# SonarBell®

**Clearwater Hydroacoustics Ltd.**

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# About Clearwater Hydroacoustics Ltd. (CHA)

- Acquired exclusive license for SonarBell® technology  in 2018.
- Core patent owned by UK Ministry of Defence (MoD).
- Minority share owned by Ploughshare Innovations Ltd., a company established by the UK government to commercialise technologies developed by the UK's Defence Science and Technology Laboratory (Dstl).
- CEO and Ultimate Majority Shareholder: Nigel Hill

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# SonarBell® – Advantages

- Fully passive sonar reflector
- Omnidirectional
- No battery or electronics
- Highly efficient sonar target
- “Tuneable” to provide specific echo level response
- Easy to handle
- Minimal maintenance

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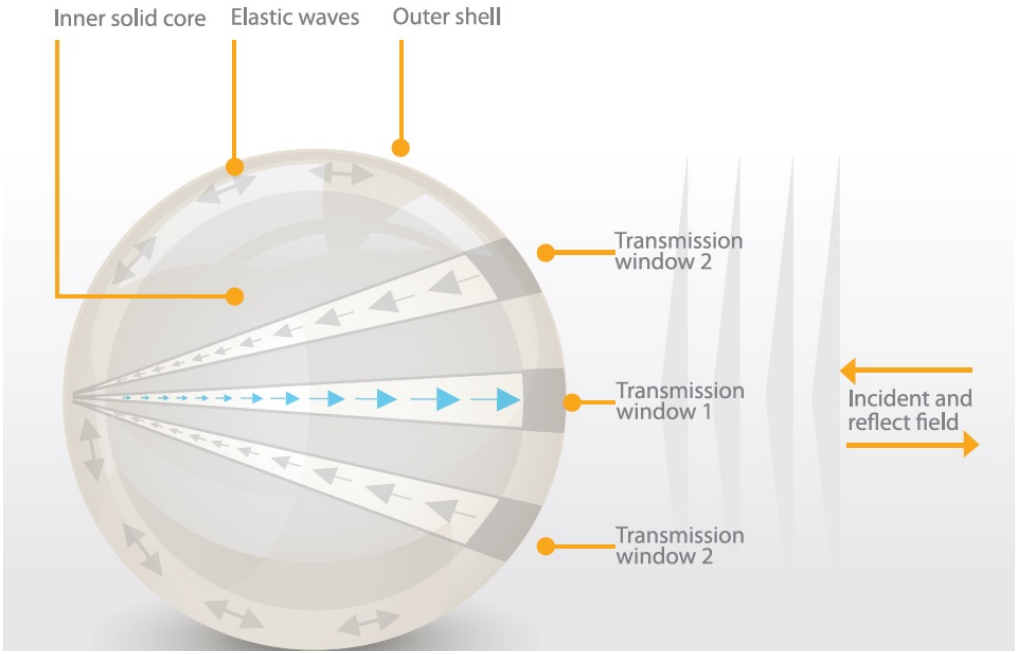
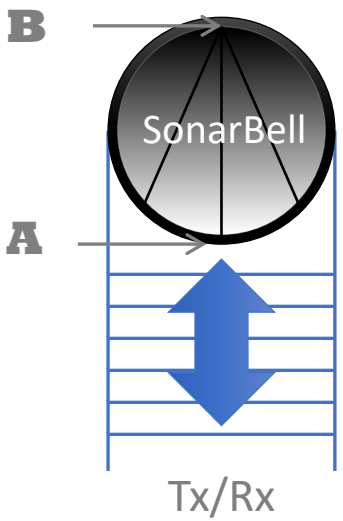
# SonarBell® - Technology

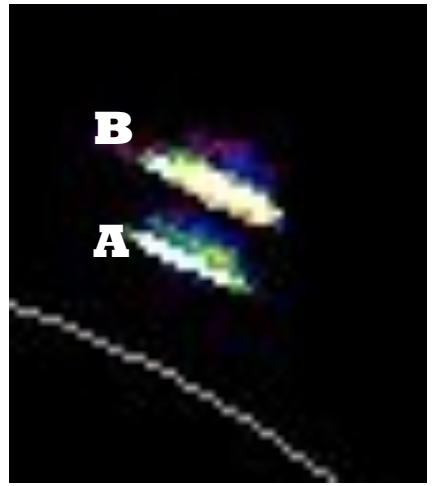
- SonarBell® consists of a shell and a core.
- By changing parameters such as shell material, shell thickness and core material SonarBell® can be “tuned” to provide specific echo level responses.
- Two echoes emanate from SonarBell®:

  A (Front Echo)

  B (Focused Return)

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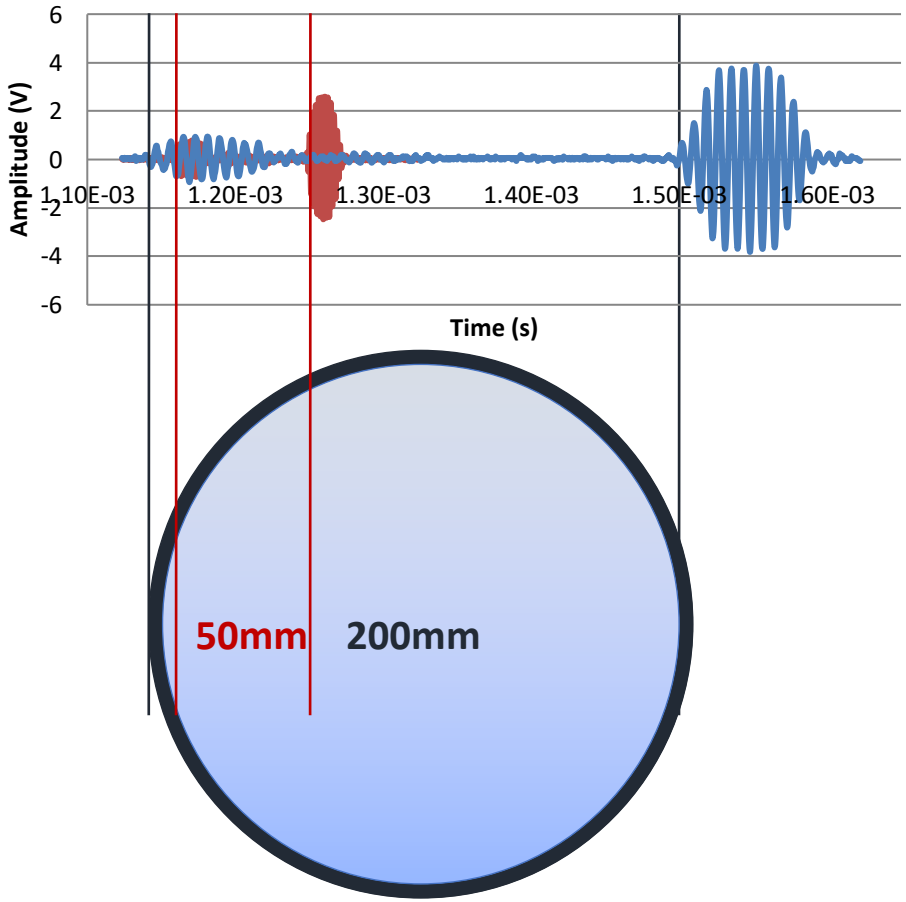
# SonarBell – Diameter Discrimination

- Distinguishing between different SonarBells acoustically is made easier by changing the overall diameter of the SonarBell®.
- The acoustic diameter can be found by measuring the time difference between the front and back echo.
- The acoustic diameter is larger than the SonarBell's physical diameter due to the speed of sound in the core being slower than the speed of sound in water.




Note: The echo response of a 50mm SonarBell® is denoted in red. Blue denotes the response of a 200mm SonarBell®.

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# Some Examples of SonarBell® Response Curves

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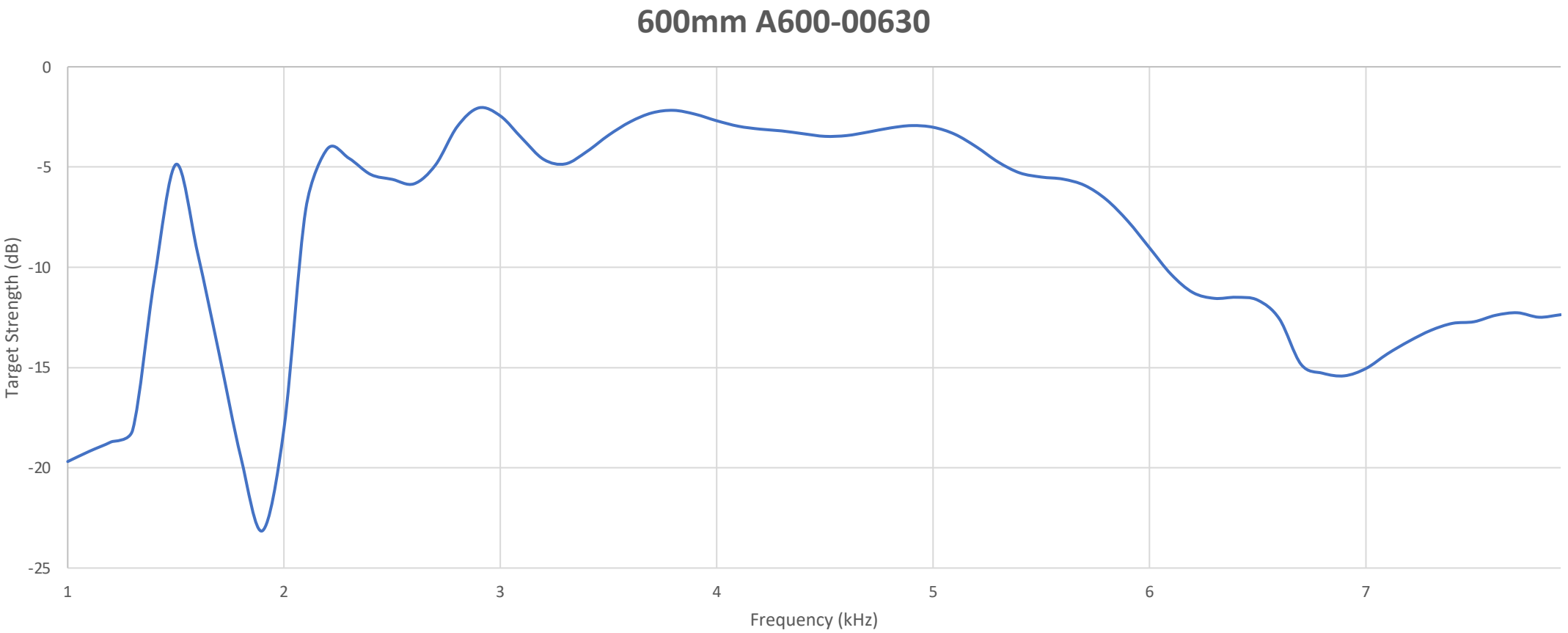


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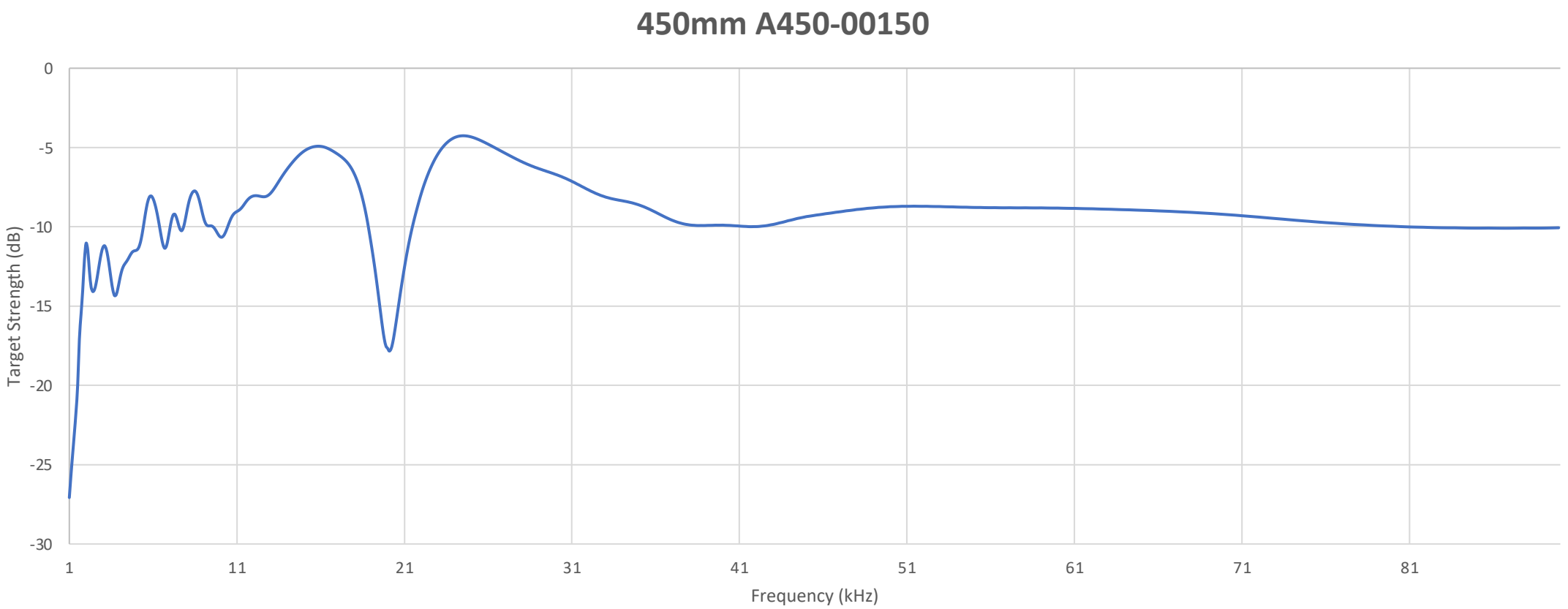


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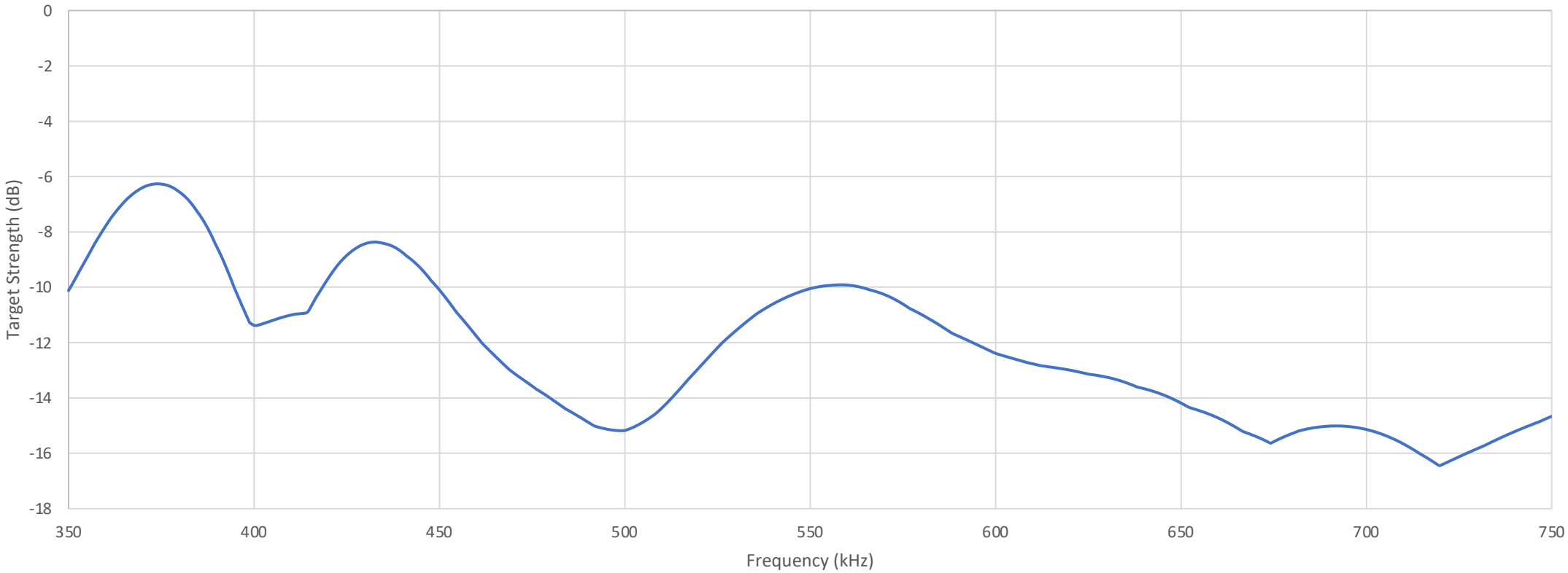
# 205mm Z205-0088

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# Defence Applications

- Sonar Testing
  - To test sonar sensitivity levels a SonarBell® with an echo level response sightly higher than the sonar's detection threshold is used to verify the sonar's detection capability.
  - E.g.: A sonar is supposed to detect objects with a TS as low as -30dB. A SonarBell® with a response of -30dB is used to verify the sonar's sensitivity.
- Operator Training
  - Imitate the echo signature of mines or submarines to train sonar operators.
  - E.g.: Use a realistic SonarBell® mimic to train sonar operators in target identification.

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# Advantages of Using SonarBell® for Sonar Testing and Training

- Realistic test and training targets.
- No batteries or electronics.
- Minimal maintenance.
- Strong echo returns can be achieved with relatively small reflectors, making handling of test and training targets easier.
- Pressure-equalising, free-flooding design enables deep water deployment.

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# SonarBell® on different Sonar Systems

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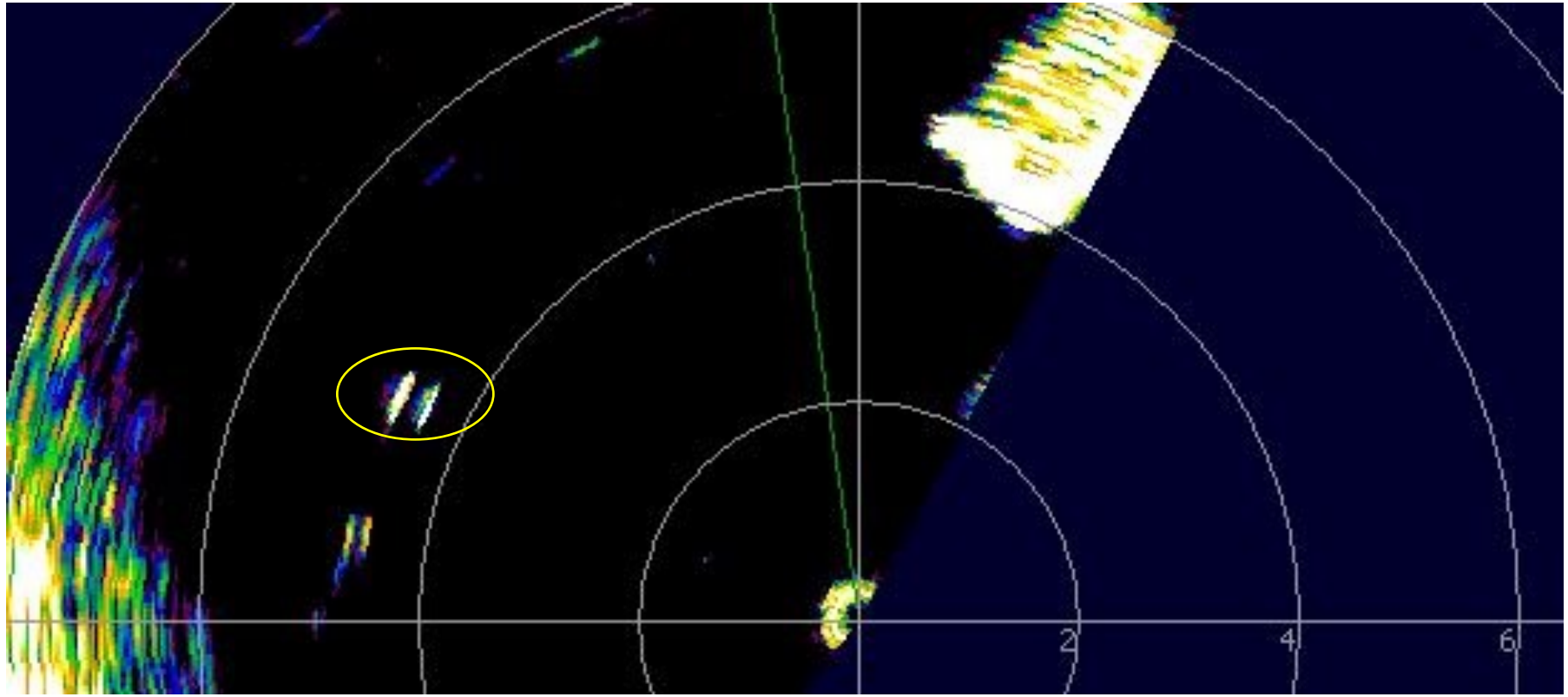
| | |
|---|---|
| Sonar | Tritech SeaKing |
| Frequency | 325kHz |
| SonarBell® Configuration | 200mm SB200-0085 |

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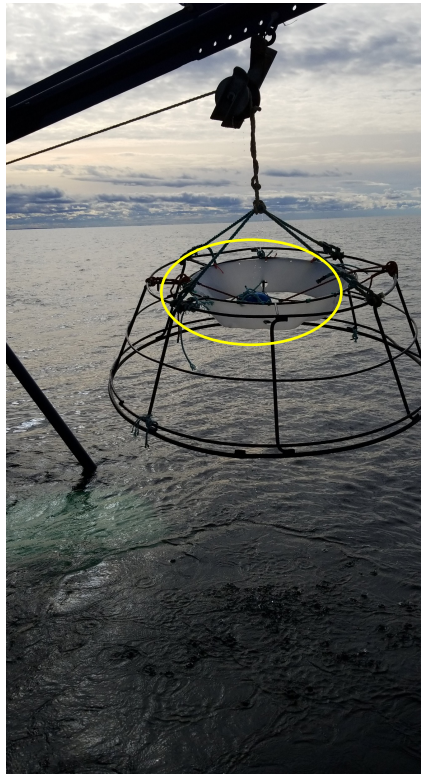
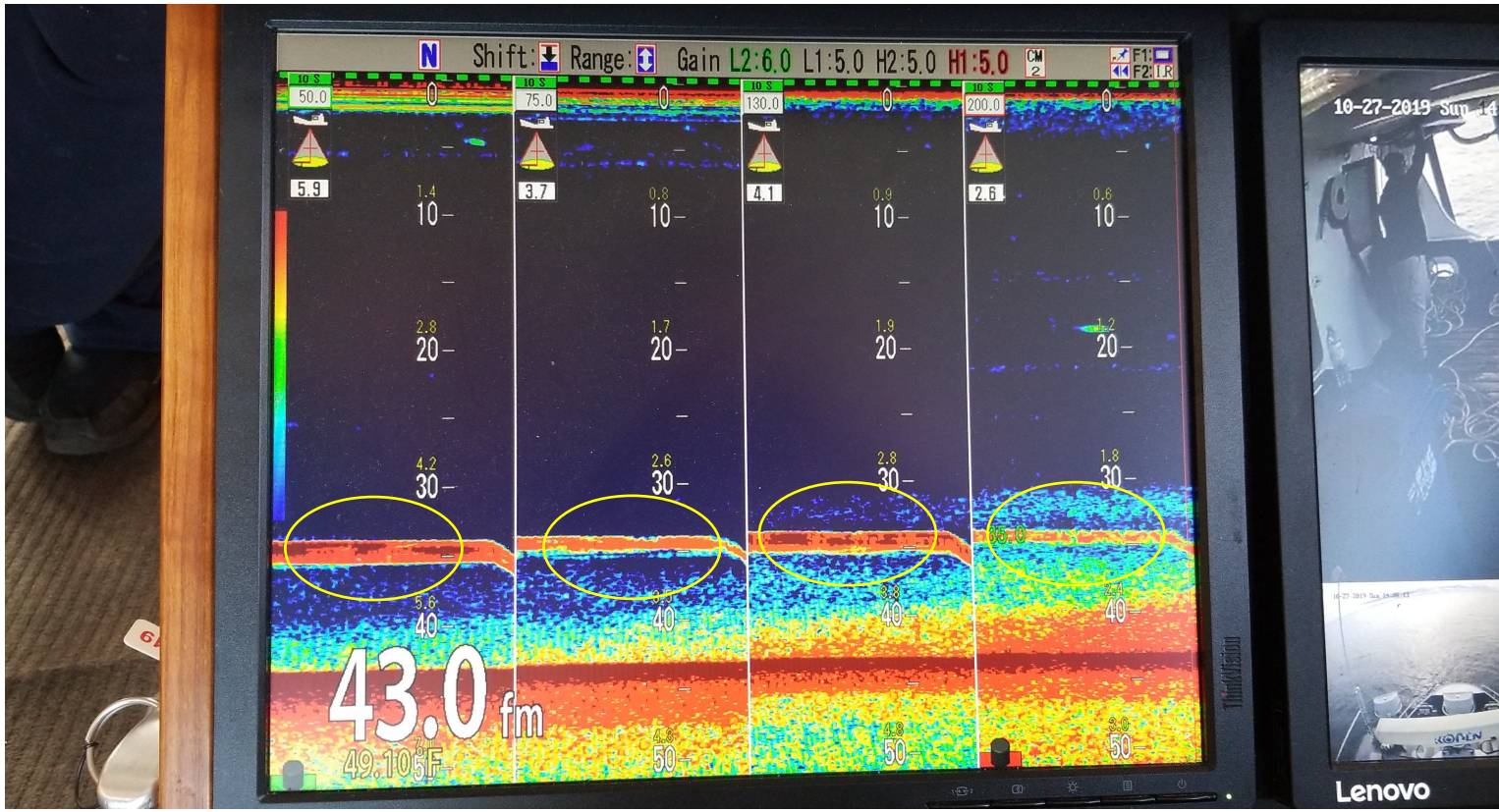
| | |
|---|---|
| Sonar | Furuno |
| Frequency | 50, 75, 130 and 200kHz |
| Range | 35 fathoms (64m) |
| SonarBell® Configuration | 275mm A275-0085 |



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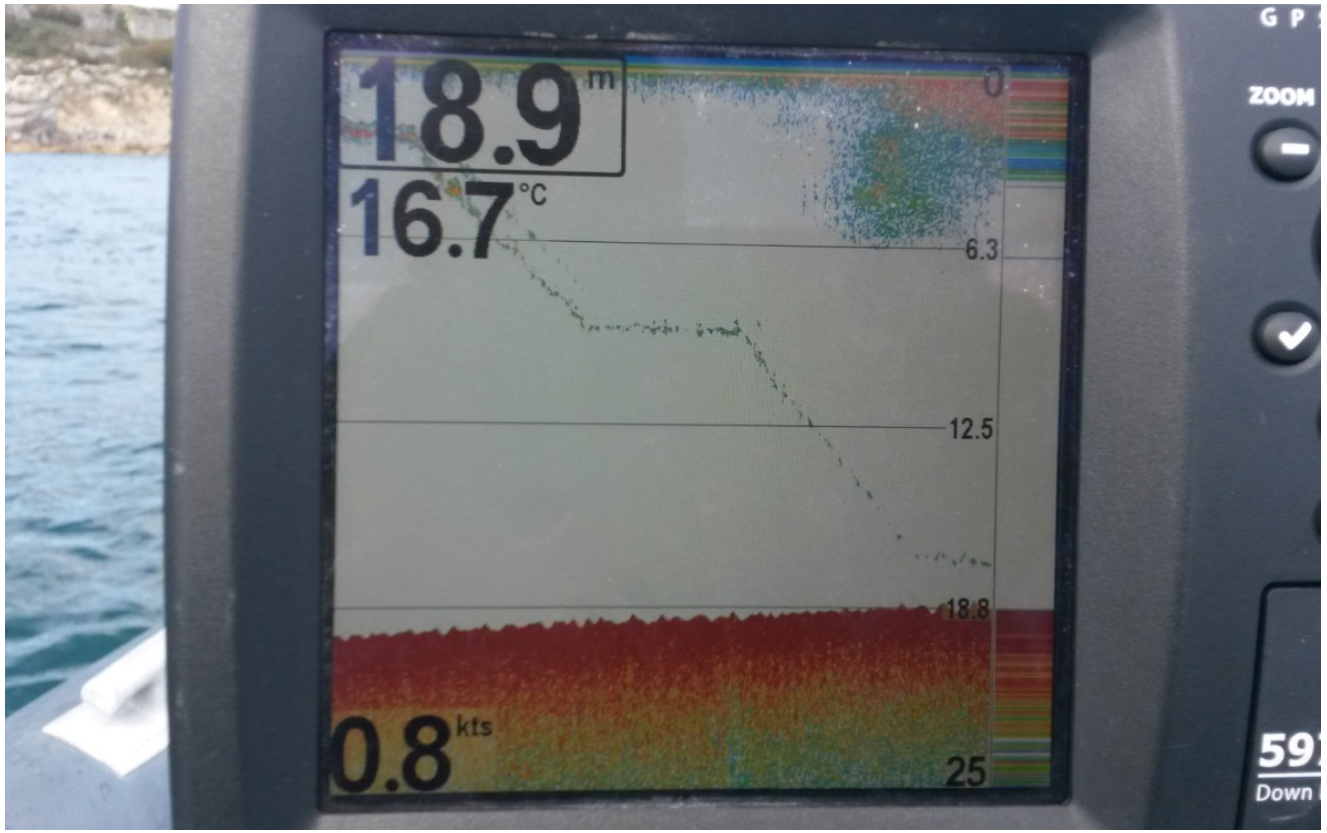
| | |
|---|---|
| Sonar | Humminbird |
| Frequency | 200kHz |
| Range | Up to 18m |
| SonarBell® Configuration | 200mm Z200-00109 |

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