Solutions for Subsea Well Abandonment

Presentation to the Norwegian P&A Forum Workshop
June 2011

Subsea P&A AS

An and NCA company

Agenda

Subsea P&A AS
An and NCA company

- 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?

Subsea P&A AS

An and NCA company

Why Rigless P&A of Subsea Wells?

Subsea P&A AS
An and NCA company

- 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;

Subsea P&A AS
An and NCA company

- 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)

P&A Categorisation (as per UK P&A guidelines)

Subsea P&A AS
An and NCA company

Category	Definition
1	The well has been sufficiently suspended that final abandonment only requires removal of the wellhead.
2.1	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.
2.2	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.
3	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.
4	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.

Introduction to Subsea P&A AS

Subsea P&A AS

An and NCA company

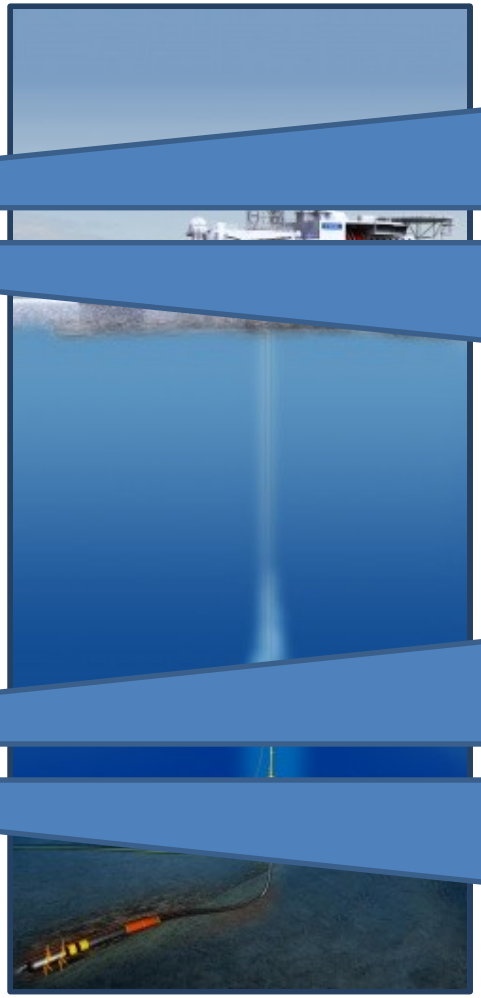
Subsea P&A AS

Subsea P&A AS
An and NCA company

(SPA)

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



Capabilities & Applications

Subsea P&A AS
An and NCA company

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

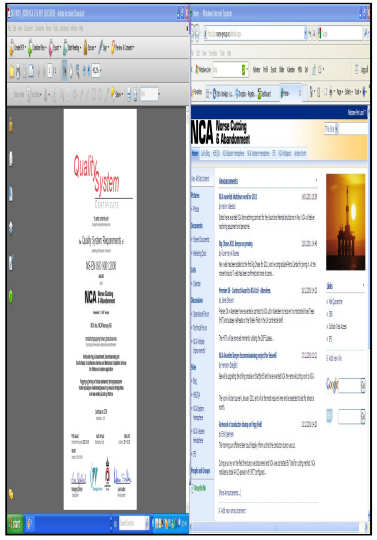
- Applications
  - P&A of old suspended exploration & appraisal wells (cat 1 and cat 2)
  - P&A of live production wells (cat 3)
  - P&A of new suspended wells (cat 3 or 2)

=> A complete provider of subsea P&A services

Resources, Management Systems & Certification

Subsea P&A AS
An and NCA company

- 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

FPAL empowered by Achilles Registered

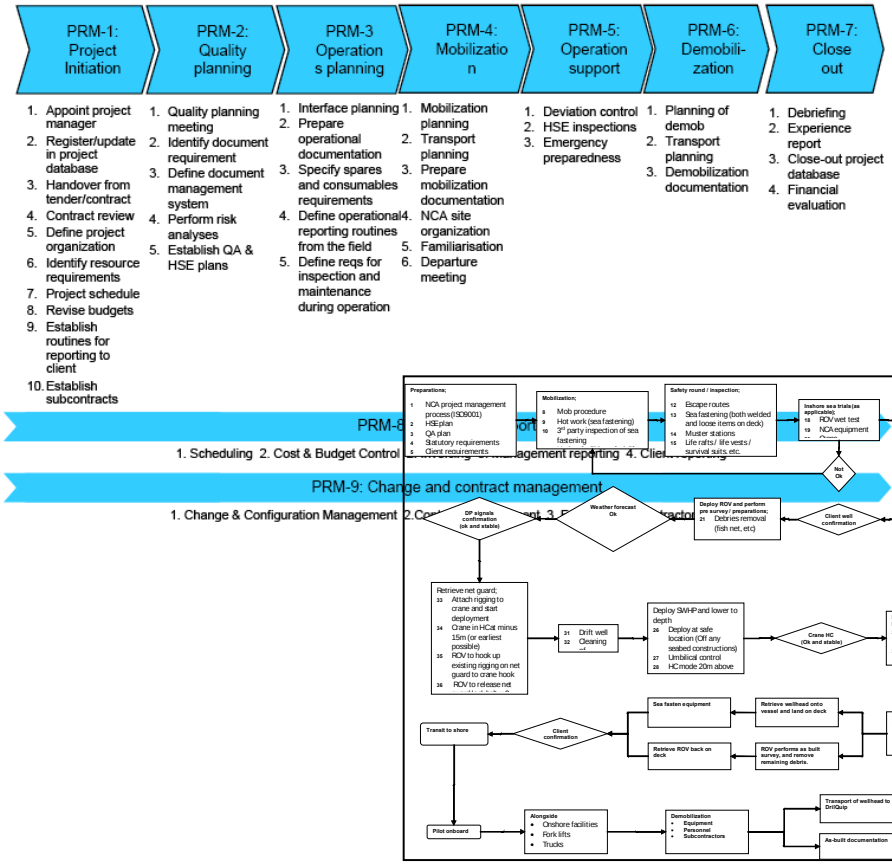
Achilles

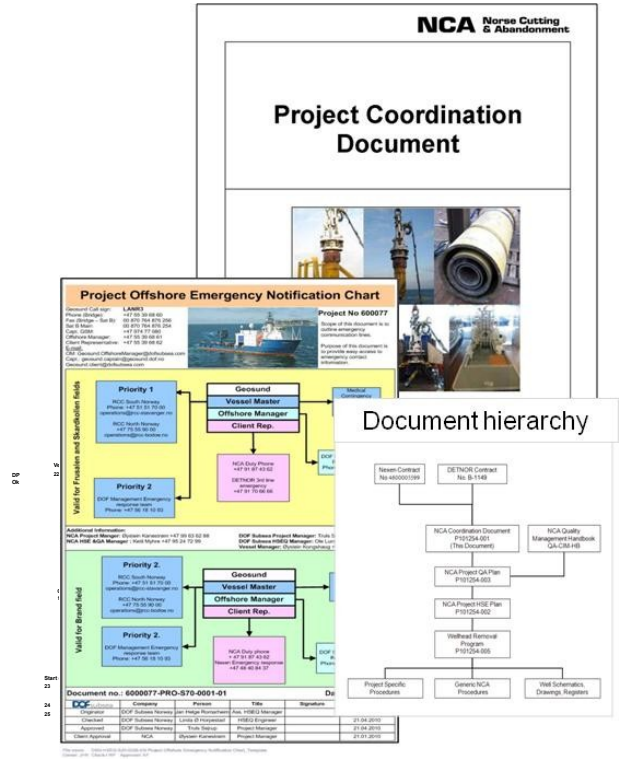
Execution Model

Subsea P&A AS

An and NCA company

- 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)

Subsea P&A AS
An and NCA company

- 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)

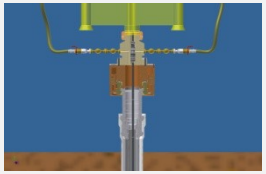
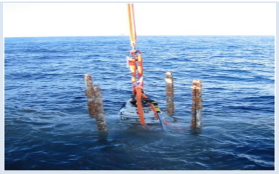
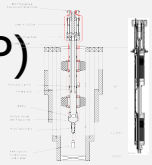
Solutions for Subsea Well Abandonment

Subsea P&A AS

An and NCA company

Available Equipment/Assets

Subsea P&A AS
An and NCA company

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

Island Constructor

Subsea P&A AS
An and NCA company

- 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

Subsea P&A AS
An and NCA company

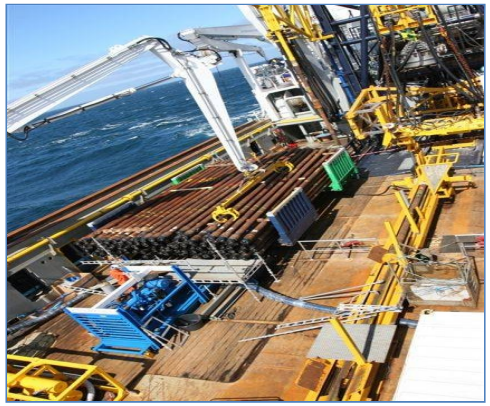
- Length/Breadth: 93,4 m / 22,0 m
- POB: 60 (marine crew: ca 14)
- Equipment
  - Module handling tower (100MT capacity, optional)
  - A-frame (200MT SWL, 100MT AHC, optional)
  - AHC crane (90MT capacity)
  - Work ROV
- Current capabilities
  - Cat 1 and UK Cat 2/WASP operations
  - Subsea decommissioning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

Pipe Handling Equipment

Subsea P&A AS
An and NCA company

- 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

Subsea P&A AS
An and NCA company

- 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

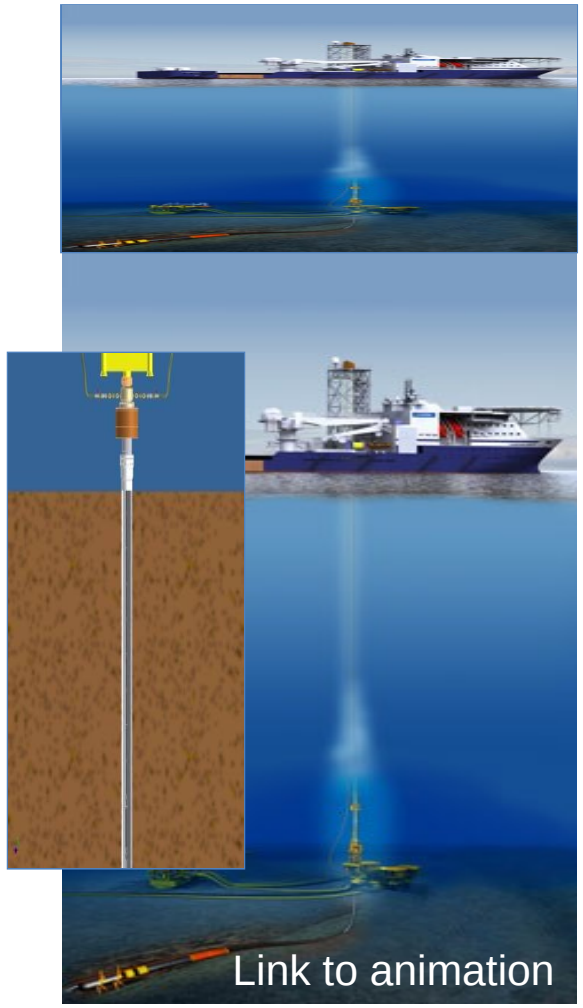
Patented 2007 (NCA)

The Cementing Adaptor Tool (CAT)

Subsea P&A AS
An and NCA company

- 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



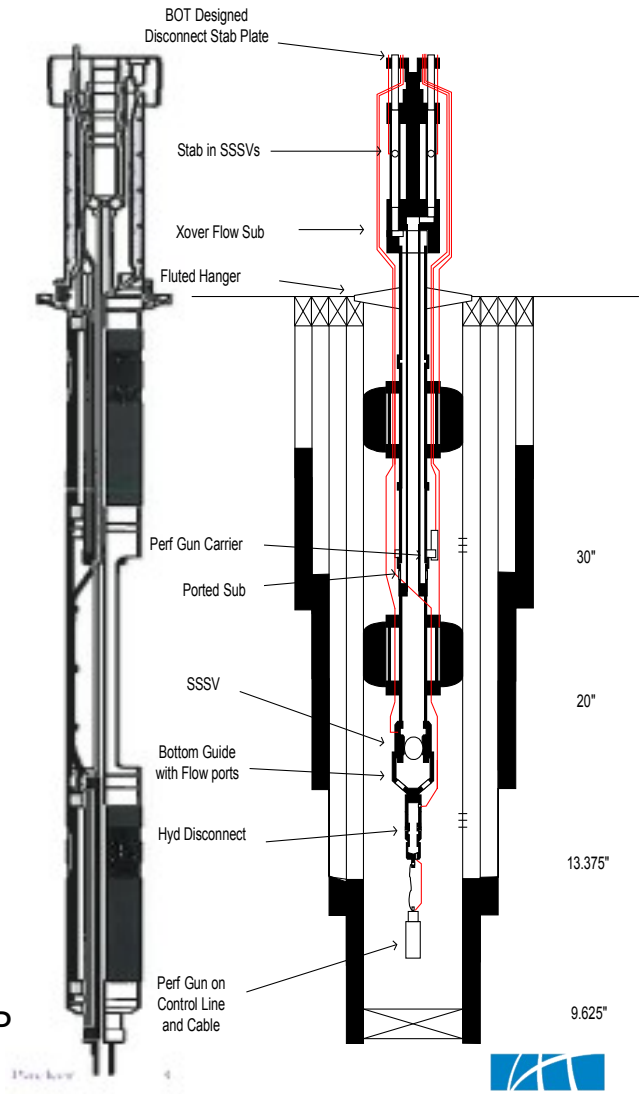
Patent pending 2010 (SPA)

Well Abandonment Straddle Packer (WASP)

Subsea P&A AS
An and NCA company

- 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



BAKER HUGHES

Critical Success Factors (to realise the rigless potential)

Subsea P&A AS
An and NCA company

- 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 accommody 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 ?