



# A needle in the haystack

## The search of “Rua Mar” in the limits of a 30 kHz multibeam sonar

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### Abstract

Hydrographic vessels are occasionally required to conduct wreck searches in ocean waters and try to solve seafloor features in the limits of their MBES capabilities. Detection probability can be maximized by adopting a survey strategy where vessel speed, angular sectors, beam spacing, line overlap, firing rate and motion compensation are adjusted so that the resulting sounding density and signal-to-noise ratio are increased.

### Introduction

In January 23, 2020, “Rua Mar”, a 15m long fishing boat disappeared during a gale 27 miles off Cape Espartel (Morocco) on a poorly charted seafloor. RV “Tofiño”, fitted with a dated Kongsberg EM-300 (2°x2°) MBES and a Klein 3900 towed side scan sonar, joined the search of Rua Mar by providing an accurate seafloor model and detecting wreck-like features on a 525 km<sup>2</sup> area, comprising depths down to 800 m.



Figure 1. F/V “Rua Mar”.



Figure 2. R/V “Tofiño”.

### Survey strategy

The MBES EM300 was used as the main sensor. Considering an average beam footprint size of 17 m (diameter at nadir) in 500 m depth, the bathymetric survey was accordingly designed by adjusting the following parameters:

- Vessel speed of 5 knots
- A minimum 100 % line overlap.
- Angle sector 45 degrees.
- Equidistant sounding distribution.
- Range gate filters set to none
- Yaw compensation set to low

Sonar data were post-processed with CARIS HIPS 10.6, EIVA Navisuite 4.2, SonarScope and UNH/NOAA Hydroffice suite.

### Contact investigations

A Klein 3900 SSS was used to obtain acoustic images of the MBES detections down to 300 m deep.

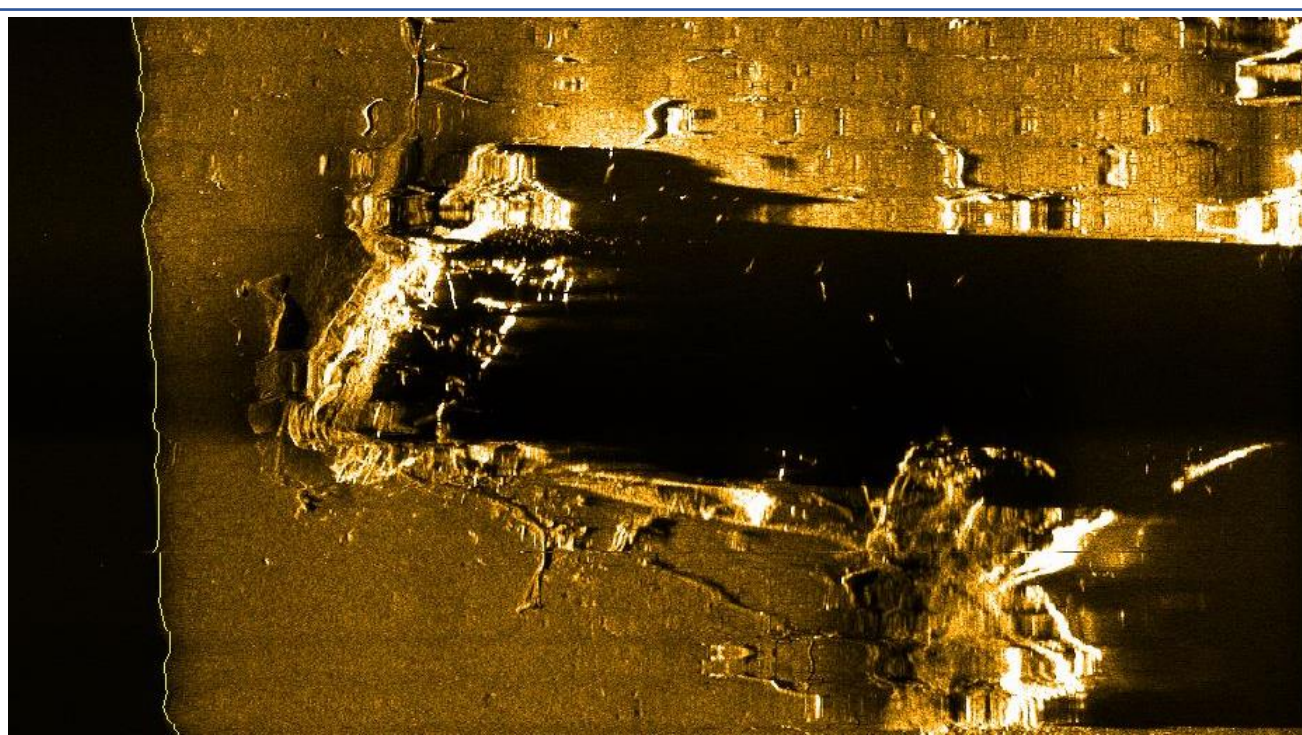


Figure 3. Shipwreck image from the SSS

### Oceanography

Great variability of ocean temperature and density was accounted by frequently profiling the water column

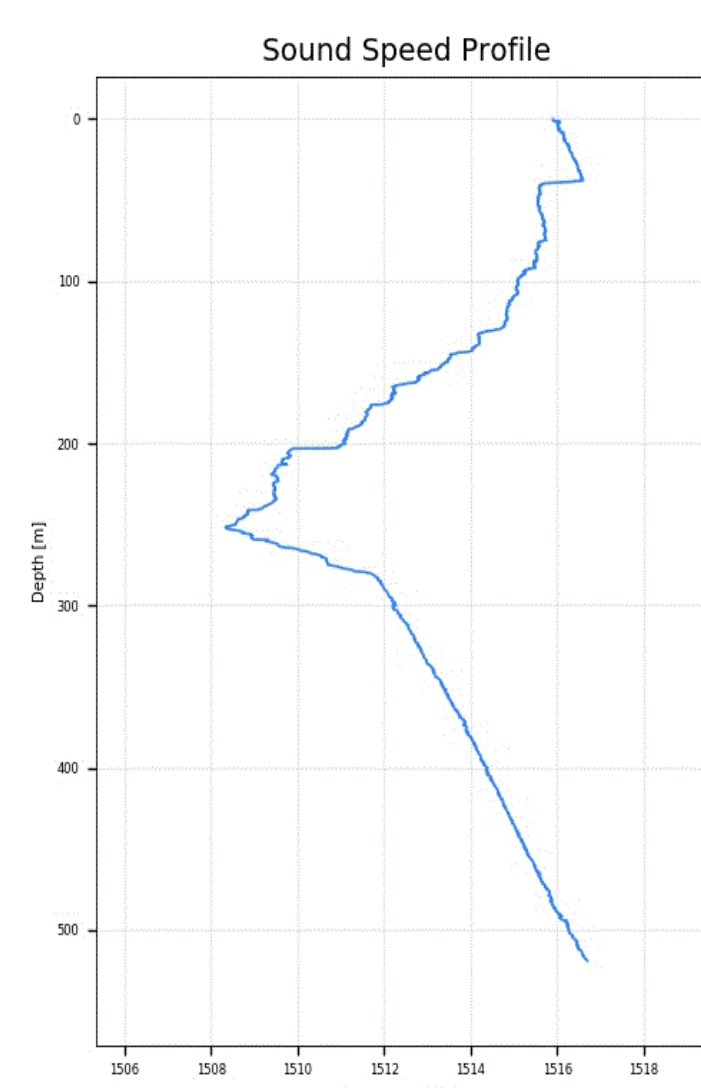


Figure 4. Sound speed profile

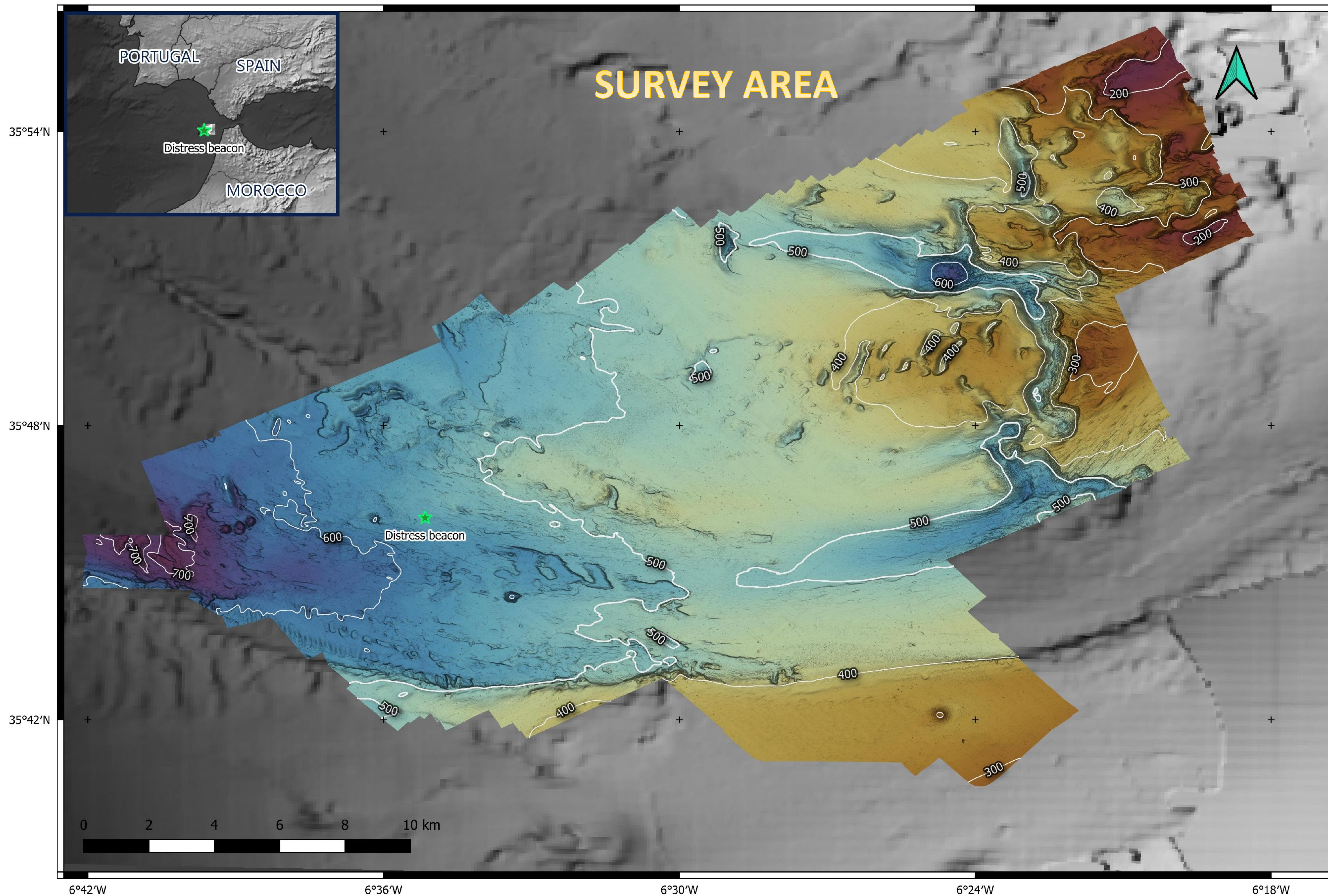


Figure 5. 3D seafloor model

### Results and conclusions

The full seafloor search was carried out with an average spacing of 6 m between soundings, obtaining an accurate seafloor bathymetric model and a backscatter mosaic that revealed a rough and steep topography, with deep canyons and numerous pockmarks.

27 sonar contacts were in-situ investigated by ROV, resulting in 4 uncharted shipwrecks and different geological formations.

The location of Rua Mar remains unclear, but the adopted survey strategy turned to be successful on detecting shipwreck-like features even at shorter wavelengths that those corresponding to half the size of the missing fishing boat.

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### Acknowledgments



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