

Subsea Pipe-in-Pipe (PIP) Integrity Assessment Using ARTEMIS® & ART



1 CHALLENGE

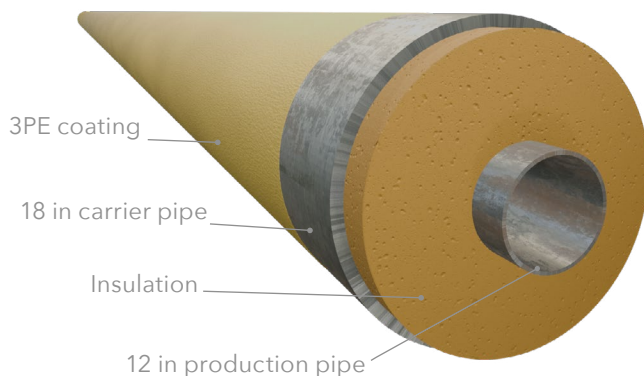
Inspection of a coated subsea pipe-in-pipe system to measure wall loss and determine whether the insulated annulus was dry or wet.

2 SOLUTION

ROV-deployed ARTEMIS® using Acoustic Resonance Technology (ART) for 360° wall-thickness mapping and PIP annulus assessment.

3 RESULT

Comprehensive wall-thickness and annulus condition data from a single external inspection, supporting ongoing PIP integrity assessment.



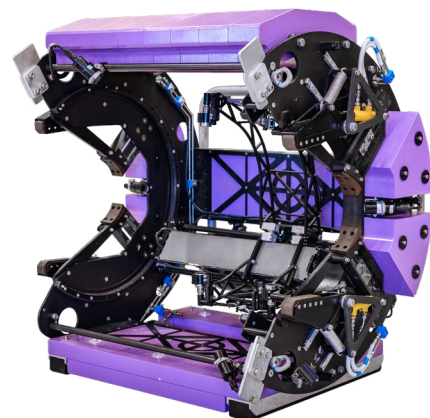
An offshore operator in the South China Sea required a detailed integrity assessment of a deepwater pipe-in-pipe (PIP) flowline consisting of a 12-inch inner production pipe housed within an 18-inch outer carrier pipe, with thermal insulation installed within the annulus.

PIP systems provide effective insulation for subsea flowlines, but their construction creates additional inspection challenges. With the production pipe and insulation enclosed within a separate steel carrier pipe, conventional external inspection methods are generally limited to assessing the outer pipe.

1. THE CHALLENGE

The inner production pipe had previously been inspected using inline inspection (ILI). This campaign focused on targeted external inspection of the 3PE-coated outer carrier pipe, while also providing information on the condition of the insulated PIP annulus.

With inspection locations in water depths approaching 300 metres, the solution needed to be fully ROV-deployed and capable of providing accurate wall-thickness measurements through the coating while determining whether the PIP annulus was dry or contained liquid.



ARTEMIS

2. THE SOLUTION

TSC Subsea deployed ARTEMIS®, an ROV-operated inspection system equipped with Acoustic Resonance Technology (ART).

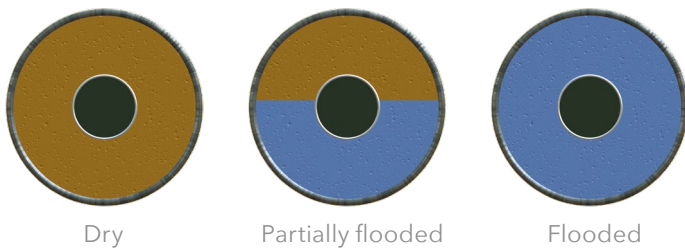
ART uses a broadband, multiple-frequency acoustic signal to generate resonances in the target material. The resulting resonant frequencies are characteristic of the material and its thickness, enabling quantitative wall-thickness measurement and characterisation of metal loss. Measurements can be taken through non-metallic coatings without direct contact with the steel surface.

For this application, ARTEMIS® provided a 700 mm axial scan width with full 360° circumferential coverage, producing a detailed wall-thickness map of the carrier pipe at each location with an accuracy of ± 0.2 mm.

ARTEMIS® was mobilised offshore in a dedicated subsea deployment basket and lowered to the seabed. A work-class ROV recovered the system and completed the subsea connections using hydraulic hot stabs and wet-mate electrical connectors before transporting ARTEMIS® to the first inspection location. At each location, the system was clamped to the carrier pipe to complete the circumferential scan, then released and transferred to the next location.



ARTEMIS in deployment basket

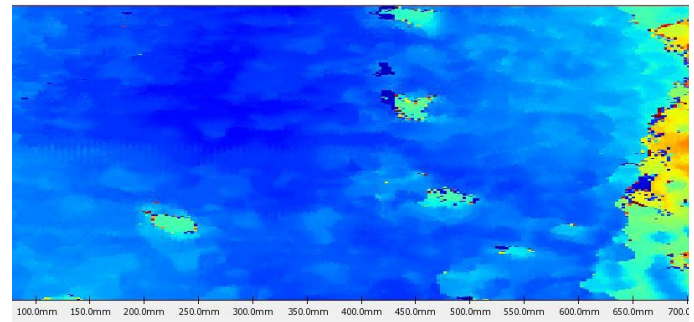


The acoustic data was also analysed to assess flooding within the insulated PIP annulus. Differences in acoustic transmission through the PIP system and the circumferential distribution of the response enabled differentiation between dry, partially flooded and fully flooded conditions. A change from the expected dry condition can indicate a potential integrity issue within the PIP system and support further investigation.

3. THE RESULT

All 10 planned inspection locations were successfully completed, providing detailed wall-thickness measurements of the outer carrier pipe and information on the condition of the PIP annulus.

The combined wall-thickness and annulus-condition data provided the operator with the information required to support ongoing integrity assessment of the PIP system.



Sample ART data

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