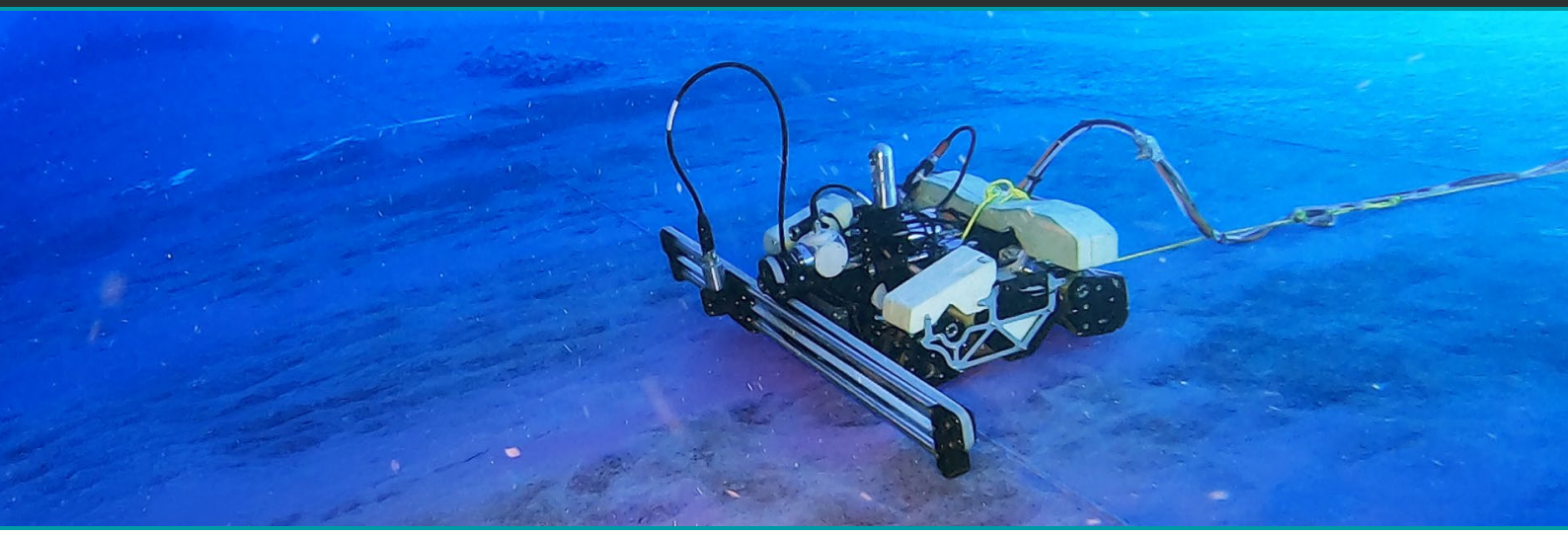
CASE STUDY:

Transforming FPSO Hull Inspections: A Cost-Effective, In-Service Solution with ORCA.



1 CHALLENGE

Carry out a diverless, in-service hull inspection of hard-to-reach areas below the waterline, in harsh sea conditions, and deliver quantifiable data.

2 SOLUTION

Deck-launched ORCA robotic crawler equipped with ART delivered high-resolution corrosion mapping, safely, efficiently.

3 RESULTS

ORCA confirmed hull integrity, providing cost-effective, high-quality data to support proactive maintenance and minimise operational disruption.

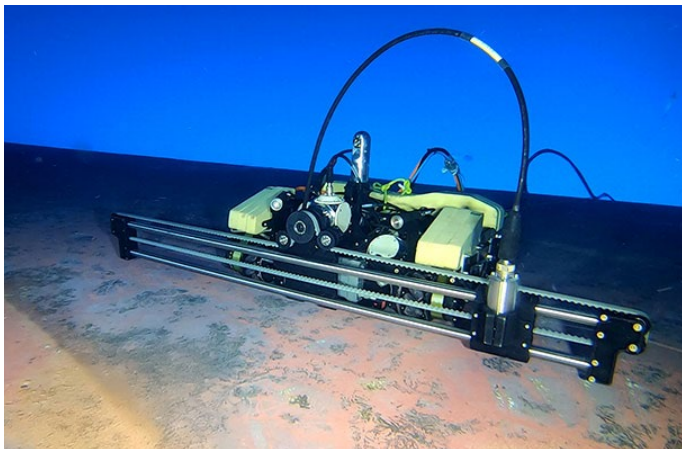
A major offshore operator approached TSC Subsea to provide an efficient and cost-effective solution for in-water hull inspections. The objective was to collect wall thickness measurements below the waterline to generate a corrosion map for an FPSO stationed approximately 40 km off the northwest coast of Australia.

The FPSO in question is a single-hull vessel originally built in 1981 and later converted into a disconnectable FPSO in 2008. It is classed by Lloyd's Register and has operated under a periodic inspection regime since its conversion, with a dry dock Special Survey 8 hull structures inspection completed in 2020. Since then, the vessel has been maintained under a Risk-Based Inspection (RBI) scheme.

1. THE CHALLENGE

The Risk-Based Inspection (RBI) scheme is an alternative to the periodic classification survey, which requires the vessel to be taken out of production for dry-docking integrity assessment. Hull integrity management under the RBI framework involves internal inspections of hull plates where possible. However, certain areas, such as those beneath the engine and pump room, require external inspection.

The client sought an advanced inspection solution without relying on divers, thereby reducing safety risks. Conducting inspections underwater posed additional challenges, including marine growth, currents, swells, equipment deployment constraints, and accurate positioning for thickness readings.



ORCA deck launched robotic crawler

2. THE SOLUTION

The project came at a pivotal moment for TSC Subsea, which had been developing its ORCA magnetic robotic crawler incorporating proprietary Acoustic Resonance Technology (ART), which delivers sub-millimetre accurate wall thickness measurements, with reduced cleaning compared to alternative techniques, and has received validation from Lloyd's Register for this exact application.

"Application of Acoustic Resonance Technology (ART) to perform quantitative Ultrasonic Thickness Measurement (UTM) for both internal and external corrosion defects of ship hull carbon steel plates through coating."

ORCA is a deck-launched, modular, omnidirectional magnetic robotic crawler designed by a team of robotic engineers with extensive experience in subsea operations. Purpose-built for ship hull and marine structure surveys, it represents a step forward in safe, remote, and accurate ultrasonic thickness measurments (UTM) inspection.

TSC Subsea mobilised its team to Australia, where the inspection was conducted over four days. ORCA was deployed from the topside main deck and remotely driven down the hull to the designated inspection area.

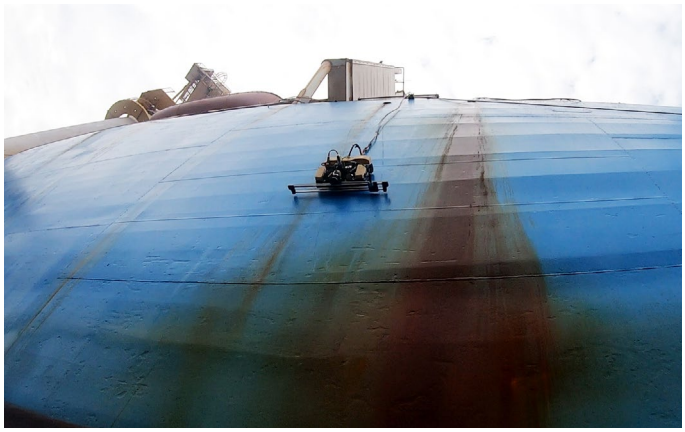
A key feature of ORCA is its omnidirectional movement with data-position calculation. Mecanum wheels provide multi-directional navigation, optimising scan patterns for maximum coverage, reducing the number of deployments, and providing real 'as scanned' data sets.

To ensure optimal adhesion and scanning accuracy, all designated inspection areas along the crawler's path were cleaned using a high-pressure jet.

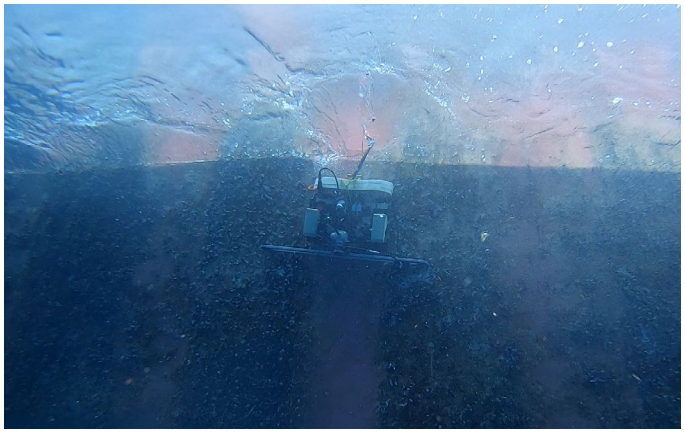
Despite challenging conditions, including 4-meter sea swells, ORCA maintained reliable adhesion and maneuverability, capturing high-resolution in-water wall thickness measurements at the lowest points of the hull. This data was used to produce a detailed corrosion map of the target area, providing actionable insights into hull integrity.

Even with variations in cleaning and coating conditions, ART technology successfully collected wall thickness readings across a variety of surface conditions.

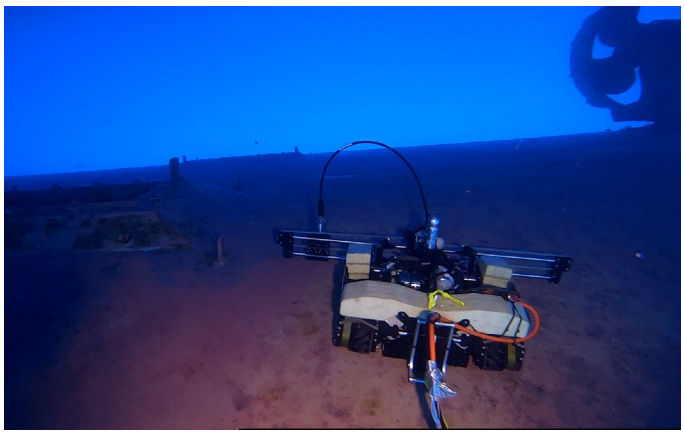
Data collection was conducted using ORCA's scanning mechanism, where the scanner arm moved left to right (X direction) while the transducer was positioned in the Y direction. Depending on detection requirements, data can be collected in either coarse or high resolution; in this case, a resolution of 1x25 mm was used to optimise productivity while maintaining data quality. A specific datum point, along with frame and weld numbers, was utilised for unique scan area identification.



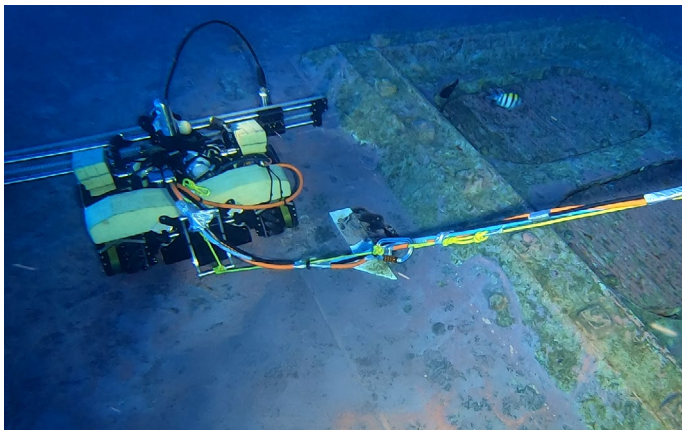
ORCA being launched from the deck



ORCA entering the water



ORCA driving to the inspection location



ORCA scanning around a sea chest

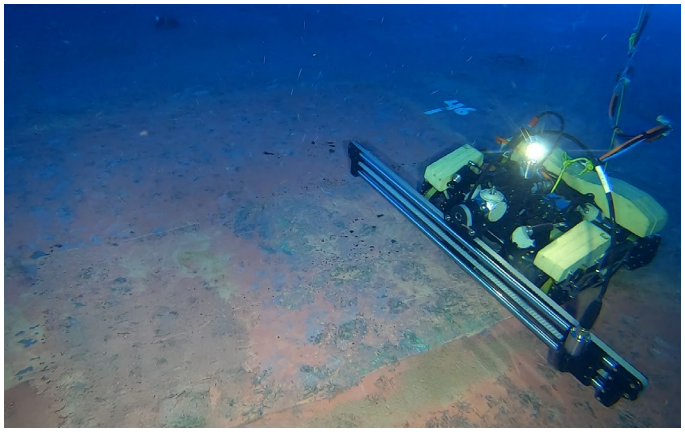
3. THE RESULT

ORCA successfully gathered detailed wall thickness measurements, with data scans seamlessly stitched together in ORCA software to generate a comprehensive corrosion map. This provided a clear and holistic view of the hull's internal and external condition, identifying key structural features such as internal framing, scantlings, external plate welds and detecting the presence of any internal medium.

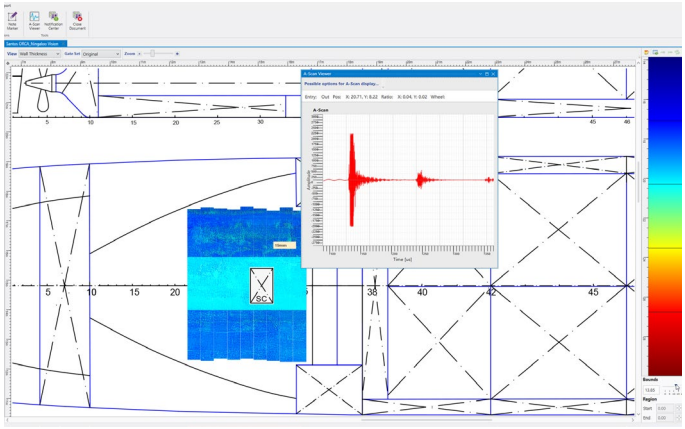
The inspection confirmed the integrity of the hull, verifying that no critical wall loss was detected. By conducting the assessment while the FPSO remained in service, the client achieved significant cost savings.

Additionally, if any reportable wall loss had been identified, it would have enabled a proactive maintenance strategy, allowing for more efficient planning ahead of scheduled dry-docking and repairs.

The successful completion of this project highlights ORCA's role as a transformative solution for hull inspections in the maritime and offshore industries. By reducing costs, enhancing safety, and delivering high-quality inspection data, ORCA is setting a new benchmark for FPSO and vessel hull integrity assessments.



Corrosion mapping at the bottom of the hull



ART corrosion mapping data

PROJECT HIGHLIGHTS:

✓ **Deck-Launched Deployment**
Launching the crawler directly from the deck allowed our client to remove the need for support ROVs and vessels. This approach reduced inspection costs and simplified operational planning.

✓ **Diverless, Safer Inspections**
ORCA enabled fully remote inspections, eliminating the need for divers. This improved safety and lowered operational risk, supporting the client's drive for safer, more efficient practices.

✓ **In-Service Inspection**
Hull integrity assessments were carried out while the vessel remained operational at sea. This removed the need for dry docking, minimising disruption and delivering significant cost savings.

✓ **Reliable Wall Thickness Measurements**
Lloyd's Register-validated ART technology delivered sub-millimetre accuracy in wall thickness measurements, even through coatings and challenging surface conditions.

Contact

Email: sales@tscsubsea.com

Web: www.tscsubsea.com

NDT Global Subsea & Robotics | TSC SUBSEA

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