Solutions for Subsea Well Abandonment

Presentation to the Norwegian P&A Forum Workshop
June 2011

Subsea P&A AS
An and NCA company
Agenda

• Background – why rigless P&A for subsea wells?

• Introduction to Subsea P&A AS

• Solutions for Subsea Well Abandonment
Background

Why Rigless P&A of Subsea Wells?
Why Rigless P&A of Subsea Wells?

- Release rig time for more drilling
- Move activity from a ~7 MNOK/day rig operation to a ~2MNOK/day Light Well Intervention Vessel (LWIV) operation

=> If rig P&A efficiency can be matched (same no. of days per well), the saving potential is 70%

- Total est. cost for P&A’ing the ~1000 North Sea subsea wells:

  **With rigs:** 210bNOK  
  **With LWIVs:** 60bNOK  
  **Saving potential:** 150bNOK

(assuming 30 days per well for both alt’s and spread rates as indicated above)
However;

- The operation needs to be performed under the same strict regime for Health, Safety and Environment, including well control.

- There are technology gaps that needs to be filled in order to get there:
  - Cement placement techniques for LWIVs (without a riser)
  - Tubing pulling from LWIV (without a riser)
  - General P&A challenges like qualification of annulus barriers, tubing and casing integrity, collapses & restrictions, control lines etc etc

- The wells vary largely in complexity – not all will be suited for rigless P&A (not all are suited for rigs either...)

- But, LWIV capabilities will increase over time (e.g. coiled tubing)
<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The well has been sufficiently suspended that final abandonment only requires removal of the wellhead.</td>
</tr>
<tr>
<td>2.1</td>
<td>The well has one annulus uncemented. Placement of an additional barrier is required to complete the abandonment of the well. This may be done by placing a barrier into the annulus or placing a separate barrier. This type of well may be abandoned with a drilling rig or a light-well intervention vessel.</td>
</tr>
<tr>
<td>2.2</td>
<td>The well has to annuli uncemented. Placement of an additional permanent barrier is required to complete the abandonment of the well. This may be done by placing a barrier into the annuli or placing a separate barrier. This type of well may be abandoned with a drilling rig or a light-well intervention vessel.</td>
</tr>
<tr>
<td>3</td>
<td>The suspended condition of the well is not suitable for full abandonment without significant intervention. Typically, with current technology, the abandonment programme will require a drilling rig to safely effect the operation.</td>
</tr>
<tr>
<td>4</td>
<td>Wells are placed in this category for several reasons: The downhole status is not known, therefore cannot be categorised. The well is in a condition where it is not possible to safely abandon with current technology.</td>
</tr>
</tbody>
</table>
Introduction to Subsea P&A AS

Subsea P&A AS
An and NCA company
Subsea P&A AS

A Complete Provider of Rigless Subsea P&A Services

- A company dedicated to develop rigless subsea P&A solutions and deliver subsea P&A projects to the industry
- Owned and operated 50/50 by Island Offshore Subsea (IOSS) and Norse Cutting & Abandonment (NCA)
- Track record from rigless P&A of 1300 wells
- A technology leader in rigless well abandonment techniques
- Part of Oceaneering Intl.

Island Offshore Subsea

A market leader for Light Well Intervention operations.

NCA

Tracks of the Dutch well abandonment market.
Capabilities & Applications

• Capabilities
  - Well evaluation and P&A engineering
  - Campaign planning (multiwell & multiclient campaigns)
  - Project engineering and management of campaigns
  - Turn key delivery of the vessel and intervention spread with all necessary services

• Applications
  - P&A of old suspended exploration & appraisal wells (cat 1 and cat 2)
  - P&A of live production wells (cat 3)
  - P&A of new suspended wells (cat 3 or 2)

=> A complete provider of subsea P&A services
Resources, Management Systems & Certification

• Organisational resources
  - Projects are manned with highly qualified staff from IOSS and NCA
  - Leading personnel all have extensive experience from well intervention and subsea P&A work (project managers, engineers, superintendents and supervisors)

• Management systems
  - Subsea P&A is part of NCA’s management system which is certified to ISO 9000:2000 and ISO 14001
  - Extensive project HSEQ system are put in place for all project/operations
Subsea P&A has a well proven and fit for purpose execution model for subsea P&A operations, which also allows for multiclient campaigns.
Track Record (IOSS/NCA)

- Vast experience from operating 3 LWIV vessels in the North Sea
  - Cat 1 & 2 campaigns (UK and Norway)
    - 2011 Det norske/Premier/ (7 wells + 1 spud can) Vessel: Skandi Aker, Main contractor: NCA
    - 2010 Nexen/Dana/NOEPUK/Premier (6 wells) Vessel: Island Valiant, Main contractor: OIS/Acteon
    - 2010 Det Norske/Nexen (4 wells) Vessel: Geoholm, Main contr.: NCA
    - 2010 Shell (1 well) Vessel: Wellserver, Main contr.: Wellops
    - 2009 Det Norske (1 well) Vessel: Olympic Zevs, Main contr.: NCA
    - 2008 Nexen (4 wells) Vessel: Island Constructor, Main contr.: OIS/Acteon
    - 2008 BP/Perenco/Tullow (4 wells) Vessel: Island Constructor, Main contr.: TS Marine
    - 2007 Acorn (3 wells) Vessel: Normand Mermaid, Main contractor: Acergy
- Other relevant experience
  - Subsea Xmas tree set and recovery operations (Shell, BP, Premier)
  - Subsea decommissioning operations (Frigg, Maureen, NW Hutton etc.)
  - 1300 wells P&A'd rigless by (NCA Energy Services)
  - Subsea jetting/trenching campaign with drill pipe (Ormen Lange)
Solutions for Subsea Well Abandonment

Subsea P&A AS
An and NCA company
## Available Equipment/Assets

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Owner</th>
<th>Cat 1</th>
<th>Cat 2</th>
<th>Cat 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riserless Well Intervention Vessels (Constructor, Wellserver, Frontier)</td>
<td>ISLAND OFFSHORE</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Anchor Handling/SSC Vessel (Valiant, Vanguard)</td>
<td>ISLAND OFFSHORE</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Pipe Pulling and Handling Equipment (available for all the above vessels)</td>
<td>ISLAND OFFSHORE</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Cementing Adaptor Tool (cementing of intermediate plugs)</td>
<td>Subsea P&amp;A AS</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subsea Wellhead Picker (non-explosive wellhead removal)</td>
<td>NCA Norse Cutting &amp; Abandonment</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Well Abandonment Straddle Packer (WASP) (cementing of intermediate plugs)</td>
<td>BAKER HUGHES</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
Island Constructor

- Length/Breadth: 120,2 m / 25,0 m
- UK safety case + AoC/SUT
- POB: 95 (normal LWI crew: 65)
- Equipment
  - FMC Wireline lubricator (ID 7 1/16”, length: 23,4m)
  - Aker Well Service Wireline spread
  - Module handling tower (100MT capacity)
  - AHC crane (150MT capacity)
  - 2 Work ROVs
- Current capabilities
  - Wireline services
  - Pumping services
  - Cementing services
- Meets latest UK regulations for helideck pitch, roll and heave limitations to help crew change schedules
Island Valiant

- Length/Breadth: 93,4 m / 22,0 m
- POB: 60 (marine crew: ca 14)
- Equipment
  - Module handling tower (100MT capacity, optional)
  - A-frame (200MT SWL, 100MT AHC, optional)
  - AHC crane (90MT capacity)
  - Work ROV
- Current capabilities
  - Cat 1 and UK Cat 2/WASP operations
  - Subsea decommissioning work
  - Tree recovery etc.
Pipe Handling Equipment

• Both the LWI vessels and the Island Valiant may be equipped with pipe handling equipment

• The equipment typically include
  - Pipe rack
  - Drill Pipe Feeder
  - Drill pipe and/or casing gripper for deck crane
  - False Rotary (non-rotatable) mounted on moon pool door
  - Iron Roughneck
  - Top drive installed in MHT for pipe-handling and reactive forces from mud motor /-drill string (optional)
  - BX elevator, insert bushings, remote operated slips, manual slips, rig tongs, bails, and pick up elevator as needed
The Subsea Wellhead Picker

- **Features and benefits**
  - Combined tool for cutting and removal of subsea wellheads
  - Enables removal of subsea wellheads by use of a simple vessel
  - Wellhead is severed and lifted in **one single deployment**
  - No need to relocate vessel during the operation
  - No need for marine riser or drill pipe
  - Environmentally safe – no use of explosives
  - Can be used on single wellheads or on wellheads installed on templates
  - Clean cuts for easy recovery of the wellhead and conductor

- **Cost efficient – no need for costly drilling rig**

- **Connector can be adapted for any type of subsea wellhead**

- **The severance is made by NCA’s Internal Multistring Cutting Tool, which is based on the extremely efficient abrasive water jet**

- Link to film

Patented 2007 (NCA)
The Cementing Adaptor Tool (CAT)

- **Features and Benefits**
  - P&A of Cat. 2 wells with full well control from a LWIV, in accordance with NORSOK D-010 and PSA requirements
  - Allows intermediate cement plugs to be placed in casing and annulus with the Well Control Package installed on the well

- **CAT functionality**
  - Allows selective perforation of production casing to establish lower and upper annulus communication ports (wireline run through RLWI and CAT)
  - Provides selective seal between stinger OD and production casing ID to isolate upper and lower perforations in production bore
  - Provides a circulation route for annulus cleaning (forward and reverse with returns to the vessel), and displacement and spotting of competent cement (annulus and balanced)
  - Allows for pressure testing of cement plugs
  - In combination with the Well Control Package, maintains well barriers/control during above operations

Link to animation
Patent pending 2010 (SPA)
Well Abandonment Straddle Packer (WASP)

- Features and benefits
  - Rigless and cost efficient cementing of UK subsea Cat. 2 wells
  - Safe perforation and annulus cementing of wells prior to wellhead removal
  - Run from a DP monohull vessel (no well control or safety case normally required)

- Main functions
  - The system lands and seats in the HP wellhead housing
  - Single trip system provides isolation, shut-in casing perforation, displacement of OBM and annulus cement
  - Utilizes inflatable elements to isolate formations and range of casing sizes and casing conditions
  - Can accommodate two pairs of perforating guns to selectively perforate and cement two casing strings in a single trip
  - Incorporates three surface controlled sub-surface safety valves for emergency shut in
  - Allows containment to circulate OBM back to the vessel via an umbilical hose
  - Allows the control umbilical to be disconnected to allow for BOP installation should a rig intervention be required
Critical Success Factors
(to realise the rigless potential)

- Operator involvement and commitment
  - Interest (to invest resources into realising the saving potential)
  - Courage (to try the untried)

- Close dialogue between Contractors, Operator and Authorities (PSA)
  - New and existing technologies needs to be applied in new combinations
  - P&A regulations will probably have to change/adjusted to accommodate for rigless solutions

- More engineering studies are required – "the devil is in the details"

- Access to real wells for qualification of technology is essential
The End

QUESTIONS ?