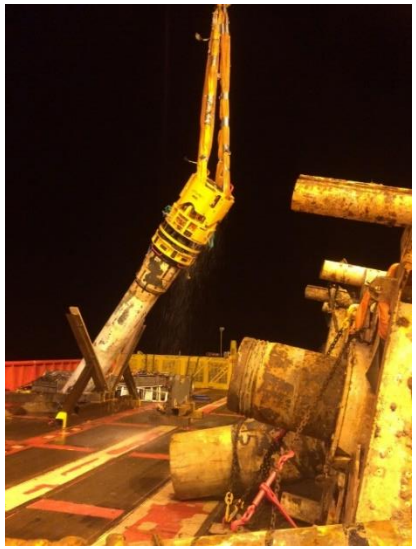
Atlantic & Cromarty Xmas Tree Recovery

- In an attempt to minimise HSE exposure, at the end of the A&C P&A campaign, the Xmas trees were lifted off the wellhead and placed back in an unlocked position to avoid taking them back to the rig and having to handle them through the moonpool
- Prior to recovering the trees, the telescopic joint legs had to be cut to assist in their safer recovery and also, in order to comply with the transportation limit requirements. These were cut using diamond wire cutters.
- All 3 SXTs c/w torque reaction bases (TRBs) recovered without any issues ~60T lift in air



Atlantic & Cromarty Wellhead Recovery

- 4 string design (30", 20", 13-3/8" and 9-5/8") similar to Everest
- Atlantic & Cromarty wellhead recovery proved a little more challenging compared to the Everest E&A wells
  - Difficulties encountered in maintaining the required air gap to achieve successful cuts
  - Conductor and surface casings were thicker than the ones on Everest
- 2 cuts required for successful retrieval of the 2 wellheads and third cut required to recover the third and final wellhead
- Max ~150T pull required for retrieval



Minimising HSE Exposure

- Had the wellhead severance been completed immediately following the P&A operations on the rig, the recovery of the wellheads would have been effected through the moonpool and double lifting would have been required, once onto a suitable area on the rig and additionally onto a supply vessel in order to be returned to Aberdeen
- Through the use of the Edda Freya the wellheads were recovered in a single lift and stored on deck until the vessel returned to port eliminating additional heavy lifts, logistics and overall exposure to other risks
- Last minute optimisations relating to securing the SXT on the TRBs were accommodated, thereby eliminating the requirement for separate lifts of the two components upon their arrival back to Aberdeen

Lessons Learnt

Contracting Phase

- Tender for both lump sum and day rate contracts and evaluate accordingly using discrete models. This is an important consideration if wellhead recovery is to be bundled with other decommissioning work
- Award contracts early to ensure schedule flexibility

Planning Phase

- Ensure project manager is on seat from early planning stages through to execution and project close-out
- Planning of contingency options while ensuring sufficient time for these to be included in any relevant permit applications
- Ensure permits & notifications for rig-based activities consider the subsequent vessel-based operations

Operational Phase

- Defining maximum pull limits for wellheads upfront
- Review of critical spares with supplier
- Ensure detailed well and casing information is available to offshore team on vessel

Looking Ahead

2,500
Wells to be P&A'd across the North Sea up to 2025

- Thousands of wells require abandonment in the North Sea and wellhead severance and recovery forms an integral part of such abandonment operations
- Vessel based wellhead recovery has now been tried and tested successfully as part of a campaign, resulting in significant cost savings and reducing offshore HSE exposure
- Shell UK's upcoming 25 well subsea P&A campaign plans on continuing to use the same approach of a vessel based wellhead severance campaign to complete the phase 3 abandonment of subsea wells

- Regulatory guidelines
- Moral responsibility
- Operational risk
- Environmental Impact

- Long term exposure of leaving equipment in place

Acknowledgements

- Patrick McGrath (Well Engineer), Bora Uysal (Contract Engineer), St.John Read (Subsea Ops Team Lead), Euan Magill (A&C Project Lead), Leon McManus (Transport Analyst), Steve Arcus (Underwater Ops Supervisor), Tony Moore and Ian Finlayson (Marine Services), Todd Franks (Well Ops Team Lead), Hamish Hogg (Senior Well Engineer), Vinit Raje (Well Ops Manager) and many others
- DeepOcean, Proserv and OneSubsea onshore and offshore teams

DEEPOCEAN

proserv

Questions and Answers

Deck Plan Example