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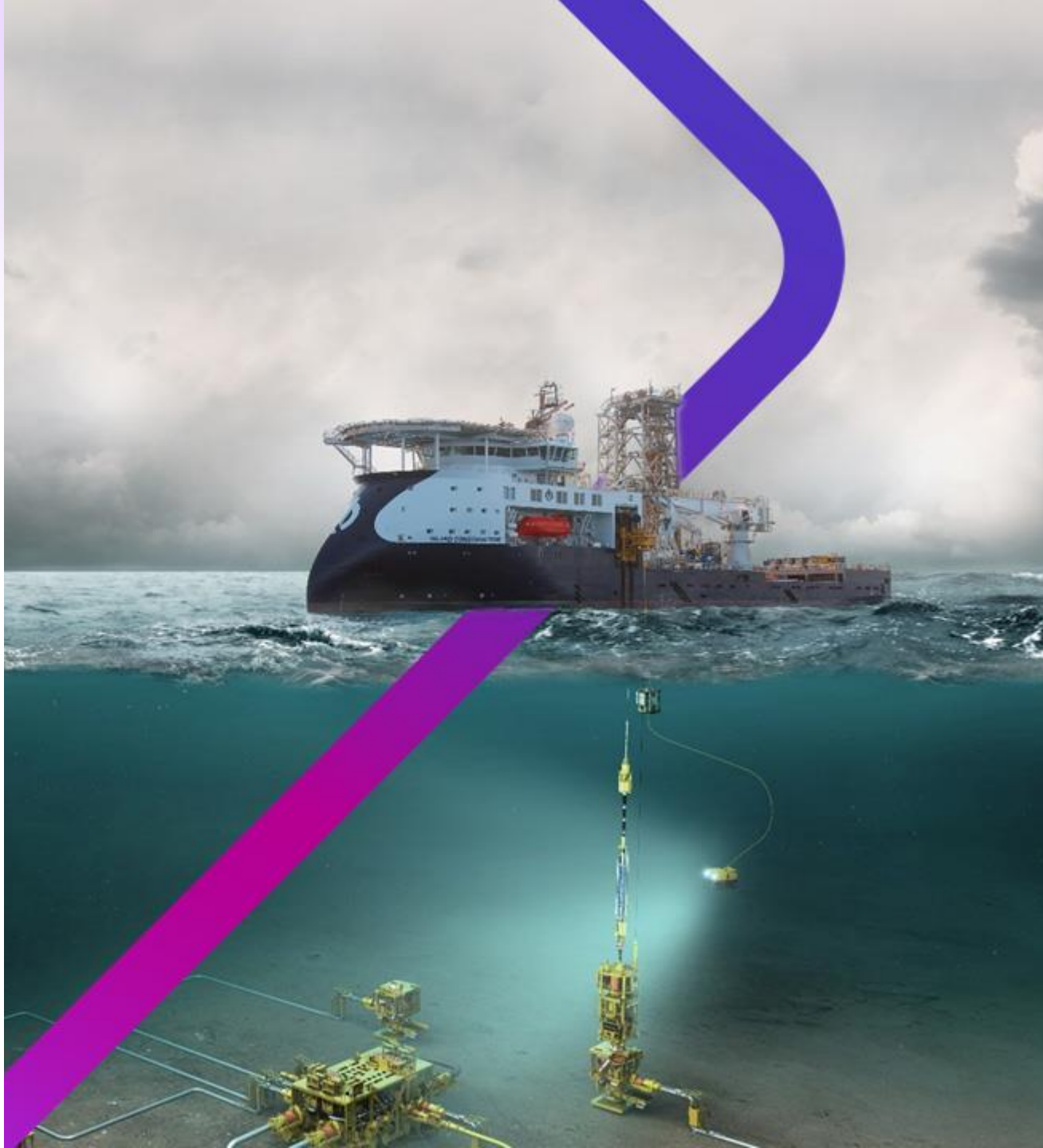
Riserless Coiled Tubing (RLCT) Services from Light Well Intervention Vessel

First Operation in a Live Subsea Well

In collaboration with HALLIBURTON

3 February 2025



Agenda

1. RLCT Track Record
2. RLCT Technology Overview
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4. Mobilization
5. Test Program
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8. Results
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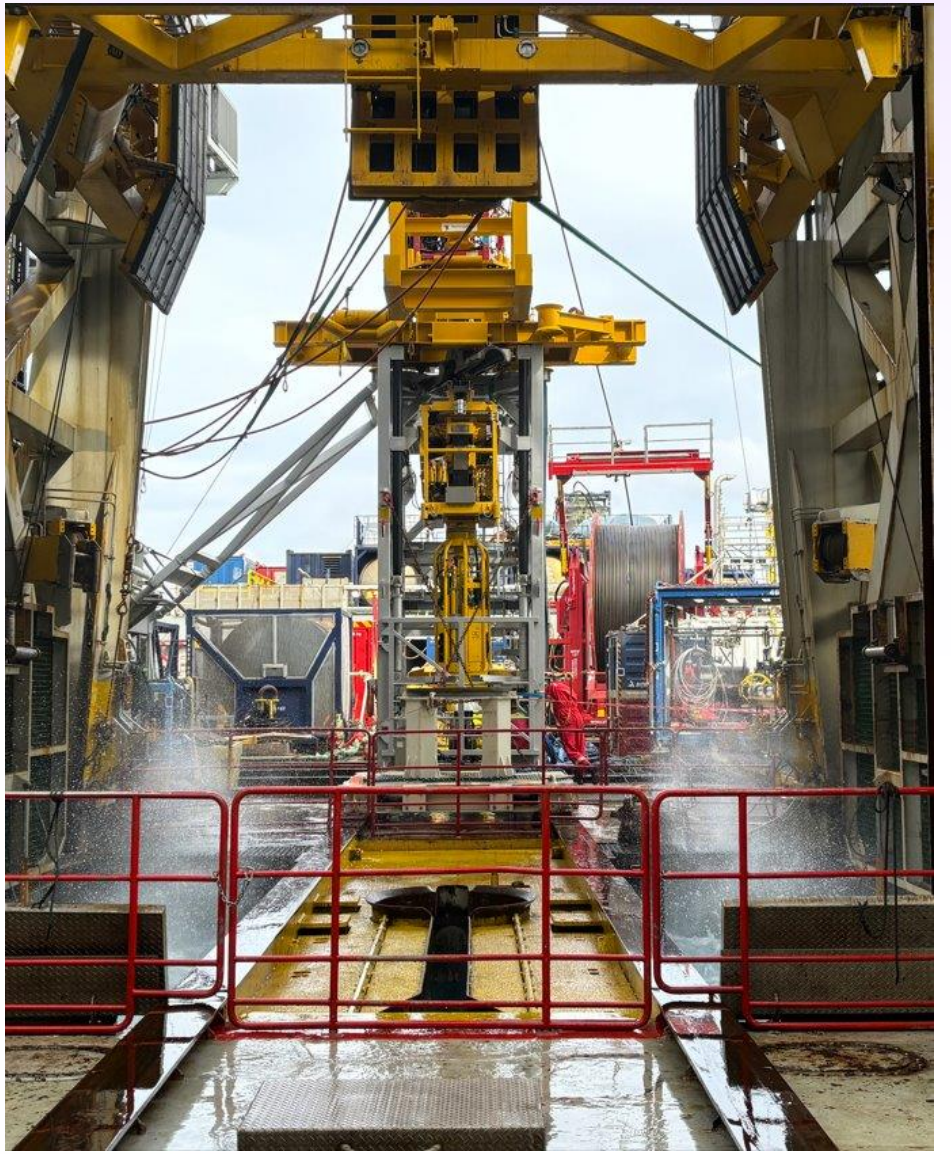
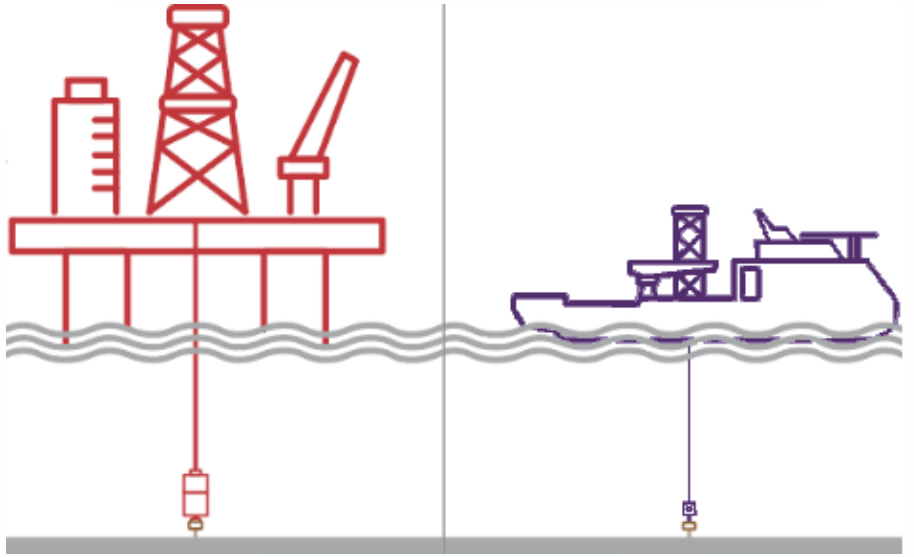
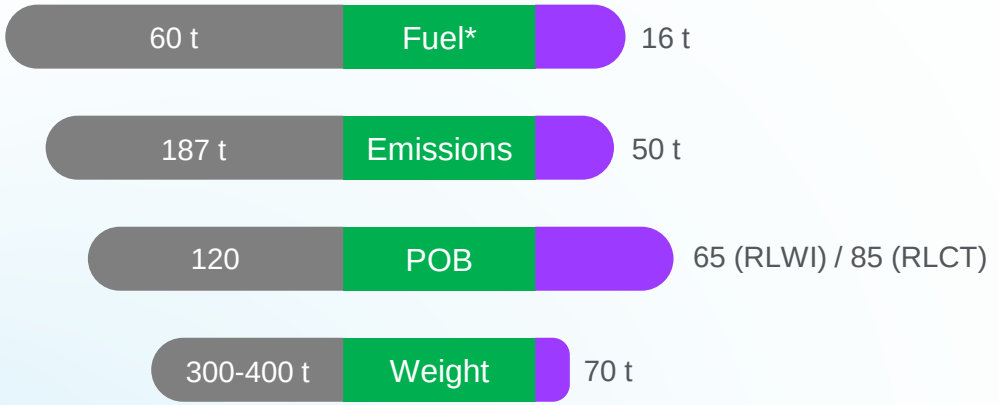


Why Riserless Intervention?



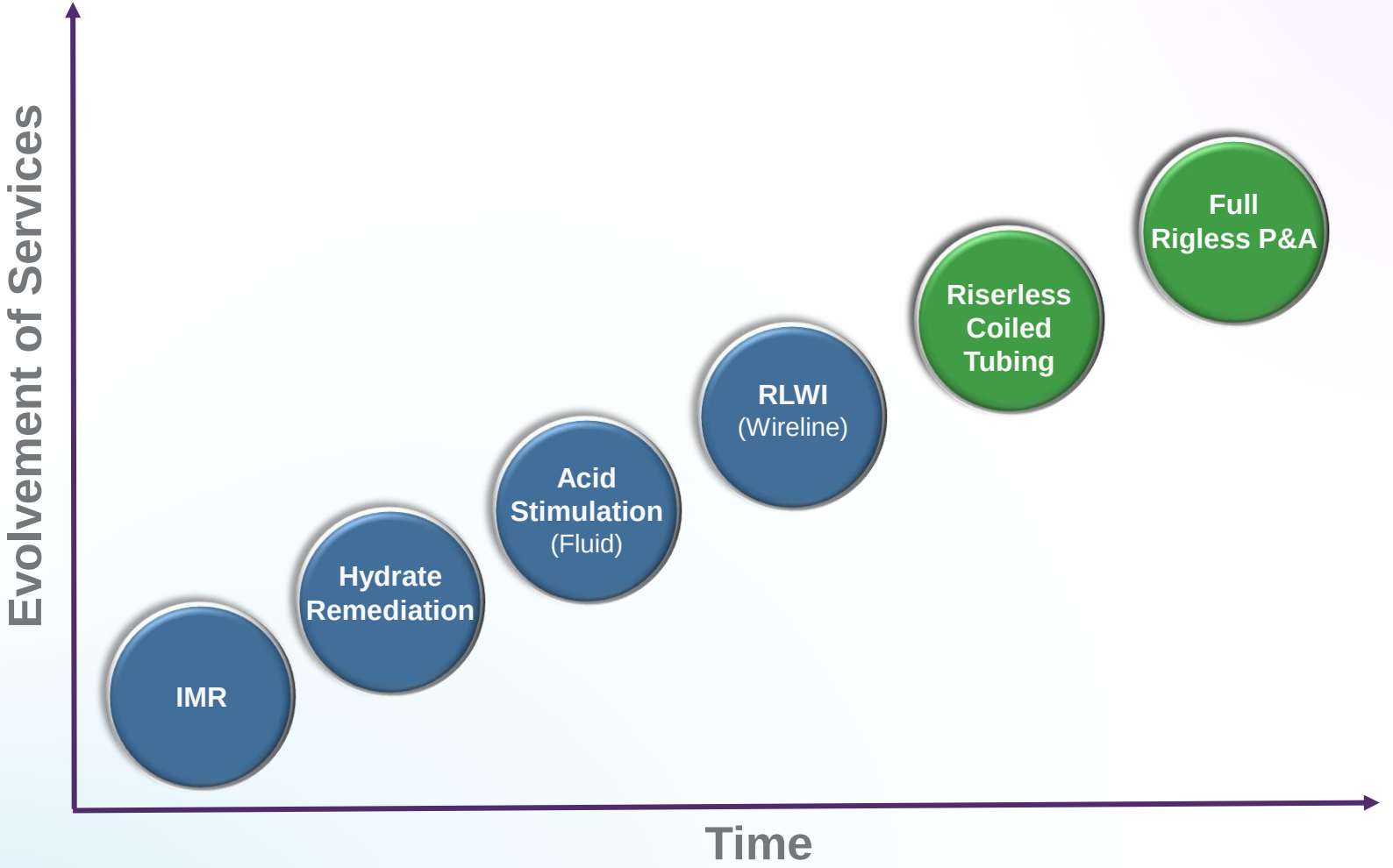


*Fuel consumption per day on DP

- Simpler setup and operations
- Unmatched efficiency
- Reduced POB and personnel exposure
- Reduced environmental impact
- Reduction in wellhead stresses and fatigue
- RLCT and additional tooling expands the RLWI offering

REDUCED COSTS FOR INTERVENTION

Long Term Vision: From Rig to Vessel



FEATURES	WIRELINE	COILED TUBING
Production Logging	✓	✓
Replacement of Hardware, Shifting Sleeves	✓	✓
Plug & Perforation	✓	✓
Temporary P&A	✓	✓
Circulation	✗	✓
Sand/ Scale Removal	✗	✓
Spotting Fluids/Cement	✗	✓
Lower Abandonment	✓	✓
Full Permanent P&A	✗	✓

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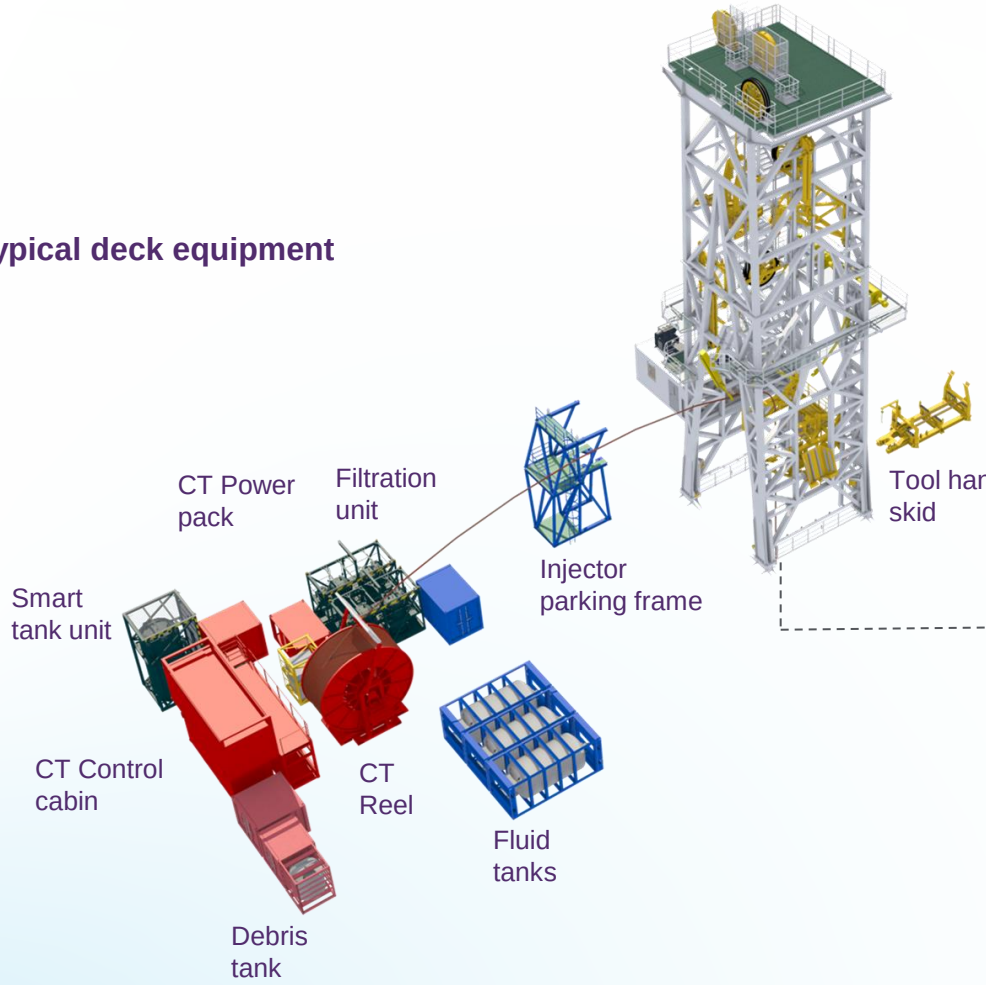
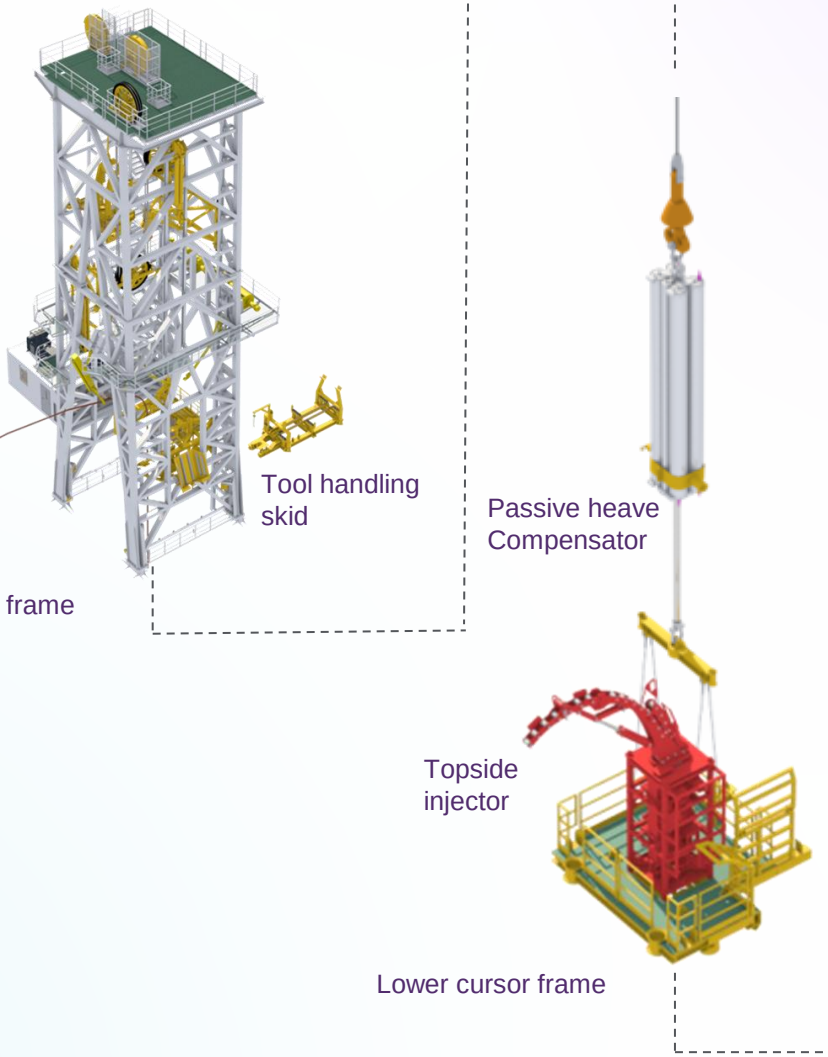
RLCT Technology Overview

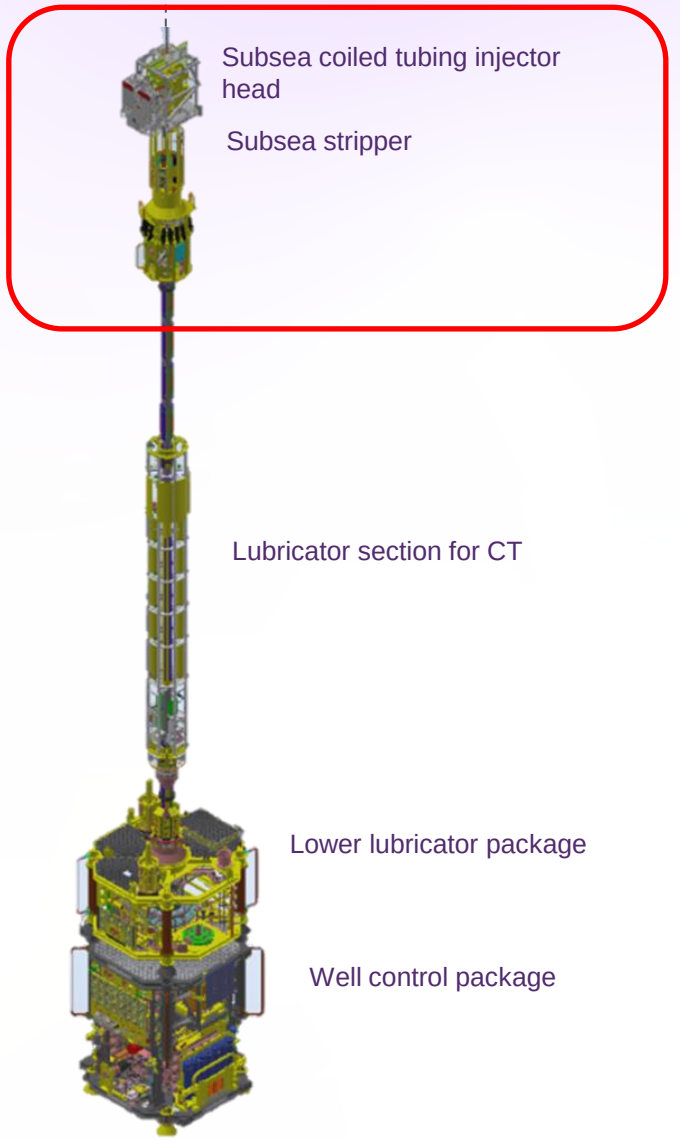
Typical deck equipment



Equipment inside tower



Subsea well control equipment



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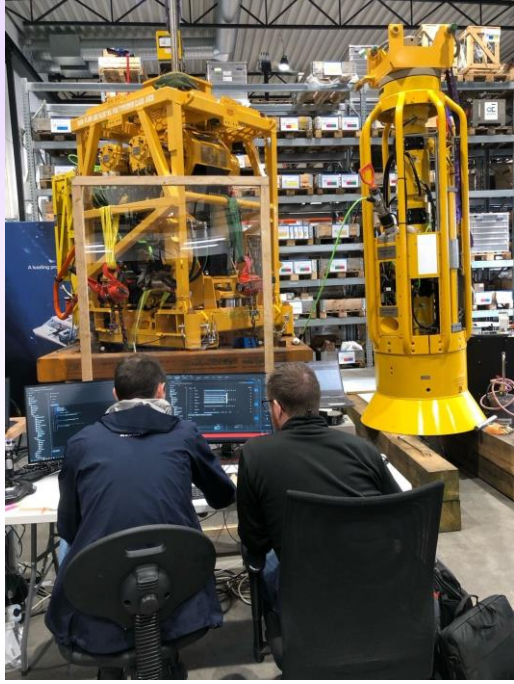
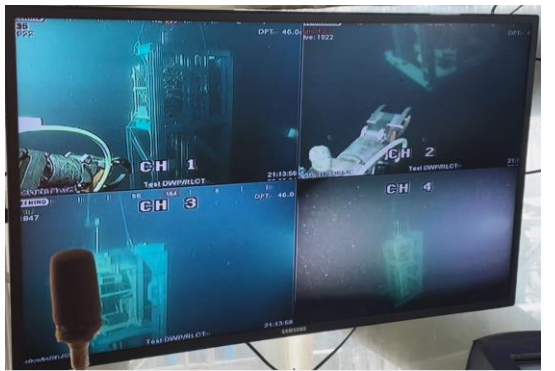
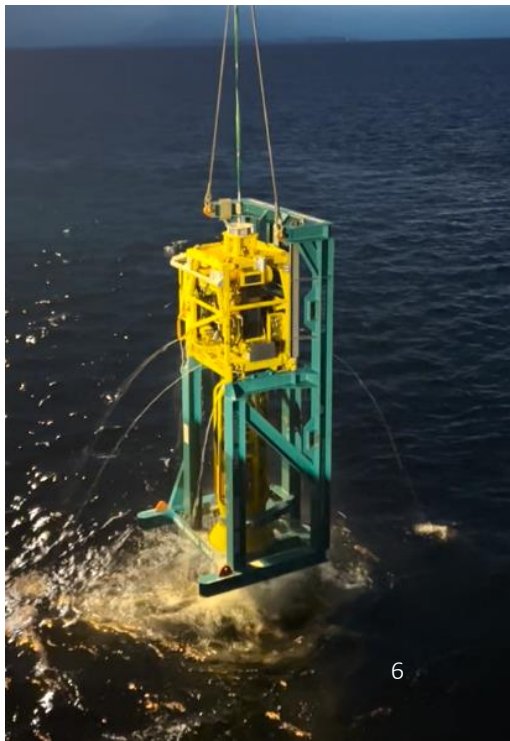
Preparation

- Stripper and injector JIP Phase 1 and 2 (2021-2023)
- DNV certification
- Injector, stripper, control system FAT
- Deck handling equipment design and testing
- Surface SIT
- RLCT School (60 people)
  - Classroom training
  - Hands-on training on surface test setup
- HAZID/ HAZOP/ well on paper/ contingencies
- Operating circle study and improvement
- CT design software upgrades
- CT real time data acquisition software upgrades
- CT high and low cycle fatigue prediction and monitoring system
- Strain gauges on safety join to monitor stresses on stack and wellhead
- Real time watch circles to improve operability and decision making
- Operating procedures
- Wet test

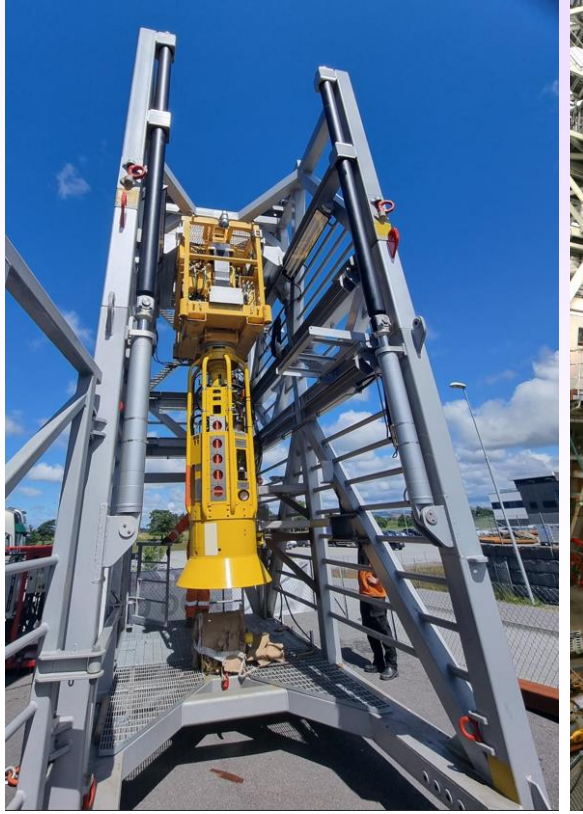






Mobilization

- Mobilization done in Norway
- First time integration of whole RLCT spread onto *Island Constructor*
- No major issues experienced
- Modifications and adaptations implemented by the Team according to contingency planning
- All CT preparation work (including stabbing of pipe, making up of connector, pull test and pressure test of lines, coiled tubing, connector and stripper) was performed in port prior to departure, simplifying operations at the wellsite
- SIT performed onboard prior to departure, including skidding in and lifting of the passive heave compensator, top side injector, subsea injector and subsea stripper in the module handling tower
- Duration: 8 days total for first time mobilization
- Will be shorter next time (expected ~5 days if RLCT is not already onboard)

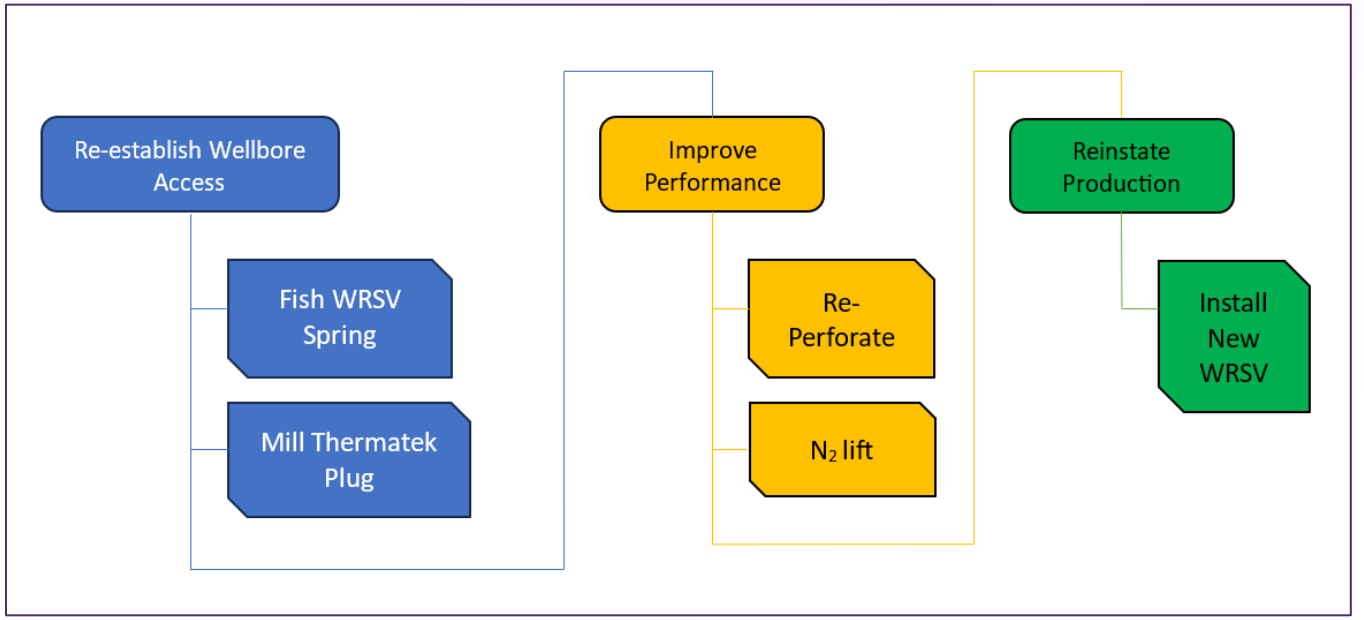


Test Program

- Final comprehensive testing before actual operations in live well
- RLCT system rig-up and deployment
- Well entry procedure
- Dual injector system testing under dynamic condition
- Well exit procedure
- RLCT system retrieval and rig-down
- Full verification and optimization of operating procedures
- Performed 2 runs (2nd run tagged suspension plug at ~2000 m. / ~6,500 ft)
- Test program completed successfully
- Minor hydraulic leak fixed between the 2 runs on subsea stripper due to loose fittings
- **RLCT test program duration: 4.5 days**
- POB: 84 people

Scope of Work

- Job objective: Reinstate production in a suspended subsea oil well
- Location: UK Central North Sea
- Water depth: 133 m.
- Cameron 4” x 2” Vertical Tree
- Well depth: <4000 m.
- Maximum well deviation: 22 deg.
- Completion: 4.5” tubing in 7” liner
- Coiled tubing: Halliburton 2" HS-90



Intervention Program:

- Fishing parted WRSSSV (7/32” line)
- **Milling of a suspension plug to gather well access (Thermatek tubing plug, 240 m. length) (RLCT)**
- **Pulsonix acid wash/ near bore scale clean-out (RLCT)**
- Perforations (E-line)
- **N2 Lift → Well flowing (RLCT)**
- Straddle/ safety valve installation (E-line)

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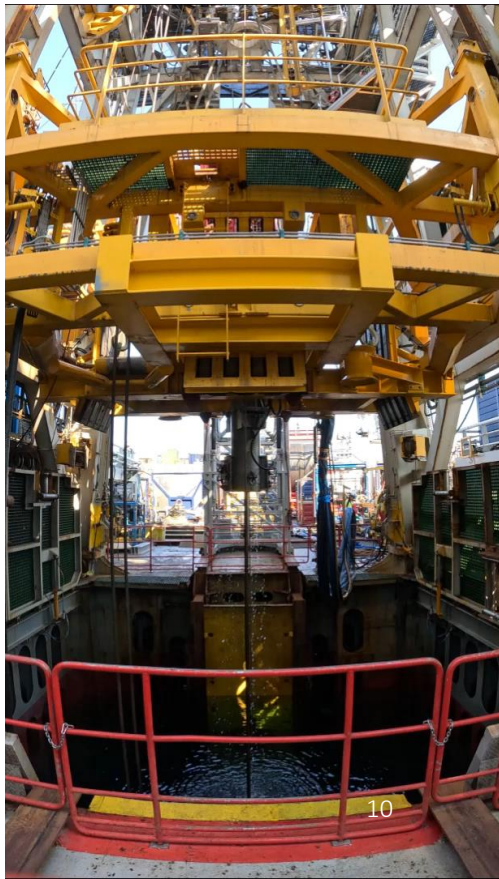
Operations

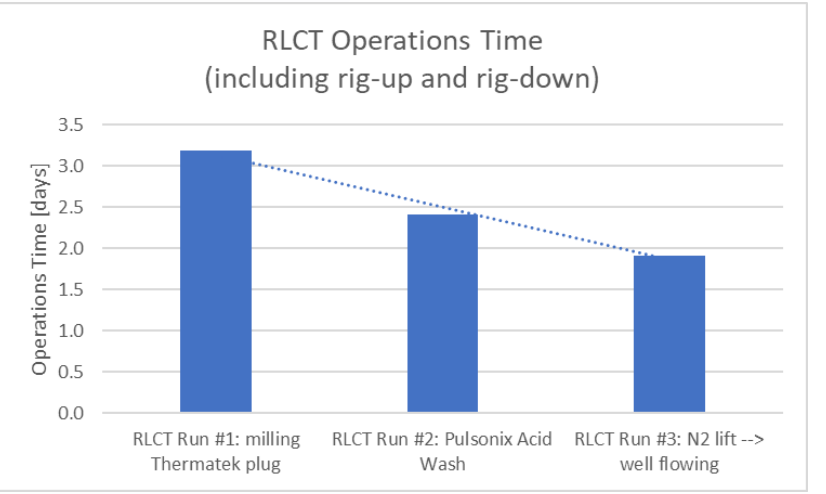
- POB: 86 people
- 12 runs with 7/32” line for fishing a parted safety valve
- Interim port-call for repairs of standard RLWI equipment (not related to RLCT)
- 1st RLCT run with 3.4” Raptor Mill (3.2 days including RLCT rig-up and BHA rig-down):
  - Mill through 246 m. (807 ft.) of Thermatek well suspension plug
  - Drifted well to depth for perforations
  - Mill 52 m. (170 ft.) of debris before tagging bottom
  - Returns to flowline
- 2nd RLCT run with Pulsonix acid wash (2.4 days including rig down of RLCT)
- 3 e-line perforating runs (+1 misrun)
- 3rd RLCT run with nitrogen to lift well → well flowing (1.9 days including rig down of RLCT)
- E-line run to install straddle packer with DHSV



Results

- **Job objective safely achieved**: well back in production!
- RLCT overall **system fully validated** in a live well:
  - Dual-injector operations
  - Control system
  - Pressure control equipment
  - Surface handling equipment
  - Operating sequences
- Change of mode from CT ←→ WL has been confirmed to be 6-9 hours with margins for improvement
- **Total operational time** for mob + transit + 17 WL runs + 3 CT runs + transit + demob (excluding test program and interim port call): 33.5 days

Activity	Duration [days]
Mobilization (including 11 hours ROV wet test)	8.8
Transit	0.6
Well preparation and stack deployment	2.8
Safety Valve Fishing (12 slickline runs)	4.1
RLCT Test Program (2 RLCT runs)	4.5
Interim Port Call (SCM repair, including WOW)	9.1
RLCT Run #1: milling Thermatek plug	**3.2**
RLCT Run #2: Pulsonix Acid Wash	**2.4**
Perforating (3 e-line runs + 1 misrun)	2.8
RLCT Run #3: N2 lift --> well flowing	**1.9**
e-line install straddle packer with DHSV	0.9
Stack retrieval, well handover and final survey	3.0
Transit	0.6
Demobilization	2.3
TOTAL	**47.2**



Value to the Industry

Safer

- **No tension frame** and no people on it
- **No BHAs raised** to top of riser in tension frame
- **No moving equipment** in tower during rig-up and rig-down
- All work happens with **minimal human interaction** and all at moonpool level
- Lighter equipment, lower forces, **simpler operations**
- Less POB

Faster

- **No time to deploy and retrieve** the riser
- **No time to rig-up and rig-down** the tension frame
- **No need for rig mooring** and/or BOP tethering in shallow water
- **Short time to rig-up and rig-down** CT
- **Short time** to change between CT ←→ WL/SL

Lower Environmental Footprint

- **Lower fuel** consumption
- **Shorter duration** of operations
- **Less helicopter flights** and less PSV supply runs

Improved Economics

- **Less equipment** needed (no riser, no flex joints, no tension frame, smaller fluid volumes)
- **Smaller vessel**
- **Reduced POB** (86 vs 120)
- **Lower spread rate**
- **Lower fuel** consumption
- **Shorter duration** = lower cost/well

Conclusions & Acknowledgement

- RLCT is now a **commercial service**
- System has **confirmed significant value & capabilities** it brings to an existing RLWI integrated system
- The system **confirmed its simplicity, efficiency and effectiveness**
- Both the **team and the equipment graduated** with full marks in the first RLWI/ RLCT operation in a live well

Thanks to the Team who worked on this exciting project for relentlessly chasing its full success with passion, patience and persistence!

A special thanks to our coiled tubing partner

HALLIBURTON

for their significant contribution to this successful RLCT project!

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