Utilising a Multi-Mode Subsea Deployment System for Subsea Trenching and Component Delivery Operations

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Current state of play – trenching ops

Current status

• Exploration has moved towards challenging environments – e.g. arctic regions, deeper waters
• Multiple and various equipment in use
• Costs ever increasing
• Resources – experienced pilots, crane operators are diminishing
• Space – deck space on vessel limited (multiple vessels?), real estate of operating area is large
• Coordination of work packages with multiple equipment etc
• Too many pieces, potentially too many mistakes, not hitting project deadlines and customers reputations on the line...
• Regulations are getting tighter - HSE, Operational, Environmental

DON’T PANIC – there’s always a solution...

• Depending on scale of operations, there is potentially a better solution
• Create a multi-mode platform to ‘serve’ and meet various subsea work requirements
• E.g. combine subsea trenching and subsea component delivery
• Easy and intuitive human machine interface as per ROV console in cabin
Contents

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Trenching – an Overview

• Definition
  ‘A type of excavation or depression in the ground that is generally deeper than it is wide and narrow compared to its length. In subsea engineering, trenches are created to install pipelines or cables (telecommunications, power).’

• Products (pipelines/cables) laid in trench to:
  • Safeguard product – fishing gear (anchors), trawling
  • Protect product – currents, wave action (surf zone)

• Pre-lay trenching and Post-lay trenching

• Proven methods:
  • Ploughing
  • Jetting
  • Mechanical cutting
  • Dredging

• Evolved world of trenching – combination of methods applicable not only in O&G, but mining and offshore renewables

• Calls for equipment of higher reliability, performance, flexibility – costs!!

• Draws in expertise and best practices...

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The QT1400 System Platform

- Common buoyancy module with HPUs and thrusters
- Free-fly tracked jetting skid with parallel swords and rear eductors
- Heavy tracked chain cutting skid with dredge pump and cable handling
- Bespoke Skids for special applications
- 40Te package
The QT1400 System Platform

Q-Trencher 1400 SS6 LARS
42Te A-Frame with Cursor
26Te lifting Umbilical winch
3x 20ft control containers
460kW HPU
The QT1400 System Platform

QT1400 with LARS & Deck transfer system
Platform Tooling Capabilities – Multi-Mode
Jetting Swords & Mechanical Cutting

- Tracked jetting base with 800kW HP swords for sands and 100KPa clay
- Tracked chain cutting base with cable handling and dredge pump for clay and rock;
  - 2.0m depth at 400KPa/10Te to 1,000m SS6
  - 2.0m depth at 1,000KPa/15Te to 500m SS6
  - 2.0m depth at 5.0MPa/18Te to 500m SS5

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Arctic Multi-Mode ROV QT1400

- Operational environment: Icebreaker with 6.5m x 6.5m Moon-pool and habitat
- Operational isolation: Multi-skid functionality & maintainability
- Iceberg scour Soft ground: Mass flow & jetting skids for 6-7m Trenching (100KPa)
- Iceberg scour Hard ground: Chain cutter post-lay (400KPa) and pre-lay (10MPa)
- Seabed survey: Coring and CPT geo-tech survey
- EDC & Boulder clearance: Road-header cutter/dredge pump skid
- Well construction: 20-40Te Load delivery skid
Post-Lay Jet Trenching to 100KPa

- Free-fly Mass-flow excavator first pass
- Extended HP Jetting swords for 5.0m second pass
Post-lay chain cutter for pipeline trenching to 400KPa

- Trench 1.5m deep V trench
- Pipelines 100mm-800mm dia to 500m SS5
Pre-Lay Pipe-line Trenching to 10MPa

- 3.0m wide 1.5m deep 35deg V trenching
- Clear trench with a mass-flow excavator skid, prior to pipe-lay.
- Pipelines 100mm-1000mm diameter to 500m SS5
Tracked wire-line coring drill skid

- 75-125mm drill rod
- 90m coring to 1000m SS5
- 45m coring to 1500m SS5
- Subsea drill rod loading to 3000m
- Cone penetration testing CPT
- 10Te push and 20Te pull drill mast
Crane Manipulator Intervention skid

- 3000m 2Te free fly depth capability
- 160 deg arc operation
- Deploying 26kW rotary cutters, Dredge pumps, digger heads, drills, rock splitter etc
Digger Arm Intervention skid

- 500m 15Te Heavy tractor with 50kW Rotary cutter with two 25kW dredge pumps
Well Construction skid

- 20Te load capacity from vessel
- 40Te load capacity at seabed
- Air buoyancy tanks for 500-3000m depth
- Operations with 200-1000m vessel offset
- Compressor vessel based with hose supply
- WROV DP with auto hold & positioning with 300kW Thruster Power
- MBS object recognition lock and approach
- Patent application EP13183324.6
Platform Tooling Capabilities – Multi-Mode
Air Lift ROV with BOP Deployment

- ROV launched from A-Frame without BOP – A-Frame rated to 65Te
- ROV locates and picks up BOP off seabed
- ROV and BOP linked by WROV, with BOP sitting on seabed, whilst ROV hovers above
- Patent application EP13183324.6
The Control System Architecture

Overview

SCADA PLC BASED SYSTEM

1. Flexibility – vendor / supplier / support
2. Widely available skills

Process Control to PAC / PLC GUI to COTS SCADA
Q-Trencher 1400 Control System
HM Interface & Diagnostics

ROV Diagnostics

Ship Diagnostics
Q-Trencher 1400 Control System
Smart ROV Modes

- Auto-Positioning
- Keep constant Position and Orientation
- Use Doppler – bottom lock, inputs directly to DP, linear error growth
- Operations close to seabed
- Breadcrumb trail
- Speed control
Q-Trencher 1400 Control System
Smart ROV Modes

- Auto Fly Survey
- Import survey data
- Set heading, bearing, orientation of ROV to desired/defined position
- Controlled speed/travel
- Breadcrumb trail
- Cartesian motion
• MBI Sonar Track
• Object relative positioning
• Sonar used for range, depth perception and visibility
• Object/target lock
• Enable ROV to orbit structure
• Enable ROV to approach/dock

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Please note that this screen is an excerpt from tests performed on a WROV.
Conclusions

- A solution has been discussed to address multiple operations in challenging environments ✔
- Multiple tools that ‘plug-and-play’ into one generic platform ✔
- Initial investment based on operations at hand – build-up as you go; minimise complexity and large costs ✔
- Containerised (modular) solution allows more efficient vessel deck management ✔
- Training will be focussed and controlled – more controlled working environment ✔
- Meeting regulations and potential to set new working standards (e.g. ops, safety) ✔
- Provide best customer experience with equipment usage and support ✔
- All based on existing proven technologies, but integrated into one intelligent package ✔

An integrated technology which is an incremental step change in conventional trenching, that is overall cheaper than current, conventional solutions in the right conditions! ✔
Thank you