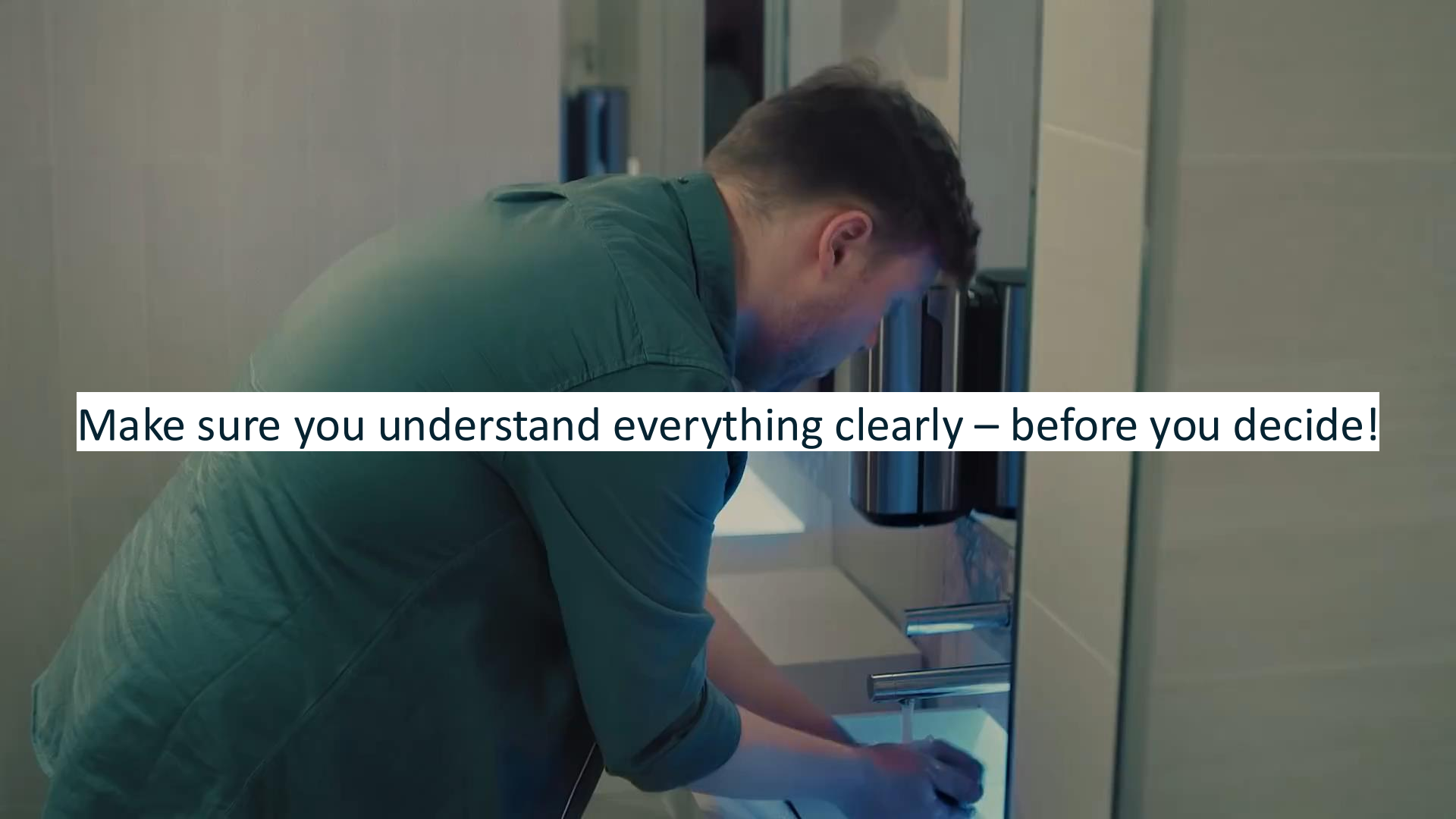


Decision making

Layered Media Detection

Uni Bull
DHYG 37. HydrographenTag 2025
2025-06-18

A man with short brown hair, wearing a green button-down shirt, is leaning over a white sink in a modern bathroom. He is washing his hands under a chrome faucet. The background shows a tiled wall and a glass shower door. A white text box is overlaid on the image.

Make sure you understand everything clearly – before you decide!

Seafloor
Fluid mud / fluff
Acoustic challenges
Navigable depth

Seafloor
Fluid mud / fluff
Acoustic challenges
Navigable depth
LMD – decision making tool

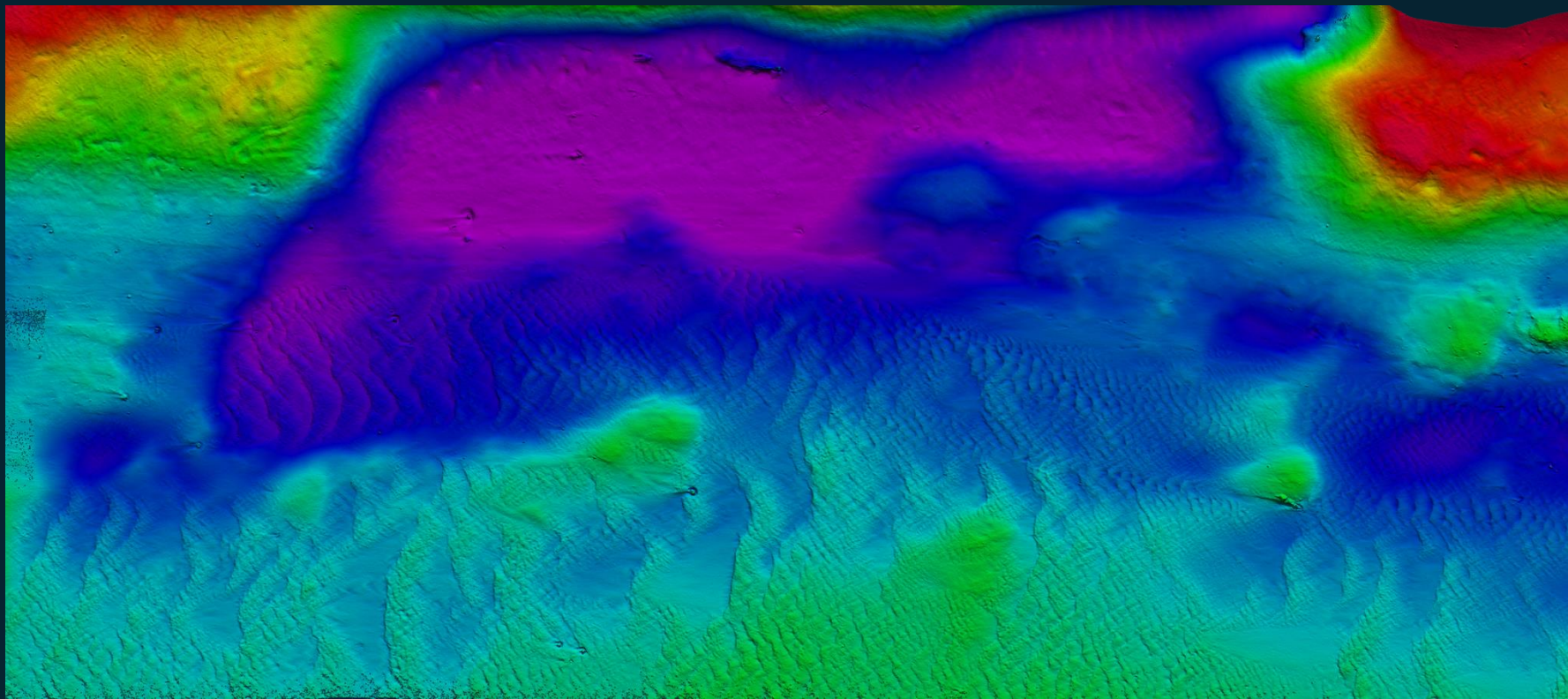
Seafloor

Fluid mud / fluff

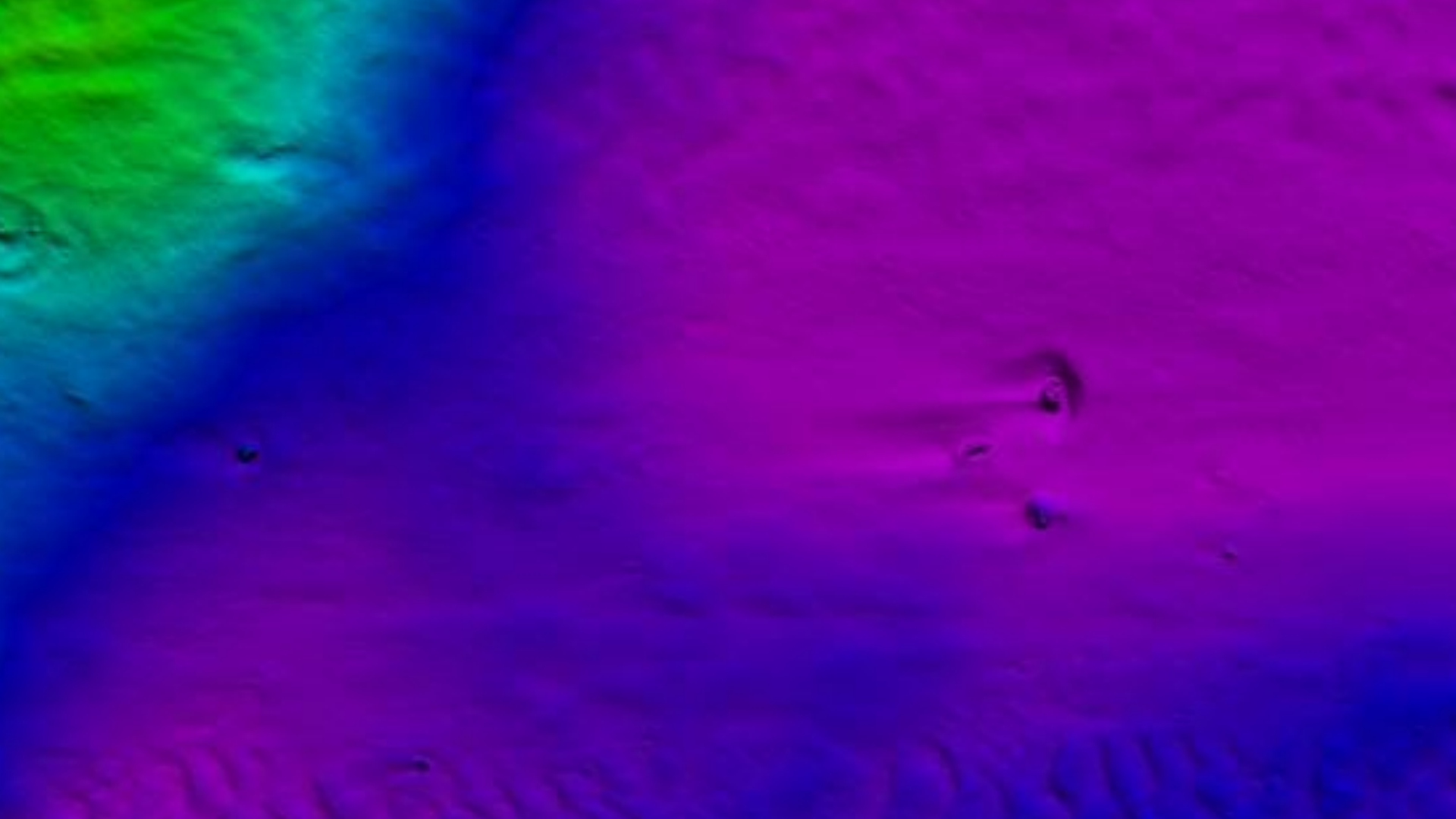
Acoustic challenges

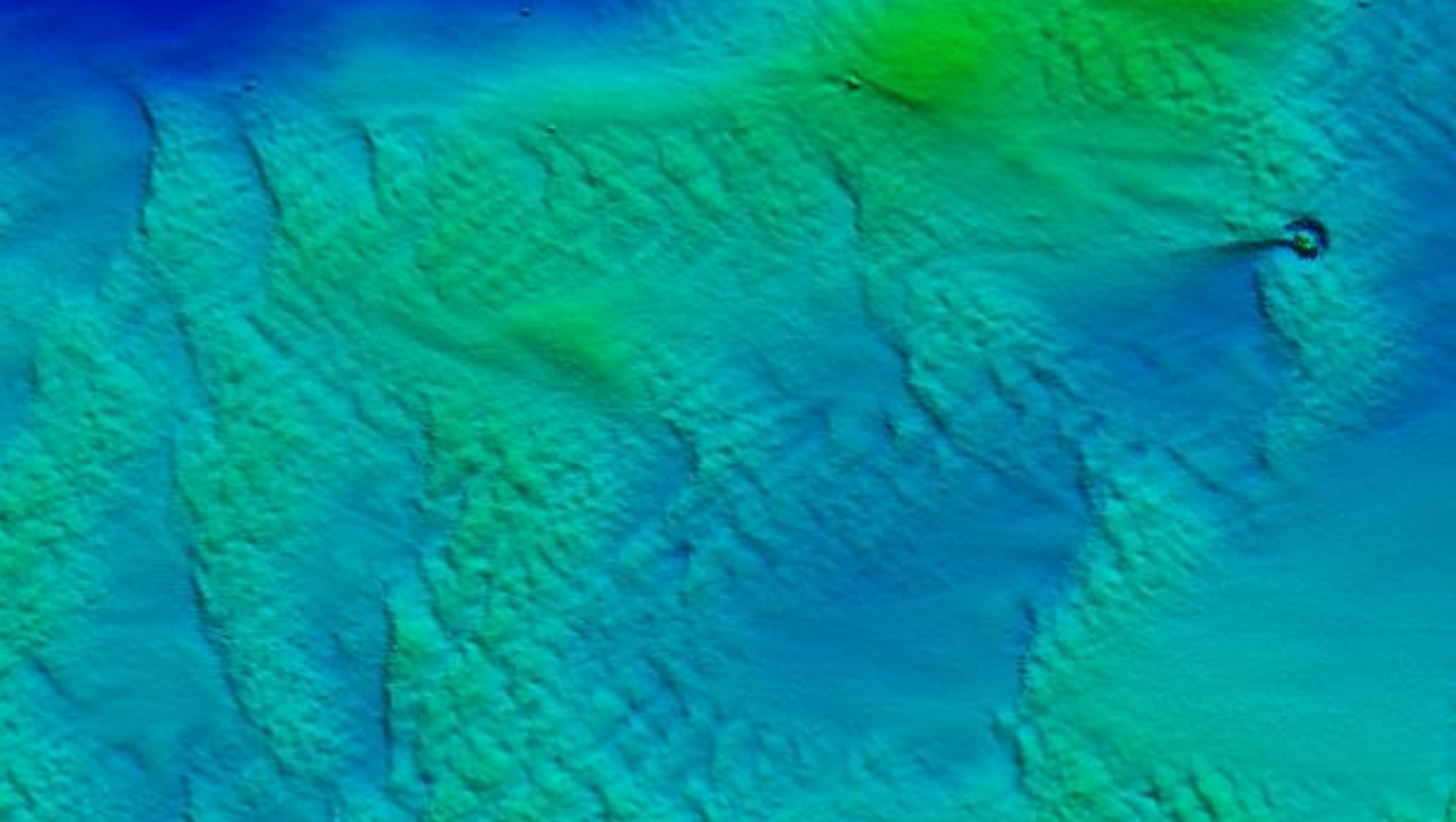
Navigable depth

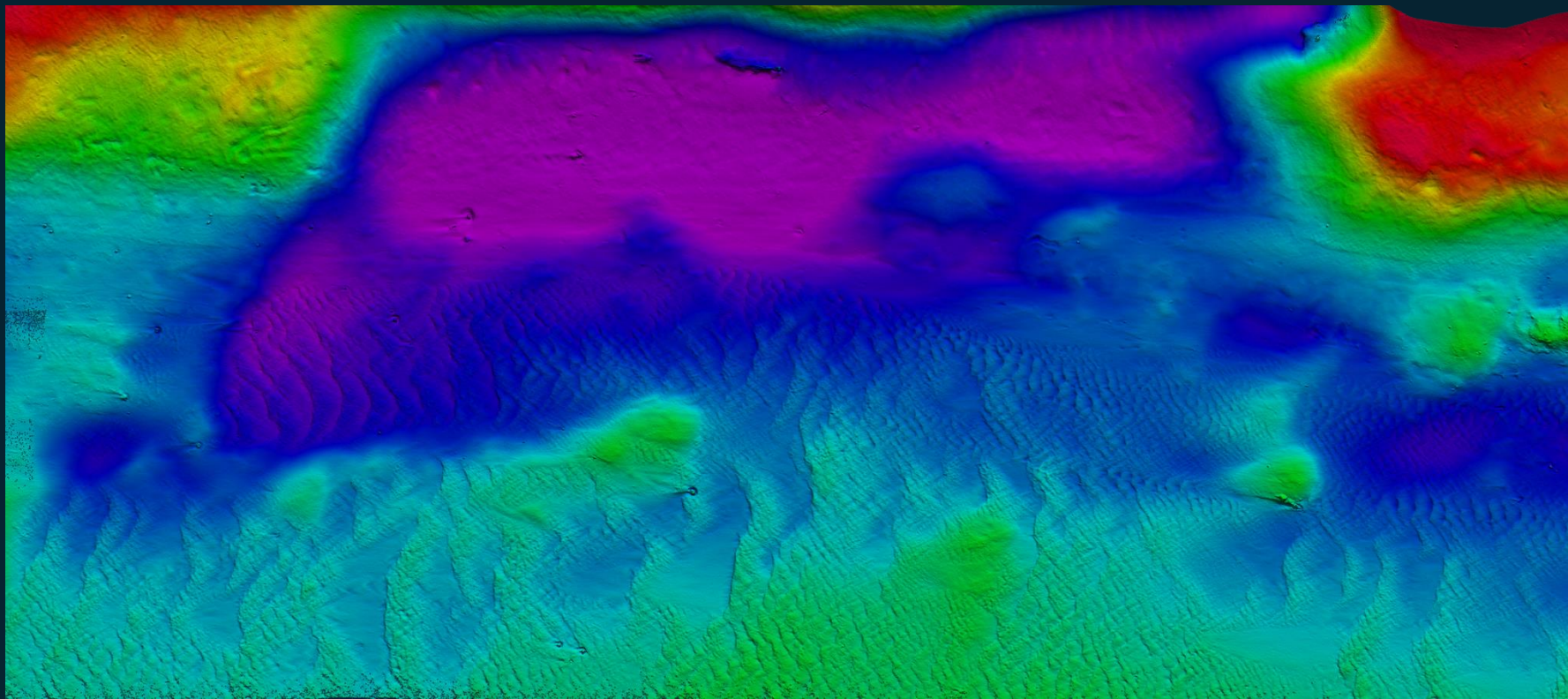
LMD



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Sonar : ■ Bathy ■ SS ■ WC ■ SN ■ Roll/Pitch Stab

Version: 10.5.0 FW: 5.0.0-50-g8c86571-7

Sonar Name: 24115-1-HBDDJA4B3AA_2110165

Sweep Time: 500 μ s

Bandwidth: 40 kHz up

Frequency Range: 380 kHz - 420 kHz

Ping Number: 73024

Sound Speed: 1479.5 m/s

Sun, 12.02.2023 09:55:59

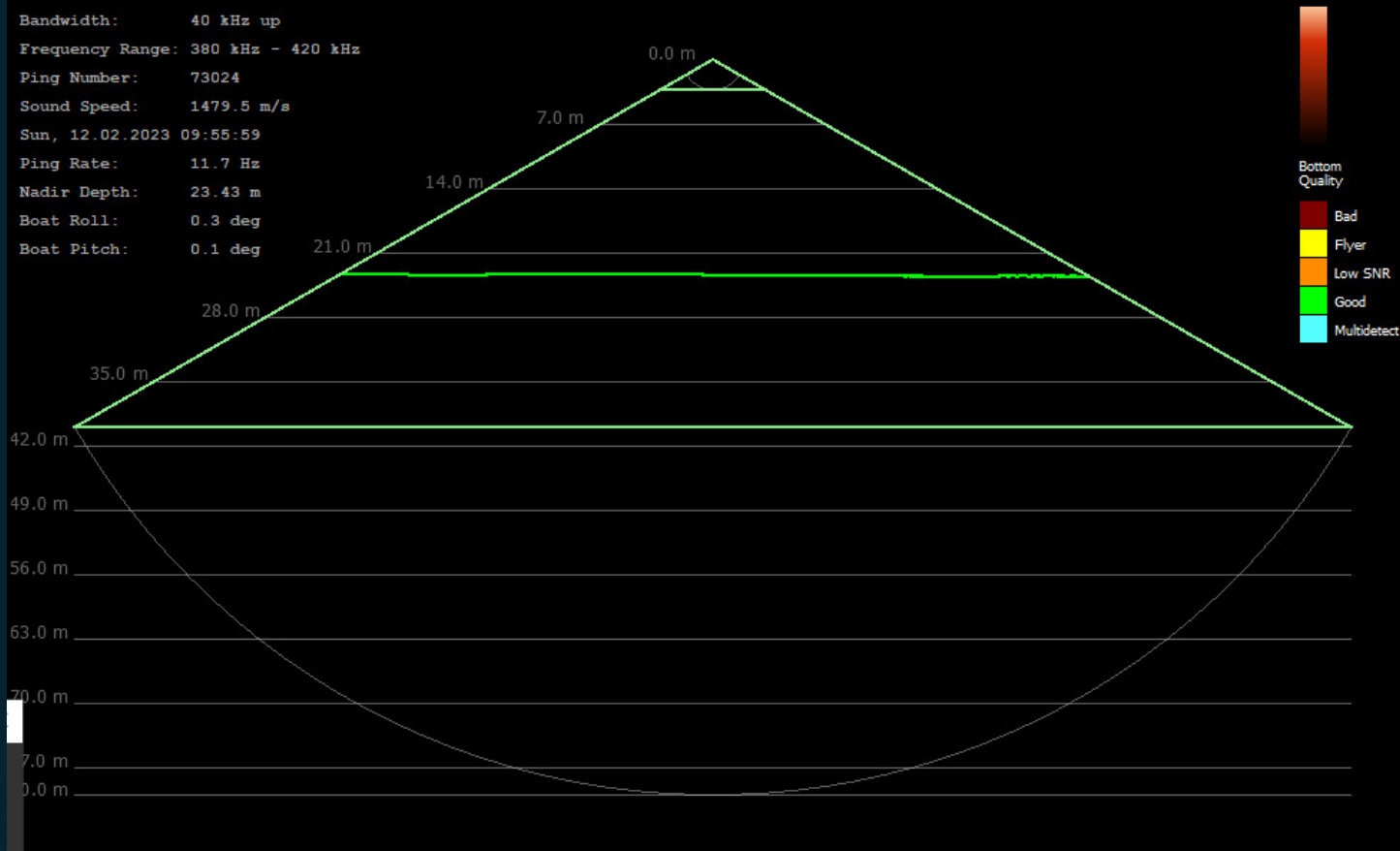
Ping Rate: 11.7 Hz

Nadir Depth: 23.43 m

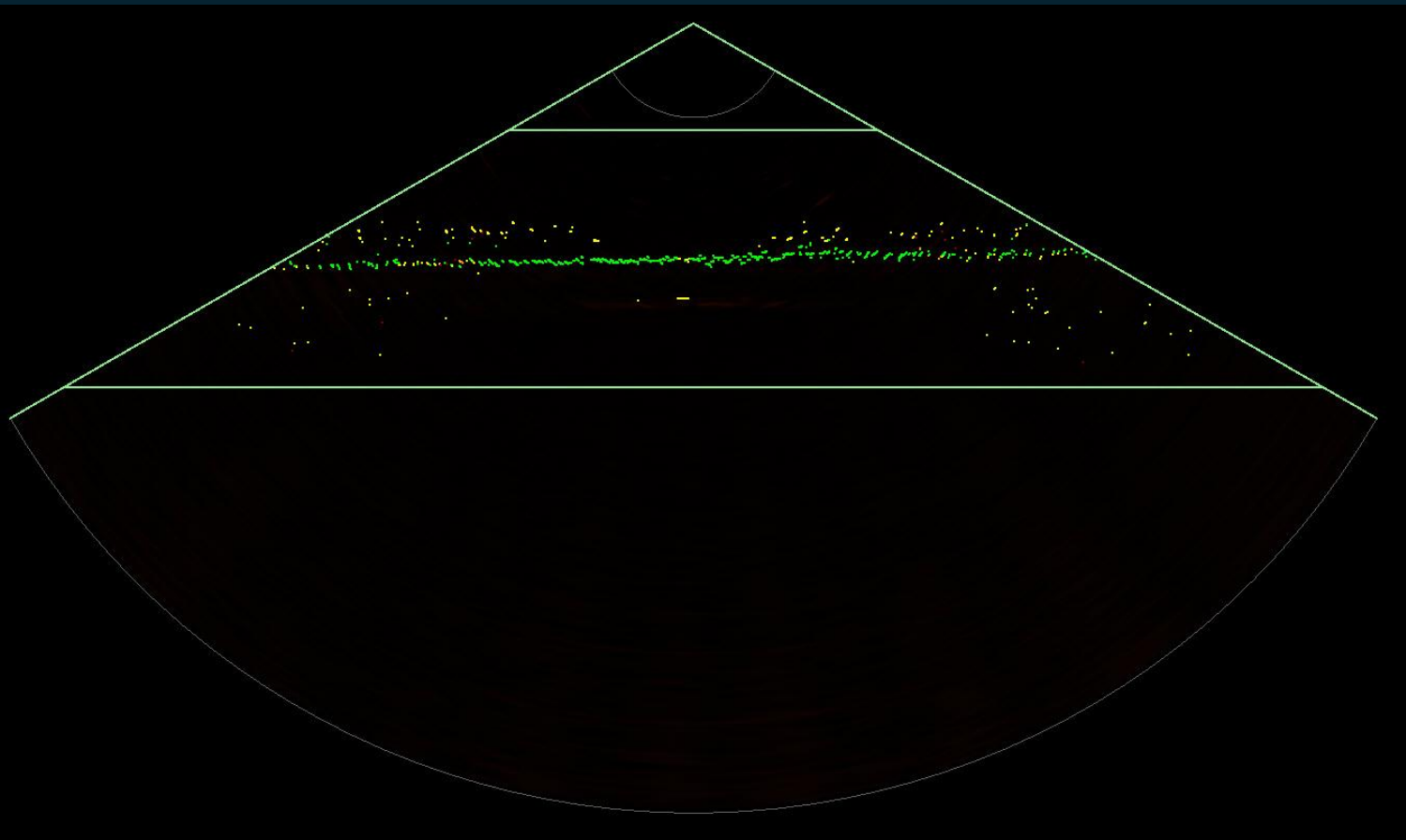
Boat Roll: 0.3 deg

Boat Pitch: 0.1 deg

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Seafloor
Fluid mud / fluff
Acoustic challenges
Navigable depth
LMD

Mud is not just mud...



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What is fluid mud?

Water with silt
Flocculated mud
Fluid Mud
Firm Mud

1



Water with silt

2



Flocculated mud

3



Fluid mud

4



Firm mud



Behaviour
Maneuverability

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Behaviour
Maneuverability

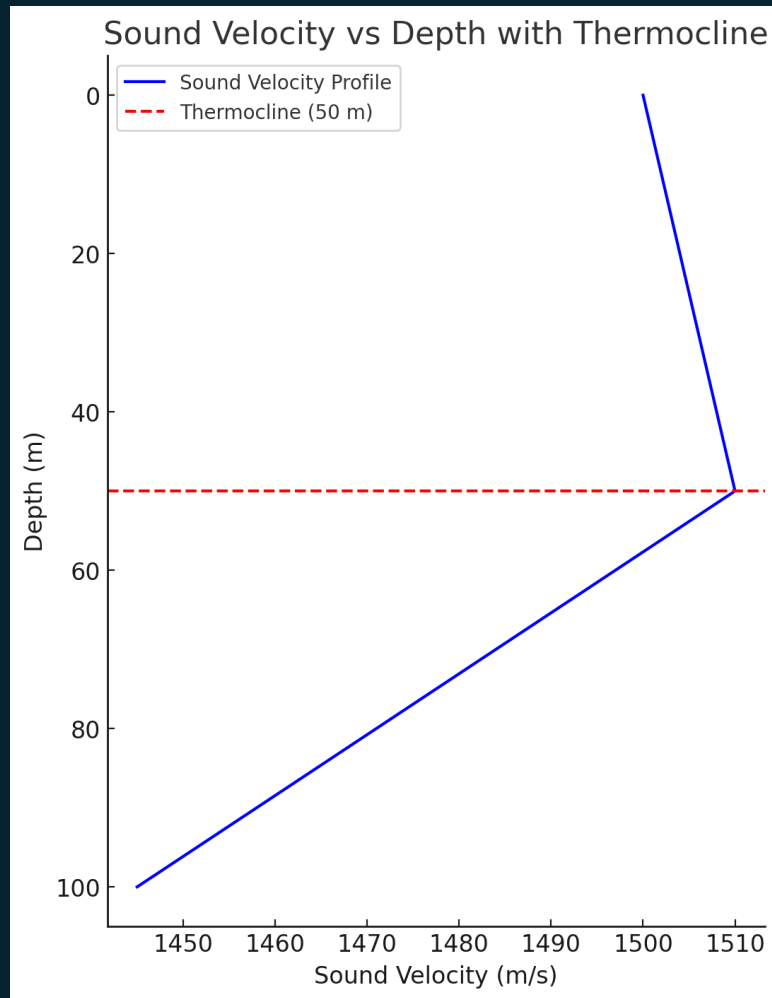
Depth measurements

Seafloor
Fluid mud / fluff
Acoustic challenges
Navigable depth
LMD

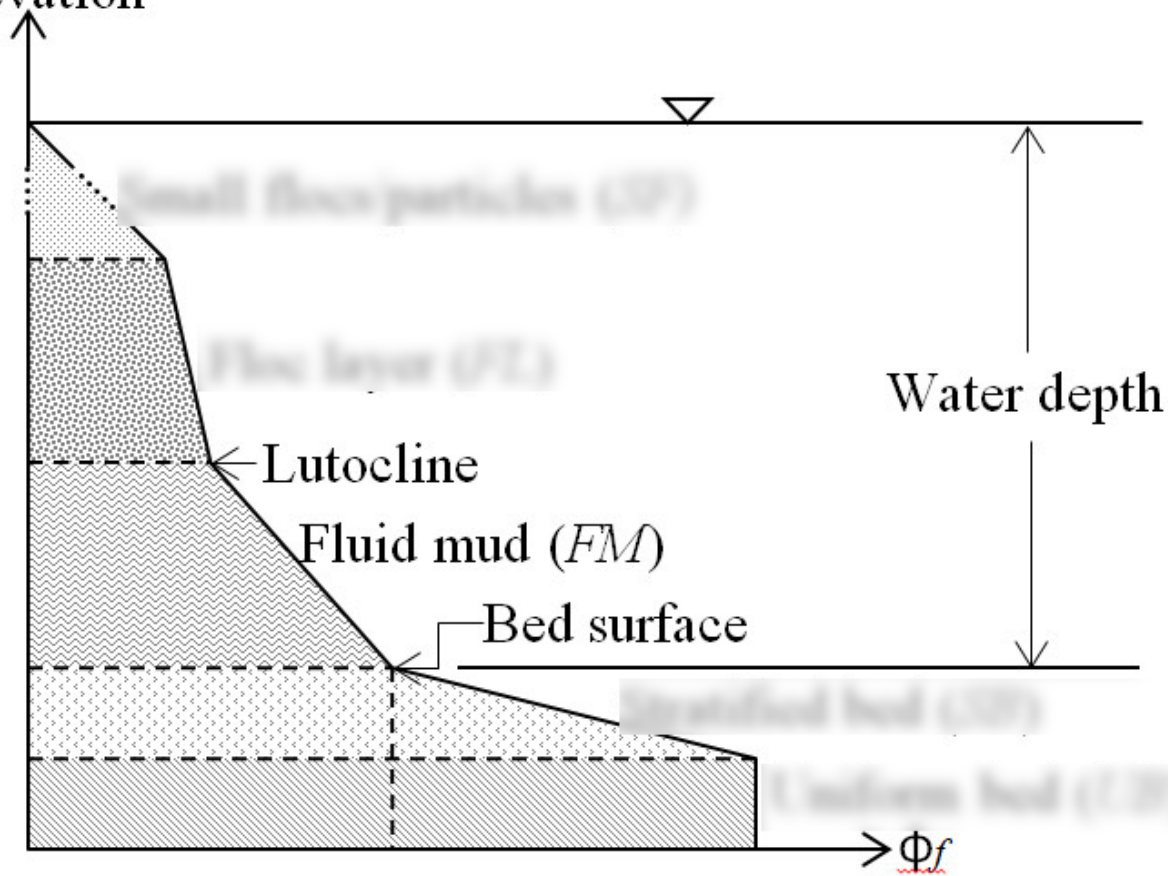
Lutocline

Lutocline

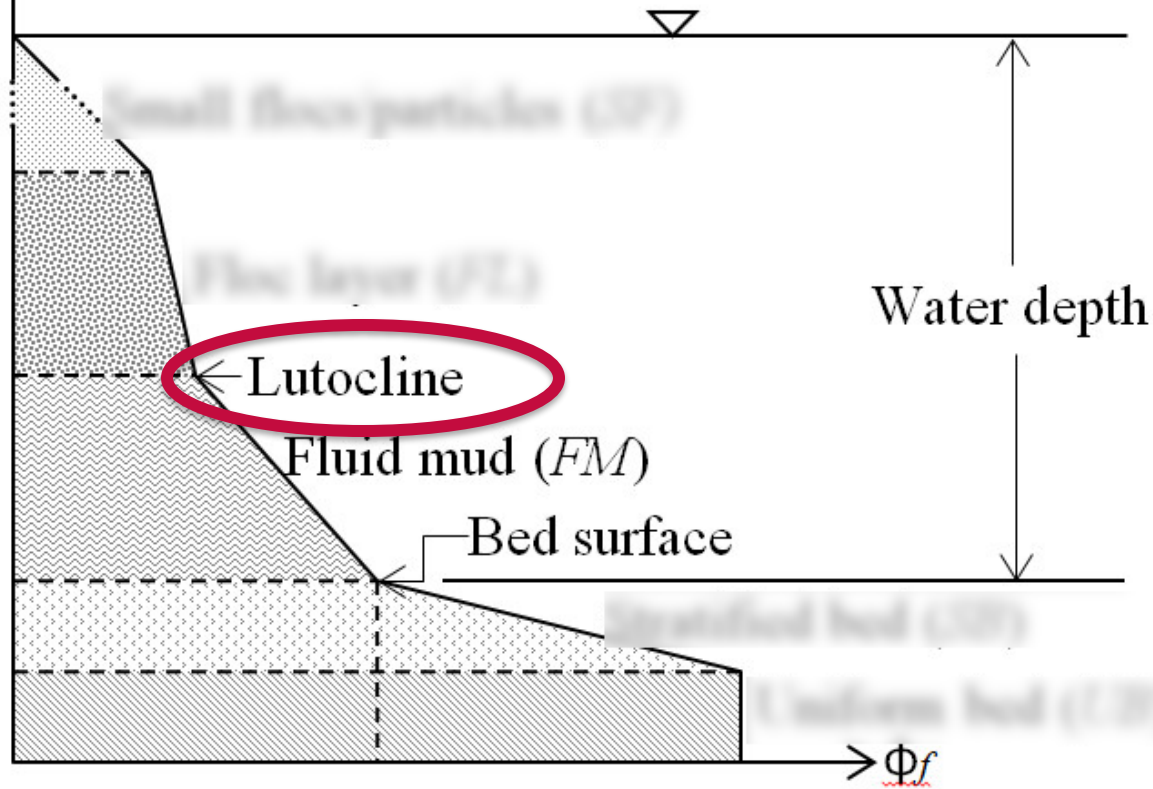
Thermocline

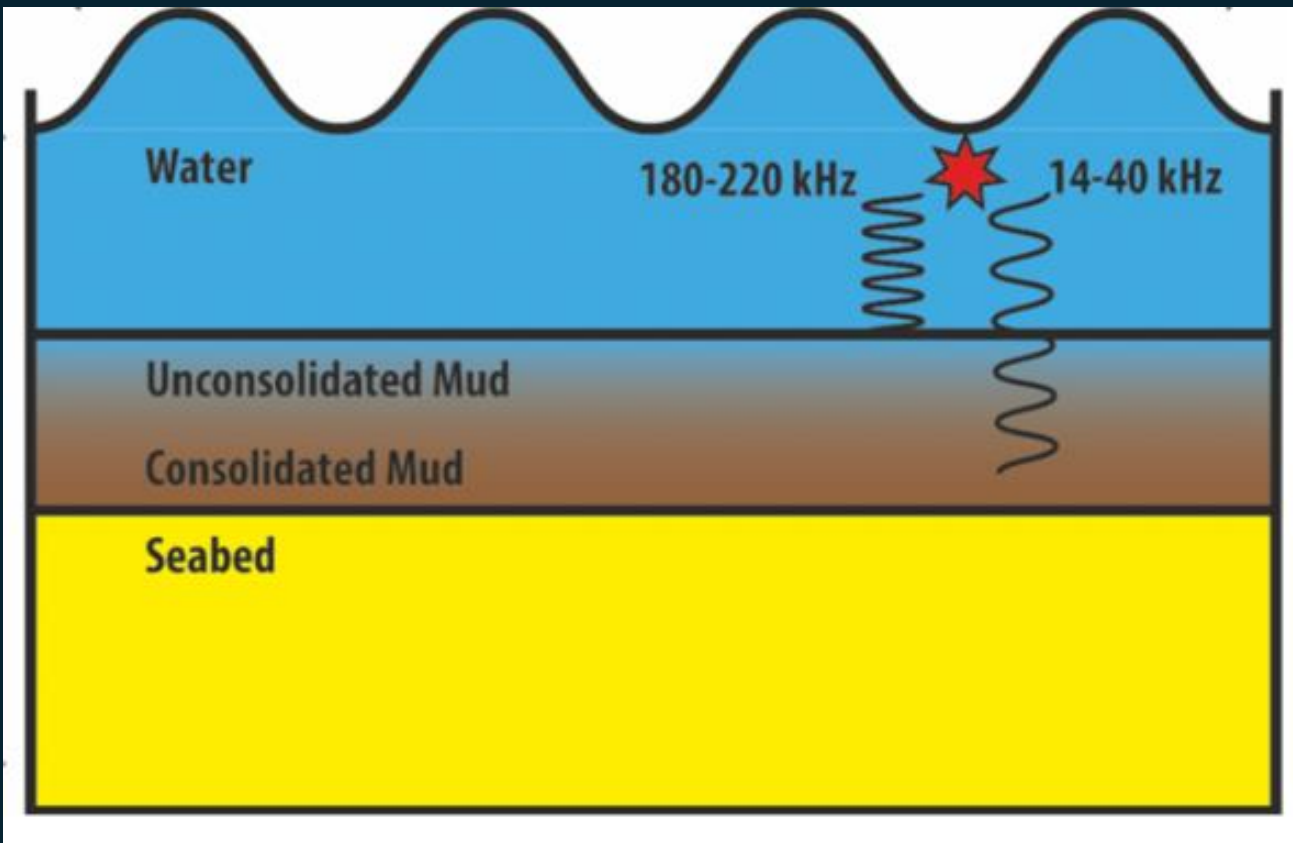


Elevation



Elevation



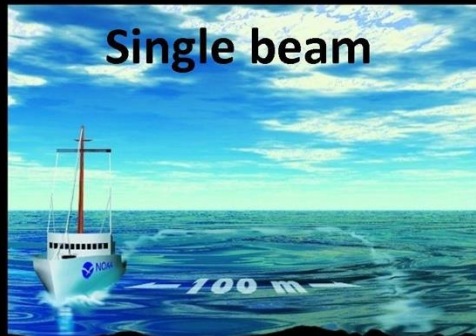


Single beam

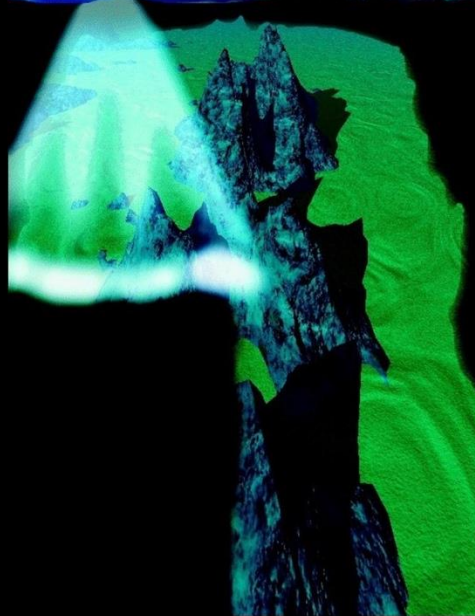


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Single beam

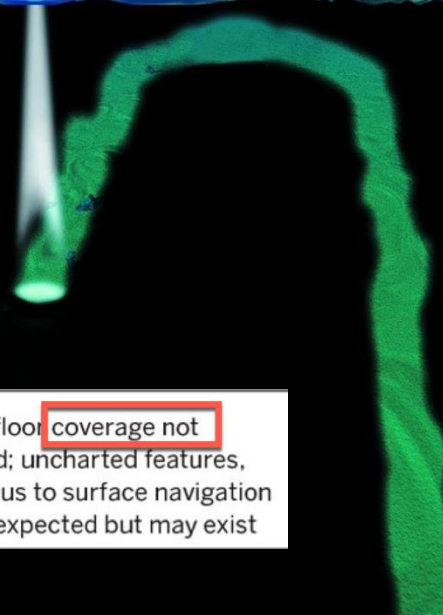
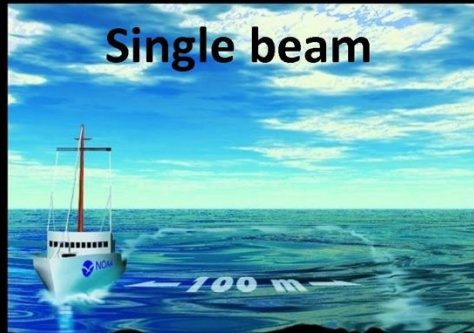


Multibeam

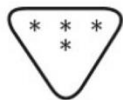


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- explore more -

Single beam

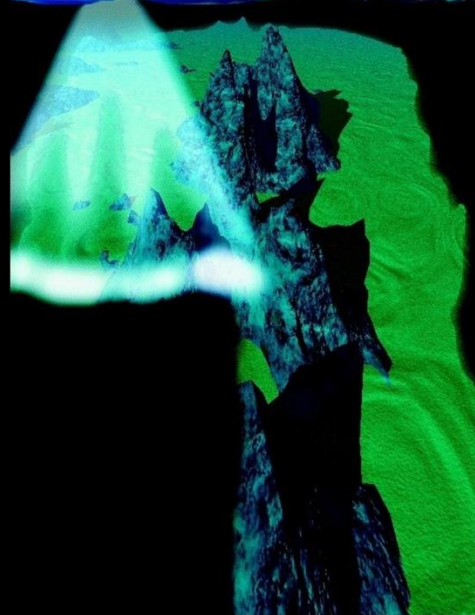
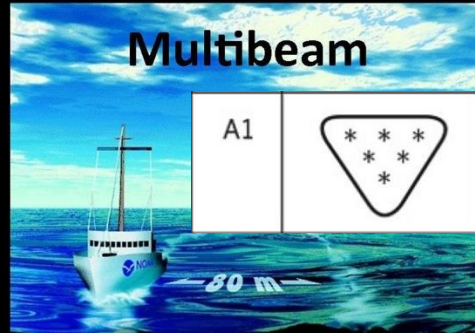


B

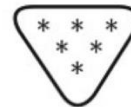


Full seafloor coverage not achieved; uncharted features, hazardous to surface navigation are not expected but may exist

Multibeam



A1



Full area search undertaken.
Significant seafloor features detected and depths measured

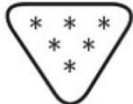
Surveying for a CATZOC A1 navigable bottom in the presence of fluid mud

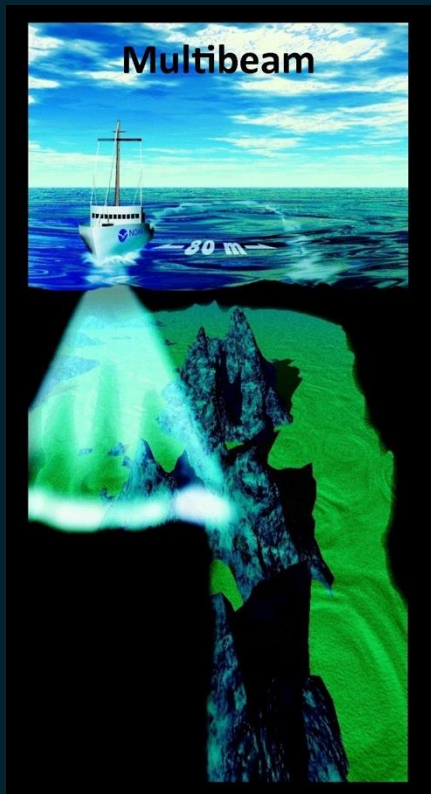
Mapping through fluid mud

By Dr Pawel Pocwiardowski, NORBIT

The presence of suspended sediments in water bodies presents significant challenges for the dredging industry. Existing methods to determine nautical depths are intrusive single point methods relying on in situ density or shear strength measurements^{1,3} or low-frequency single-beam echosounder recordings^{1,2}. The use of single-beam echosounders is however systemically problematic as they are not practical in satisfying the CATZOC A1 coverages required for contemporary electronic navigational charting.

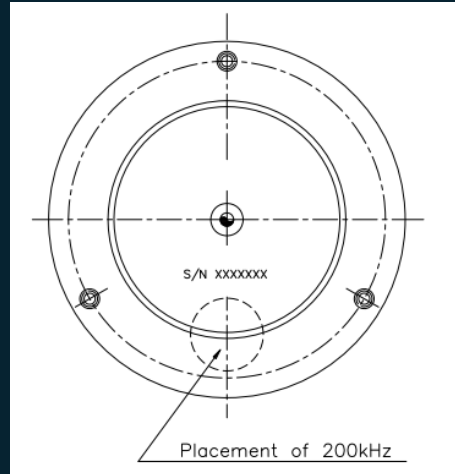


A1		Full area search undertaken. Significant seafloor features detected and depths measured
----	--	---

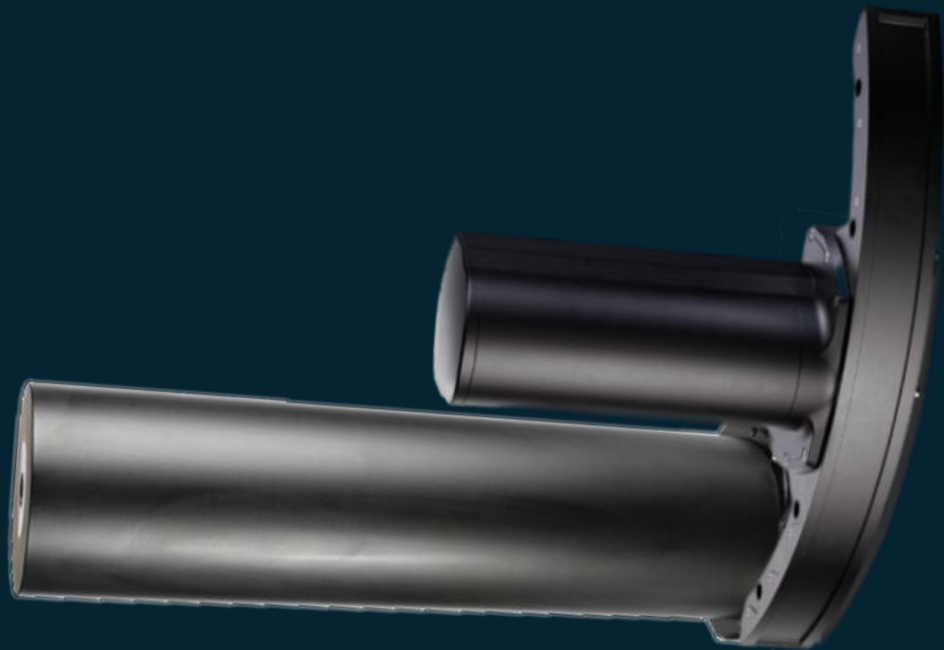


Challenge

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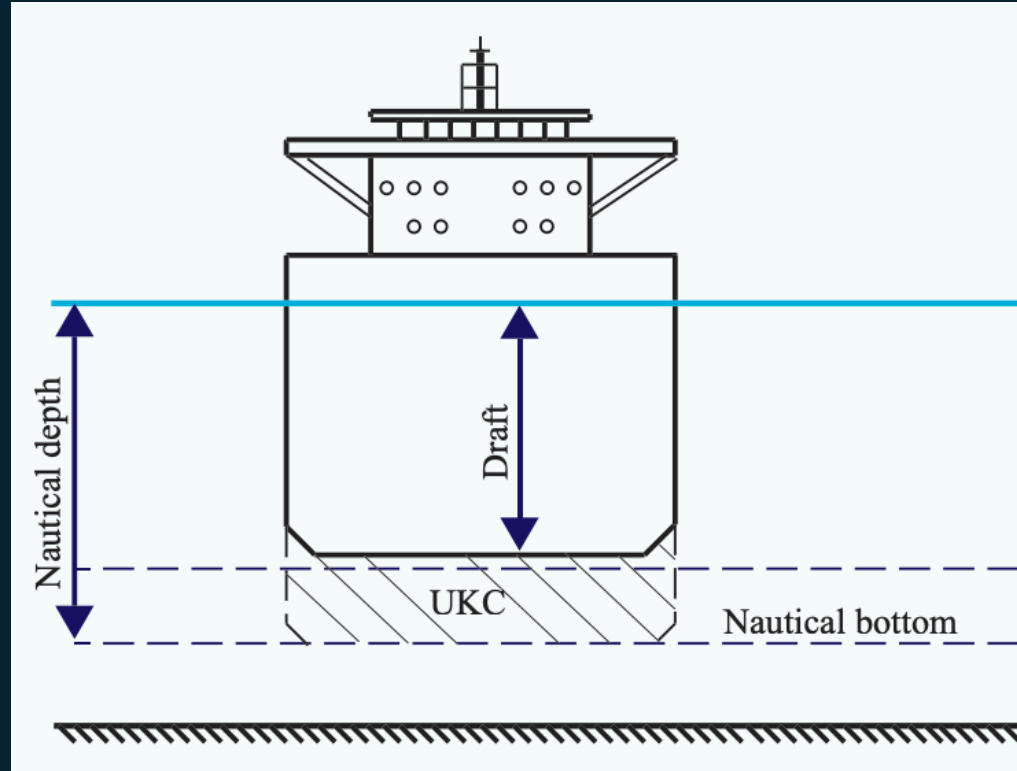


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Seafloor
Fluid mud / fluff
Acoustic challenges
Navigable depth
LMD

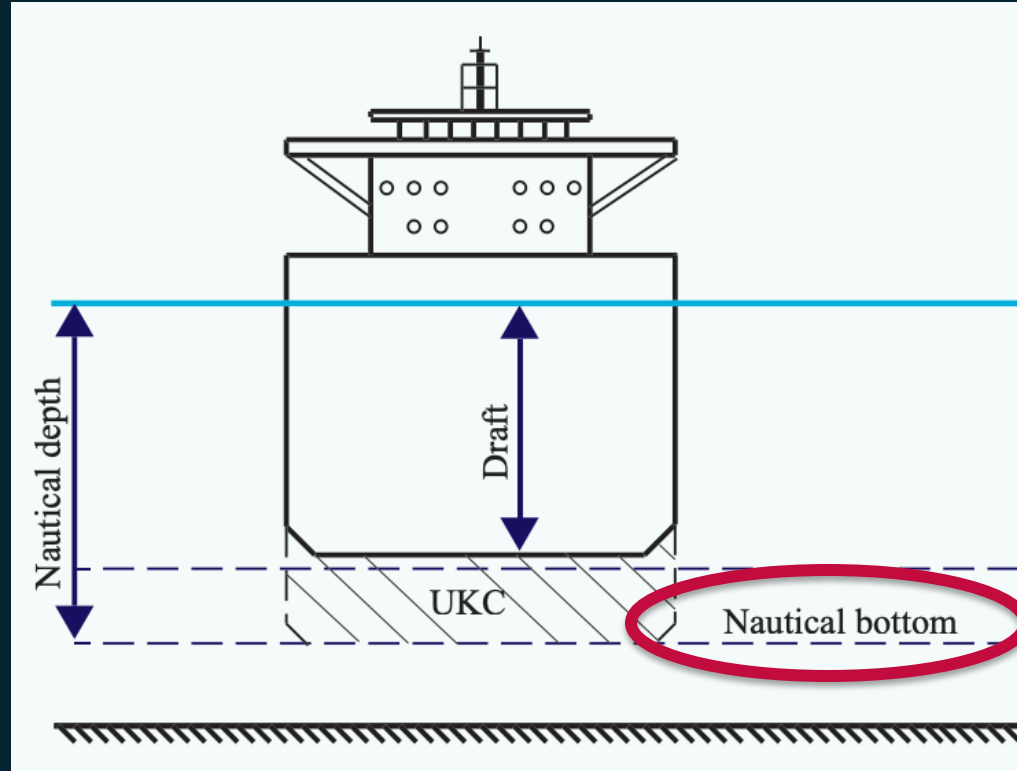
Under Keel Clearance

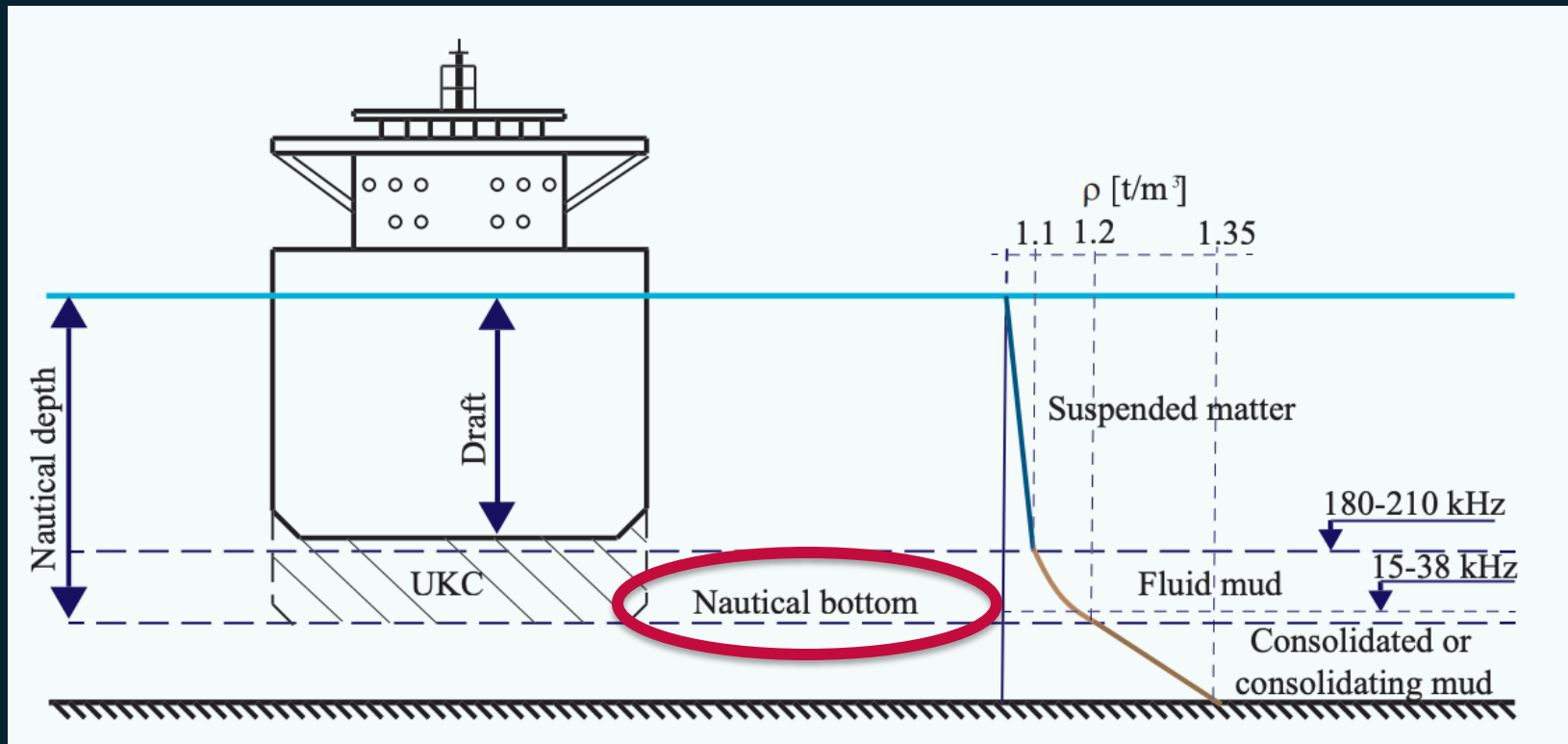
- Restrict draft
- Maintain depth

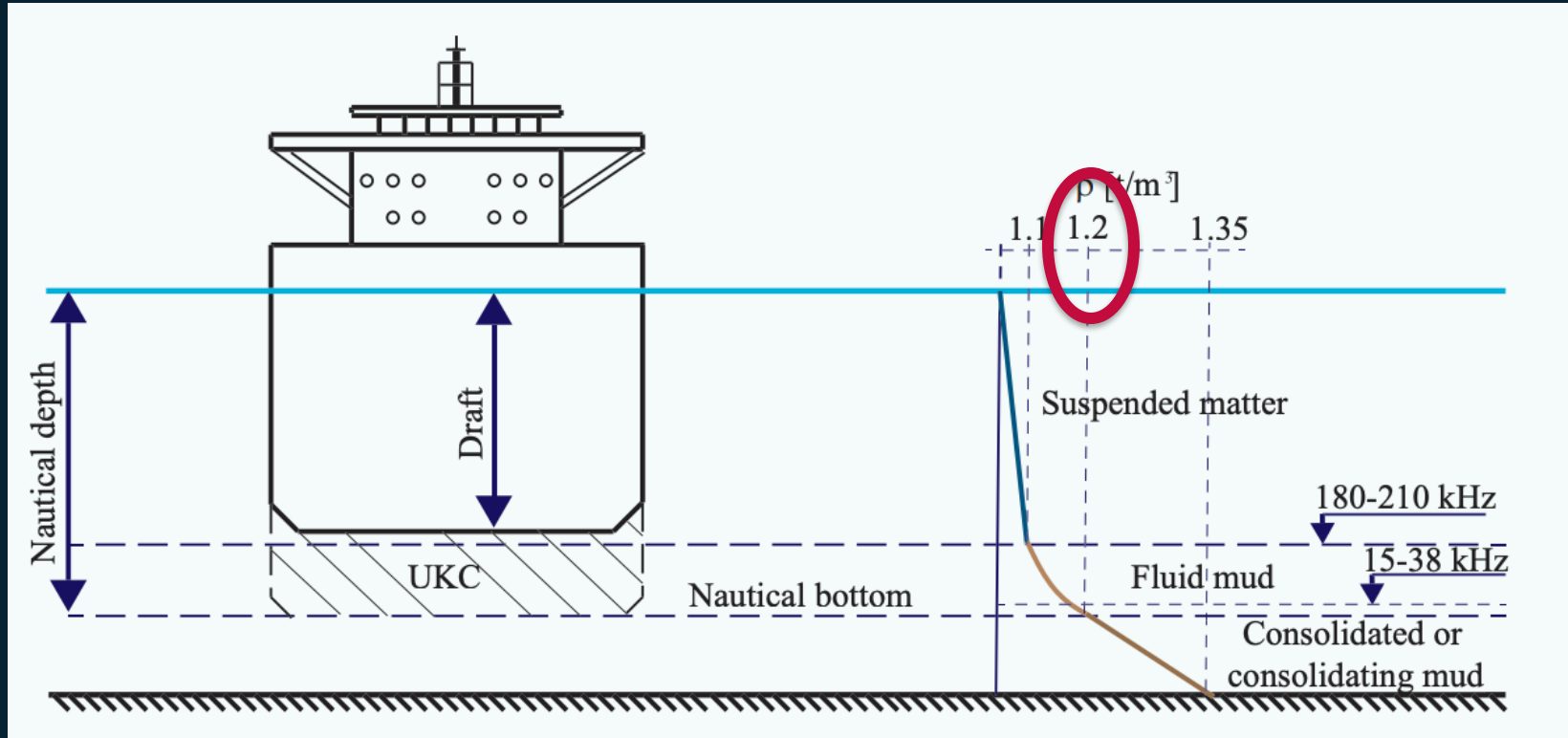


Under Keel Clearance

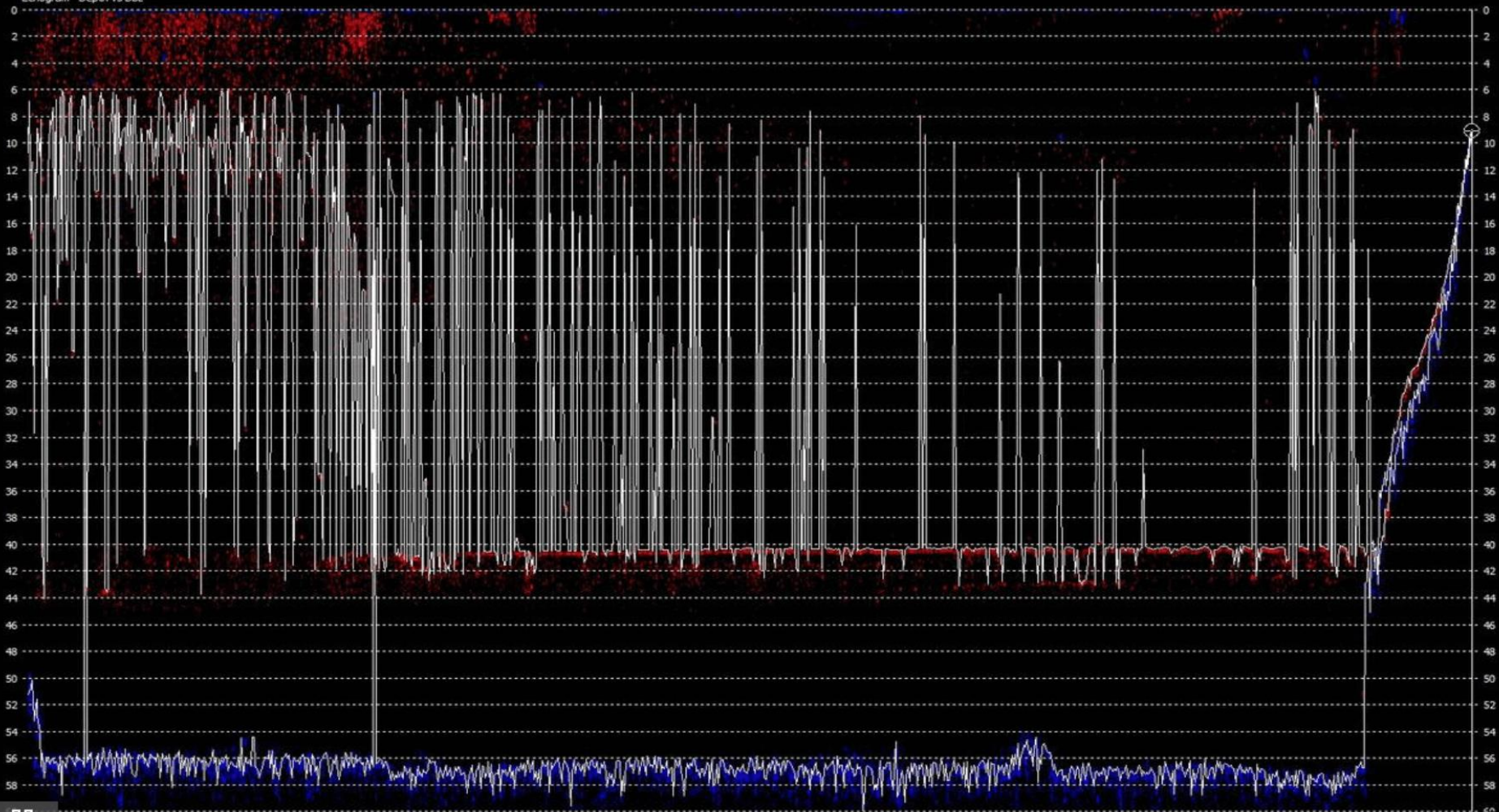
- Restrict draft
- Maintain depth







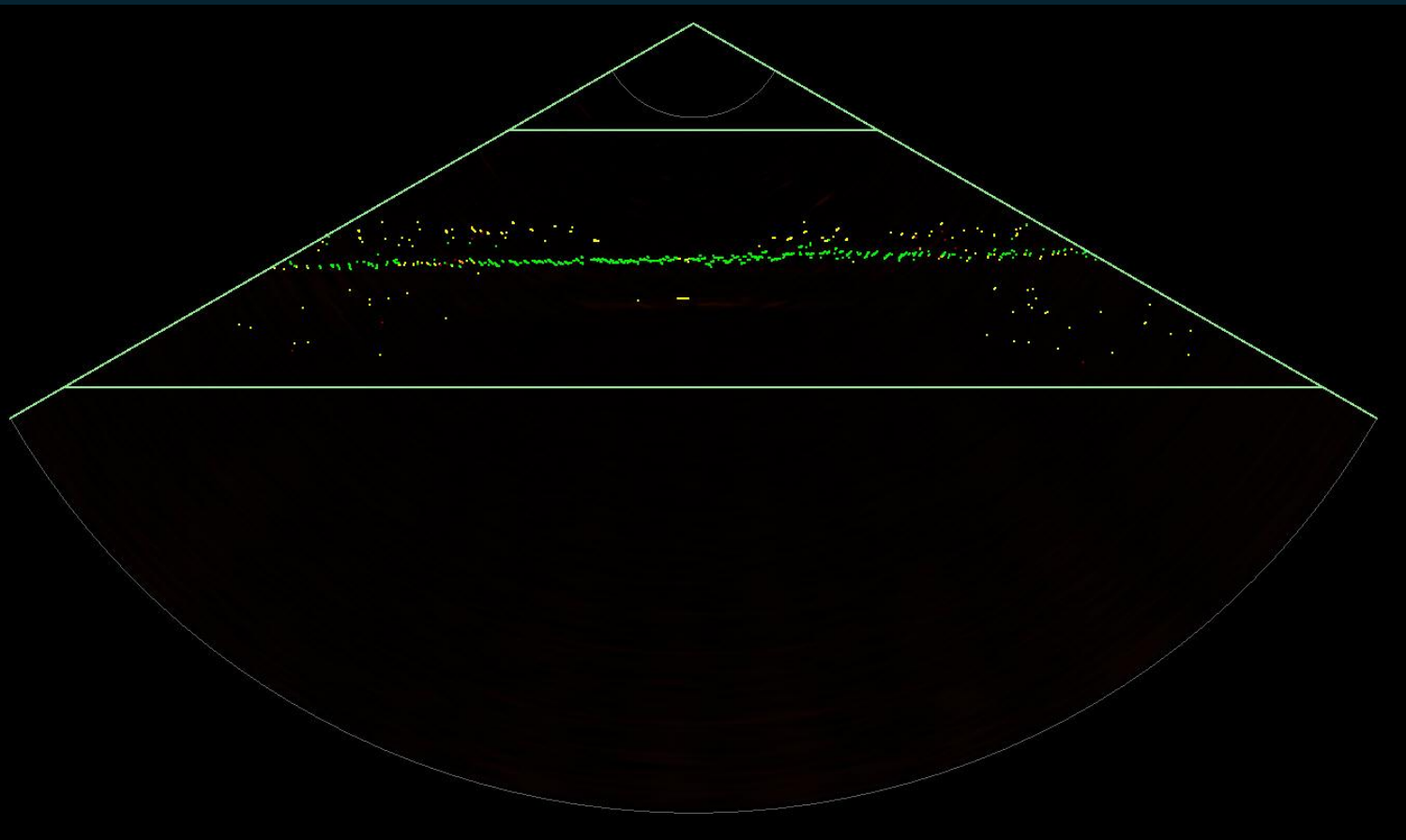
Seafloor
Fluid mud / fluff
Acoustic challenges
Navigable depth
LMD



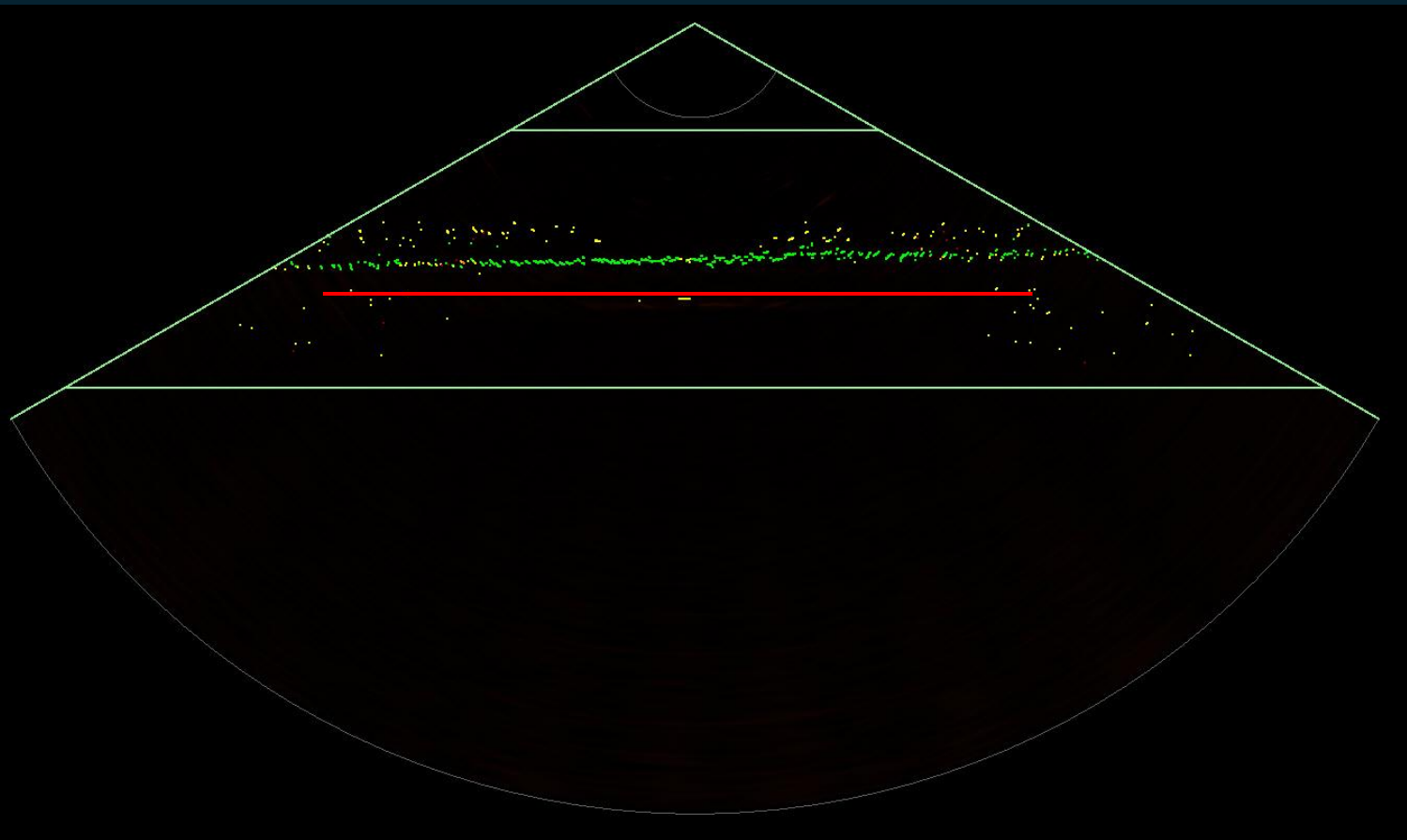
Single beam



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NORBIT
- explore more -



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- explore more -

WINGHEAD i87S
LMD-mode

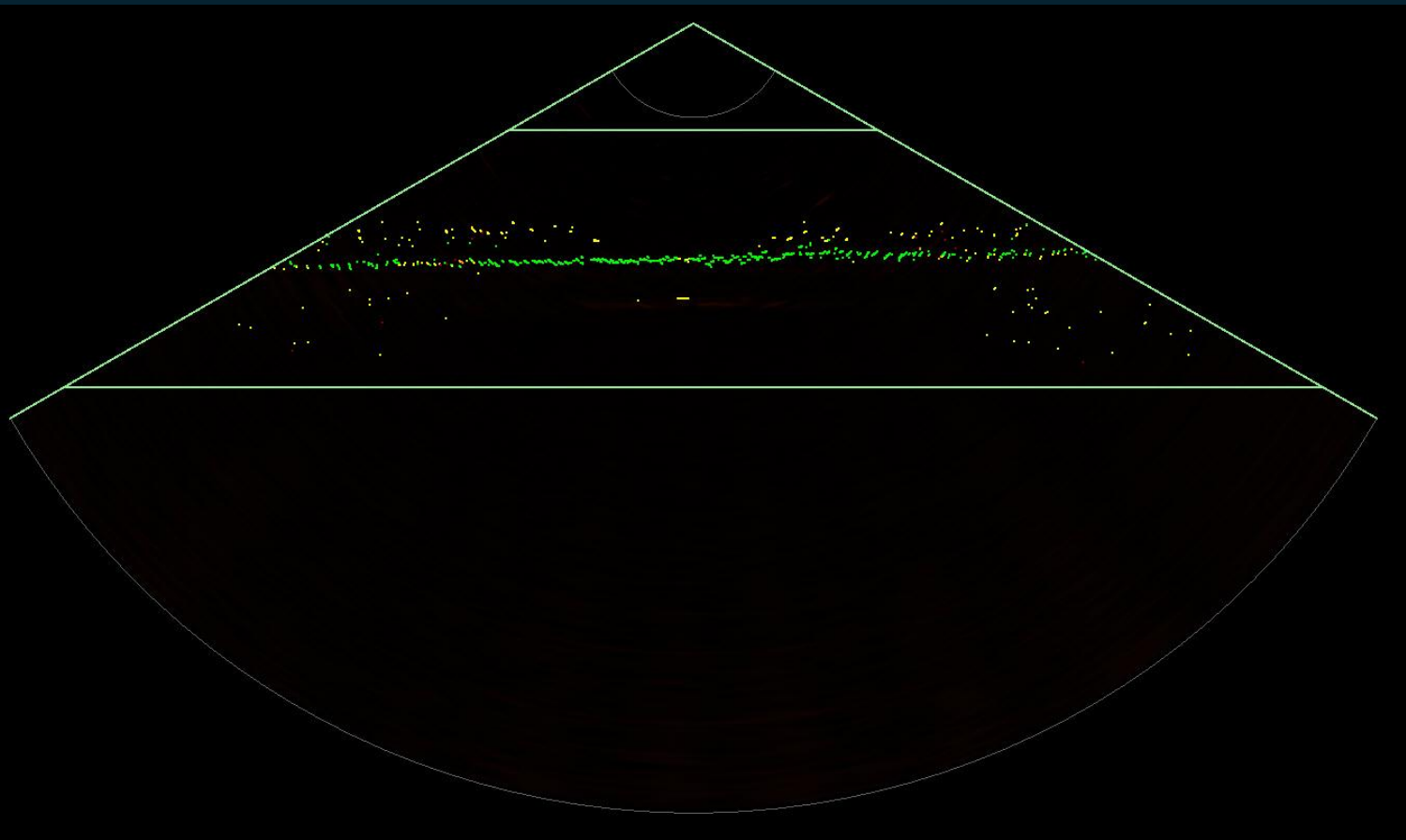


NORBIT
- explore more -

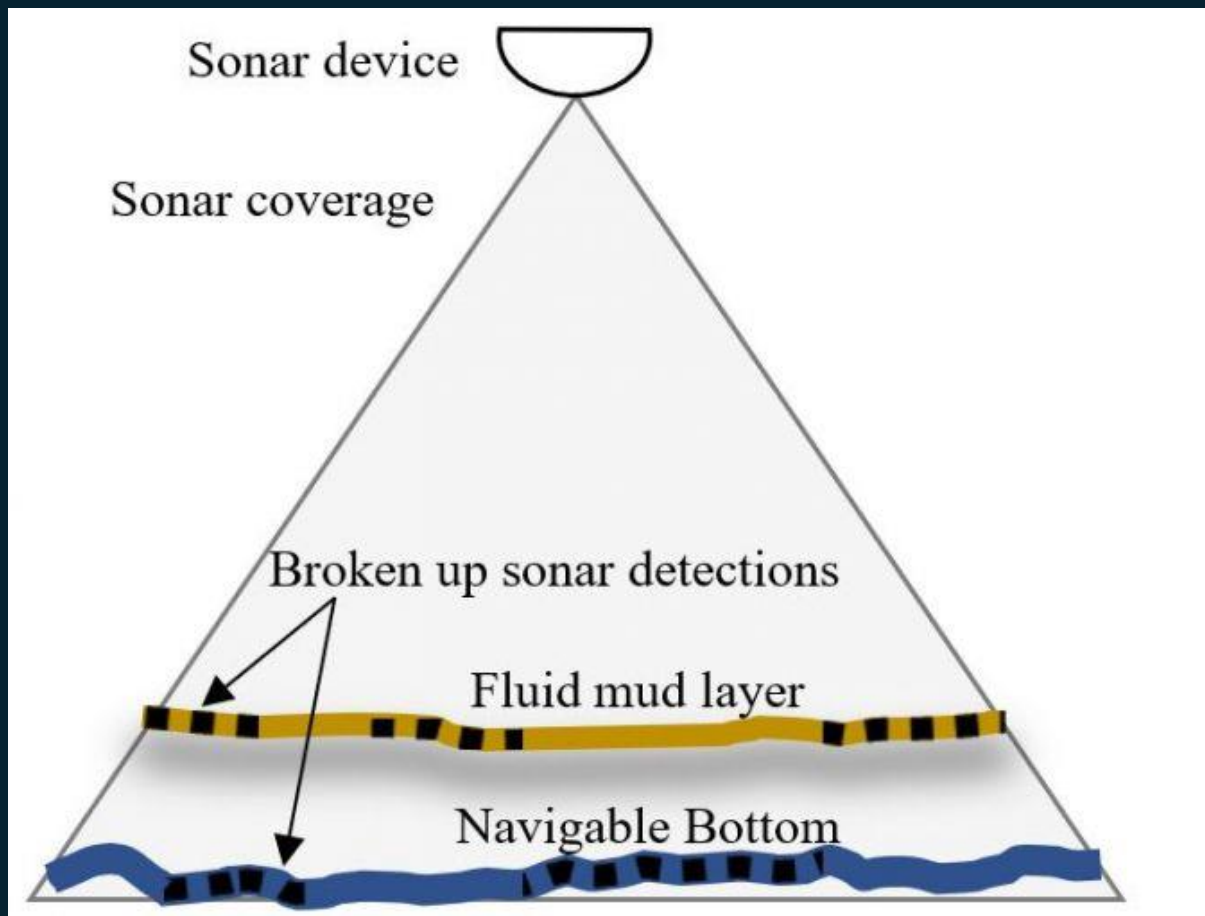
WINGHEAD i87S
LMD-mode

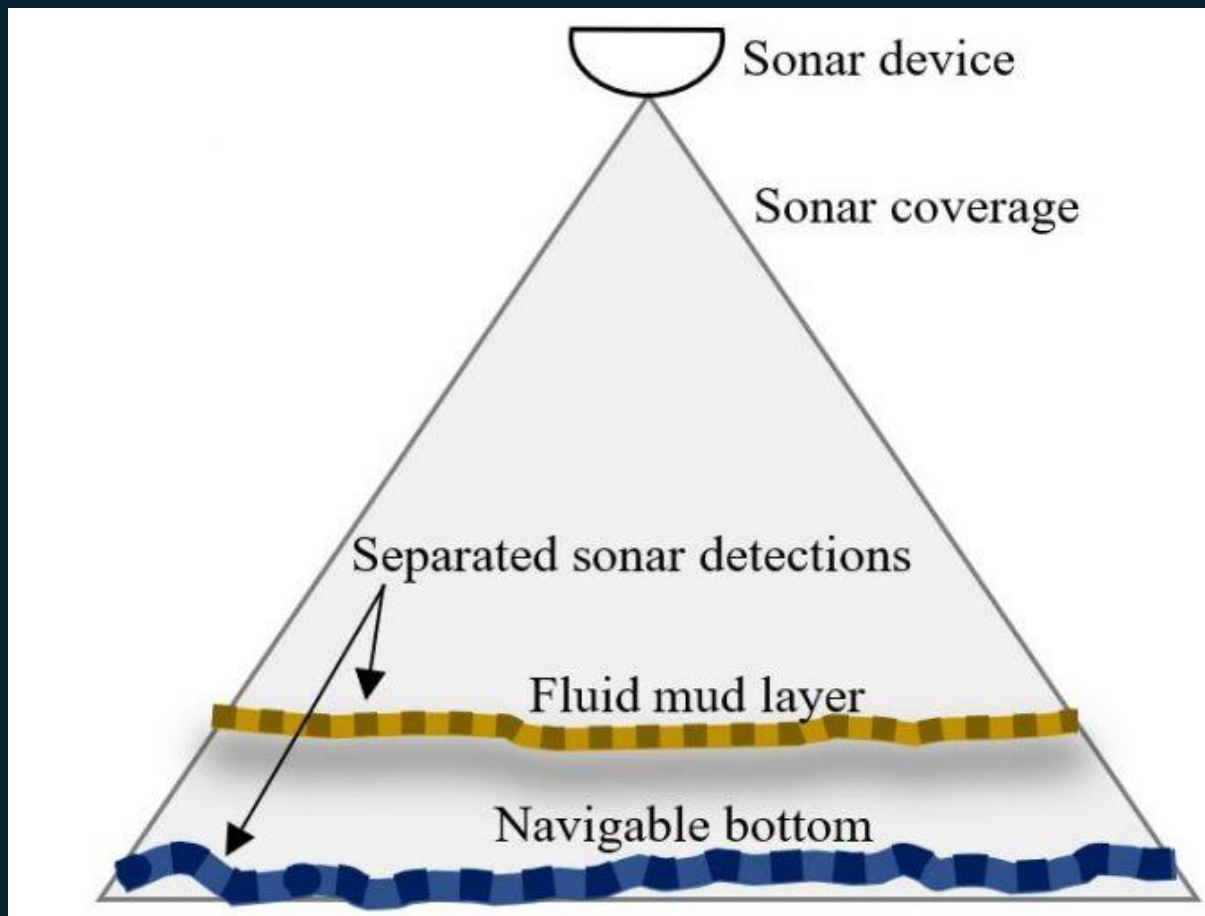


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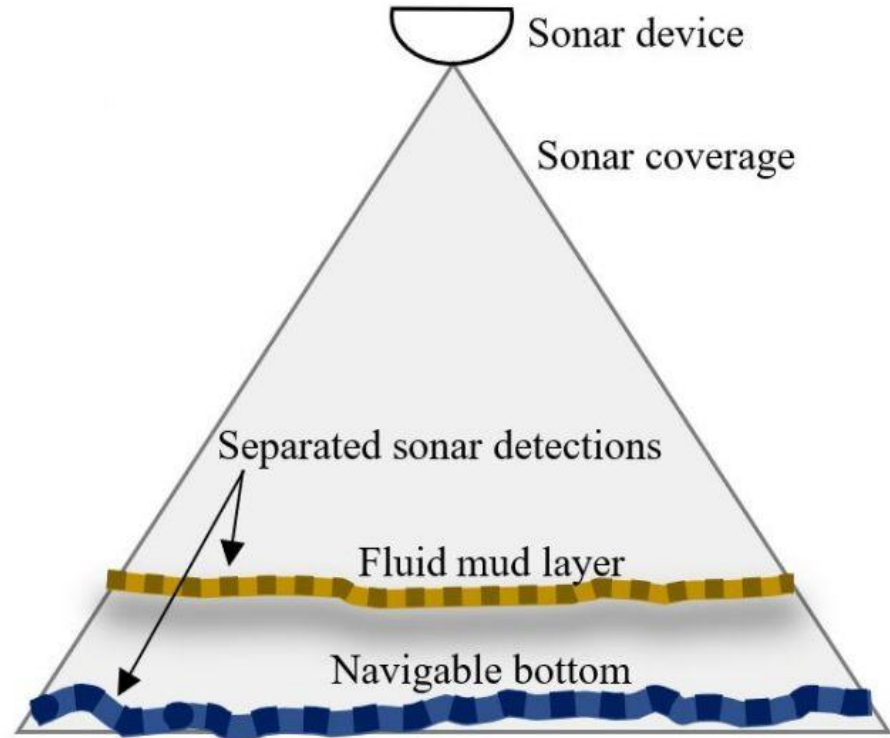
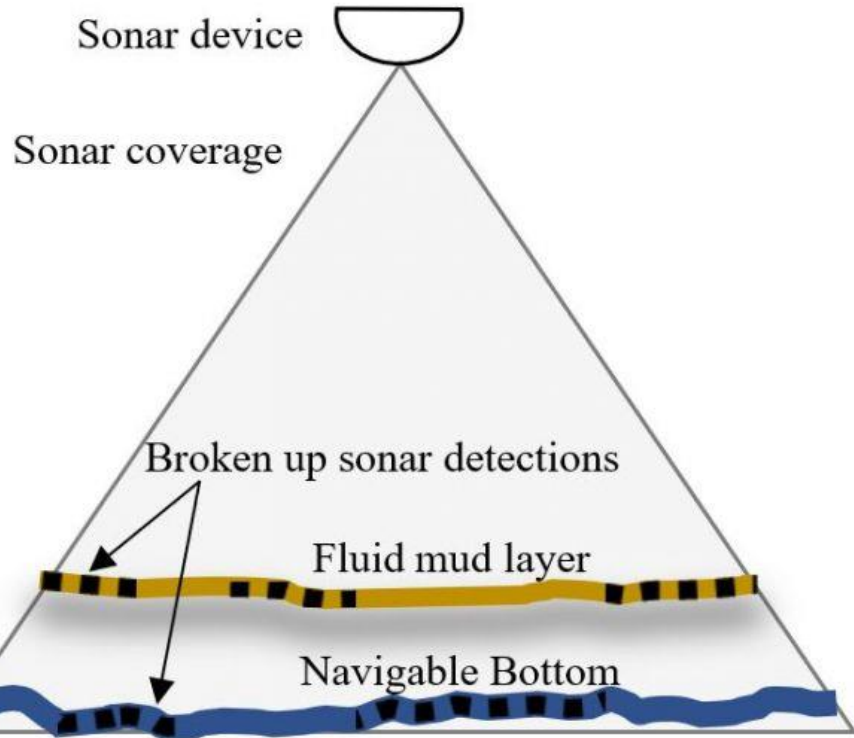
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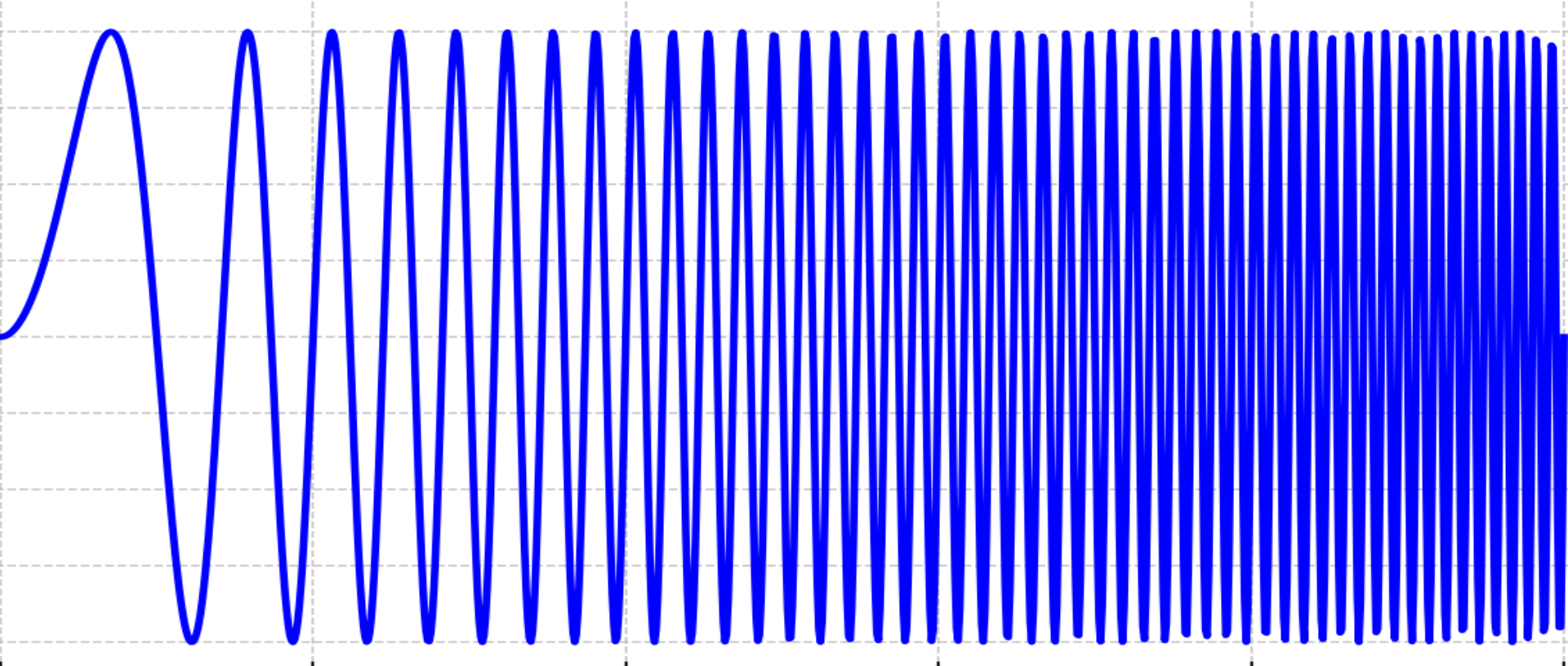




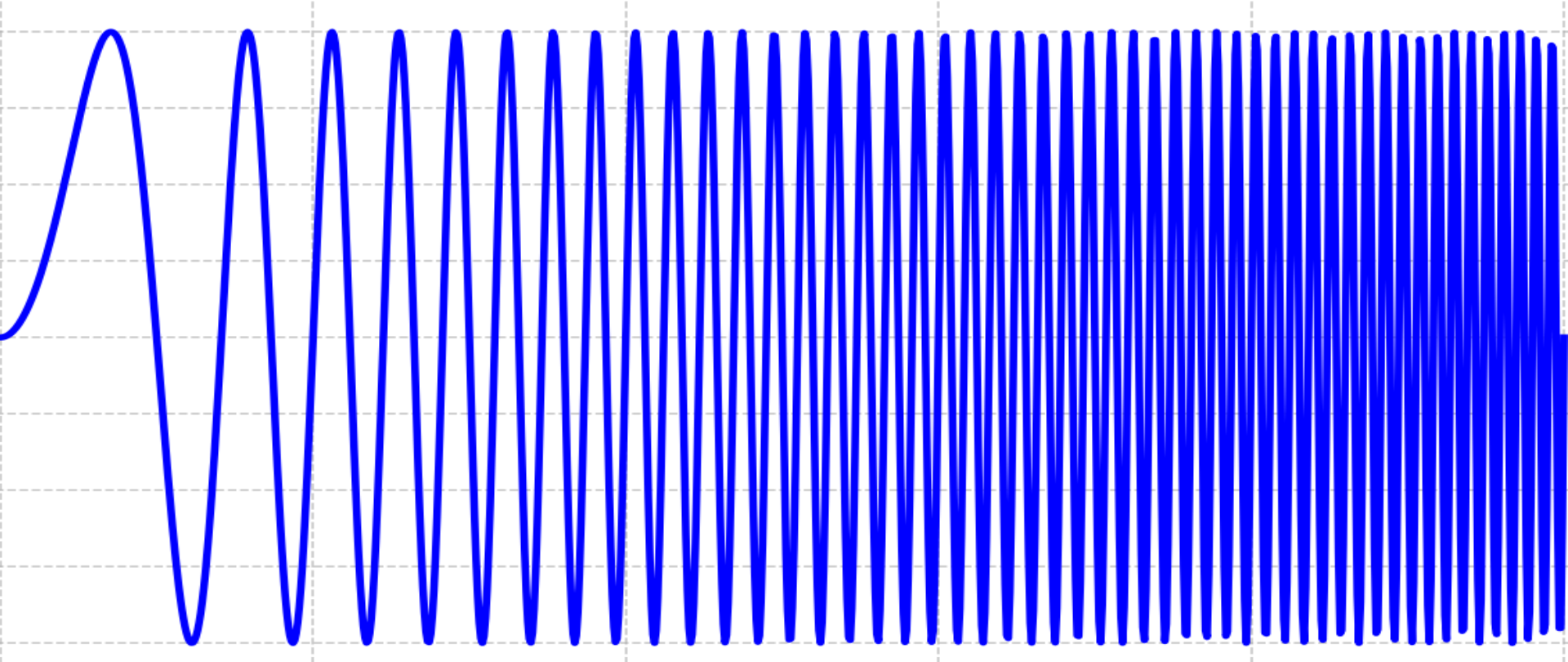
ORBIT

- explore more -





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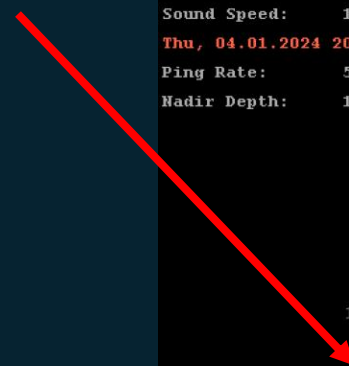
NORBIT
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Sonar Name: 2024-01-04-15_37_33
Sweep Time: 400 μ s
Bandwidth: 40 kHz up
Frequency Range: 350 kHz - 390 kHz
Ping Number: 22229
Sound Speed: 1467.3 m/s
Thu, 04.01.2024 20:40:16
Ping Rate: 5.0 Hz
Nadir Depth: 13.83 m

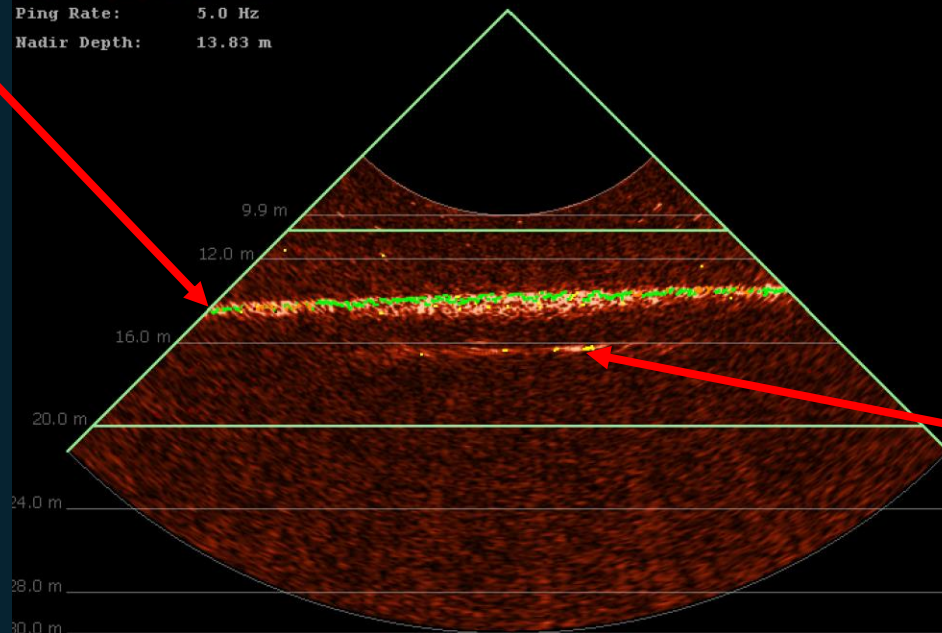


440kHz

Lutocline



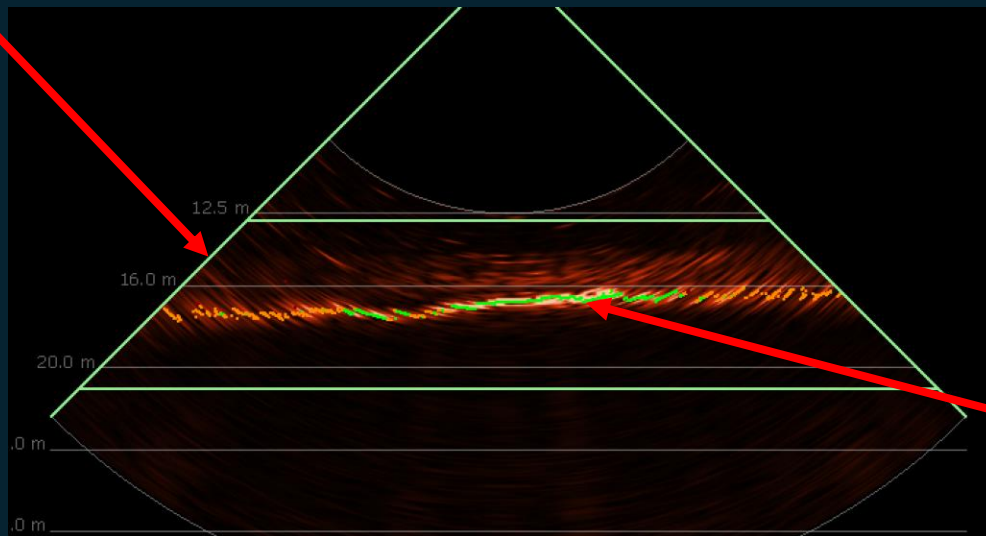
LF Bottom



NORBIT
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Lutocline

90kHz



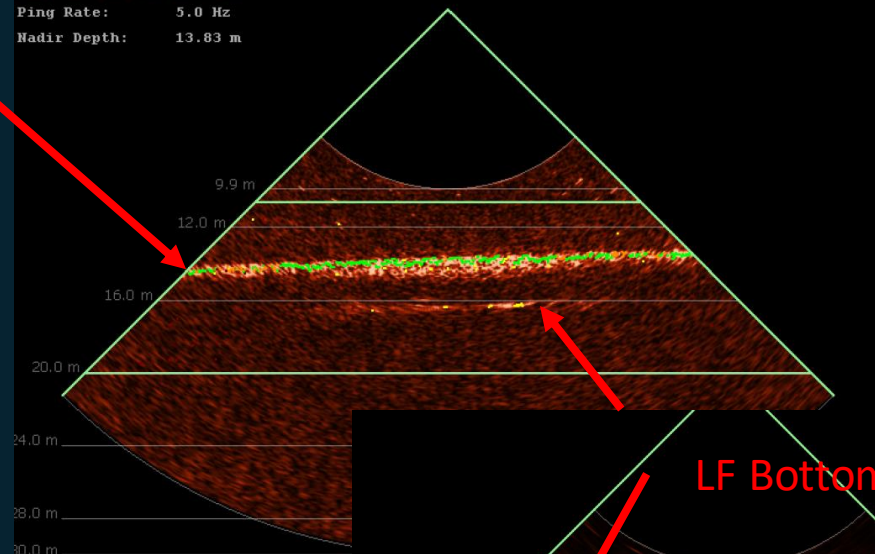
LF Bottom
Sub-lutocline detections

NORBIT
- explore more -

Sonar Name: 2024-01-04-15_37_33
Sweep Time: 400 μ s
Bandwidth: 40 kHz up
Frequency Range: 350 kHz - 390 kHz
Ping Number: 22229
Sound Speed: 1467.3 m/s
Thu, 04.01.2024 20:40:16
Ping Rate: 5.0 Hz
Nadir Depth: 13.83 m

NORBIT®

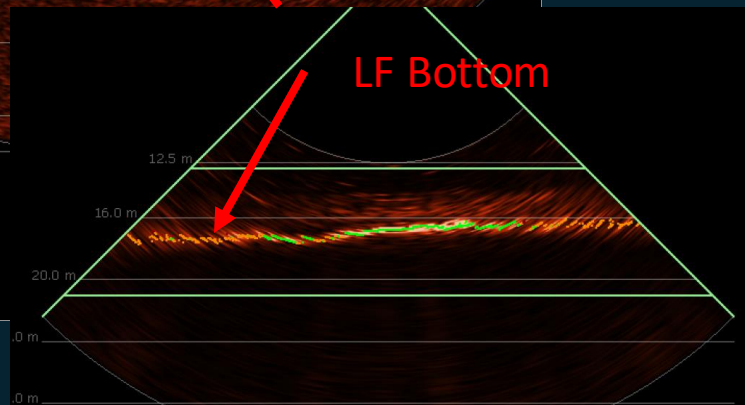
Lutocline



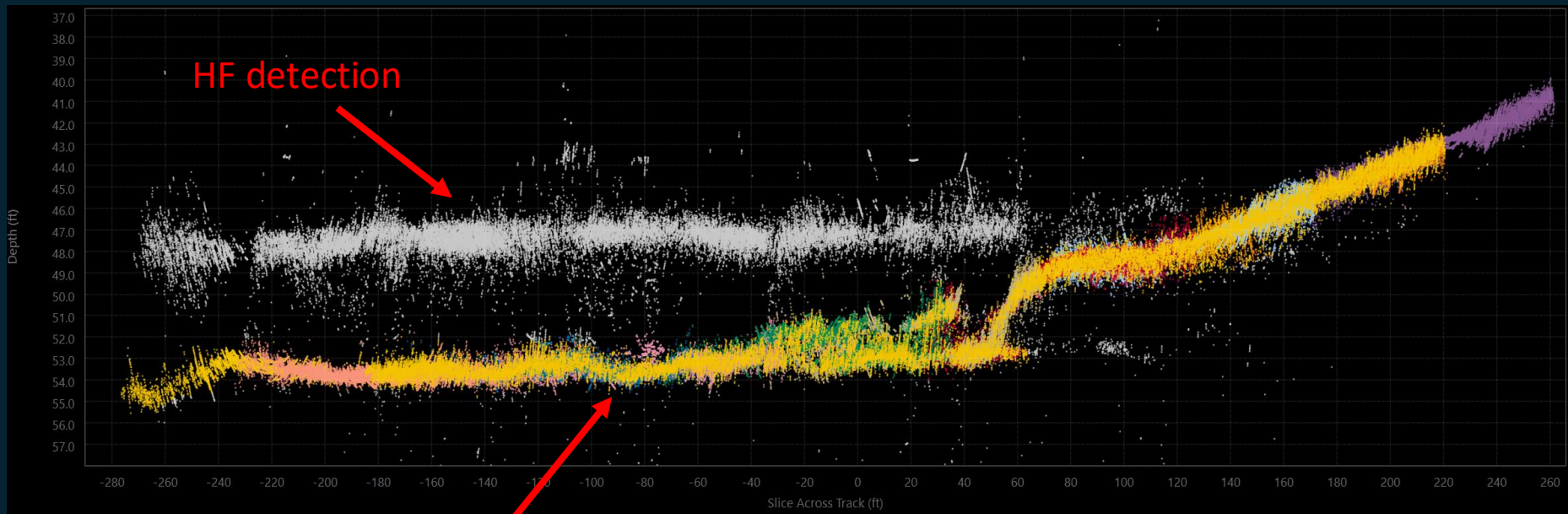
440kHz

90kHz

LF Bottom



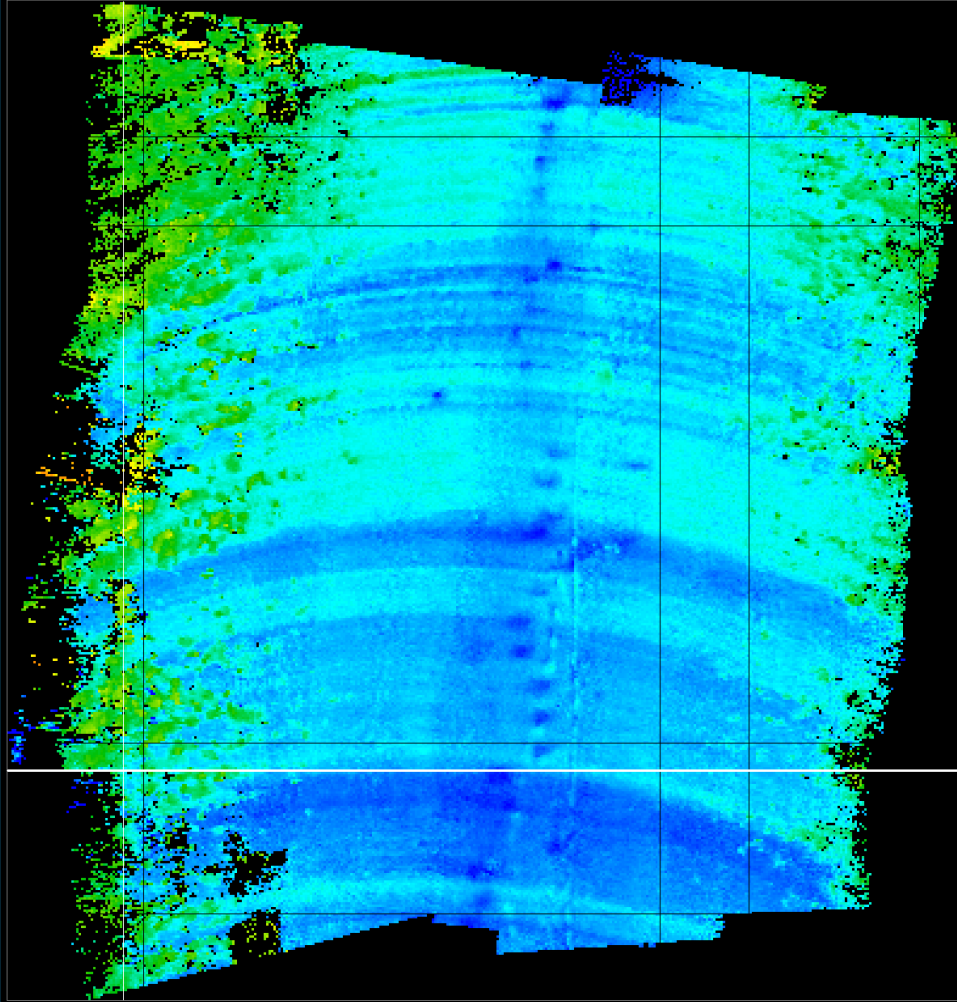
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Survey Matrix = Average

Color By
Depth

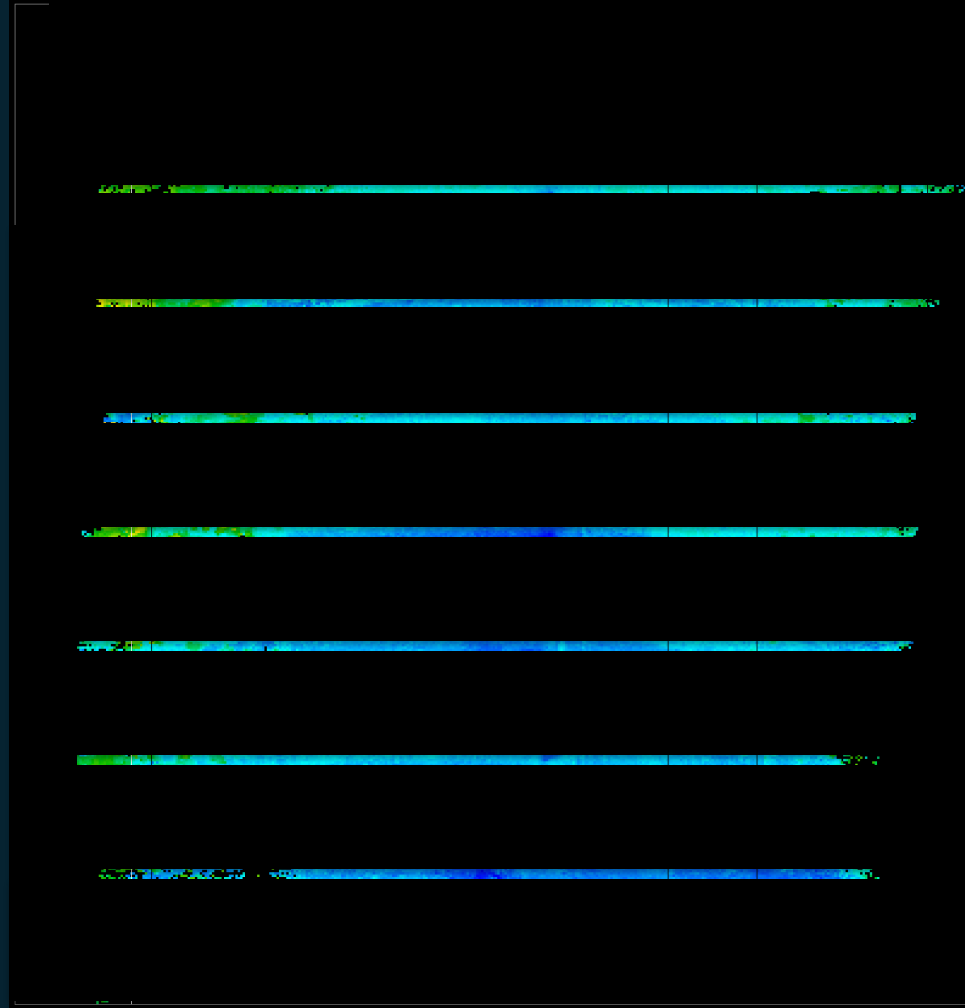
40.0
43.7
47.5



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Survey Matrix = Average

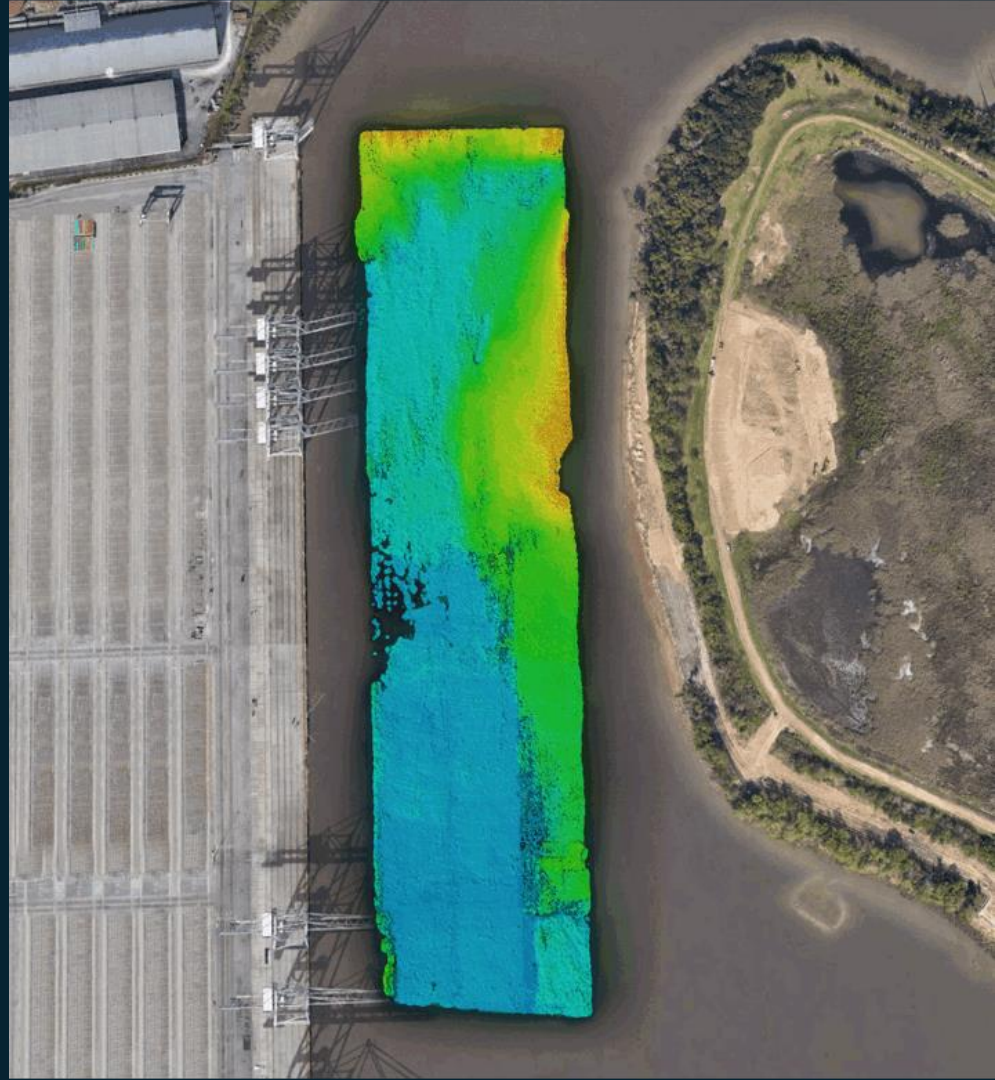
Color By
Depth
40.0
43.7
47.5

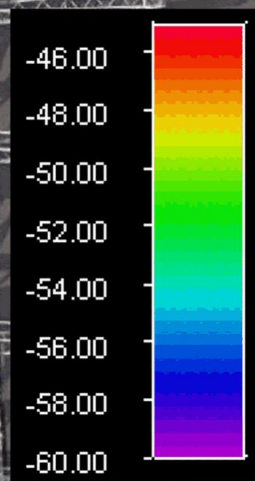


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King's Island Channel
Savannah River, US

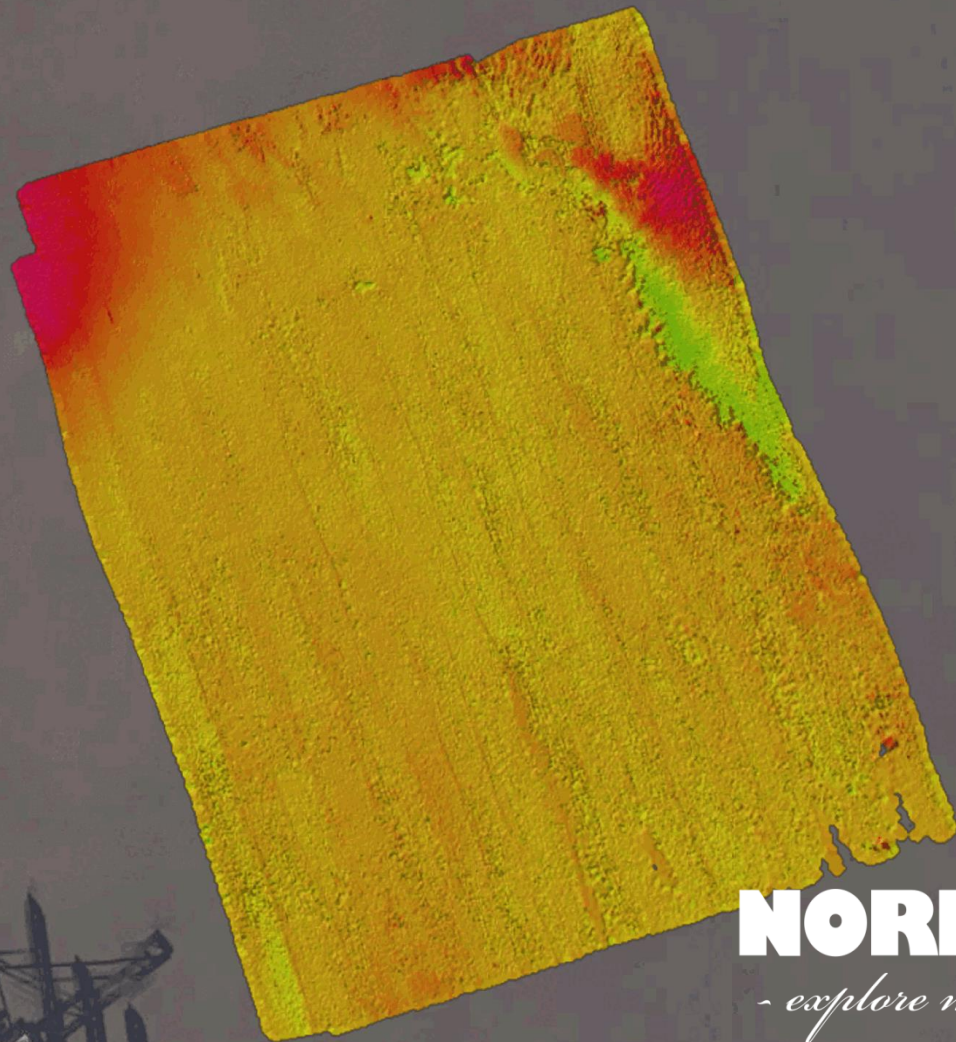
3-4 meters of penetration





Turning Basin
Savannah River, US

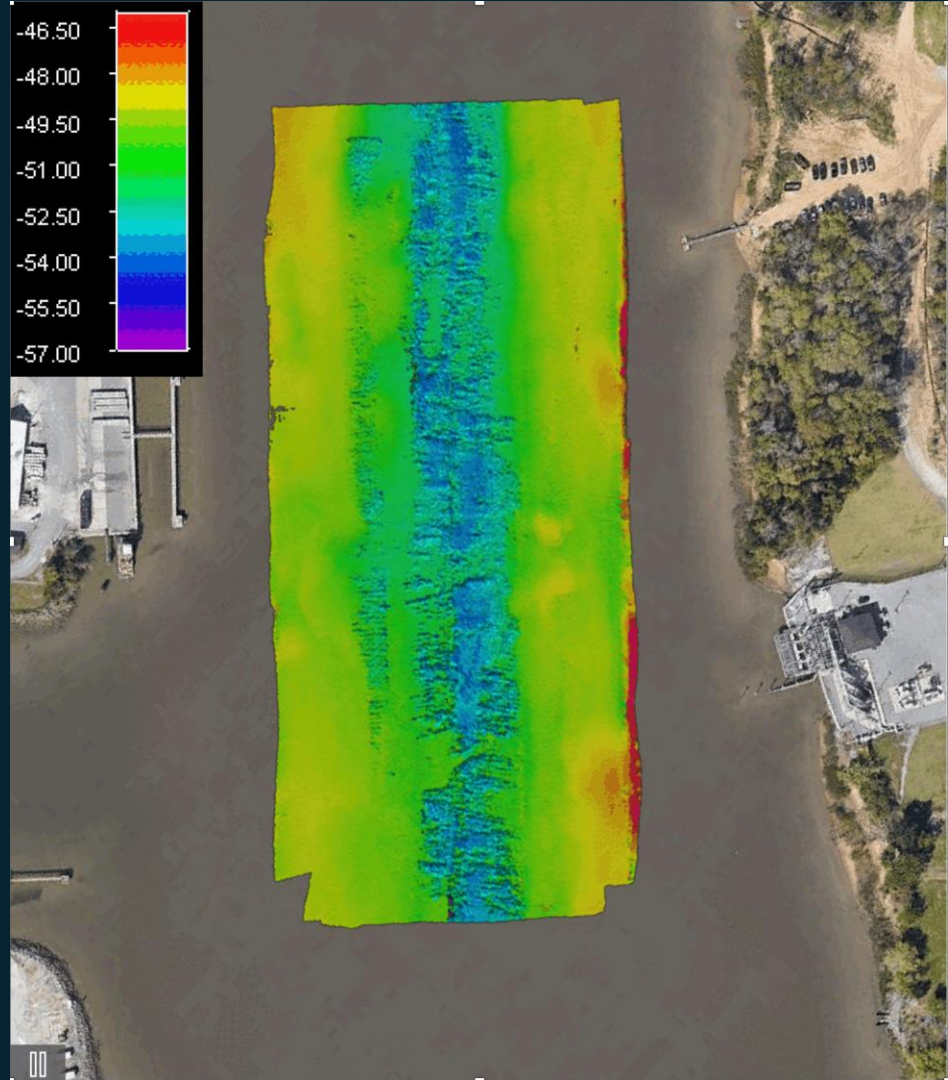
3-4 meters of penetration



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Marsh Island Channel
Savannah River, US

2 meters of penetration



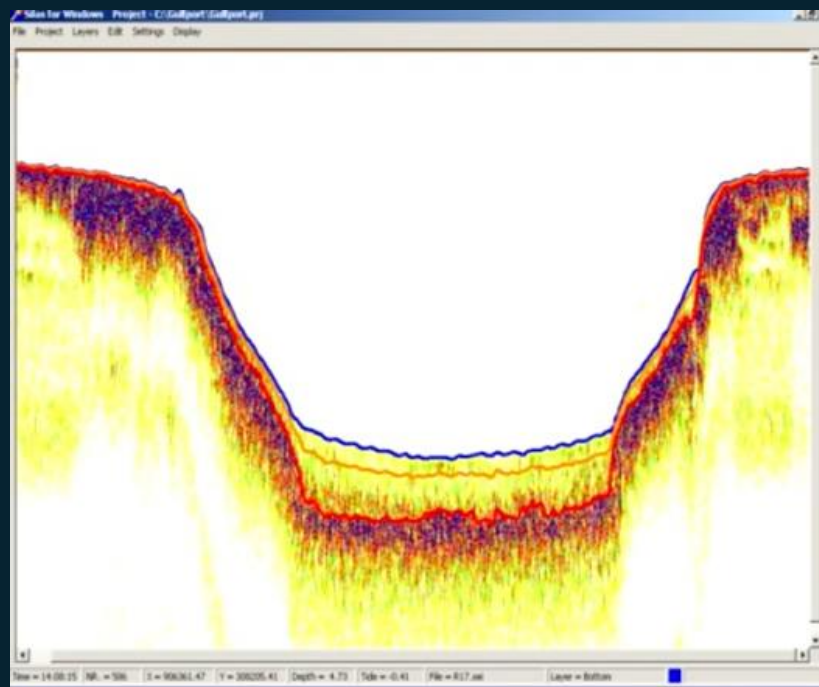


- ORIGINS
- HARDWARE
- PROOF OF CONCEPT
- FIELD VERIFICATION
- REFINEMENT
- TECHNOLOGY DISTRIBUTION

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More challenges

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GULF PORT SHIP CHANNEL
DIGITAL RECORDING OF ODOM ECHOTRACK MK III
24 kHz FREQUENCY

Lutocline – difference in sediment concentration

Navigable bottom – 1200g/l

WINGHEAD i87S
LMD-mode



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A close-up shot of a man with short dark hair and a light beard, looking upwards with a wide-eyed, open-mouthed expression of surprise or awe. He is wearing a dark jacket over a light-colored collared shirt. The background is slightly blurred, showing vertical lines and a soft light source.

Remember this guy...?

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A close-up shot of a man with short brown hair and a light beard, looking upwards with a wide-eyed, open-mouthed expression of surprise or awe. He is wearing a dark blue jacket over a light blue collared shirt. The background is slightly blurred, showing vertical wooden slats on the right and a grey wall on the left.

Remember this guy...?

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LMD
Layered Media Detection