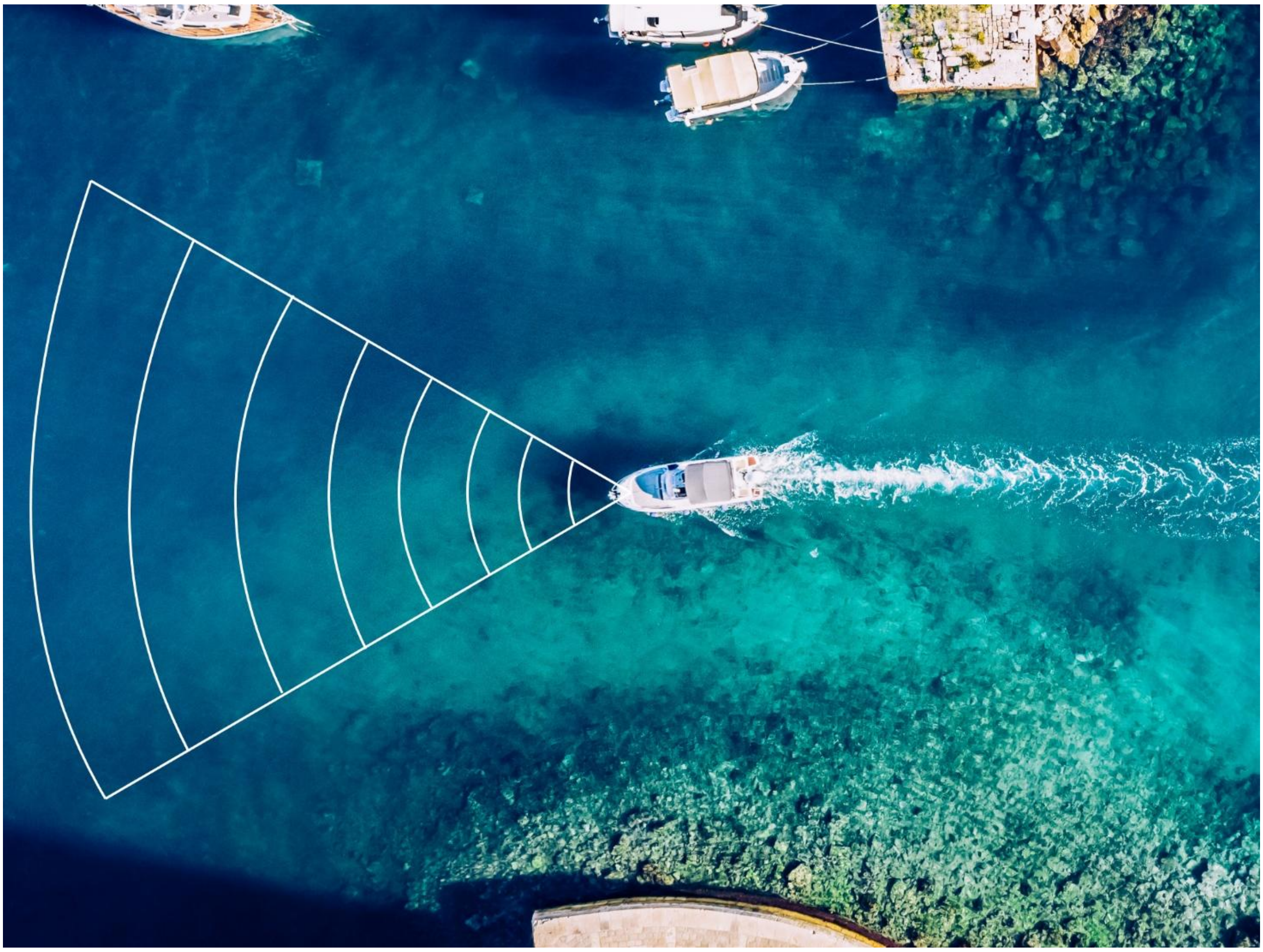
FLS First Time Usage



Forward Looking Sonar is a new and revolutionary way of navigating while sailing. It is a new vital tool to be able to sail and navigate poorly- or uncharted areas with confidence.

With this new tool and technology there are also new learnings curves as Forward Looking Sonar acts differently from other well know sounders like depth sounder, side scans etc.

Forward Looking Sonar acts differently and will take some practice before understanding the visualization that is shown of the Seabed. ¨

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1. Forward Looking Sonar Interference

Forward Looking Sonar uses sound frequencies to coordinate and map out the seabed ahead. These sound frequencies can be affected by physical and environmental factors.

1. **Acoustic reflections from nearby structures**

When the boat is close to quay walls, pilings, or other vessels, the sonar pulses ("pings") bounce off multiple hard surfaces at different angles and distances. These reflected echoes arrive back at the transducer at slightly different times and directions, causing overlapping or confusing returns. The system interprets these mixed echoes as "noise," which leads to an unstable image.

2. **Turbulence and air bubbles**

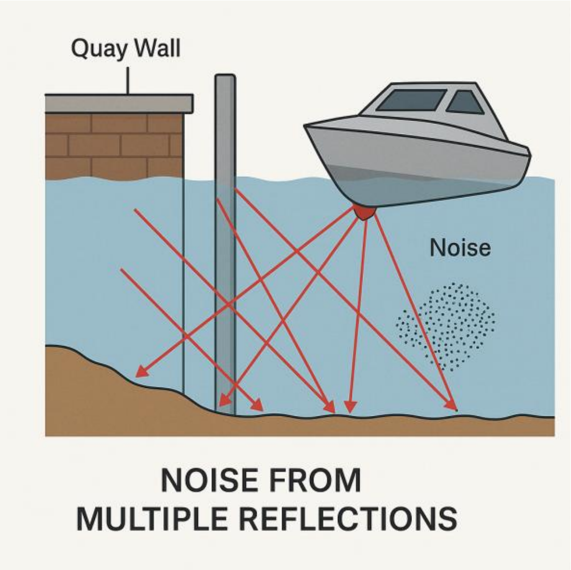
Harbours often have disturbed water—propeller wash, currents, and aerated water from other boats. Air bubbles and turbulence scatter and absorb the sonar signal, preventing some of the sound energy from reaching or returning from the seabed. This reduces the clarity and consistency of the sonar image.

3. **Interference from other sonar systems**

Many vessels in a harbour may be running depth sounders or fish finders that operate on the same 200 kHz frequency as the FLS. These overlapping signals create acoustic interference, resulting in unstable or noisy returns on the display.

4. **Real-time operation characteristics**

The FLS 3D is a "real-time sonar," not a historical recorder like a fish finder. It updates the entire image roughly once per second, and because every ping interacts slightly differently with moving water and reflections, consecutive frames will rarely look identical. This normal behaviour can appear as an unstable picture when stationary.



In summary:

the combination of multipath reflections from nearby structures, turbulence and air bubbles, interference from other sonars, and natural biological noise all contribute to an unstable sonar image. For best performance, testing and calibration should be done in open, calm water with minimal nearby acoustic clutter.

2. Approaching Vertical Wall:

When you approach a vertical wall (such as a quay wall) with the Forward Looking Sonar (FLS 3D), the sonar image will not show it as a perfectly upright, solid surface. Instead, you'll see a slanted or "soft-edged" red area indicating the wall, and often returns appearing behind it.

This happens due to how sonar beams behave and how the FLS interprets reflected signals.

1. **Beam geometry and reflection angle**

The FLS 3D emits sound waves in a fan-shaped pattern—about 60° wide horizontally and 90° from straight ahead to straight down.

When these waves strike a vertical wall 30 m ahead, most of the sound is reflected sideways, not directly back to the transducer. Only a small portion returns, and usually from different depths and angles, so the sonar cannot define a sharp vertical edge.

2. **Limited angular resolution**

The system interprets distance based on time of echo return. If the surface is vertical, echoes from the top and bottom of the wall arrive at very different times and angles. The sonar "spreads" these into a sloping or curved feature instead of a vertical one.

3. **Range vs. display depth**

When your range is set to 50 m but the wall is at 30 m, the sonar still continues to send and listen for echoes out to 50 m. After the wall reflects most of the energy away, the sonar may pick up weaker, scattered echoes from behind or above the wall (surface reflections, suspended particles, or reverberation).

These are then displayed as faint returns "behind" the wall—even though, physically, the sonar cannot see through it.

4. **Multipath and reverberation**

In confined areas, sonar pulses can bounce multiple times between the wall, the seabed, and the hull before returning. These delayed echoes appear as secondary or false returns beyond the real structure, giving the illusion of something behind it.

5. **3D interpolation effect**

The FLS 3D continuously interpolates between multiple beams to form the 3D image. When there's a sudden stop in echo energy (like a solid wall), the software smooths the edge, causing it to appear as a slanted or semi-transparent layer instead of a solid barrier.

In Summary:

The FLS 3D cannot display a vertical wall as a perfect "flat stop" because of the way acoustic beams reflect, the viewing geometry, and echo processing. The system interprets some scattered reflections and multipath echoes as signals from "behind" the wall—but in reality, these are ghost or secondary returns, not real objects beyond it.

3. How Forward Looking Sonar is affected by the movement of the boat:

When using Forward Looking Sonar (FLS 3D), the movement of the vessel through the water has a strong influence on how the sonar image appears. Because the sonar transducers are fixed in the hull, every change in the boat's angle or speed changes how the sound waves travel and reflect. This can make the picture appear unstable or uneven — even though the seabed itself is not changing.

1. **Pitching and Rolling**

As the boat moves through waves, the bow rises and falls (pitching) and the hull rocks from side to side (rolling).

Since the transducers are rigidly mounted, these motions cause the sonar beams to sweep up and down with each movement.

The result is that the seabed may appear to rise and fall, or the image may "breathe" slightly from one frame to the next. This is completely normal and simply reflects how the sonar's field of view changes with the boat's motion.

2. **Heeling Under Sail**

When the sailboat heels over in the wind, one transducer (on the lower side) moves deeper into the water while the other lifts closer to the surface.

The deeper transducer often gives a stronger echo return, while the shallower one can be affected by turbulence and air bubbles.

The FLS 3D combines data from both transducers to create the 3D image — so when one side is weaker, the image can appear slightly tilted or distorted.

Once the boat levels out again, the picture returns to normal.

3. **Speed and Water Flow**

At higher speeds, water flowing along the hull becomes more turbulent. Air bubbles or disturbed water scatter the sonar pulses and reduce how far the sonar can see.

The FLS 3D works best when the transducers are placed where there's a clean, smooth flow of water — even when the boat is moving quickly.

If turbulence or prop wash reaches the transducers, parts of the image may briefly disappear or turn noisy.

4. **Turning**

When the boat turns, the sonar beams continue to point straight ahead of the hull, but the direction of travel curves.

This means the sonar begins to "look" slightly to one side of the turn.

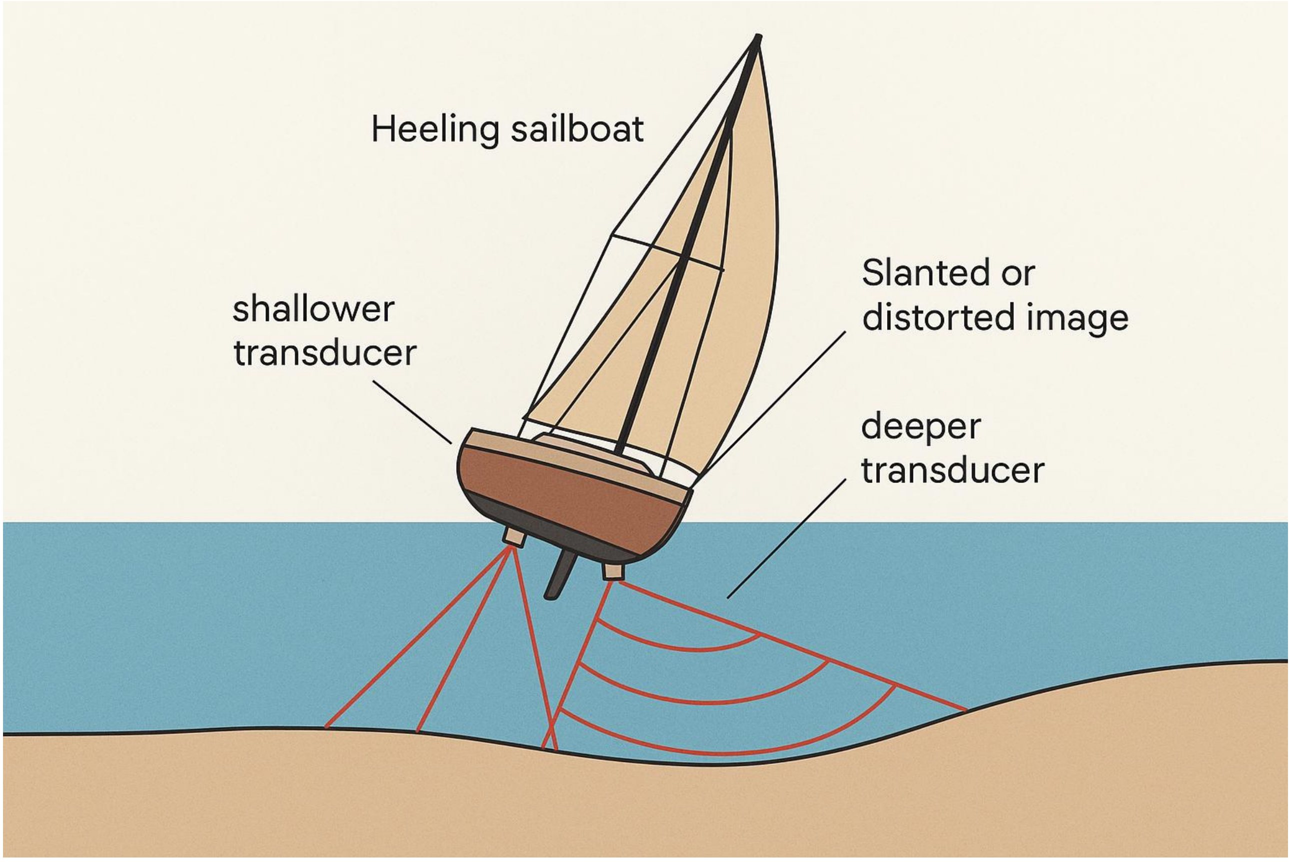
On the display, the image can appear to stretch or smear sideways for a few moments until the boat straightens up.

5. **Real-Time Picture**

The FLS 3D is a real-time sonar. It updates roughly once every second and does not keep a rolling history like a fish finder.

Because each ping is unique and the boat is always moving, no two frames will ever look exactly alike.

This small variation gives the display a “lively” look — which is a normal part of real-time forward sonar operation.



4. How Average Forward Depth Works:

The Average Forward Depth feature gives the skipper a quick, simplified indication of how deep the water is ahead of the vessel — not directly under the keel like a traditional depth sounder. It helps anticipate whether the seabed is rising, falling, or staying level as you move forward.

You’ll see this value displayed at the top left corner of the screen, next to the range indicator.

1. **What the Forward Looking Sonar Actually Does**

The Forward Looking Sonar continuously sends out short sound pulses, called pings, in a fan-shaped beam that spreads about 60° horizontally (port to starboard) and 90° vertically (from straight ahead to straight down).

Each ping travels through the water, reflects off the seabed or other underwater surfaces, and returns to the transducers.

By measuring how long the echo takes to return — and using the known speed of sound in seawater (~1500 m/s, adjusted for temperature and salinity) — the system calculates the distance to that surface.

2. **How the FLS 3D Builds Its Depth Picture**

Within the sonar's 60° forward "view cone," hundreds of tiny depth measurements are taken at different angles and distances for every ping.

Each measurement gives one point on a 3D map of the seabed ahead.

The FLS 3D then interprets all these return points to form a full 3D image — with shallow areas in red and deeper areas in blue on the colour scale.

3. **The "Average Forward Depth" Calculation**

Instead of showing every small bump or dip numerically, the FLS 3D computes a single average depth value for the whole forward view area.

Here's how it works conceptually:

It identifies all valid seabed echoes within the current sonar cone (for example, 60° wide × user-selected range).

It filters out invalid or weak echoes (e.g., from bubbles or floating objects).

It averages the depth values of all remaining points within that area.

The resulting number — the Average Forward Depth — is displayed as a simple readout.

Mathematically, it's the mean of all detected depth values within the active sonar range ahead of the vessel.

4. **What the Value Tells You**

It gives a general trend of the seabed in front of you — whether it's shoaling, flat, or deepening.

Because it's an average, it "smooths out" small irregularities or rocks and focuses on the overall depth profile.

It's most helpful when entering shallow or unfamiliar waters, where you want a quick sense of how much depth lies ahead.

Think of it as a "headline number" for what the sonar sees in front — not the full story, but an excellent early warning.

5. **Limitations and Accuracy**

The accuracy depends on how well the transducers are aligned (must be vertical) and how clean the water flow is.

Heavy turbulence, bubbles, or steep slopes can distort the average slightly, since they affect which echoes are returned.

The user's range setting also matters: a shorter range gives more detailed but smaller-area averages; a longer range averages over a wider, less detailed zone.

6. **In Practice**

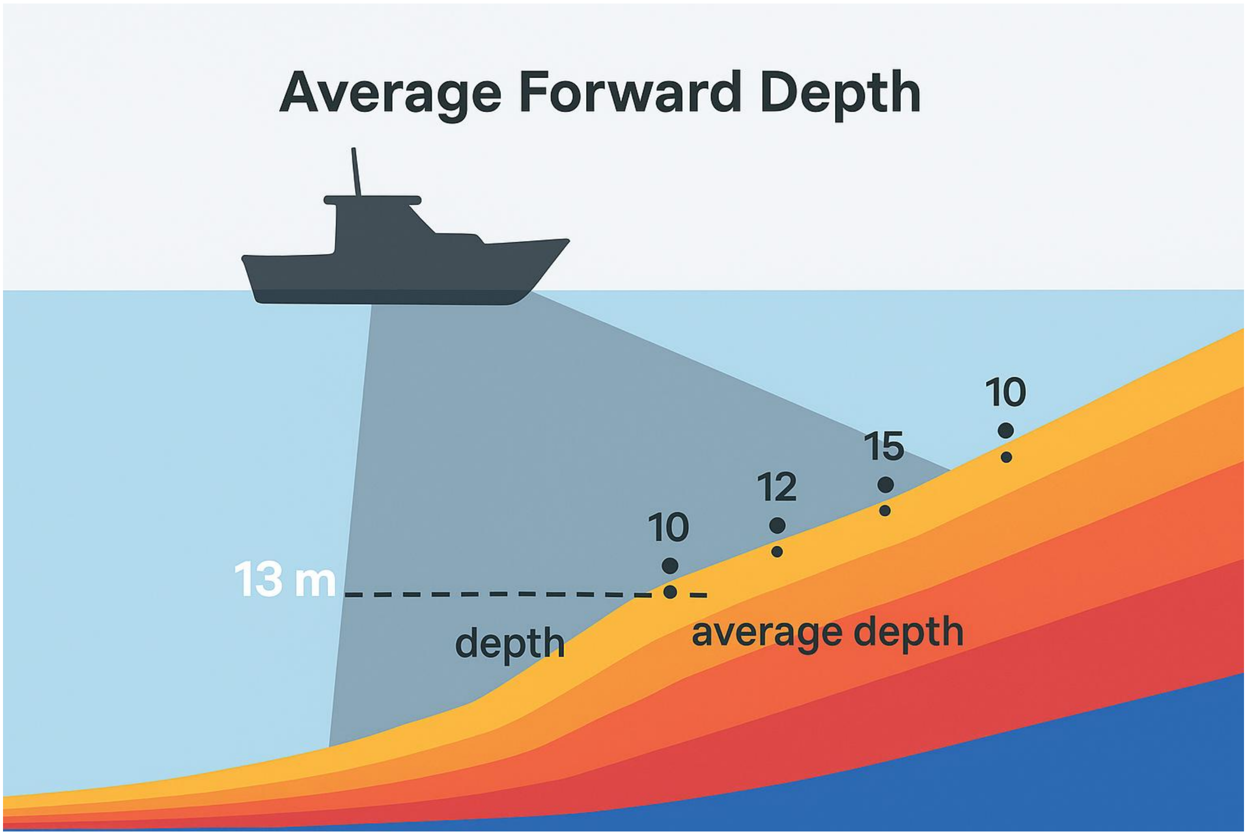
When you're moving slowly ahead:

If the Average Forward Depth number decreases steadily, the seabed is rising or you're heading into shallower water.

If it increases, the seabed is sloping away.

If it fluctuates slightly, that's normal — it reflects natural variations in seabed shape and sonar beam coverage.

Used together with the 3D colour display, it gives you an instant, reliable sense of what's coming next under the waterline.



5. Tips for training of Forward Looking Sonar:

The Forward Looking Sonar gives a unique "live view" of what lies ahead — but interpreting that image accurately requires time and practice. The following steps help captains develop confidence and skill with the FLS 3D system.

1. **Start in Familiar Waters**

Begin by training in areas where you already know the underwater layout — such as a marina approach, or a well-charted anchorage.

Compare what the sonar shows with what you already know from charts or experience.

Note how hard surfaces (quay walls, rocks) and soft seabeds (mud, sand) look different in colour and shape.

This helps you calibrate your eye to what "real" targets look like on the FLS 3D display.

2. **Practice with Clear, Predictable Targets**

Use a quay wall, mooring buoy, or rock ledge to practice. Move slowly toward it while changing the range setting.

Observe how the target first appears faint, then grows stronger and more defined as you approach.

Notice how reflections change with the boat's angle and how the sonar's perspective updates in real time.

This builds understanding of how distance and beam angle affect the picture.

Practice around clear targets such as a quay wall to learn interpretation and range perception.

3. **Experiment with Range Settings**

The FLS 3D can display from 40 to 200 meters ahead.

In shallow areas, use shorter ranges (40–60 m) for detail.

In open water, use longer ranges (100–200 m) to plan ahead.

Changing range affects how "compressed" the display looks — captains should practice adjusting range dynamically to match the situation.

4. **Learn the Colours and Depth Scale**

The depth scale uses colour to show relative depth: red = shallow, blue = deep.

Practice correlating these colours with the seabed contour and the vessel's own depth sounder.

This helps you quickly spot shoaling or rising ground before it becomes dangerous.

5. **Observe Under Different Conditions**

Train in various conditions to learn how the sonar behaves:

Calm vs. choppy water: notice how small waves or air bubbles can create temporary noise.

Still vs. moving boat: when stationary, returns fluctuate more; when moving slowly ahead, the picture stabilizes.

Tidal currents: reflections may shift slightly due to moving water.

The goal is to recognize which image variations are due to real seabed change and which are environmental effects.

6. **Practice Maneuvering by Sonar Alone**

Once familiar, try slow-speed maneuvers (1–2 knots) using only the sonar image to "feel" your way toward a target.

Keep a lookout for visual confirmation to stay safe, but use the sonar as your main reference.

This develops instinctive timing — knowing how quickly new information appears and how to interpret echo shapes.

7. **Stay Aware of Limitations**

Remember that the FLS 3D is a real-time sonar, not a history recorder. Each ping gives a new snapshot, so the image will never look completely still or identical from one second to the next.

This natural variation should be seen as normal live feedback, not a fault.

8. **Combine with Traditional Seamanship**

Use the sonar as an aid — not a replacement — for visual navigation, charts, and depth sounders.

The best captains use all available inputs together: eyes, instruments, and experience.

Forward Looking Sonar adds a valuable real-time window ahead, but judgment always belongs to the person at the helm.