# CASE STUDY No 3

## Casing Inspection

The use of the Cereus Nusonix Ultrasonic logging tool to deliver high accuracy wear measurements in $9^{5}/_{8}$" casing for slot recovery applications.

### Challenge

- Slot recovery on offshore installations is an essential procedure to ensure maximum productivity from a development.
- Repeated side-tracks from a slot will subject the upper casing to erosion due to rotational drilling activities resulting in reduced pressure rating and strength.
- Accurate and verifiable measurement of the drilling erosion and resultant wall thinning is essential to ensure well integrity and safety criteria is adhered to.

### The Solution

- Use the next generation Cereus Nusonix ultrasonic tubing and casing inspection logging tool.
- The tool uses the Cereus Engine to deliver ultra-wide-band frequency response of 100kHz to > 3.0MHz.
- Slim hole tool, capable of measuring in variable casing sizes
- Ultra-high fidelity ultrasonic provides high resolution casing internal radius, wall thickness measurements and evaluation of the cement bond, from a single acoustic pulse.
- Measurements are compensated for wellbore fluid velocities using an integrated secondary time-of-flight sensor.
- No other corrections or compensation/calibration required. Providing fast turn-around on-site results.

### Results

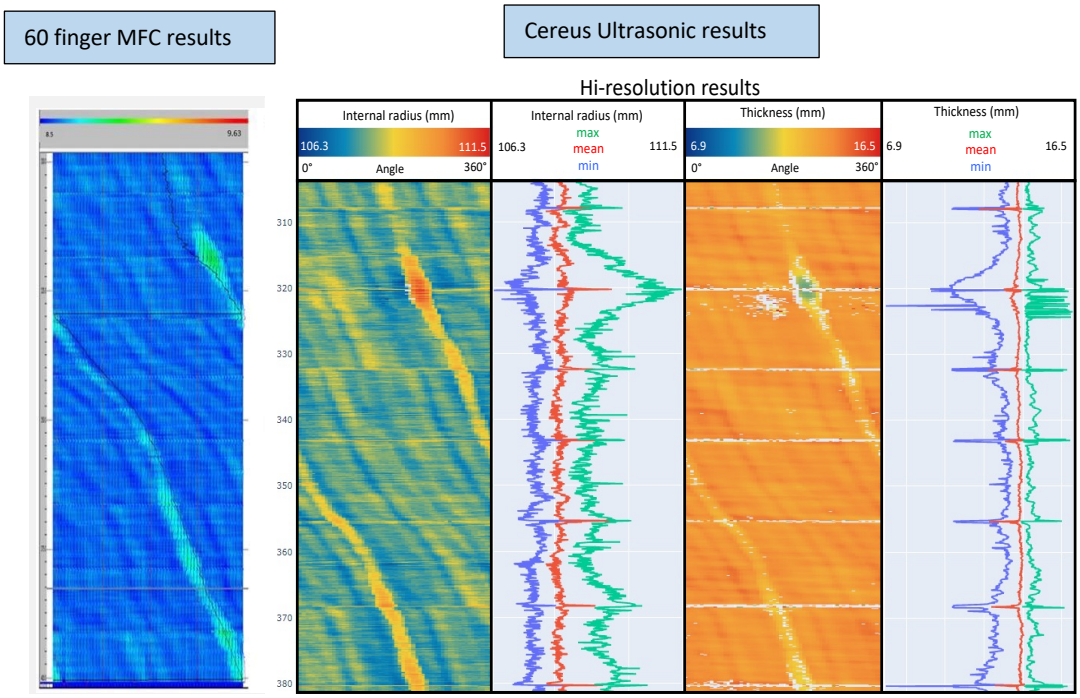
- The ultrasonic tool delivered high resolution and repeatable measurements of the casing internal radius and wall thickness.
- Tool clearly capable of measuring in variable internal diameters and casing wall thickness changes.
- Clear indication of the $13^{3}/_{8}$" casing position beyond the $9^{5}/_{8}$"
- The tool provided a direct physical and absolute measure of the casing thickness and as a result a direct measure of casing wear as a percentage loss.
- The tool was run in conjunction with a 60 fingered calliper, which only provided internal radius.
- Magnetic thickness tools were not considered by the client to have the accuracy or resolution required to determine metal loss.

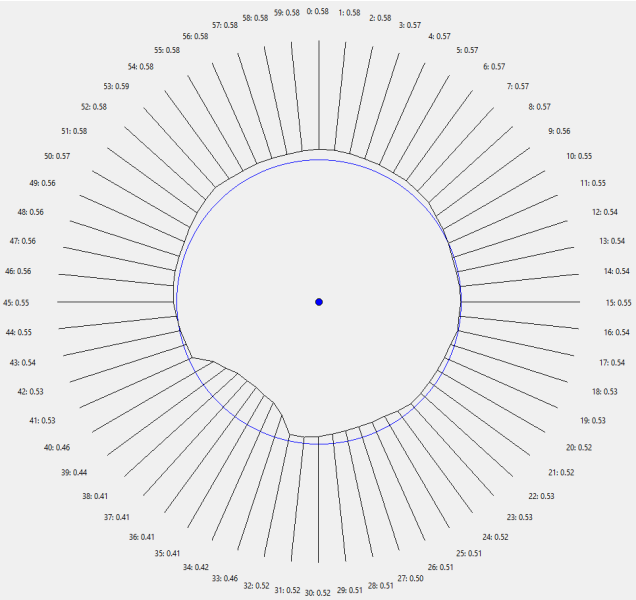
## Summary

The Cereus Nusonix Ultrasonic tool was run in tandem with a 60-finger calliper (MFC) on wireline. The primary objective of the logging operation was to determine the casing wear in the highly deviated section of upper $9^5/_8$" casing at around 300-350m where the deviation was over $60^o$.
The log was run at a logging speed of 9m/min over the section of interest.
Both the MFC and the Ultrasonic tool clearly identified internal casing wear due to drilling operations, with the ultrasonic providing an absolute measure of the casing wall thickness.
In addition to the internal radius and wall thickness measurement, the Ultrasonic tool provided secondary information on the relative position of the $13^3/_8$" casing.
Using the MFC internal radius results alone in the API approved casing wear calculation, the results delivered a pessimistic casing wear which exceeded the client allowable threshold.
The absolute measurement of the wall thickness provided by the Nusonix Ultrasonic tool provided an accurate direct measure of wear which was within the client's prescribed cut-off.
As a result of the direct measure from the Ultrasonic tool, the client approved the use of the slot for a further side-track.

## Results

In comparison with the MFC, the Ultrasonic tool provided a significant improvement in the resolution of the internal radius measurement. The scale on the MFC plot (bright blue) has a full range of 1.13" (28.7mm) compared to the equivalent ultrasonic plot having a full range on the colour scale of only 0.2" (5.2mm). The wall thickness measurement shows excellent consistency over the length of the casing except at the point of erosional wear due to the drilling operations.



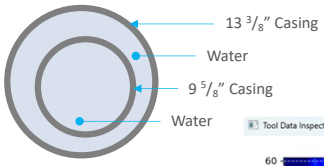



Polar plot of the wall thickness wear

Nominal wall: 0.57”
Minimal wall: 0.41”
Material loss 28%

In addition to the high precision direct measurement of the wall thickness allowing the accurate determination of metal loss, the Ultrasonic tool also detected the subsequent casing from within the 9⅝” casing. At a deviation of over 60º, the casings were eccentric to one another, given this, the Ultrasonic tool has limited radial recovery of the acoustic pulse. In this scenario of extreme eccentricity, enough information is provided to map the subsequent casing position.

## Multi-casing detection




Observation of 2nd casing.

Single revolution of the transducer

60 shots = 360°