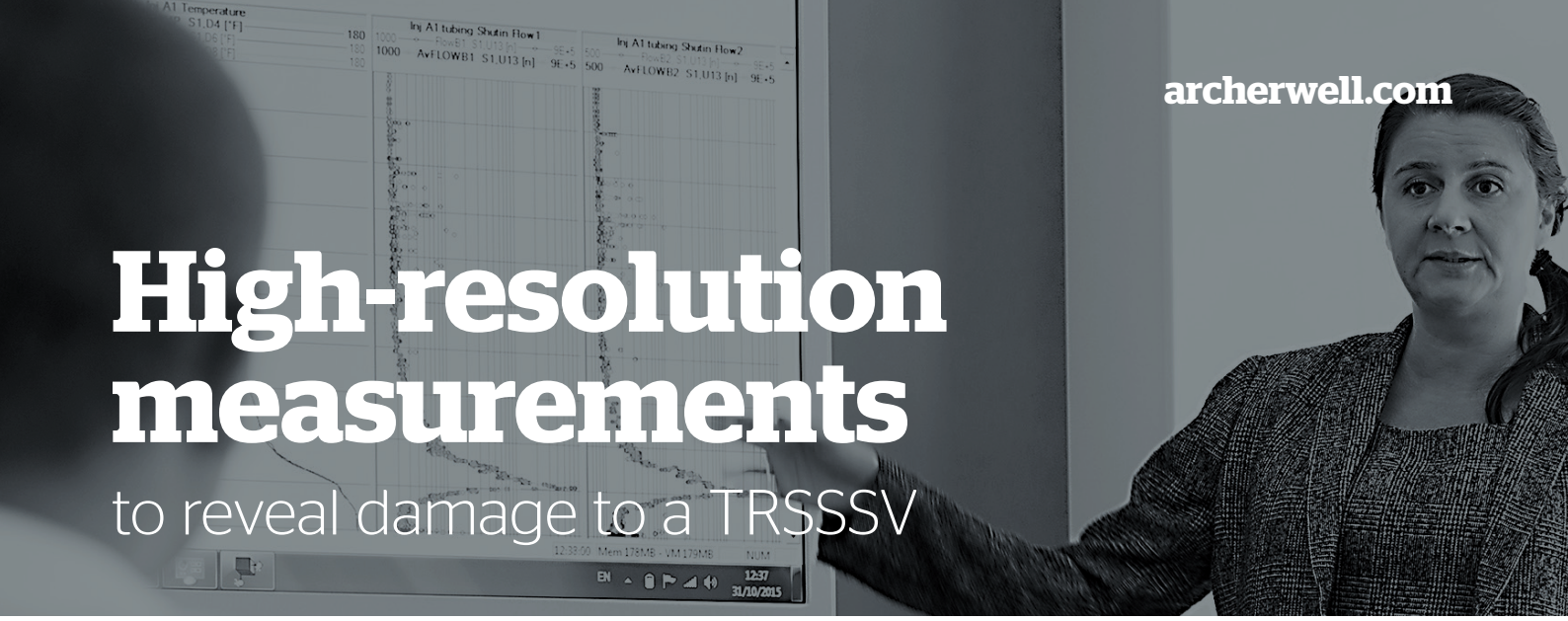

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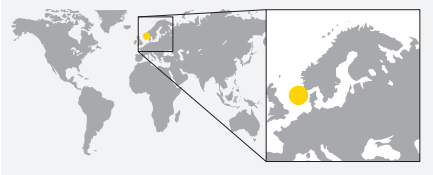
High-resolution measurements

to reveal damage to a TRSSSV

Case study: **SPACE® Vernier**

Downhole ultrasound scanner providing high-resolution measurements of ID and thickness to reveal damage to a TRSSSV.



Region: North Sea
Customer: Maersk
Well Type: Producer

Case Benefits
- Detailed in-situ analysis of sub-assembly components.
- Accurate, high-resolution ID and thickness evaluation in one run
- Real-time 2D mapping of internal and external interfaces

Key Capabilities
- High azimuthal resolution
- Real-time information from e-line conveyed services
- Millimetre accuracy ultrasound measurements obtained in three dimensions
- Full 360° coverage of wellbore circumference

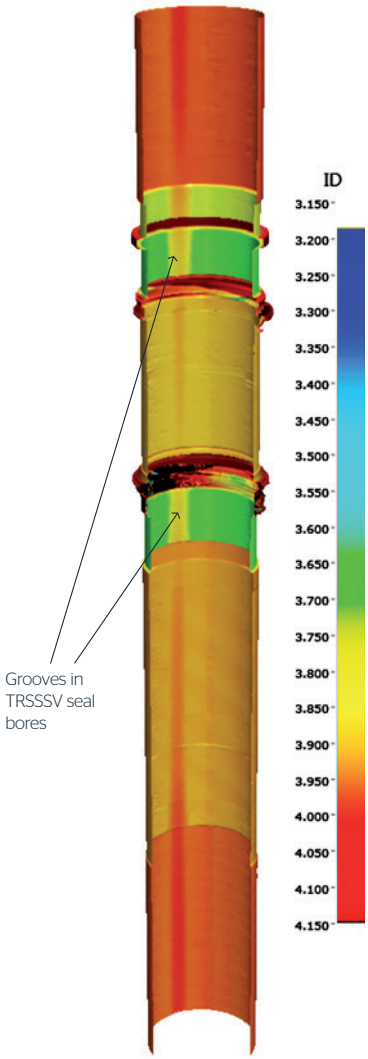
Typical Applications
- Internal diameter evaluation
- Direct pipe thickness measurement
- Metal loss and corrosion evaluation

Challenge
Several attempts were made to reactivate the tubing retrievable sub surface safety valve (TRSSSV) in an oil well in the North Sea..

All inflow tests were unsuccessful, hence a decision was made to keep the TRSSSV locked open position..

During later intervention programs, wireline retrievable sub surface safety valves (WRSSSV) with different seal configurations were installed. However, none of them could make a proper seal, leaving the situation unchanged.

Solution
The **SPACE® Vernier** tool, with its high resolution measurements of both internal diameter and wall thickness, was chosen to identify the reason for the TRSSSV's inability to seal and to evaluate the condition of the tubing to surface. Survey data acquired revealed a groove running from below the safety valve all the way to surface and was visible throughout the TRSSSV, including the seal bores. The high circumferential resolution (288 samples) of **SPACE® Vernier** allowed precise measurement of the width of the groove (averaging 0.5") while the maximum depth was measured at 0.05" through the seal bores, clearly explaining the inability of the valve to seal correctly. In the data recorded above the valve, the tubing appeared in generally good condition with the exception of a consistently narrow (no more than 0.5") groove indicated by increased ID measurement. Corresponding directly measured thickness readings



3-D rendering of ***SPACE® Vernier*** *ID data from the TRSSSV. Signs of wear appear all the way through the TRSSSV.*

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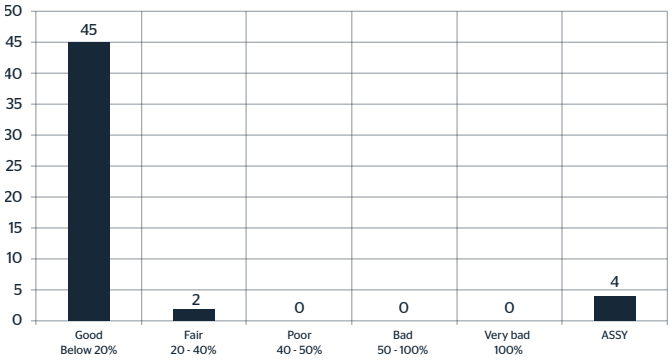
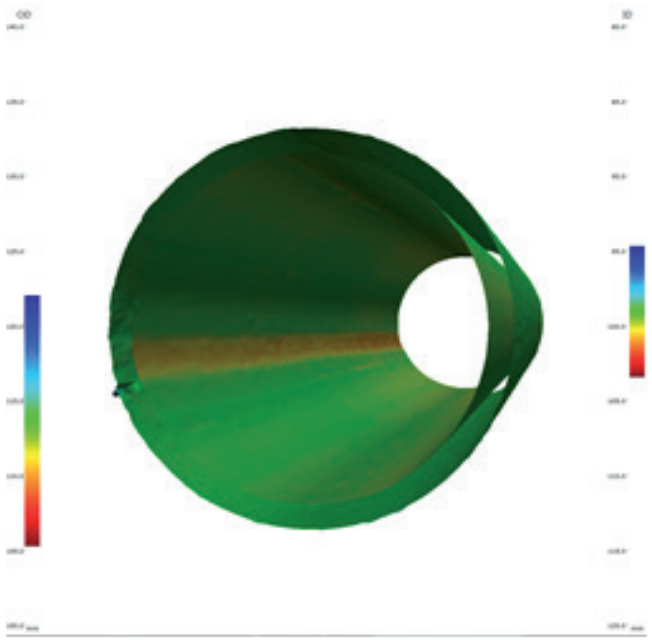
revealed reductions in remaining wall thickness of up to 21% at the point of the groove, while the remainder of the wall maintained largely nominal thickness.Taken together, the high resolution internal diameter and thickness data indicate that there is very little general corrosion or metal loss in the tubing as a whole, but that there is localised wall loss of up to 21% due most probably to physical wear.

Result

The precise and complete information supplied by **SPACE® Vernier** allowed the well owner to understand the nature of the integrity failure and to take remediating measures. Due to the resolution of the data supplied it is also feasible to be able to identify possible mechanisms for the formation of the groove and to optimise intervention procedures to minimise the chance of re-occurrence.



Statistics on max loss of nominal wall thickness, %.



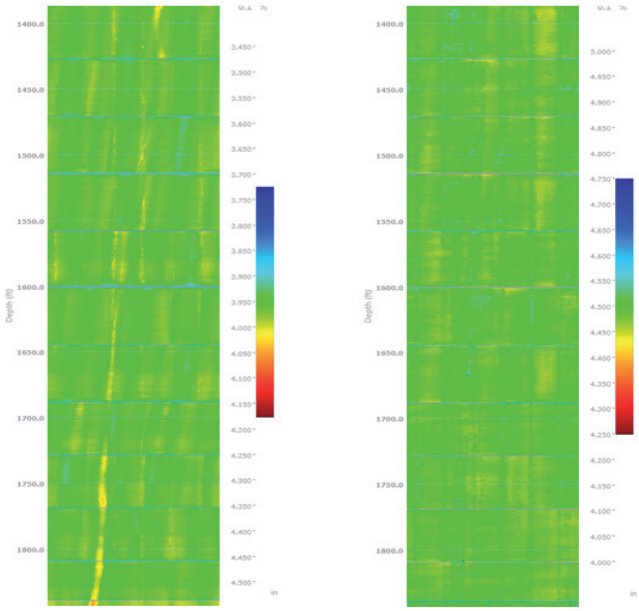
3D rendering of inner and outer diameter. The outer surface of the completion seems to be in good condition (green color).

Specifications - SPACE® Vernier

Physical	
Outer diameter	3" [76 mm]
Length	52.8" [134.1 cm]
Weight	49.2 lb [22.3 kg]
Environmental	
Maximum temperature	275°F [135°C]
Maximum pressure	7,500 psi [517 bar]
Electrical	
Voltage	240 VDC
Current	200 mA
Functional	
Number of sensors	288
Maximum azimuthal resolution	1.25 deg
Vertical resolution	0.39" [10 mm]
Precision–ID	± 0.012" [0.3 mm]
Precision–Thickness	± 0.012" [0.3 mm]
Measurement range–Thickness	0.2-0.8" [5-21 mm]
Measurement range–ID	4-13" [102-330 mm]
Operational	
Logging speed	3-30 ft/min [0.9-9.1 m/min]
Logging mode	Real-time
Well conditions	
Fluid	Water, brine, oil, produced liquids
Minimum casing ID	4-1/2" [114 mm]
Maximum casing size	13-3/8" [340 mm]

Inner diameter

Outer diameter



Direct inner and outer diameter measurements reveal that the damage (yellow/orange color) has occurred on the tubing's inner surface. Here showing the depth interval from 1380 ft to 1850 ft.

Captured by SPACE®

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