



Redefining low flow pigging and inspection

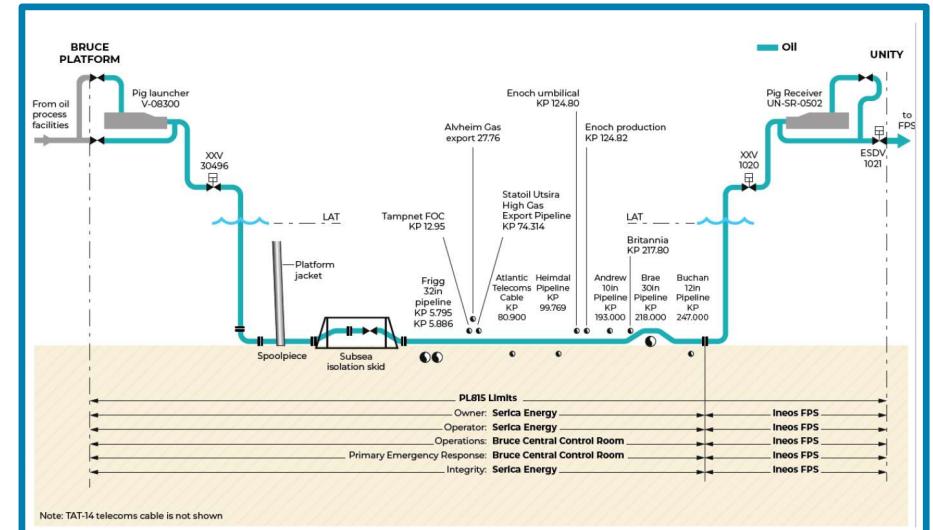
By Neil Stewart (Jee), Ben Bergius (NDT Global), Matt Roberts (Serica Energy)



Introduction



- 248km MOL from Bruce to Unity
- Pipeline last inspected 2014 by NDT
- Inspection had only covered 37km due to low flow / battery life of tool
- Inspection was due 2020 but further assessment allowed deferral to 2025 at reduced MAOP
- Pipeline pigged regularly for cleaning and IMS fluid management
- Passing trap isolation valves only allow pig loading & recovery during shutdown



Inspection plan



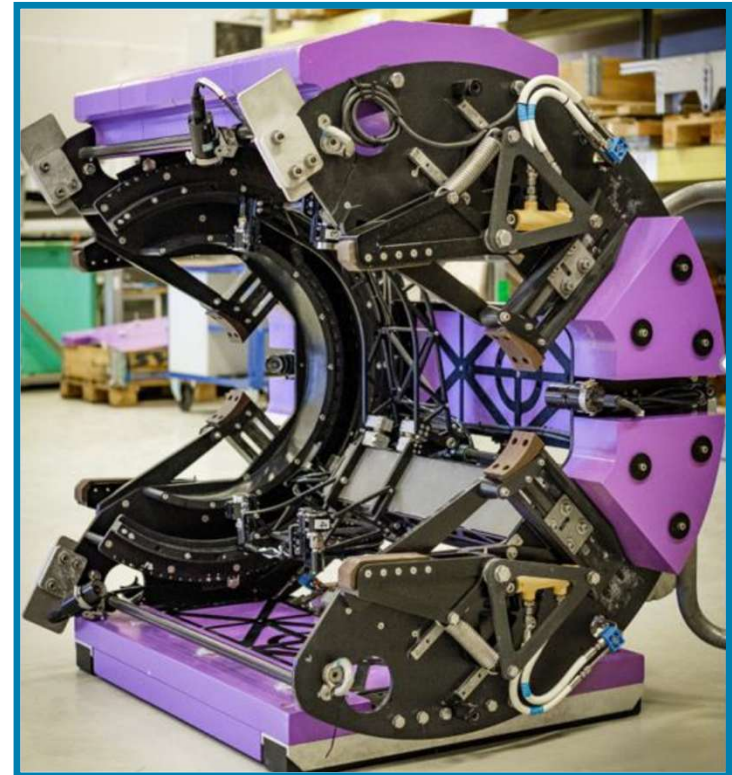
- Inspection planned for 2022/23
- Flow velocity of 0.0138m/s equivalent to the top speed of a garden snail
- Section from KP8.9 to approx. KP19.5 identified as required for inspection to allow assessment of significant defects identified in 2014
- NDT contracted to provide ILI
- Ultrasonic technology selected as used previously to allow straightforward comparative assessment
- Similar tool design to previous run
- Jee engaged to perform project management and technical assurance



Inspection feasibility



- Project KO Q1 2022
- Identified during HAZID that there was low confidence in the pigability of the pipeline at the flow velocity
- Project was put on hold while feasibility was investigated
- Jee investigated alternative inspection options feasibility
- NDT performed pigging trials

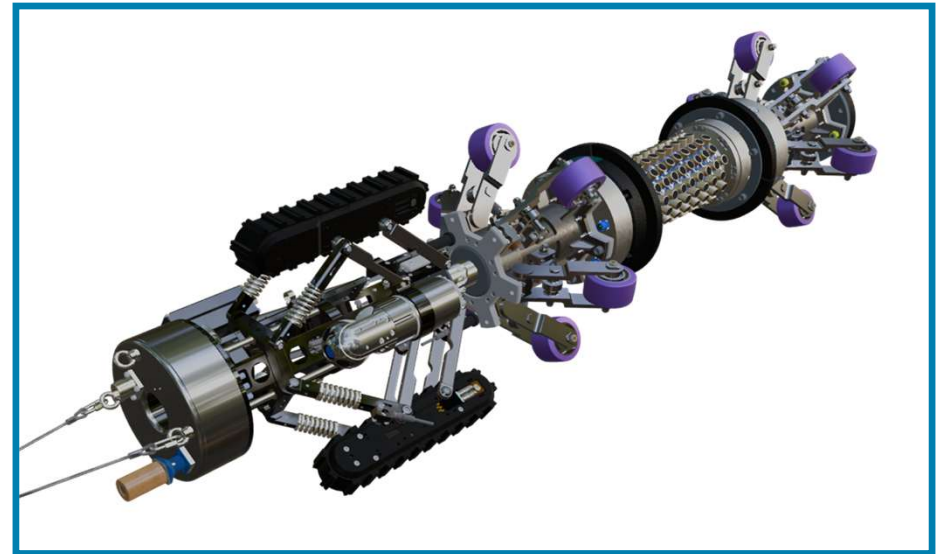


Alternate options



- Conventional ILI – considered as a comparison assuming piggability was proven
- Bi-di ILI
 - Pros – Increased inspection coverage, reduced time to results
 - Cons - Increased flow required, tanker hire, receipt of fluids, tool availability
- External inspection
 - Pros – No shutdown requirement
 - Cons – Limited inspection coverage, cost
- Crawler
 - Pros – Increased inspection coverage, reduced time to results
 - Cons – Significant equipment requirement, operational impact, track record

Conclusion to continue with crawler option whilst pigging trials ongoing



ILI Tool technical assurance



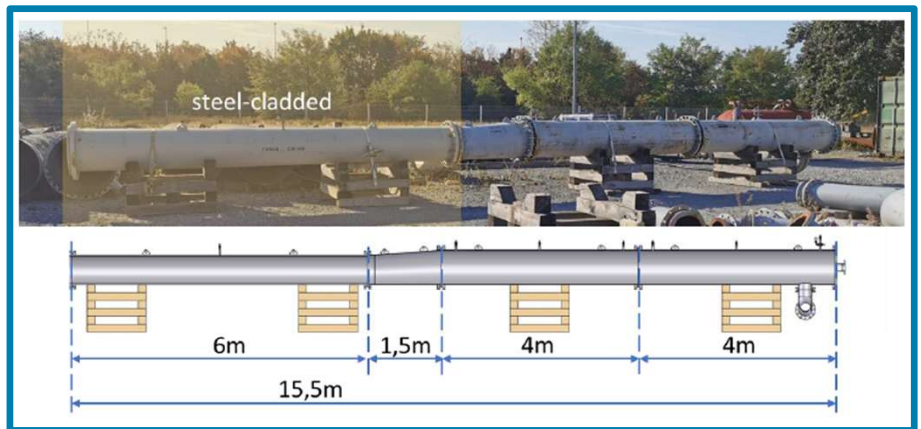
- Tool assured for use in 2014
- Gap analysis performed focusing on:
 - Tool dimensions
 - Battery life
 - Operating parameters
- Requirement to reduce the pig launcher leak test to 120 barg from the standard test pressure of 127 barg to prevent over pressurising the ILI tool
- Risk of the rear of the ILI tool stalling partly within the gate valve closest to the receiver preventing its closure and therefore requiring a non-standard isolation
- Visit to NDT to confirm tool build as per design



Pigging trials applicability



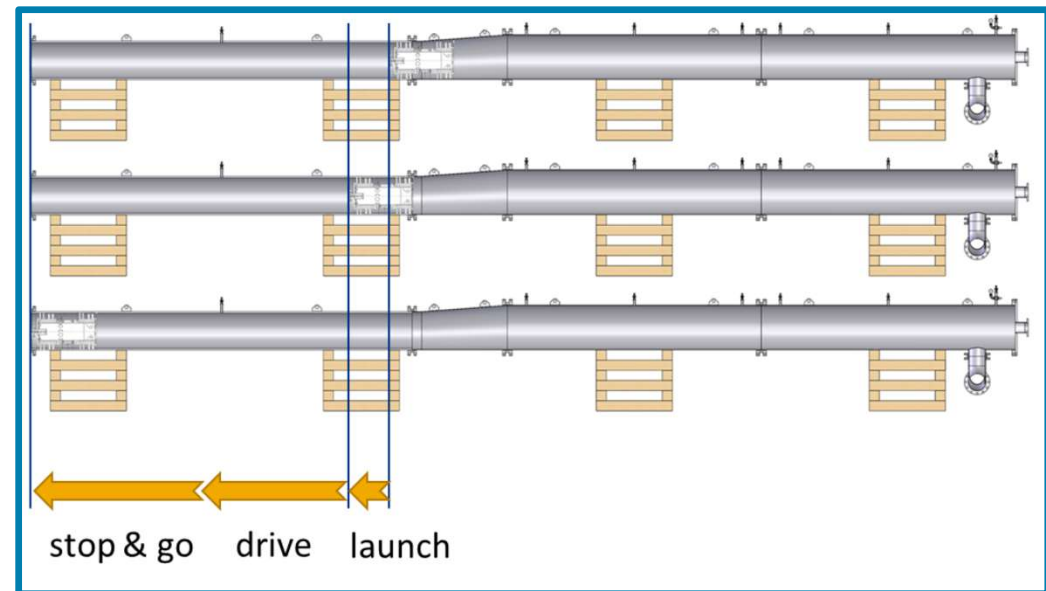
- How applicable were the conditions in the test rig to the in-situ pipeline conditions?
 - Potential for unintentional bypass due to wear and potential sagging over the significant pipeline length
 - Running the tool in water in clean pipe in the test rig compared to crude oil in the pipeline
- Soap added to water and pig lubricated
- Accepted that differences would always be present
- Previous tools and pigs had not suffered from wear with ILI having multiple sealing elements



Pigging trials execution



- Pipeline representative test fixture built at NDT yard
- Pigging trials to be performed to confirm:
 - Tool would traverse pipeline at expected flow of 0.0138 m/s
 - Identify minimum tool velocity
- Ops pig testing
 - Tightening of bolts reduced bypass by 50%
 - Minimum launch velocity of 0.001 metres per second
 - Minimum drive velocity of 0.0002 metres per second
- ILI tool testing
 - Minimum launch velocity of 0.0007 metres per second
 - Drive velocity of 0.00045 metres per second



Pigging trials conclusion



- High confidence in ILI tool ability to traverse pipeline as:
 - Tool would launch at 1/16th of available flow
 - Tool would drive at 1/30th of available flow
- Inspection of pipeline to go ahead with conventional ILI
- Crawler tool option work stopped
- ILI scheduled for Q3 2023



Operations – subsea activation module



- Subsea activation modules supplied by NDT for remote tool activation
- Cradle with electromagnetic transmitter with corresponding receiver in the ILI tool
- Mobilised and deployed circa. 1 month prior to planned launch during opportune vessel availability
- Located at KP8.805 and KP8.905 and placed 1.4 m away from target location for the primary and 0.4 m for the secondary
- Deployed with delayed activation set at expected launch date and battery >6 months



Operations – Tool running



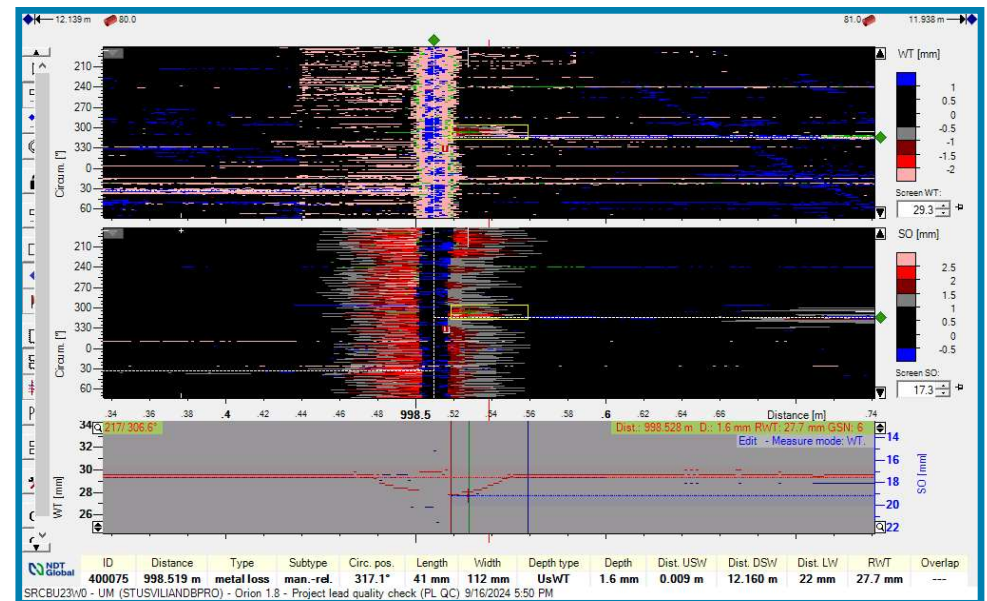
- Tool loaded during platform TAR
- Delay in platform start up meant tool was launched September 11th, 2023, approximately 7 weeks after loading
- Launch confirmed by isotope tracking
- Tool received at Unity on April 13th 2024
 - Run time of 7 months
 - Average velocity of 0.0132 m/s
- Tool activated at KP8.89 and recorded an inspection length of 14,460m
- Tool was recovered July 5th 2024 due to shutdown requirement
- Data was not downloaded until the tool was returned to Germany due to the total depletion of the batteries



Data and reporting



- Acceptable data recovered from the tool to allow fitness for service assessment
 - Excellent comparability of ILI results
 - Very low measured corrosion rates
 - Process data review
 - Conservative corrosion rates used for assessment
- Assessment concluded negligible corrosion and acceptable pipeline FFS until after current date for cessation of production with no reinspection requirements



Conclusion



- Pigging is possible at rates far below those conventionally accepted
- With the correct engineering pigs can be run at the ultra-low flowrates increasingly seen in North Sea pipelines
- Subsea activation technology allows specific areas of pipelines to be targeted for inspection
- Data gained allows operators to make informed decisions about their integrity status, using a risk based approach, to ensure they can continue to be operated safely and meet the regulatory requirements.





Thank you

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