



THE UNIVERSITY OF
MELBOURNE

Hydrodynamics
Research &
Development

AQUAMARS

**Advanced Quality
Underwater Mapping and
Analysis for Rough Surfaces**



An Operational Support System for Quantifying the Hydrodynamic Effects of Hull Roughness

Background

Ship roughness from marine biofouling **increases** frictional **drag** and turbulence, reducing vessel performance, while raising fuel consumption and GHG emissions. Ship operators **often delay cleaning** because it is **costly** and renders vessels out of service, while the higher running and environmental costs remain poorly quantified.

Capability

Developed by an engineering team with expertise in turbulent flows, AQUAMARS is an innovative system designed to fill this data gap. It **accurately assesses hull condition** and **quantifies the fuel and emissions penalties** caused by biofouling. Using advanced photogrammetry, it integrates a high-precision 3D scanner **purpose-built for ship hulls and propellers**, capturing detailed surface data to estimate added drag, fuel use, and CO₂ emissions.

Hardware

Easy-to-use diver-operated system is housed in a compact enclosure. It's **neutrally buoyant** in water, and captures high-resolution data from multiple cameras totalling **128MP**. Per 45 minute dive, up to **100 spot inspections** can be made.

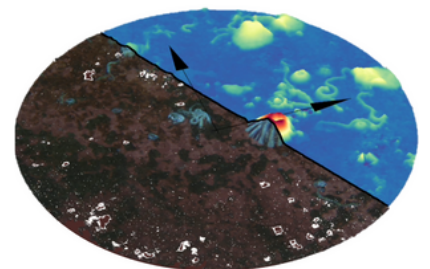
AQUAMARS can accurately reconstruct a range of **fouling levels**, from the paint goughness of clean hulls, to heavily fouled surfaces.

Biofouling Reconstruction

Photogrammetry is used to reconstruct the images to provide a highly detailed surface geometry. Each scan yields a 3D field-of-view of up to **150 × 150mm**. These measurements provide the detailed topographical statistics required for predictive drag modelling, where world-leading researchers at The University of Melbourne are at the forefront.

A Case Study

For a 100m cruise ship with medium to heavy hard fouling, 40 spot samples around the hull were collected by a commercial diver. From hull fouling alone, compared to a smooth baseline, the fouled ship hull requires additional fuel expenditure of approximately **A\$1,400/hour** while cruising at 12 knots, and emits an additional **2 tonnes of CO₂/hour**.



A real AQUAMARS scan and reconstruction. Barnacles and tubeworms can be seen on the surface. Resolution is up to 20µm.