Proceedings of the 11 th Workshop "Seabed Acoustics", Presentation P05:

Marking of seabed cables using SonarBell

Graeme Symes
Clearwater Hydroacoustics Ltd, UK
gsymes@clearwater-hydroacoustics.co.uk

5 th November 2025

I'm going to cover

- Overview of SonarBell®
- Specific infrastructure project using SBPs and SonarBell® for cable marking
- Some other general uses of SonarBell® for underwater marking

Clearwater Hydroacoustics Ltd

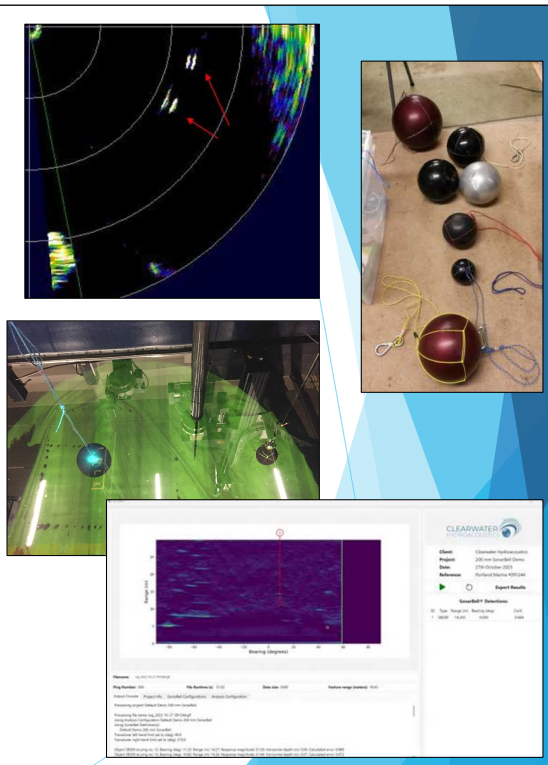
Overview of SonarBell®

- History
  - SonarBell® reflector developed by UK Ministry of Defence
  - Commercialised through government spin-out initiative
  - Technology and patents now owned by Clearwater Hydroacoustics Ltd
- Originally designed as an acoustic target for mine countermeasures and general sonar testing
- Distinct sonar signature
- Suitable for a range of underwater marking and relocation tasks
- Civil and military use

Clearwater Hydroacoustics Ltd

Overview of SonarBell®

- Passive Acoustic Reflector
  - No electronics or batteries – simply reflects acoustic energy from a sonar
  - Produces a multiple echo to assist identification by sonar
  - Range of standard and bespoke sizes from 50mm to 600mm in metal and plastic
  - Different sizes and materials allows sonar response to be customised according to client needs
  - Each unit coded with RFID to allow traceability
- Performance independently confirmed
  - Scanmatic (SWE), National Physical Lab (GBR), INM-CNR (ITA), Birmingham University (GBR)
- Auto-Detect® software tool for automatic SonarBell® detection
  - Able to detect multiple echo
  - Displays results on screen

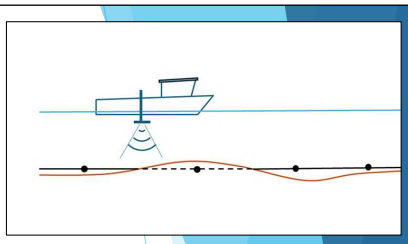


Clearwater Hydroacoustics Ltd

SonarBell® for acoustic marking of telecoms cables

Clearwater Hydroacoustics Ltd

Relocation of telecoms cables



The project

- Major infrastructure project delivering 5G network to remote communities via extensive river network
- Small diameter cable (c. 25mm diameter)
- Laid on riverbed in 20 to 30m depth of water
- Both natural and intentional cable burial (up to 1.5m buried)

The challenge

- Cable susceptible to damage from other river users and from natural movement of the sediment / debris
- Damaged cables taking a long time to relocate
- Unable to use electromagnetic effects in freshwater for relocation
- Alternative solution required to speed up cable detection when repairs needed
- Client has stated the use of SBPs and acoustic reflectors

Clearwater Hydroacoustics Ltd

De-risking tests

- Project at early stages
- No previous data of SonarBell® performance at SBP frequencies
- No experience of SBP operation

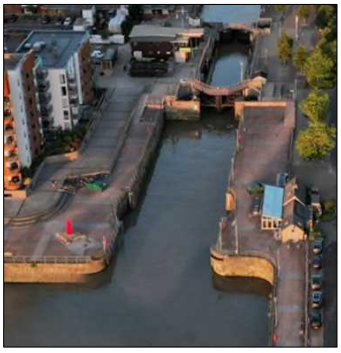
- Undertake de-risking tests
  - To establish if SonarBells® can be detected using an SBP
  - To enable us to advise the client on feasibility and implementation

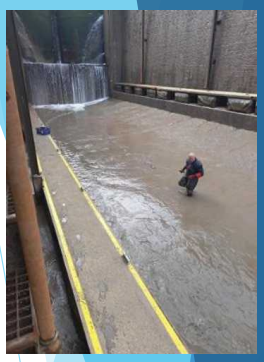
- Tests conducted in two UK locations
  - SonarBell® resting on the seabed, part- buried and fully buried
  - Soft and firm sediments
  - Using readily available SBPs

Clearwater Hydroacoustics Ltd

De-risking trials

- Two locations used
  - Portishead lock (soft mud)
  - Portland Harbour (mud/sand)
  - 9m water depth in both locations
- SBPs used
  - Edgetech 3400 OTS
  - Innomar SES-2000-Compact
- Multiple SonarBell® types tested
  - 100, 150 and 200mm
  - Plastic and metal

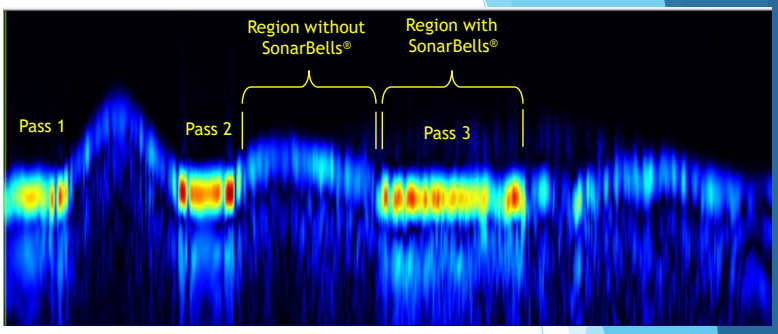


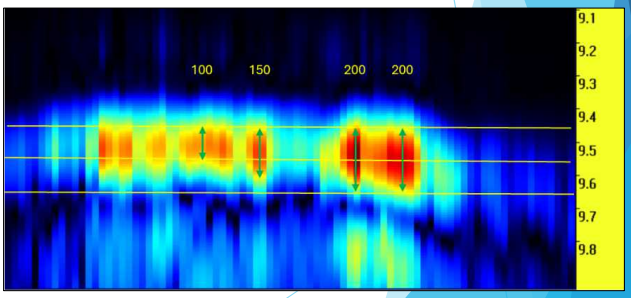



Clearwater Hydroacoustics Ltd

Results in soft mud

- Line of 7 SonarBells® laid along the lock floor
- Lock flooded and SBP runs undertaken
- SonarBell® visible in sediment layer
  - Sediment layer c. 0.5m
- Dimensions of acoustic features correspond to SonarBell® sizes being used
- **Test successful** ✓

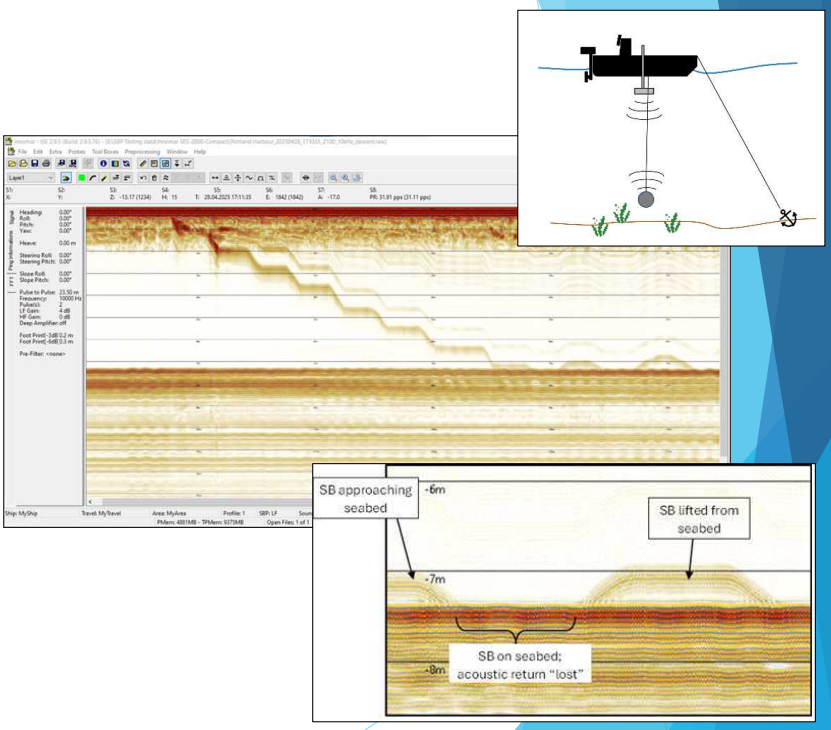




Clearwater Hydroacoustics Ltd

Results on sand

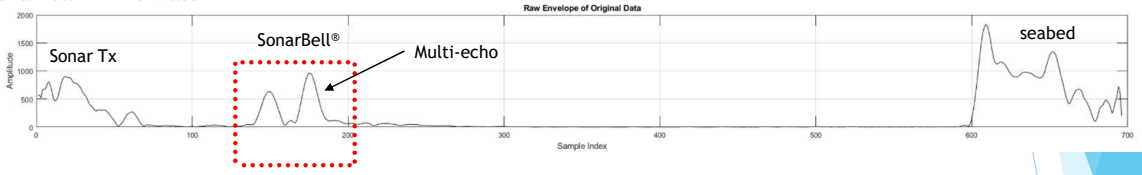
- SonarBells® lowered under SBP
  - Lowered in steps
  - Acoustic data collection
  - Assess interaction with seabed
- SonarBell® visible at all times
- Some signal response "lost" at seabed
- **Test successful** ✓
- Investigate better detection at the seabed



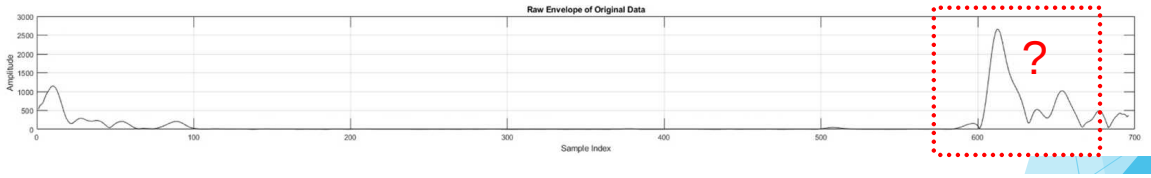
Clearwater Hydroacoustics Ltd

Improving SonarBell® detection at the seabed (Innomar SBP data)

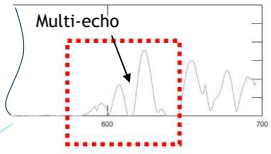
SonarBell® in mid-water



SonarBell® on seabed



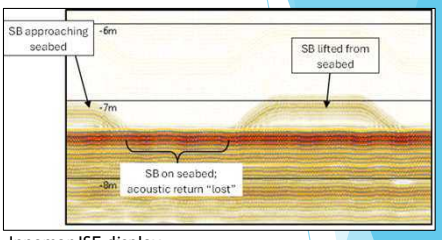
- Innomar ISE software to extract data traces
- Combination of SonarBell® characterisation and seabed characterisation has enabled the SonarBell® signal to be extracted from the seabed response
- **Test successful** ✓



Clearwater Hydroacoustics Ltd

Automated detection

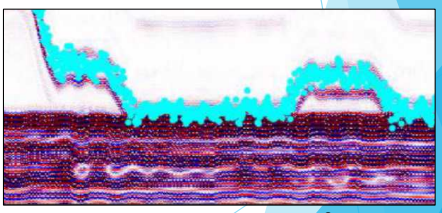
- Data traces have been extracted using the Innomar ISE software
- Machine Learning methods applied to the raw data traces
- SonarBell® signature reliably detected including the region where "lost" in the seabed on the standard sonar display



Innomar ISE display

Next Steps - Software

- Test with more challenging data
- Gather more data in other conditions / locations
- Develop real-time version of the current auto-detection software using live feed from the sonar


Innomar data with Clearwater SonarBell® classifier

Clearwater Hydroacoustics Ltd

Infrastructure Project – next steps

- In-country testing (SonarBell® performance)
- Sonar selection **
- Design of cable attachment / cable-laying

Development phase

- Install SonarBell® hardware
- Implement real-time automated detection software
  - Simplify location/relocation
  - Minimise false alarms
  - Reduce operator workload

Implementation

Clearwater Hydroacoustics Ltd

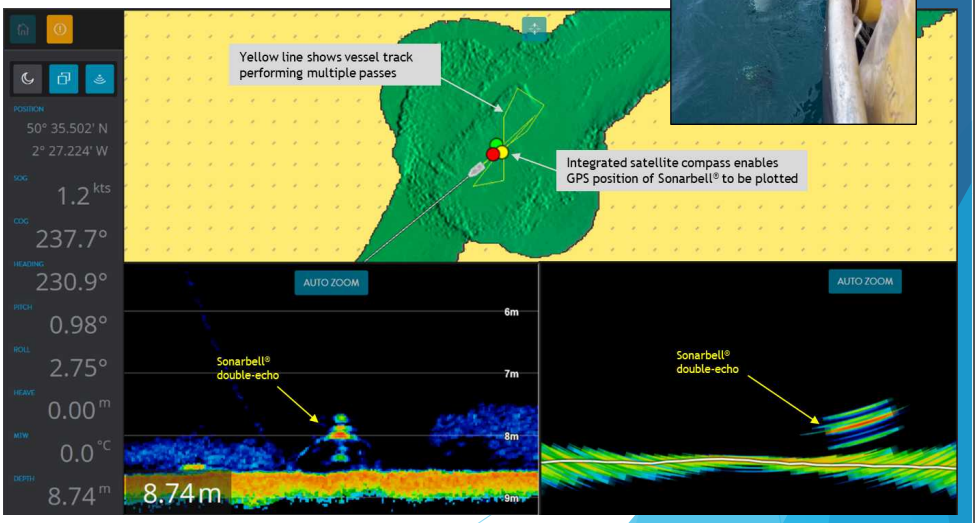
** sonar will be selected by the client

Other seabed marking applications

Clearwater Hydroacoustics Ltd

Tethered seabed marker

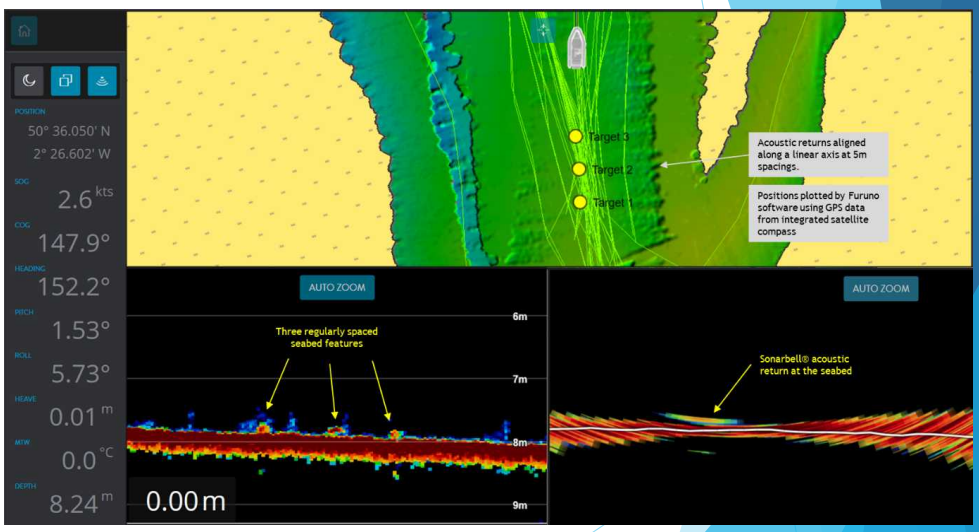
- SonarBell® attached to seabed anchor weight
- Flotation collar to suspend SonarBell® above seabed
- Client 1 using for ROV operations
- Client 2 for marking of underwater debris, UXO ahead of offshore infrastructure project
- Client 3 for marking pipeline landing positions



Clearwater Hydroacoustics Ltd

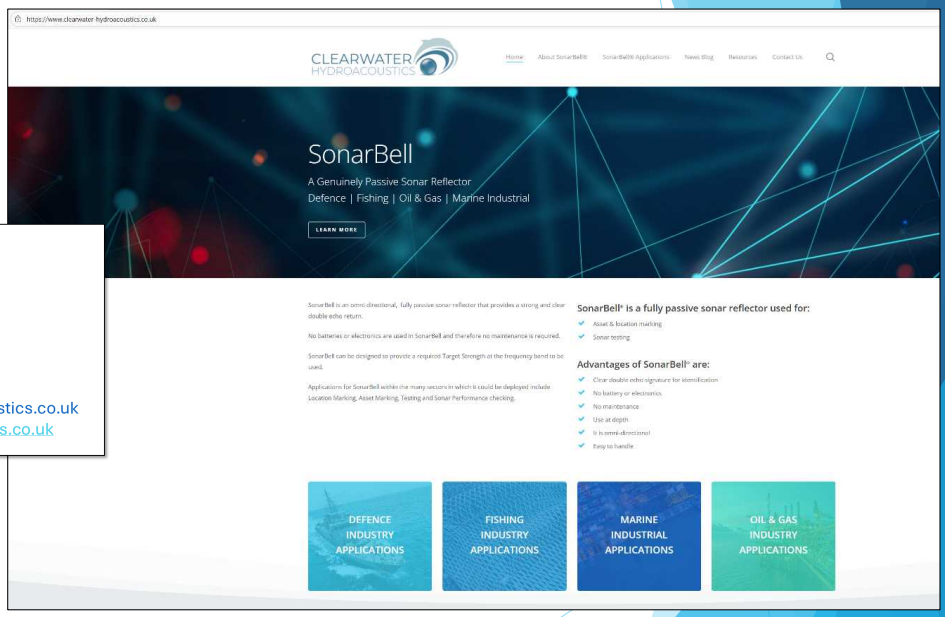
Untethered seabed markers

- SonarBell® deployed directly onto seabed
- When tethered markers undesirable
- Client 1: marking of seismic nodes
- Client 2; military application



Clearwater Hydroacoustics Ltd

Thank You



Graeme Symes

Chief Technology Officer
Clearwater Hydroacoustics Ltd

M: +44 (0)7788 272851
E: gsymes@clearwater-hydroacoustics.co.uk
W: www.clearwater-hydroacoustics.co.uk

Clearwater Hydroacoustics Ltd