Managing Technical and Logistical Challenges on a Deepwater Gas Field: Tamar Pipeline Pre-Commissioning and Baseline Inspection Project



Bob Snodgrass and Suji Kurungodan PPSA Annual Seminar, Aberdeen, UK 19th November, 2014

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- Ultrasonic Wall Measurement (UTWM) Baseline Inspection
- Close & Questions



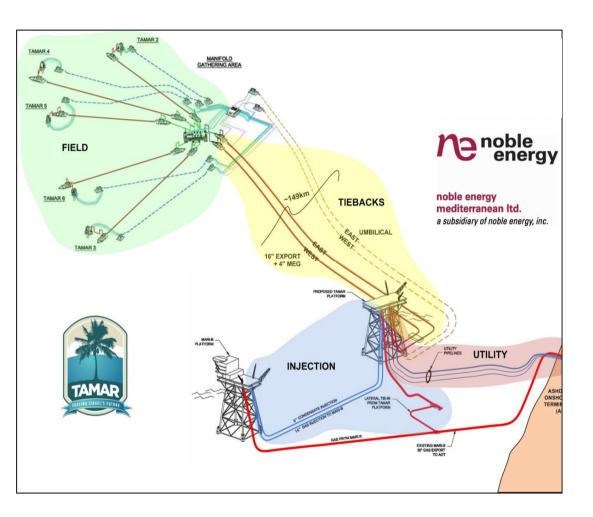


Tamar: Project Overview



TAMAR Field Overview

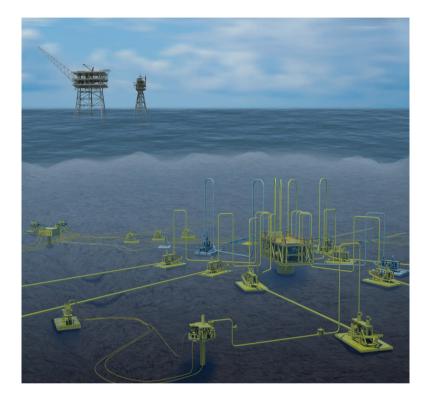
- In-Field
 - 10" Flowlines x 5 (3 mile ea.)
 - Jumpers & Manifold
- Tiebacks
 - 16" x 2 (90 miles ea.)
 - 4" MEG
- Injection
 - 8" Condensate Injection
 - 16" Gas Injection
 - 30" Gas Export Riser
- Utility
 - 10" Condensate
 - 6" MEG
 - 6" MEG/Produced Water
- Maximum field water depth 1700m





TAMAR Project Overview

- Scope of Work
 - Pre-commissioning of all subsea pipelines, flowlines, jumpers and risers
 - Caliper and Ultrasonic baseline inspection of 16" tieback lines
 - Bundled within one pre-commissioning contract award

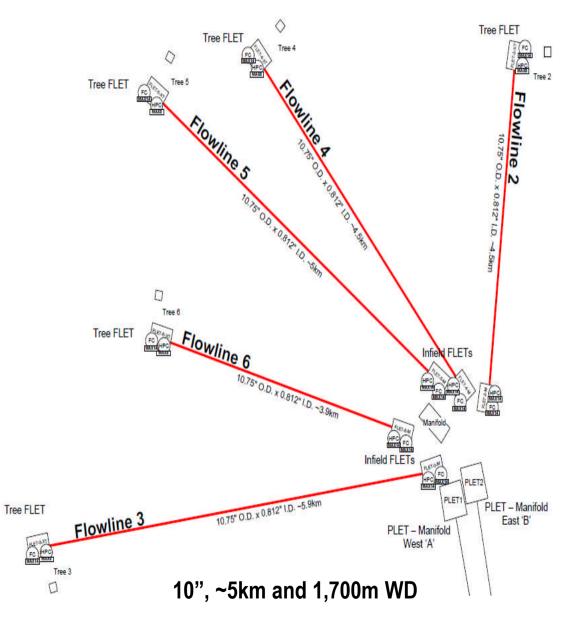




Pipeline Pre-Commissioning – Selected Highlights

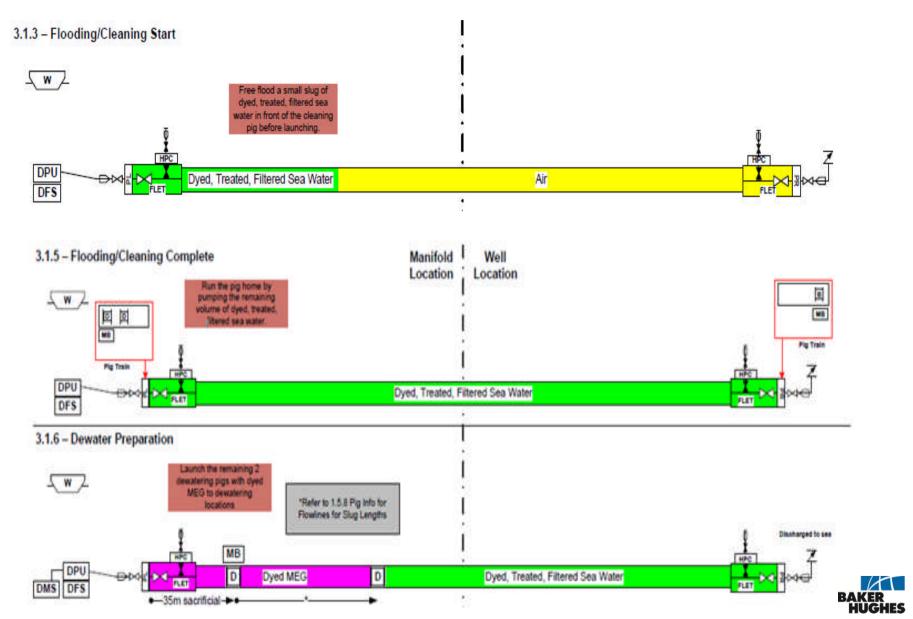


Infield Flowlines





Infield Flowlines - flood, clean, MEG launch, test



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Infield Flowlines – Denizen skids

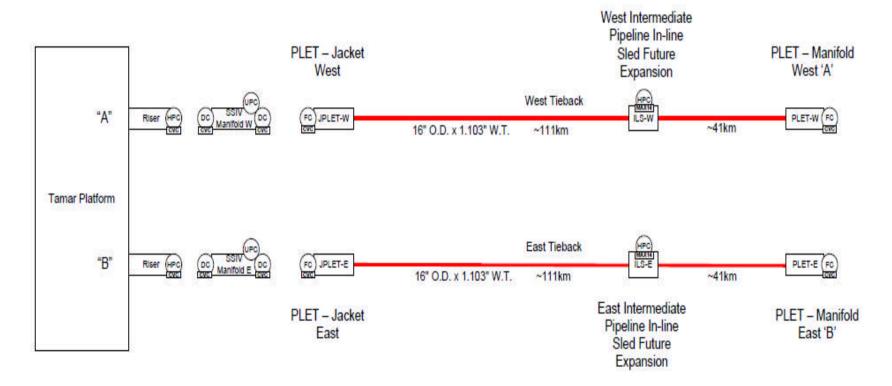




Tie Back Lines

120m WD

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1700m WD
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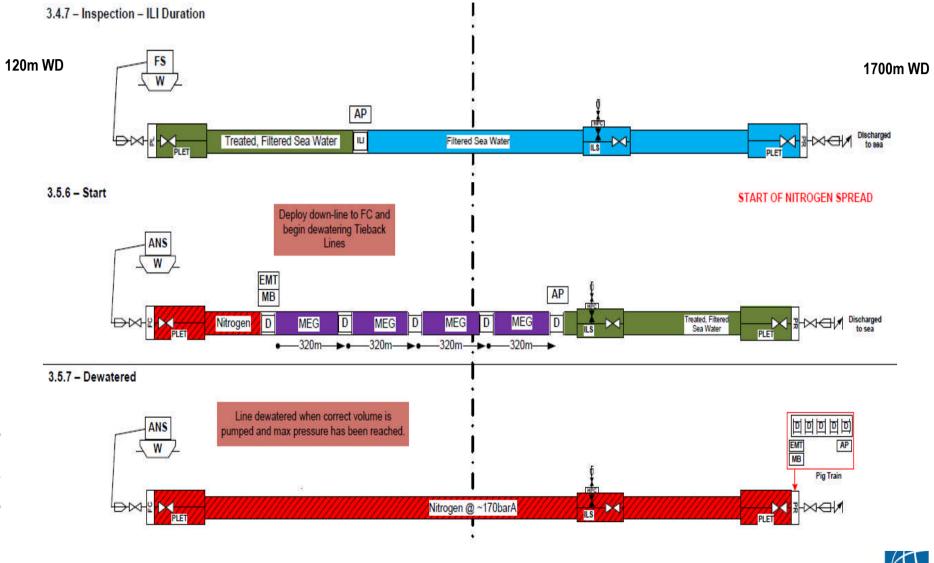


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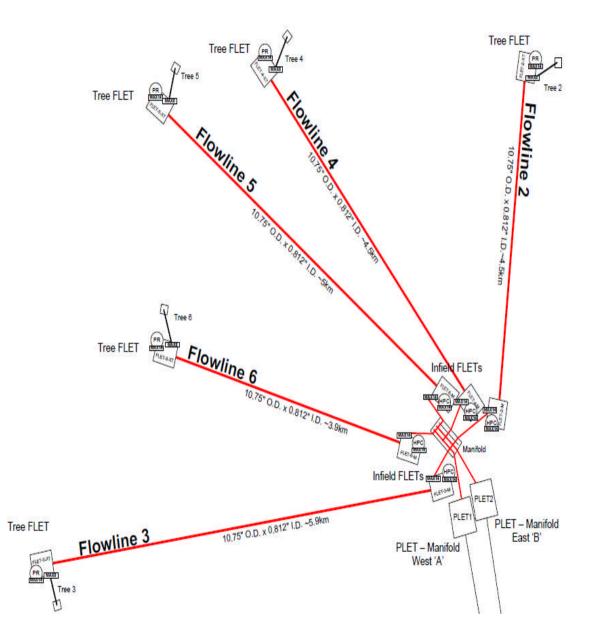
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Tie Back Lines – ILI Run and Dewater



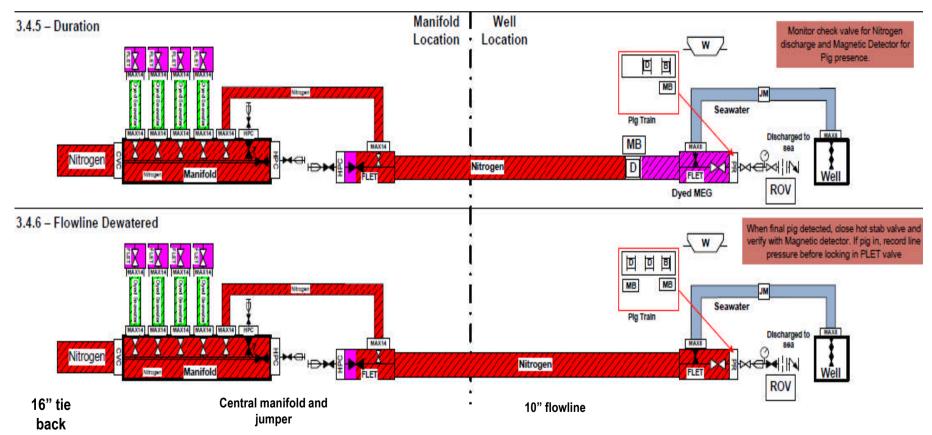
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Infield Flowlines – Field Hook Up





Infield Flowlines – Dewatering





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Pre-Commissioning Highlights

- Large vessel based high pressure nitrogen spread
 - 9000 HP
 - >230bar
 - ~5,000scfm continuous working flowrate
 - ~20 days continuous pumping
 - 110,000,000scf of N2
 - equivalent to >700 standard LN2 tanks



EMAS Lewek Falcon



Pre-Commissioning Highlights

- Infield flowlines completed <u>entirely subsea</u>
 - Flood, clean and test completed subsea with Denizen
 - MEG train launch completed subsea with Denizen
 - Dewater, condition and N2 inert completed with reservoir from tieback lines
 - Completing the majority of the operation from shallow water thus mitigating deep-water risk
 - No deep-water downline (coil, hose) intervention required
- Consequent savings in vessel space and schedule duration







Ultrasonic Wall Measurement (UTWM) Baseline Inspection



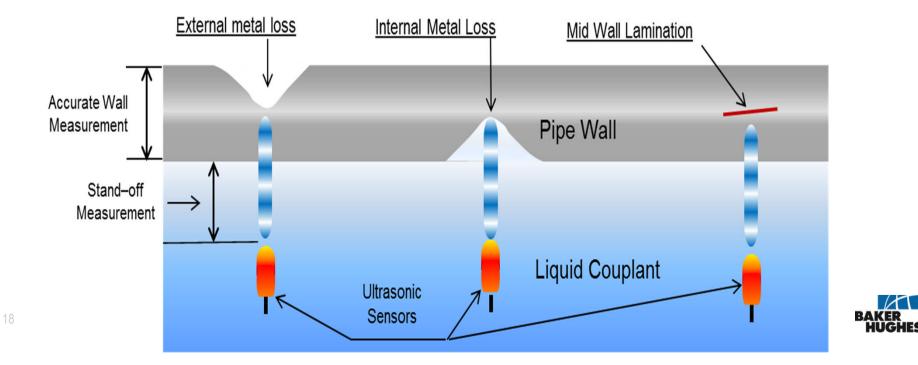
2nd Gen Ultrasonic Wall Measurement (UTWM) Tool





Operating Principle for Ultrasonic Wall Measurement Tool

- Based on inducing ultrasound compression waves into the pipe wall
- UT transducers are positioned at a 90° angles to the pipe wall
- Use an impulse-echo mode transmits an acoustic wave and receives return echoes
- Echoes represent the locations of the internal/external pipe wall and other metallurgical anomalies such as laminations



Detectable Anomalies by UT

- Internal / External metal loss
- Channeling Corrosion
- Blisters / Inclusions
- Dents*
- Ripples
- Gouge / Notch
- Laminations
- Cracks*
- Wall thickness variations
- Usable on bends, tees, and valves







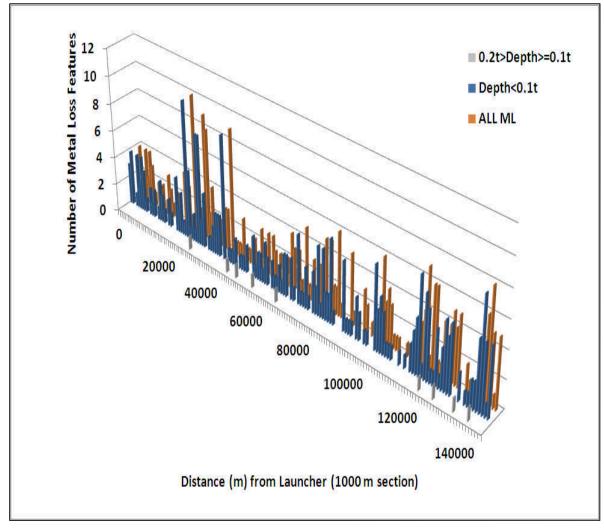
Advantages of UTWM

- Better depth sizing (+/- 0.2mm)
- Direct Wall thickness measurement
- Wall thickness capability up to 60 mm
- Mid-wall (material / manufacturing) anomalies detected
- 'River bottom profile' for level 2 assessments DNV, RSTRENG or for FEM.
- Pipeline Uprating



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Metal Loss Distribution (TAMAR)

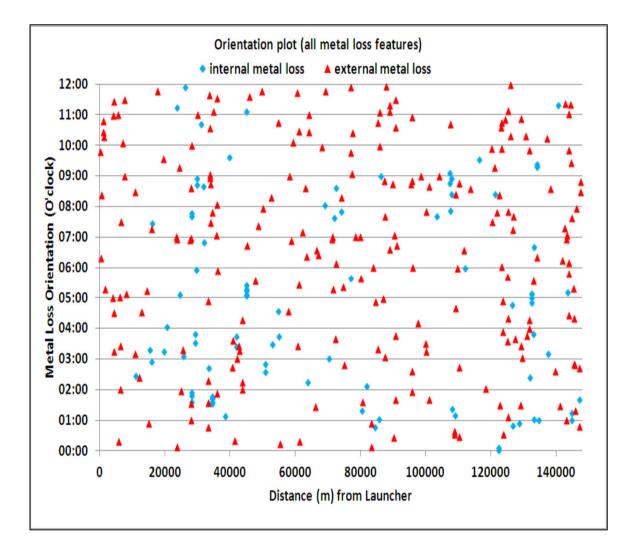






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Metal Loss Orientation Plot (TAMAR)

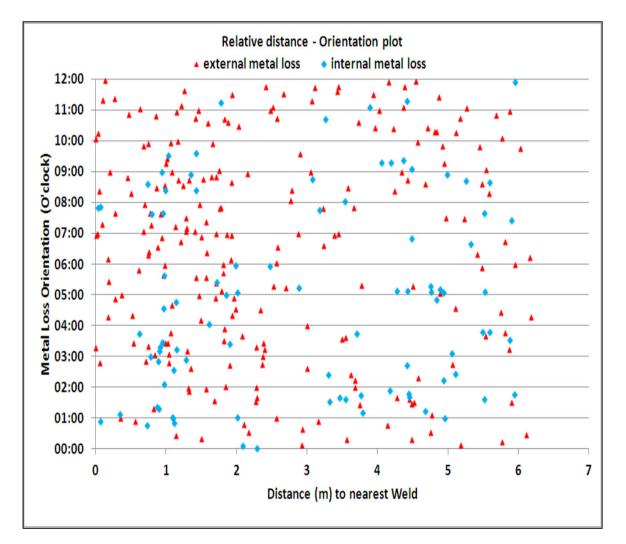


- Random distribution of ML
- All defects base-lined for next survey



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Metal Loss Distance to Girth Welds (TAMAR)



• Anomalies equally spaced in spools



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Tamar UTWM Features

Low-level Metal Loss

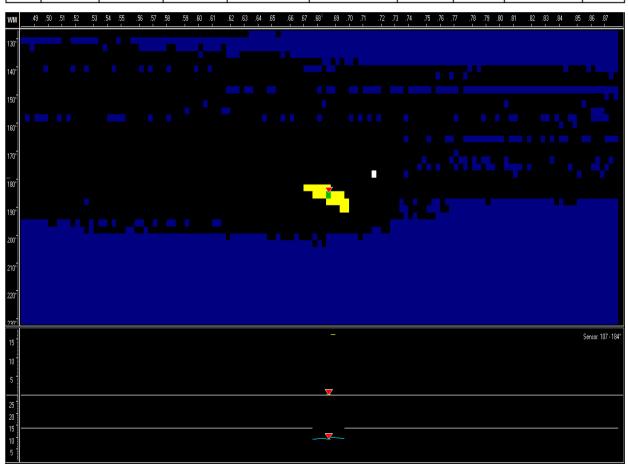
Insp. Sheet Number	#	Absolute Distance, m	Joint Number		omments		Depth, % WT	Length, mm	Width, mm	Orientation, hrs : mins	Wall Side	EK
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Tamar UTWM Features

Inclusion

#	Joint Number	Absolute Distance, m	Relative Distance, m	Comment	Local Wall Thickness, mm	Length, mm	Width, mm	Orientation, hrs : mins	Туре
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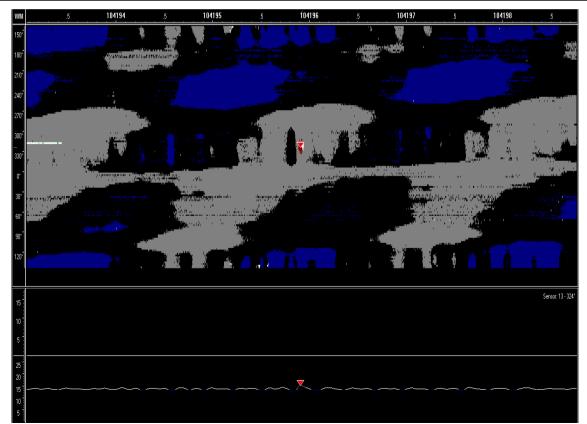




Tamar UTWM Features cont...

Wall Thickness Variations

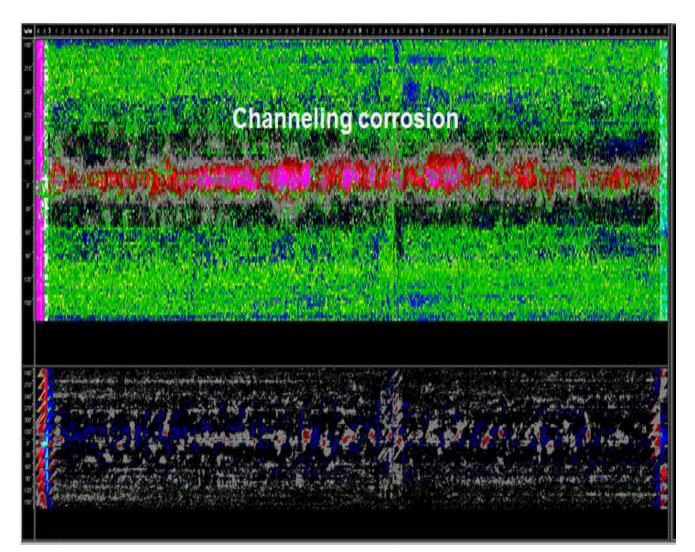
#	Joint Numbe r	e	Relative Distance		Local Wall Thicknes s, mm	Depth , % WT	Length , mm	Width, mm	Orientatio n, hrs : mins	Туре
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Typical UTWM Features

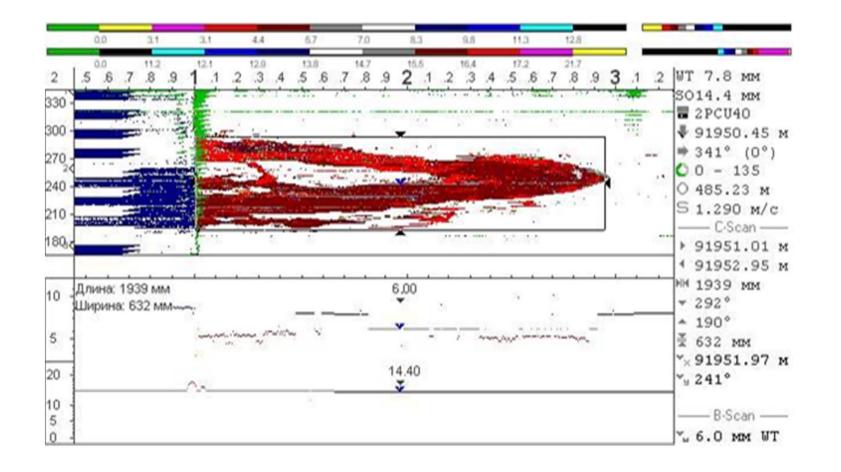
Channeling Corrosion





Typical UTWM Features

Surface Breaking Lamination

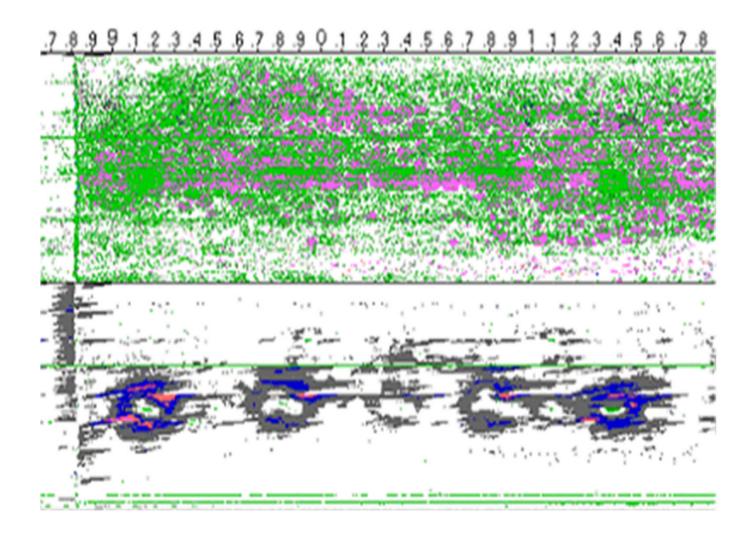




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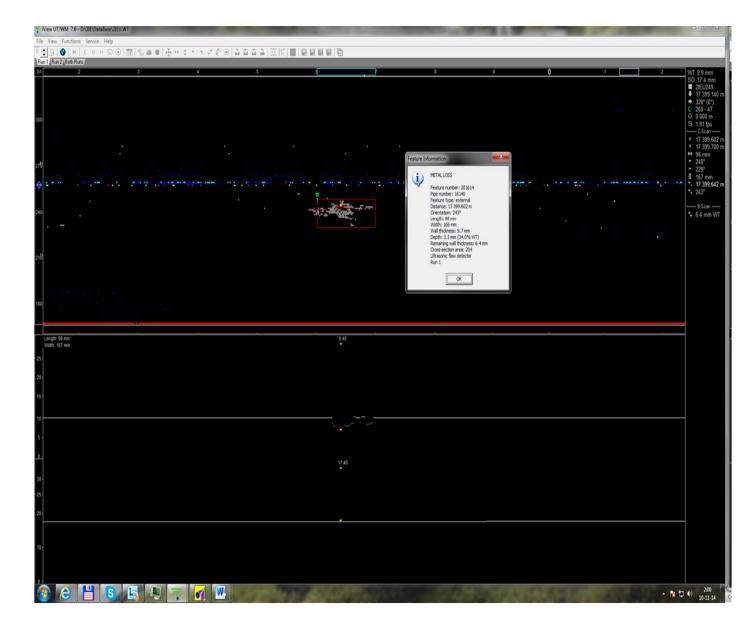
Typical UTWM Features

Hydrogen Induced Lamination



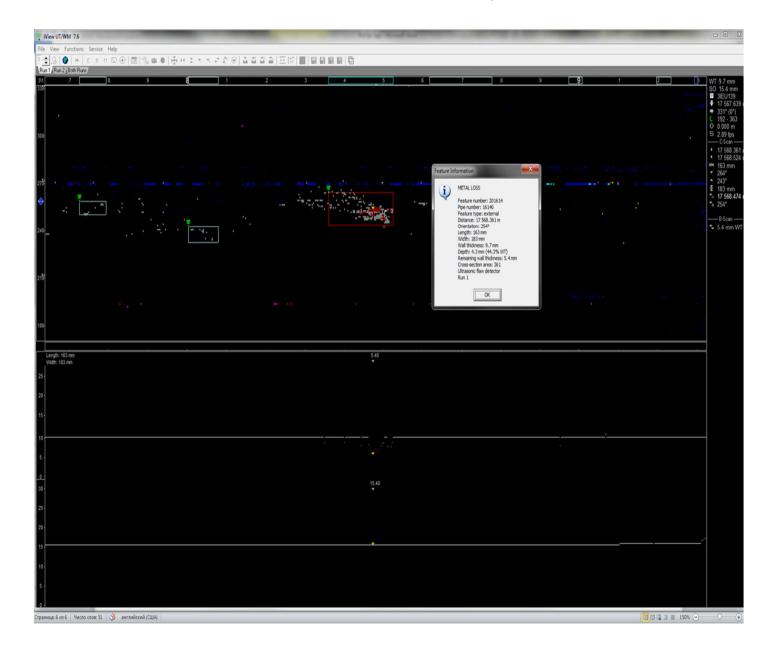


Typical UTWM Run Comparisons – 1st Run Metal Loss depth 34%





After 3 Years – 2nd Run Metal Loss Depth 44%





Typical UTWM Run Comparisons – 1st Run Small Lamination

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After 3 Years – 2nd Run Growth of Lamination

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Summary

- Pre-commissioning operations provides the ideal window to capture baseline inspection data using the most appropriate technologies.
- UT technologies offers a more comprehensive approach to baseline surveys to support long term pipeline integrity management.
- Certain material / manufacturing anomalies also tend to grow due to pressure cycling or in sour service environment becoming integrity threats.
- UT tools are able to detect and appropriately size laminations for anomaly assessments.





Close & Questions

