Deeper Offshore Handling Drives
Winch Developments

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Overview of Caley and offshore handling

Deepwater deployment issues
- Rope selection criteria
- Winch technology and synthetic ropes

Some project examples
- A deepwater synthetic rope application
- A deepwater lowering system
- A subsea intervention system

Some conclusions
Caley Ocean Systems

New office complex, Glasgow
40+ employees
25,000 sqf manufacturing facility, adjacent to Glasgow Airport
'13 turnover ~£18m

General Capabilities:

Innovative supplier of marine handling systems
Design consultancy
Worldwide manufacturing
Project Management
Engineering Services

www.caley.co.uk
Caley Ocean Systems

Over 45 years experience of building bespoke handling systems for Offshore, Ocean Science and Naval Defence sectors

Offshore
- CALM buoy hose deployment system
- MARS deployment system
- Deepwater lowering system
- 9,000Te cable installation system
- Deepwater pipe handling solutions
- Saturation and diving bell systems
- Heavy weather boat handling

Oceanographic
- Woods Hole Oceanographic Institute (US),
- Chinese Jiaolong submersible (World Record Depth)
- Indian Oceanographic Institute (10,000m).
Deepwater Handling

Input criteria

- Size and weight of equipment to be handled
- Range of water depths
- Requirement for *Lifting* as well as *Lowering*?
- Vessel characteristics (motion, positioning control, available space etc.)
- Operational requirement (e.g., sea state limitations)
- Mobilisation time
- Client and class requirements

So, what next....
Deepwater Handling - Rope selection

Is the self weight of the wire rope significant?

Is the package weight high?

Yes

Yes

No

No

Consider synthetic rope

Consider wire rope

Note - No specific reference to water depth at this stage

Note - 'Significant' is subjective but may be when it contributes 50% or more of full depth load

Note - 'High' is also subjective but at present can be taken to be more than 200Te
Deepwater Handling - Rope selection

Two extreme examples

Case 1 - Deepwater coring

- Water depth: 10,000m
- Pull out load: 4-5 times greater than the package weight

Case 2 - Subsea manifold installation

- Water depth: 1,300m
- Package weight: 1,000 Te

Neutral buoyancy of synthetic rope make this an obvious application.

This application is beyond present synthetic rope technology.
Deepwater Handling - Rope selection

Less obvious examples

Case 3 - Pipeline abandonment and recovery (A&R)

- Water depth: 2,500 m
- Top tension: 500 Te (+)

Top tension is inversely proportional to water depth

Case 4 - Seabed mining

- Water depth: 200 m (+)
- Package weight: 160 Te

Damping characteristics of selected Synthetic rope used to soft land
Synthetic rope considerations

Having decided synthetic rope has some merit what are some of the principle considerations?

Fact: Sheaves are an omnipresent feature of almost all deployment applications

The factors affecting rope selection and consequently the handling system arrangement include

- Required life (e.g. heave compensation cycles) and how this will be monitored, including inspection
- Groove design, sheave diameter and spoolability
- Coating, friction, abrasion and temperature effects
- Factors of safety and splice design (MBL)
- Ultimately .... knowledge, experience and confidence
Synthetic rope qualification

Early 2000’s - DISH (Deepwater Installation of Subsea Hardware) JIP

- Tested a range of rope constructions and identified the 12x12 open construction BOB (Braid Optimised for Bending) rope as the one with the best fatigue life
- Also identified ‘slip-stick’ and the effect of a raised temperature on the mechanical properties of these ropes
- Confirmed traction winches as the probable load handling mechanism, although other options are emerging

Ongoing - DNV DDRS (Deepwater Deployment and Recovery Systems) JIP

- Multi-phase study to develop a set of standard to qualify ropes and handling systems
- Caley is one the first to use a qualified rope
Synthetic rope winch system criteria

Drum winches and factors affecting the spoolability of the rope include:

- Tension range; rope diameter and length; roundness under crushing; fleeting angles; pre-tensioning requirements; deck space;

*Therefore, while a single drum has merit in terms of simplicity, careful consideration of these factors has to be made*

Traction winches factors

- Sheave diameters; groove positioning and profile; stretch management; back tension control; control system design

*For many deepwater applications a traction winch solves many of the single drum problems, but it is not an easy option*
Project Example 1

Coring winch system - Indian Research Vessel, 2013

- Permanent installation below deck, so variable electric speed drives
- Breakout loads many times lift loads and very deepwater, so good synthetic rope application
- Limited space and high speed operation implied use of traction winch, storage winch, right angled level wind to take out fleeting angle and inboard compensator
- Dyneema® fibre rope selected was pre-stretched and fully qualified by DNV
- Outer braid meant a higher friction coefficient and abrasion resistance, so no heating effects
- Rope analysis software for effective life monitoring
Project Example 2

Deepwater lowering system (DLS), Subsea7, Gorgon Project, 2013

Requirement - To handle a range of packages weighing up to 950Te to be installed in water depths of 1,300m

- Loads and depths beyond present fibre rope technology
- Wire weight less than 40% of the full depth load.
- Limited deck space on Sapura 3000 made it a good candidate for traction winch technology
- Vessel costs meant that the system had to be fully self contained
Project Example 2 cont.

Deepwater lowering system (DLS), Subsea7, Gorgon Project, 2013

Solution - Developed at the concept stage

- Grillage with two high tension traction winches with associated storage winches, HPUs and controls
- Fully qualified and ‘trained’, low rotation wire ropes, spooled prior to shipping (12,000m in total)
- High level of system redundancy (fully validated using FMECA techniques)
- LR certification and extensive FATs

...and a Multi-fall wire package with novel lift beam and connector
Project Example 3

Riser deployment and recovery system

Requirement
- To 1,600msw, 35Te SWL
- Mobilisation to vessels of opportunity

Solution
- Single drum winch (suitable for spooling under tension)
- Minimise deck space, while respecting riser limitations
- Portable and containerised
- Riser heavier than tool therefore detailed ConOps required
Observations - Deepwater Systems

Oceanographic applications
- Relatively small loads but can involve great depths
- Good fibre rope applications

Offshore construction
- Extreme loads and increasingly extreme depths
- Fibre rope technology hard to justify

Deepwater intervention
- Potentially a good application for fibre ropes but careful case-by-case consideration required
Concept development

Large number of factors affect the selection, so...

Get the concept right (or live with the consequences!)

- It is worth investing time and effort to define, then challenging, presumptions
- Storyboard the concept (ConOps)
- Fill experience gaps

Review frequently and vigorously

- Involve all the stakeholders
- FMECA, HazOp, HAZID and useful and often essential, but even adhoc design reviews can be extremely effective
- Post contract reviews, lessons learnt and client feedback
Conclusions

Tomorrow always comes, so...

Unless you are

Or an

You can’t assume
Thank you

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