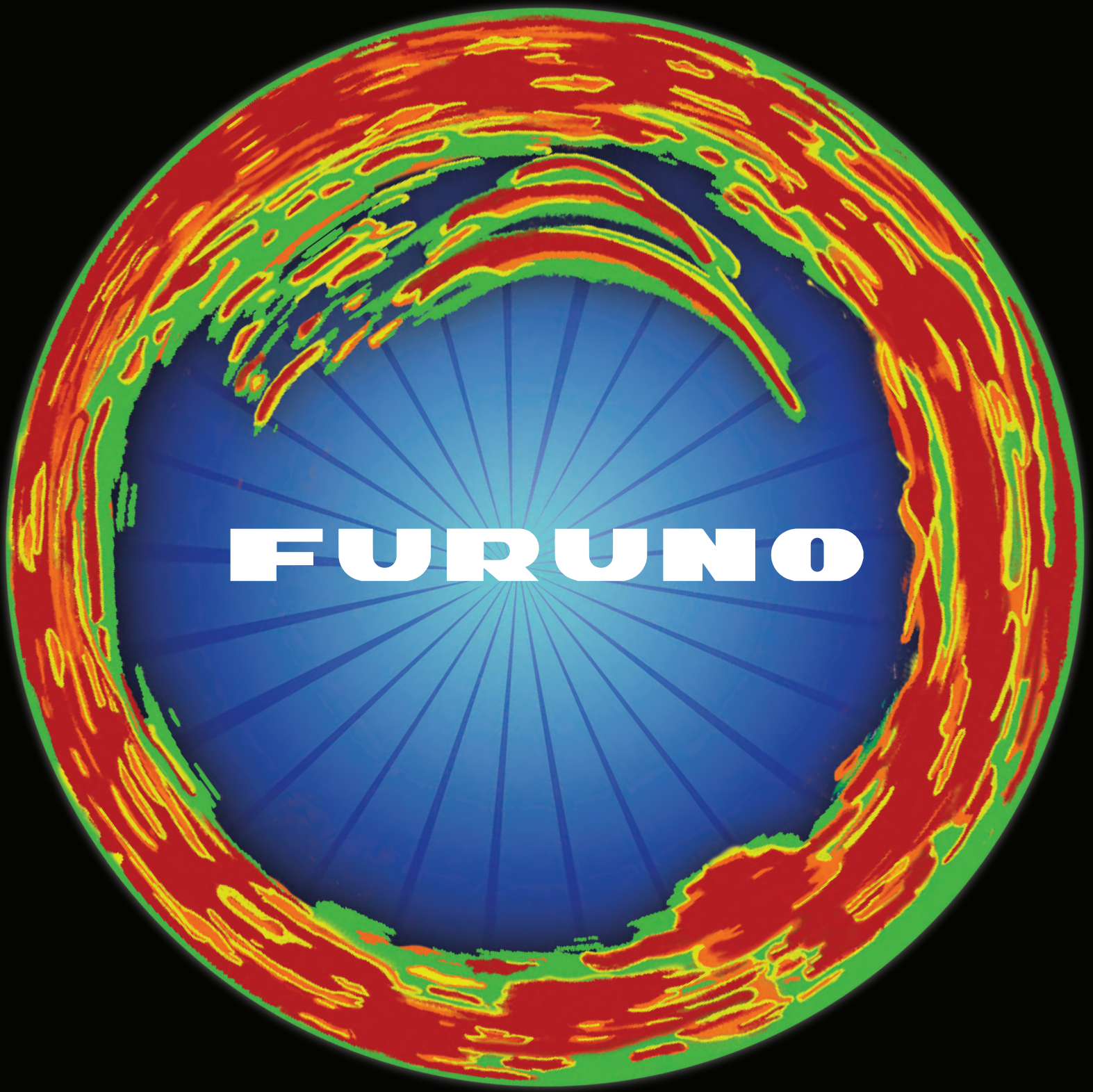

Complete Angler's Guide to Sonar

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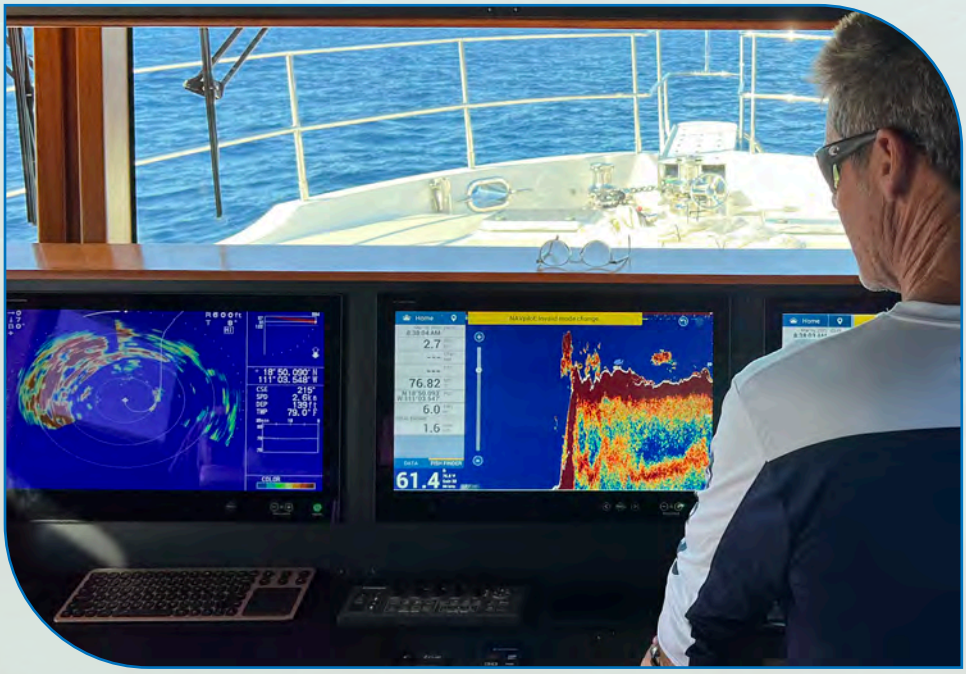


Furuno's award-winning Sonars are relied upon by both working fisheries boats and high-end sport fishing vessels, and are used in commercial fishing operations around the globe. If you're looking for a sonar to make your fishing operation more efficient and productive, the choice is clear...

FURUNO

Revised September 2023

What is a Sonar?

Sonar: Derived from the words Sound Navigation and Ranging, Sonar is an apparatus that uses reflected sound waves to detect and locate objects underwater.

Sonar is used on a variety of large and medium-sized fishing vessels, such as purse seiners, bonito ships, and trawlers, to see fish and structure in all directions around the vessel. To ensure effective usage of Sonar, the crew will often undergo specialized training to interpret the display accurately. Experienced operators can distinguish between different fish species based on their echo patterns, depth, and location, helping to target specific types of fish and avoid unintentional bycatch. Recently, some Sonars have been installed on smaller center-console fishing boats to help them target fast-moving species like tuna and billfish, giving them a distinct edge on tournament competition.

Many people think of their Fish Finder as a Sonar, and while the two are similar, there is much, much more to the story. Before we dive into what a Sonar is, let's talk briefly about what a Sonar *isn't*.

Sonars and Fish Finders work on the same basic operating principles. Sound waves are emitted from a transducer and the return echoes are used to determine the location of objects, such as fish and structure. Unlike Sonar, however, your Fish Finder can detect objects only in a cone-shaped area directly beneath the ship. Think of a Fish Finder as a flashlight that only points down.

A true Sonar can detect objects in the entire 360° area around the ship, not just beneath it, making it one of the most efficient way to search for fish. Think of Sonar as a searchlight that you can point in any direction you choose, one that can detect and display the distribution, density, and movement of fish schools in all directions around your vessel.

The Sonar is usually represented on the display as a point at the center (the boat), surrounded by echoes in a circle around the ship. Sonar is further divided into 2 distinct categories: Searchlight Sonar, and Scanning Sonar. We'll dive into this more in a bit, but first, let's talk a little more about what they have in common.

The Essence of a Sonar Transducer

A Sonar transducer is more sophisticated than that of a typical Fish Finder, but they operate on the same principles. Essentially, a transducer is a series of piezoceramic elements that create sound waves. When voltage is applied, the elements distort and reform their shape in very rapid succession - they vibrate. This vibration occurs at a specific frequency and creates compression waves, or acoustic energy - sound waves. These waves travel outward from the element in a cone-shaped pattern and encounter targets along the way.

As this acoustic energy encounters targets such as fish or bottom structure, some of the beam will be attenuated (absorbed by the target), some will be scattered, and some will be reflected back at the transducer as an echo. As those reflected echoes strike the transducer, they cause a minuscule distortion in the shape of the crystal. This distortion of the crystal creates a small fluctuation of voltage, which can be detected and processed by the Sonar. The result is an image on your display.

By measuring the time from when the sound wave is generated to when the return echo is received, we can learn the distance at which a target is encountered. The strength of the reflected echo can tell us about the size and density of the target. Because we know the direction in which the original sound wave was sent, we can determine the bearing of the target from its reflected echo.

Frequency demystified

Sonar are available in many different frequencies, some of which are better suited for finding particular species of fish than others. The frequency of a Sonar refers to the number of sound waves that radiate from the transducer each second. Sound waves are made up of high pressure and low-pressure pulses traveling through a given medium. The wavelength of sound is defined as the distance between two successive high-pressure pulses or two successive low-pressure pulses. For example, when an electrical pulse is applied to a 38kHz transducer the element vibrates at a frequency of 38,000 cycles per second – that is, 38,000 individual sound waves are transmitted every second. Generally speaking, higher frequencies deliver better results for smaller species and distances nearer the vessel, while lower frequencies are better for long-range searches.

Searchlight Sonar

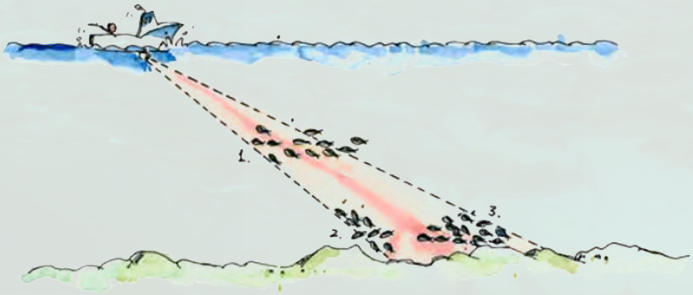
Searchlight Sonar, sometimes called PPI (Planned Position Indicator) Sonar, is designed to display underwater information in a 360° view around the vessel in steps of about 6°. By constantly rotating and tilting the sensor, Searchlight Sonar detects and displays information such as schools of fish and sea currents around the vessel. The Sonar's ultrasonic beam can be tilted and trained to any angle and bearing you desire, illuminating what it 'sees' and showing you the results on the display, just like using a searchlight to look through the water. It is often installed on small fishing boats and can even be found on recreational boats.

The cutaway shows the inside of a typical Searchlight Sonar dome. The transducer within can be rotated and trained to detect fish and structure at any angle beneath the waterline.

Searchlight Sonar sends ultrasonic waves from the transducer to the seabed, where the echoes are reflected back to the transducer. As soon as the ultrasonic waves are sent, the Sonar immediately switches to the receiving state and listens for the returning ultrasonic echoes. The angle of the sensor then shifts as the next ultrasonic wave is transmitted, and the cycle is repeated.

By emitting ultrasonic waves, listening for the echoes, and then rotating the beam in steps to repeat the process, Searchlight Sonar can detect schools of fish with good precision. However, its fairly narrow detection angle means that it takes a considerable amount of time for the sensor to complete a full rotation, and as the boat is moving, some areas might stay undetected.

While the overall detection speed is slow, the reduced size of the sensor makes it possible to install most Searchlight Sonars on small boats.



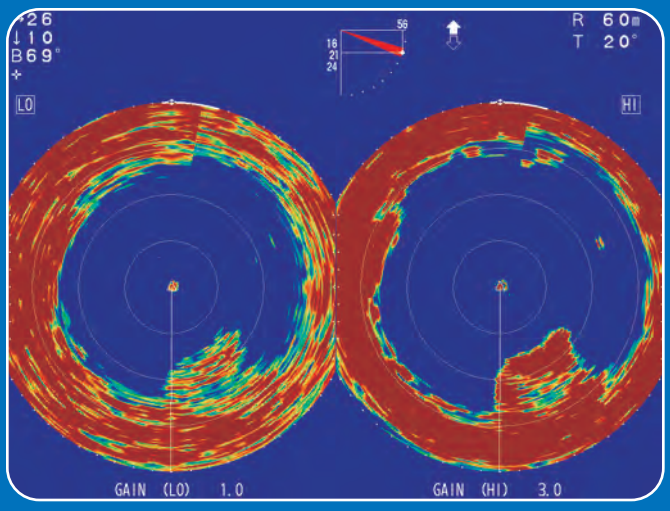
Dual-Frequency Options

As a rule, lower frequencies can 'see' farther and deeper than higher frequencies. To get the best of both worlds, and the ability to better target multiple species, some Furuno Sonars are available in dual-frequency configurations. Simultaneous dual frequency allows fisherman to compare both returns in a side-by-side display or mixed modes.

Furuno introduced the first dual-frequency Searchlight Sonar with the CH300, designed for a wide range of commercial or sport fishing vessels. Its operating frequency can be selected from either 60/153 or 85/215 kHz, and the transducers are incorporated in one soundome. The high frequency of 153 or 215 kHz gives detailed search returns nearby around the vessel while the lower frequencies of 60 or 85 kHz enable long-range searches, over 500 meters. With the advantage of both high and low frequency in a single system, the CH300 greatly enhances both seabed and fish school detection.

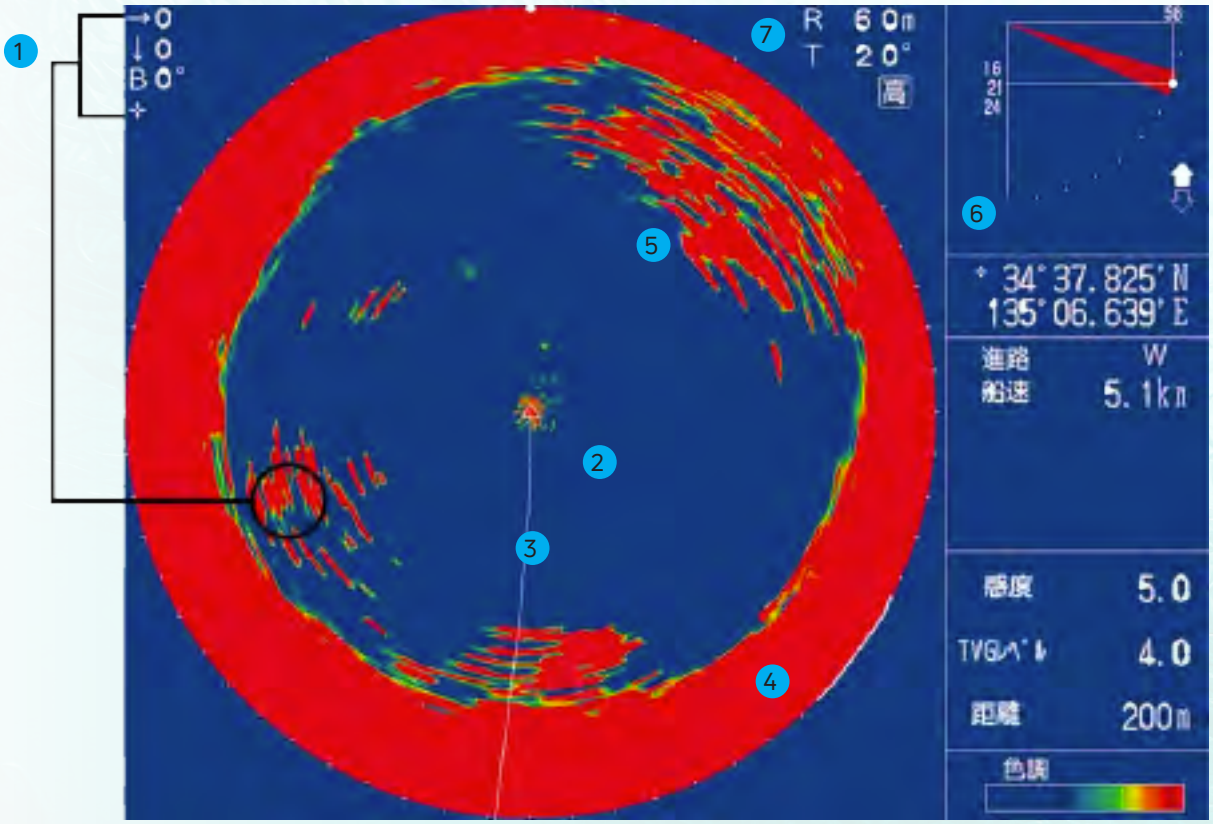
Searchlight Sonar boasts broad coverage and is ideal for deep-water exploration and seabed mapping

Note: Mixed modes are available, such as a low-frequen
You can also mix high and low frequencies in a single pr



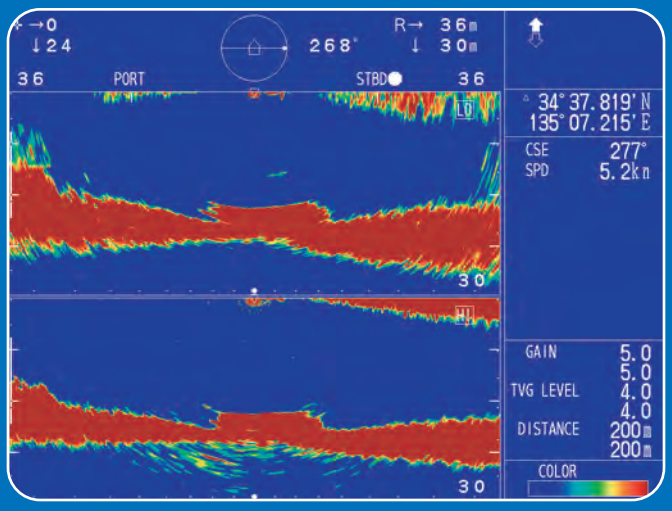
Horizontal Scan:
A full circle 360-degree scan detects fish schools around the vessel. Horizontal scan zoom mode also available to take a closer look at fish targets.

Here's what you'll see on a typical Searchlight Sonar screen:

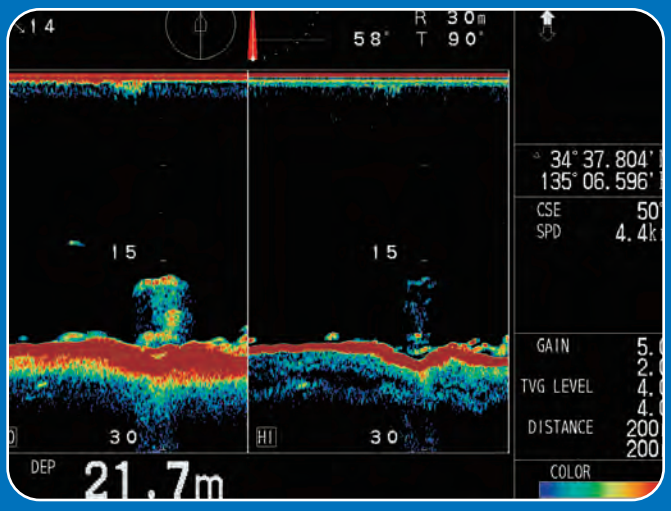


1. Fish school echo: Hover the cursor over the displayed echoes to see the distance from your ship to the fish school, as well as its depth and location relative to your vessel
2. Own ship position (Triangle icon at center)
3. Ship's track (requires a GPS connection)
4. Seabed echo: The seabed forms a ring as the sensor is rotating
5. Sea current echo: Located inside the circle, it generally looks like irregular echoes
6. Beam inclination (indicates the angle of transducer tilt)
7. Range

ncy, long-range horizontal scan mixed with a high-frequency vertical fan scan simultaneously on the screen.
esentation by either overlaying the frequencies to call out the targets that matter, or viewing them side-by-side.



Vertical Scan:
Vertical scan paints the bottom profile within a user-specified vertical plane in any direction.



Fish Finder:
When fully retracted and tilted to 90 degrees, the Searchlight Sonar can detect fish directly beneath the boat as a traditional Fish Finder.

Scanning Sonar

Scanning Sonar, sometimes called Omni Sonar, emits ultrasonic waves all around the ship for 360 degrees simultaneously, and can detect and display the returning echoes instantly. Because everything around the vessel can be detected instantaneously, the detection speed of a Scanning Sonar is much faster than that of a Searchlight Sonar. This makes the Scanning Sonar the ideal tool for evaluating the movements of fish swimming at high speed, such as bonito and tuna.

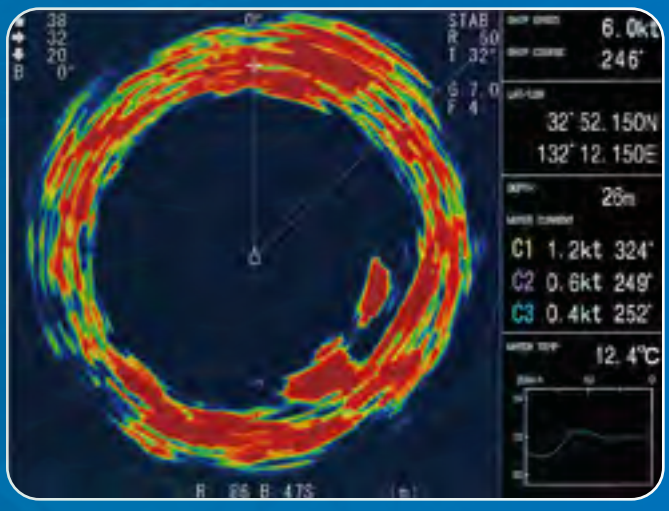
The transducer arrangement of a Scanning Sonar consists of layers of elements, each pointed in a slightly different direction. This arrangement allows the Scanning Sonar to transmit a full 360 degrees without rotating the transducer. The targets are redrawn on the display instantaneously to show the latest echo received from the transducer. On a 1,000 foot range, Scanning Sonar updates the display in 360 degrees every 0.54 seconds, while the conventional PPI sonar takes 32 seconds to complete a full circle under the same range conditions. This means that, for the same range, Scanning Sonars are capable of providing information that is about 60 times more comprehensive than PPI sonars. Faster target updates lessen the chance of missing a small change in underwater conditions, especially helpful when range and tilt require frequent adjustment while fishing for fast-moving species or navigating in shallow waters.

CSH8LMK2 Omni Sonar hull unit installation
Photo courtesy of Atlantic Marine Electronics

Sector Scanning Sonar
Sector Scanning Sonar combines the advantages of Searchlight and Omni-directional Scanning Sonars at a reduced cost. The principle is the same as the Searchlight Sonar, but the Sector Scanning Sonar searches in 45-degree steps, so the Sonar is 4 to 7 times faster than a typical Searchlight Sonar. The speed of Sector Scanning Sonar along with features such as Vertical Fan Scanning and Trawl Net Marks make them an ideal choice for bottom trawlers, tuna seiners, and other fishing vessels.

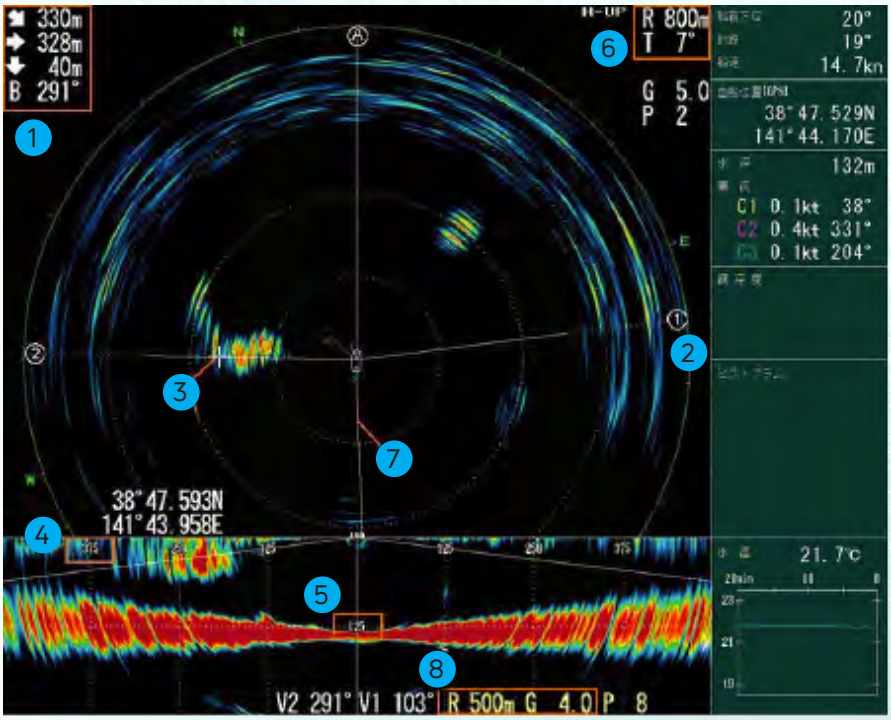
Full-Circle Scanning Sonar
The system fires ultrasonic waves in all directions around the ship in a single burst, and can instantly detect and display everything around the ship.

Half-Circle Scanning Sonar
Sensors installed on the bottom of the ship use ultrasonic waves to instantaneously search a 180 degree area under the ship.

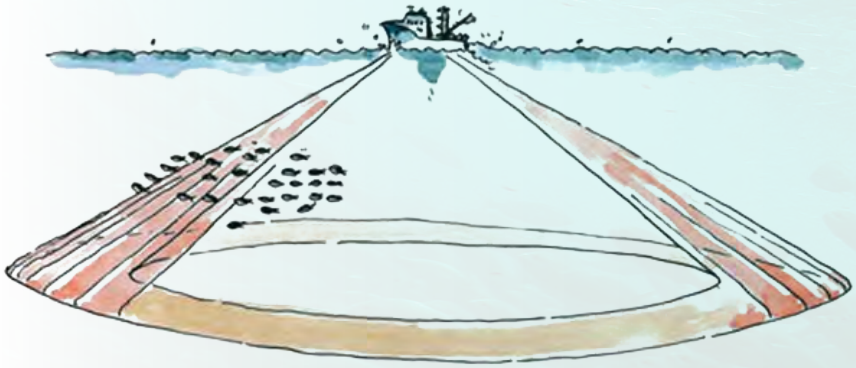


Sonar Display:
Navigation data can be displayed in the text window, with connection of appropriate sensors. This mode is useful for detecting and tracking schools of fish.

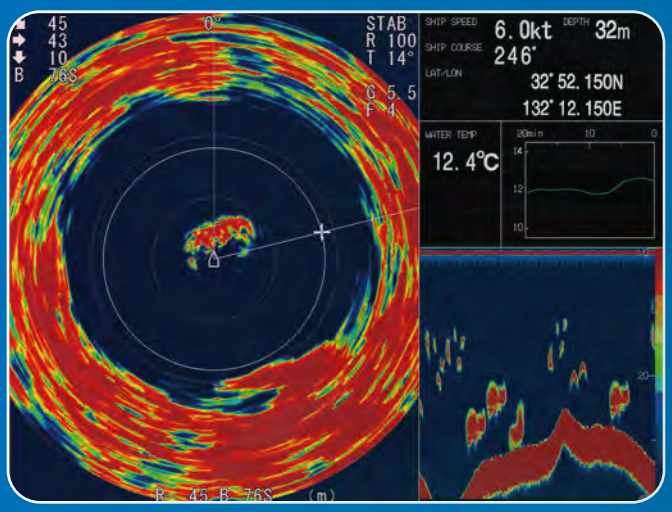
Typical Scanning Sonar screen:



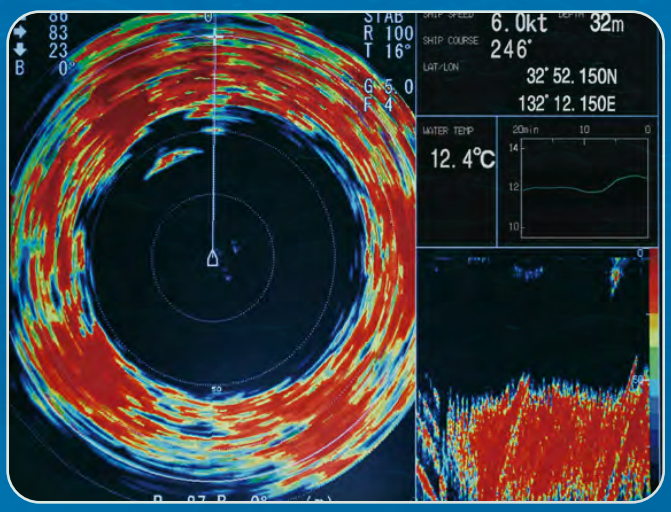
Vertical scan of the line ② Vertical scan of the line ①



1. By hovering the cursor over the targeted echo, this data box displays the horizontal and vertical distance to own ship as well as the depth and the direction of the target.
2. Vertical scan of the line
3. Cursor (currently on the fish school)
4. Vertical mode, horizontal range (distance)
5. Vertical mode, Depth range
6. Horizontal mode range, Beam inclination (tilt), Display mode
7. Own ship's track (requires a GPS connection)
8. Vertical mode range, gain



Sonar + Fish Finder:
The sonar picture appears on the left and the signal fed from the echosounder at the lower right side of the screen. This mode is suitable for judging fish school concentration. Requires compatible Fish Finder.



Sonar + Audio:
Sonar picture appears on the left and the audio display at the lower right side of the screen. This mode is useful for analyzing echoes in a desired area.

WASSP Multibeam Sonar

WASSP, an acronym for *Wide Angle Sonar Seafloor Profiler*, is a Multibeam Sonar capable of generating a profile of the seabed 100 times faster than single-beam echo sounders, revealing fish, reefs, wrecks, backscatter (bottom hardness), foreign objects, and seafloor artifacts. With its wide-angle 120° port-to-starboard view of the seafloor and water column, the viewing span is approximately three times the sea depth - when scanning 100 meter depths, you'll be recording a 300 meter swath with each pass.

WASSP data is displayed in real-time, allowing you to review recorded data immediately to determine the best place to cast a line or set the net, or adjust it to avoid a costly snag.

WASSP systems have been designed to seamlessly integrate with leading software suites such as MaxSea TimeZero Pro and OLEX, and are also compatible with hydrographic software suites such as HYPACK, BeamworX, EIVA, Echoview, and QINSy, to name a few.

Backscatter
Backscatter displays seafloor hardness reflectivity, which helps the operator distinguish between hard (rocks) and soft (mud) material. Backscatter is ideal for survey operations, identifying and charting fishing habitats, or locating a suitable anchorage.

Side Scan
Side Scan lets you locate and identify objects on the seafloor off to each side of the vessel. Structure such as a shipwreck, may appear as a large fish school on the Sonar display, but WASSP's Side Scan view lets you see a wreck sitting on the seafloor clearly identifiable as a man-made structure.

Inshore Fishing
The scalable F3 system provides a wide range of features and capabilities that can be tailored to all types of inshore fishing. F3 can optimize fishing operations for greater efficiency and increased productivity.

Coastal Fishing
With WASSP F3 and F3X, the 3D presentation of the seabed combined with the optional backscatter function helps you assess seafloor hardness to identify the best fishing grounds in a range of different environments.

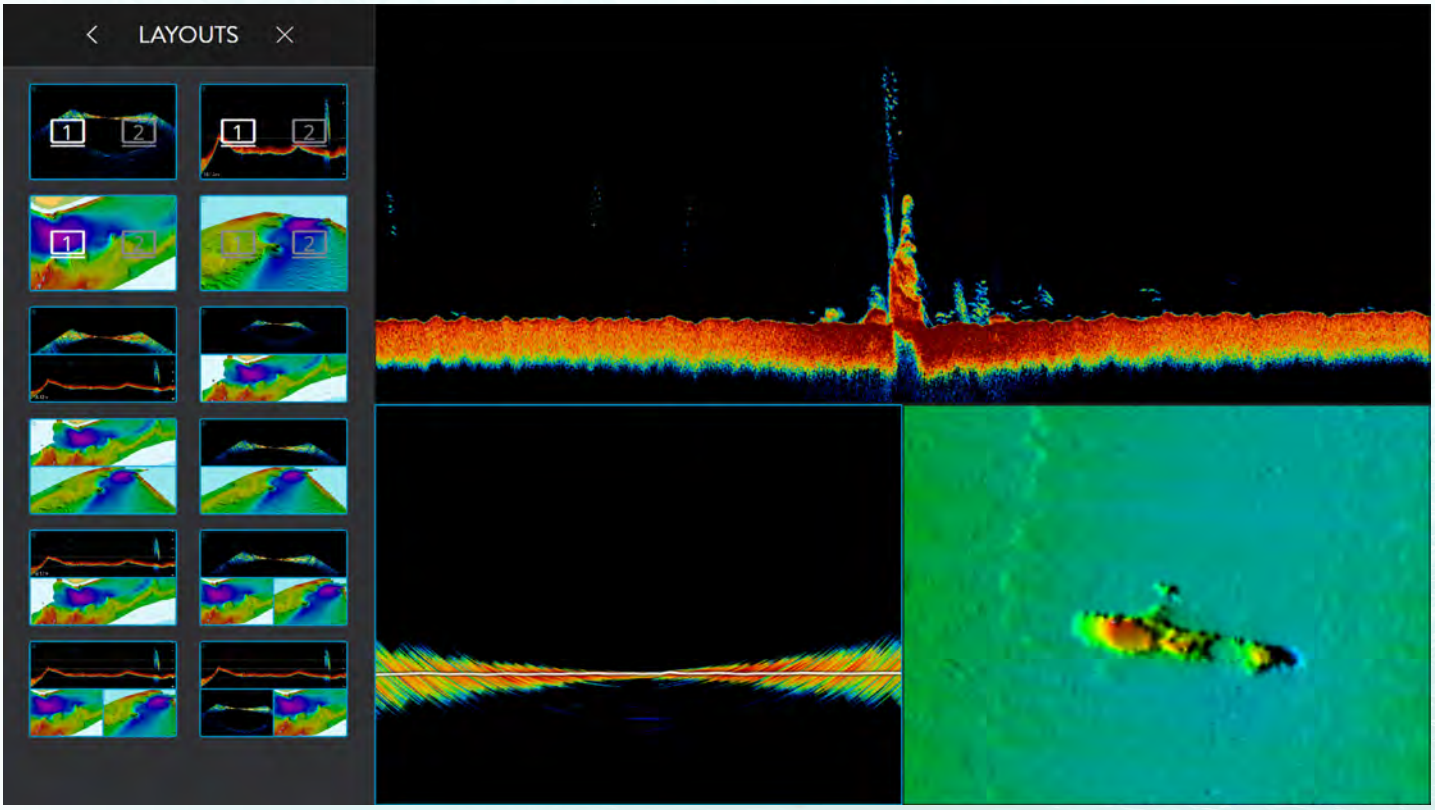
Offshore Fishing
WASSP F3X and F3XL deliver accurate water column and seabed information, so you'll be better informed to maximise your catch and minimise your time at sea. Wideband CHIRP technology delivers unsurpassed separation of target species throughout the water column for more sustainable fishing.

Sportfishing
With its 120-degree port-to-starboard swath, you'll quickly locate and map baitfish shoals. Because you can see where your target species are in the water around you, you can present your lures and baits to marauding billfish and tuna with accuracy. Wideband CHIRP technology enables excellent target separation of bottom species like bass and bluenose.

Survey
WASSP S3 bridges the gap between single-beam survey sounders and high performance MBES systems. The easy-to-use CDX graphical user interface makes data collection simple, and interfacing with your preferred survey software suite is easy. S3 is open to many different sensors, which means it can be easily installed on any survey vessel. Plus, you get flexible data output to meet your requirements.

Wireless Bottom Mapping from the Tender
Using a Tender, you can quickly generate your own up-to-date and trusted bathymetric map to safely navigate the mothership to the best anchorage for the day. You can also follow the Tender as it goes through tricky waters to make sure you avoid hidden obstacles, averting possible damage. With Backscatter, you can understand the seafloor hardness to ensure you use the correct anchor.

While a fixed transducer in the Tender is ideal, it's not always possible. In these cases, a WASSP carbon fibre mast that includes the transducer, motion sensor, and satellite compass is a light and quick to deploy solution.


LAYOUTS


1
2
3
HOW WASSP MULTIBEAM WORKS
1 Tender maps seafloor in 3D in real-time to chart safe passage for Superyacht
2 Information is instantly relayed from Tender to Superyacht via WiFi
3 Superyacht follows path mapped by Tender for safe passage

DFF3D Multibeam Sonar

The DFF3D is a Multibeam Sonar designed for NavNet TZtouch, TZtouch2, and TZtouch3 MFDs. It transmits 41 individual beams, covering a 120° water column from port to starboard at depths approaching 1,000 feet. The DFF3D is very effective in analyzing a wide area, detecting bottom contours, and spotting targets that would have been missed with a conventional Fish Finder. Transducer are available in both thru-hull and transom mount configurations, with options that package the multibeam transducer in the same housing as a high quality Fish Finder transducer for simple installation.

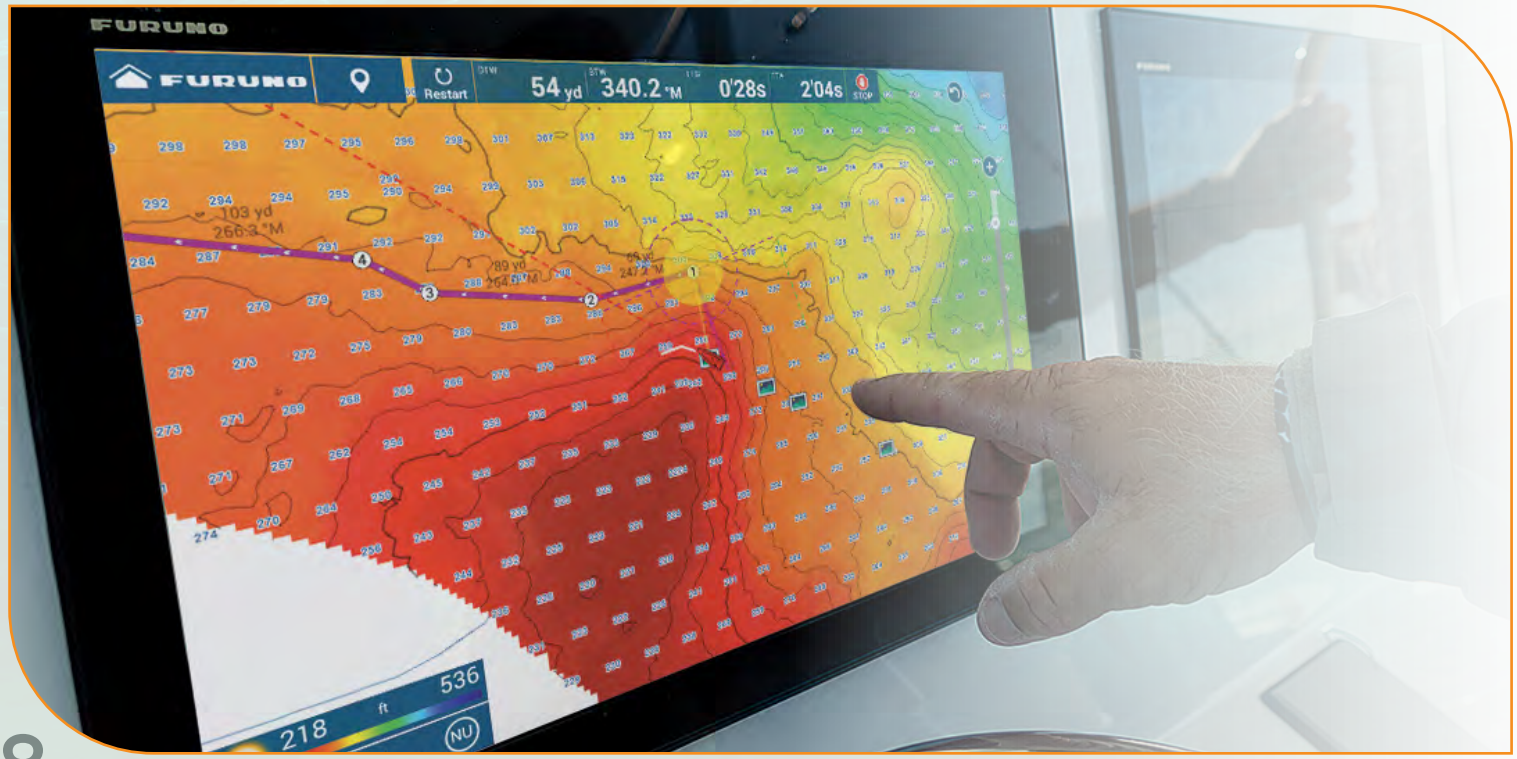
The DFF3D offers four presentation options, each suitable for a particular purpose: Cross Section, Multi-Sounder, 3D Sounder History, and Side Scan. Each function offers a unique way of seeing and analyzing the seafloor, structure, and fish targets around your vessel.

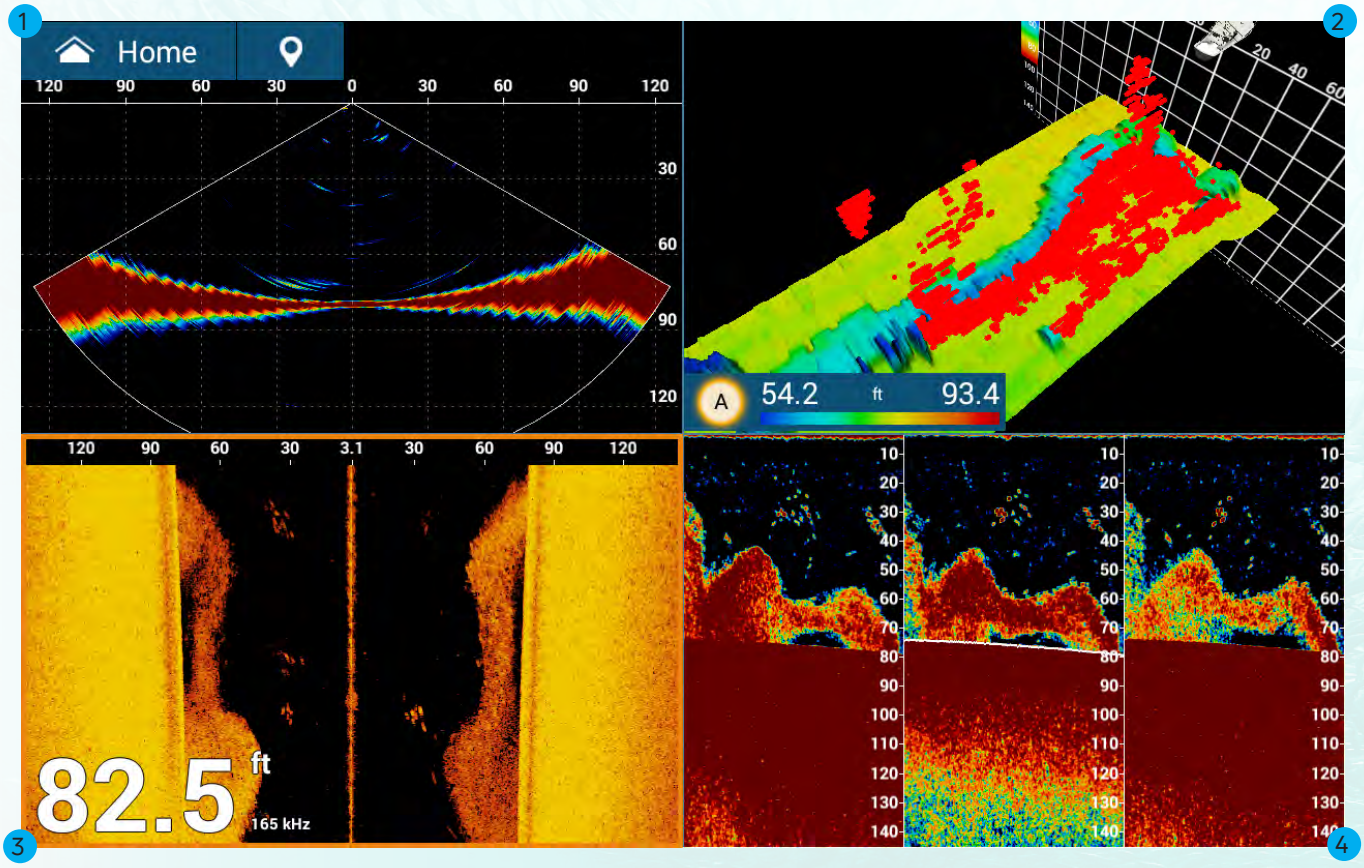
For the fisherman, the DFF3D presents an opportunity to better know the depths and distances of fish in relation to the vessel in ways that a Fish Finder simply can't duplicate while also painting and recording an image of the seafloor that is current, complete, and accurate, helping to uncover uncharted details you may have missed.

PBG (Personal Bathymetric Generator)

PBG for NavNet TZtouch3 and the black box TZtouch2 TZTBB leverages the DFF3D's detection range to quickly generate and record detailed bathymetric charts as you navigate. Bottom images are drawn with shaded relief, depth contours, and variable colors, making it easy to identify hidden structure and ridges that hold fish in a simple, easy-to-interpret way. The area covered is approximately twice the depth at the time of recording, so at a depth of 100', a 200' wide area is displayed and stored in your MFD, complete with spot soundings for at-a-glance knowledge of depths.

Taking advantage of PBG, NavNet TZtouch3's Follow-It feature instantly creates a constant-depth route to easily navigate a specific contour on your PBG chart. With just a swipe and tap, Follow-It creates a white line on the PBG chart indicating the constant depth. Tapping the line transforms it to an active route, sent directly to your NavPilot Autopilot. By following these specific depth contours, you can keep your baits at the same level as the fish while trolling without the need to constantly adjust the reels. Keeping your bait at the correct depth is critical to catching fish in areas where tide and currents flow along structure, where gamefish concentrate.





1 **Cross Section:** Conventional Fish Finders show echoes, but you can't see whether the fish is located on the port side, starboard side, or right below you. The Cross Section screen shows the water under the boat in a 120° swath, so you can easily see a fish school on the port side of the boat. Think of this mode as an extremely wide A-scope. Just like a conventional A-scope, targets are real time, not historical.

3 **Side Scan:** In the Side Scan screen, the seabed is drawn at both sides of the screen to focus on port and starboard images. This mode is suitable to analyze detailed bottom structures such as reefs.

2 **3D Sounder History:** The 3D Sounder History screen shows the bottom contours and fish locations in 3D. The viewing angle can be adjusted by dragging the screen so that you can easily analyze the bottom shape and location of fish targets.

4 **Multi-Sounder:** The Multi-Sounder screen shows triple beams for port (left), center (down), and starboard (right). To focus on the center only, a single beam screen is also available that operates as a conventional 40° Fish Finder. The beam angle of triple beam and the beam width of triple and single beams can be adjusted.

MULTI BEAM

F3D-S 3D Sonar Visualizer

Not a standalone Sonar, but an enhancement for the FSV-25 and FSV-25MK2, the F3D-S 3D Sonar Visualizer™ shows fish schools in a stunning three-dimensional rendering. F3D-S uses the 360-degree pulses from the hull unit of your FSV-25 Sonar and processes the information in a unique way, showing fish and sea floor data in a 3-dimensional "real world" view. The seabed echoes can also be removed from the picture to show only what you need to see...the fish!

With this unique 3D rendering of your Sonar targets, you can clearly see the size and shape of midwater fish marks and assess the best way to fish them. With careful and simple adjustment of the depth line control, you can easily remove the seabed echoes to visualize fish schools close to the seabed.

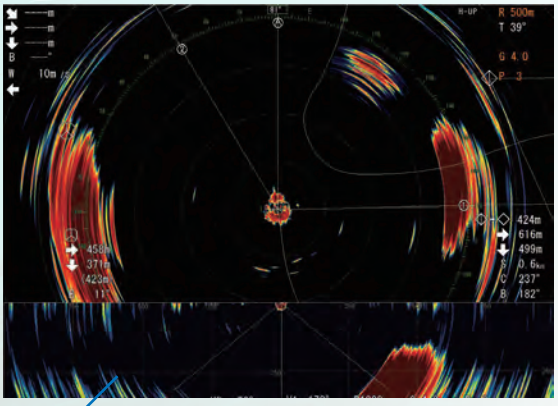
Fish schooled in both the surface and middle layers can be observed at the same time, so you can see the exact distribution of fish schools at a glance. This makes it easy to deduce the optimum tilt angle for the horizontal mode for simple and reliable monitoring of any object underwater.

Movement of fish schools can be viewed instantly, allowing for the prevention of bycatch and simplifying the process for anticipating fish escape patterns.

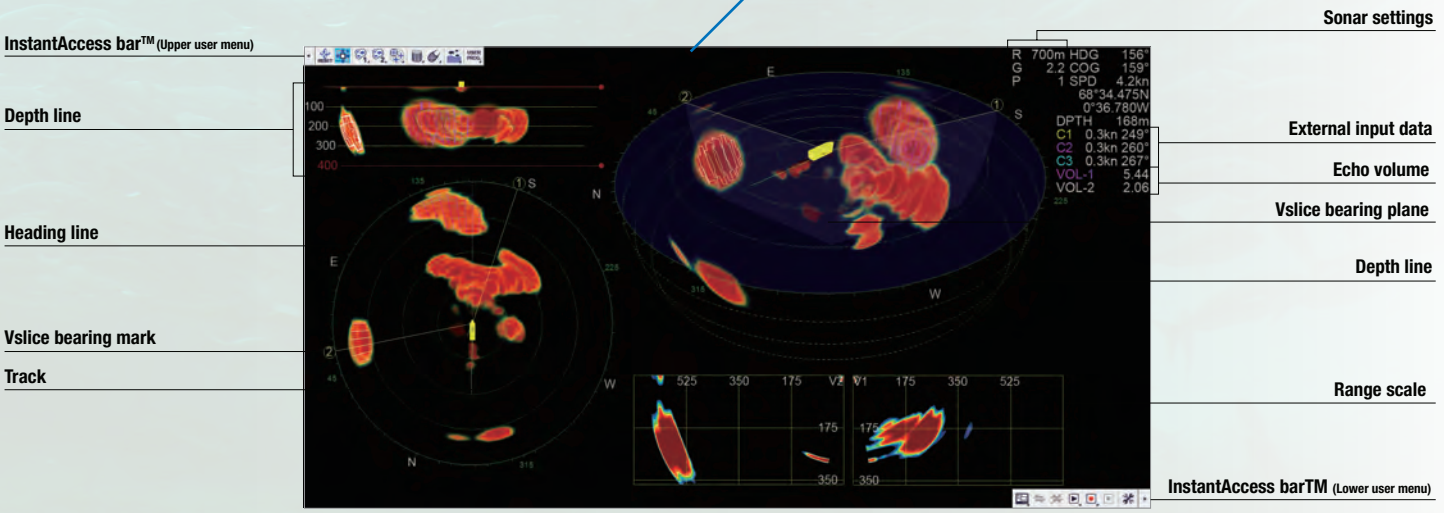
For Purse Seiners, the Purse Net Mark generates a visual 3D representation image of the net. This virtual net in 3D allows you to compare size and depth of both the fish schools and the net for faster and more effective decision making.

Trawlers can display the following marks: Trawl door, net, and wire, in the 3D image. When a fish school is detected, trawl marks assist in positioning the doors and net to maximize your catch. Additional filters are included so that the echoes from trawl doors are emphasized while the echoes of ship wake and seabed are suppressed.

The Echo Region Mark function is useful for predicting the volume of a school. Just click a point on any strong echo in the 3D-View, Top-View, or Side-View, and the echo area including the point is displayed in yellow or cyan lines along with the volume for that echo region.

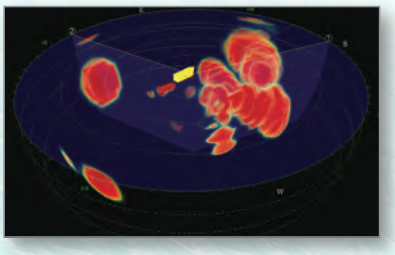


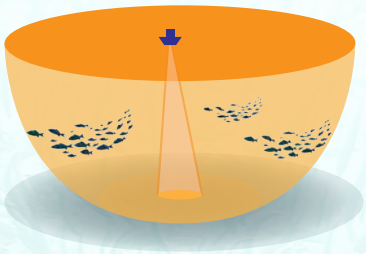
These screenshots taken at the same moment, demonstrating the power of this unique 3D visualization of fish targets



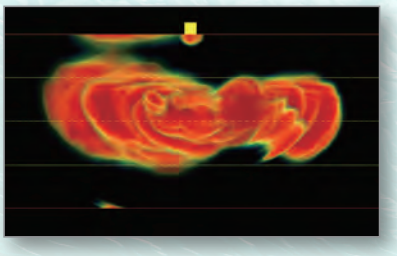
F3D-S includes 4 basic modes:

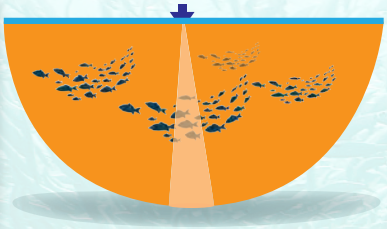
3D-View mode allows you to view the echoes from all angles. It is the ideal tool to have for an accurate 3D representation of the area.



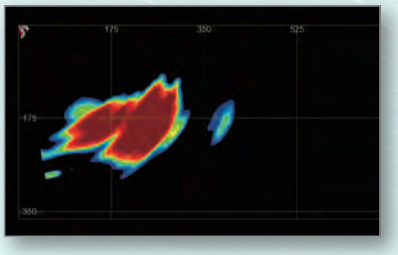


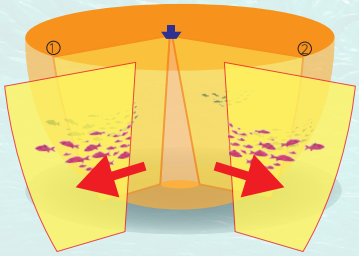
Side-View mode displays all echoes in a single vertical plane as seen from the stern of the ship. When the "Rotate Top-View/Side-View" mode is activated, this vertical section image is linked to the viewpoint of the 3D-View mode. This mode is used to measure the depth of a school of fish.



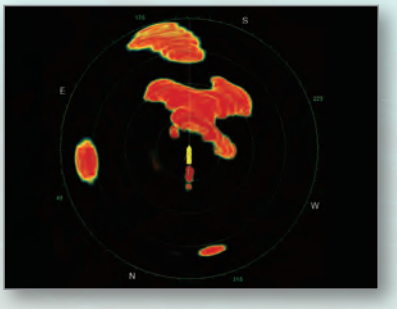


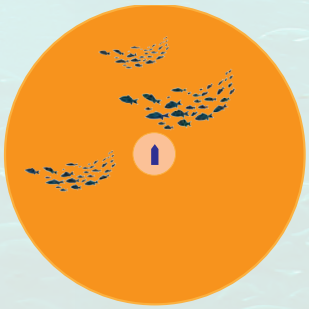
Vslice-View mode shows the echoes in a vertical plane and in a specific orientation, same as the vertical echoes of FSV-25/25S. It can display vertical planes in two different directions. The Vslice-View mode is very useful for viewing the echo in a vertical plane at a specific direction. In addition, it makes it possible to compare the depth of two targets located in two different directions.





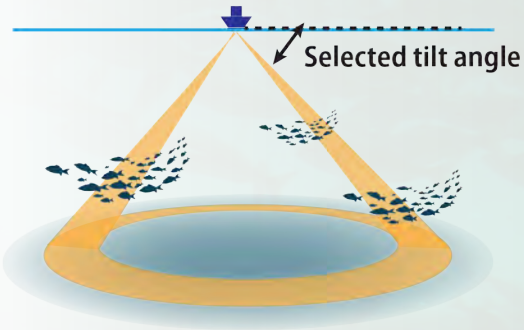
Top-View mode displays all echoes in a single horizontal plane around your ship. This mode allows you to accurately assess the horizontal distance to a fish school and know its direction with precision.





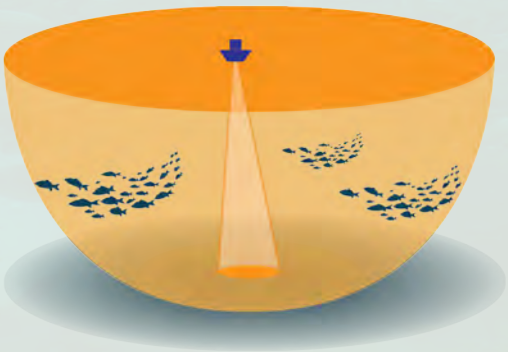
FSV-25 / 25S

Tilt: arbitrary (The setting of the degree is required.)



3D Sonar Visualizer™

Tilt: NA (The setting of the degree is not required.)



Sonar concepts and techniques

Output Power and Pulse Duration

Output Power is the amount of power utilized while transmitting. Pulse Duration indicates the duration for which the transmitter emits a pulse of sound energy. As a general guideline, it's advisable to employ nearly maximum power output and pulse duration for long range scales. For shorter ranges, slightly reducing these values is more effective. Opting for lower output power and pulse duration enhances the precision of identifying targets while providing a more accurate representation of target size, especially for nearby marks.

Gain

Imagine you're trying to see your surroundings at night with a flashlight. If the light is too dim, you won't see much detail, but if you turn it up, things become clearer. Gain in Sonar works in a similar way. It's like a brightness control for the flashlight, allowing the Sonar to make the returning signals stronger or weaker. When you increase the Gain, the Sonar boosts the strength of the signals that bounce back from underwater objects like fish, rocks, or the ocean floor.

However, just like with a flashlight, if you turn up the brightness too much, those reflections can be overwhelming, and the Sonar might show too much noise or clutter. Proper adjustment of the Gain control is critical to finding the right balance between seeing things clearly and avoiding interference or extra information.

Time Varied Gain (TVG)

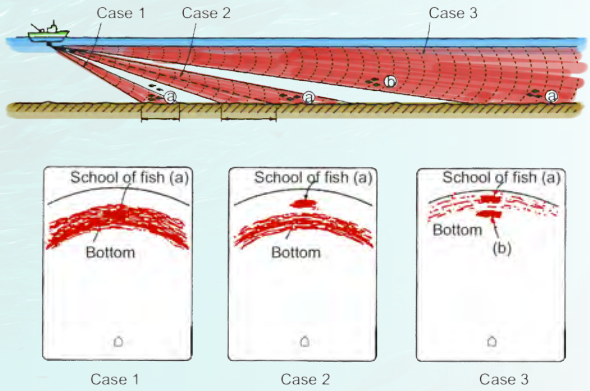
Sound waves lose strength as they travel through the water. As they travel, they bounce off objects such as fish, rocks, or the seafloor, and as they lose strength, the echoes they produce become fainter the farther they travel. This is where Time Varied Gain (TVG) comes in. The effect of TVG is like turning up the volume on these faint echoes. It's a bit like gradually making the sounds of distant echoes louder so you can better hear and identify them.

In technical terms, TVG adjusts the strength of the received echoes based on the time it takes for the sound waves to travel to an object and back. The farther an object is, the longer it takes for the echo to return, and TVG helps compensate for the natural loss of signal strength by boosting the weaker echoes.

Tilt and Train

Tilt and Train refer to the angle and direction of the Sonar beam, measured in degrees. The value of the "Tilt" is 0 degrees when the center of the Sonar beam is completely horizontal, and at 90 degrees when the center of the beam is pointed straight down.

The value of the "Train" indicates the bearing position of the center of the Sonar beam in increments of 360 degrees around the vessel. Adjusting the Tilt and Train of the Sonar allows you to search the waters around the vessel with precision.



Audible Target Detection

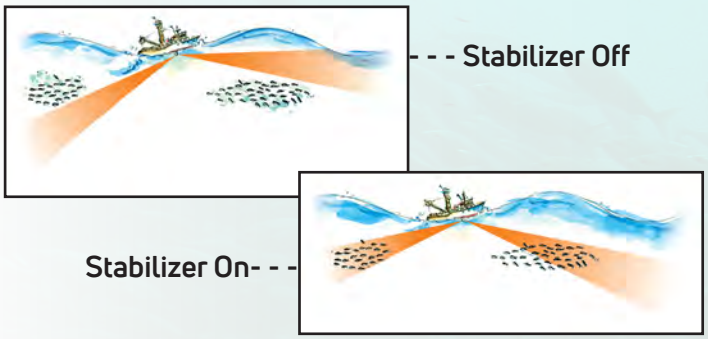
Many Furuno Sonars can produce audible fish and underwater hazard audio signals that vary depending on the nature and the size of the detected object. Whether the Sonar detects turbulence, fish schools, seabed, or structure, the sound is unique, and stronger returns generate louder sounds. With practice, it's easy to differentiate between the sounds of the fish schools and the seabed they are moving next to, allowing for better comprehension of the environment and more productive fishing. This feature is invaluable for long journeys, as well as for busy captains who need to free themselves from having their eyes glued to the screen.

Target Lock

The target lock function automatically tracks a fixed location, such as a reef, or on some models, a selected school of fish, so you won't lose sight of it on the display. It's as simple as placing the cursor on the target and pressing the Target Lock key. Once you've locked on to a target, a mark appears on the selected echo, and the range and tilt will be automatically adjusted according to the target's position. Target Lock is excellent for tracking reefs and structure, and also work well for most schools of fish, but tracking fast-moving gamefish is challenging, so the results are not always consistent for those species.

Fish Alarm
Fish Alarms are an excellent way to keep track of the underwater situation when your eyes aren't on the screen. You can easily set up an alarm zone around the vessel, either in certain sectors or in a complete 360° circle. Once an alarm is set, you'll get an audible alarm whenever a target of a user-specified strength enters the alarm zone.

Stabilization
Heavy seas cause excessive pitch (tilting motion of the vessel on the bow-stern axis), roll (tilting motion of the vessel on the port-starboard axis), and yaw (rotational motion of the vessel in the horizontal plane). Pitch, roll, and yaw effects on a non-stabilized Sonar causes the beam to shift with the motion of the vessel, so the fish or reef you're tracking appear to be moving in ways that they aren't, or disappear from the screen as they move outside of the beam completely. This makes it difficult for the operator to effectively track fish schools and structure. A Stabilizer, an integral part of most Sonar installations, compensates for the ship's motion to keep the beam trained where you need it, mitigating the effects of pitch, roll, and yaw.



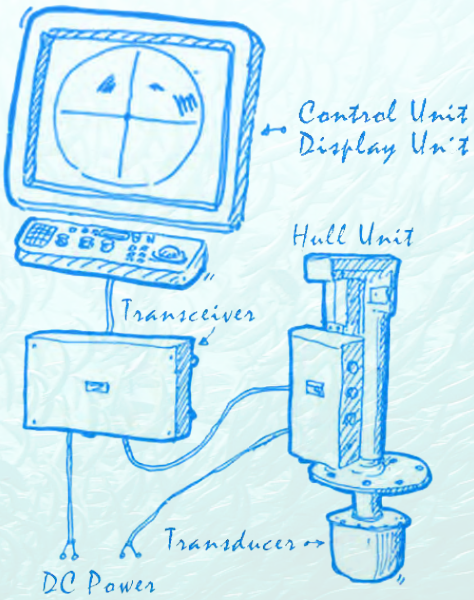
Fish Speed Measurement
Fish schools aren't stationary objects, and to maximize your haul, the captain needs to know the speed and direction they are traveling before shooting the nets. Thankfully, your Sonar makes it simple to obtain this information. By placing a Fish Mark on the school, waiting one or two minutes, then placing a second Fish Mark on that same school, you can determine the speed and course of the school, as well as the distance they traveled and current distance from the ship. Ship's speed and heading is calculated into this equation, and the longer the period of time between placing the marks, the more accurate the information is likely to be. Some captains will repeat this process two or three times to verify the accuracy of the data before preparing to harvest the school.

Event Marks
Think of an Event Mark as dropping a buoy on the sea surface with an anchor chain that extends straight down to the seafloor. The buoy is geo-fixed at the sea surface, but the Event Mark you'll see on the screen isn't tracking the buoy - instead, it remains fixed on the chain, an imaginary vertical line between the surface and seafloor at that location. As the ship moves and the tilt angle of the Sonar beam is adjusted, the Event Mark on the display shifts to show you the location of where the Sonar beam intersects that vertical line, no matter the angle. On the screen, you'll see the horizontal range to the Event Mark, the depth where the beam intersects it, and it's bearing. The latitude and longitude of Event Marks can also be output to your GPS Navigator or Chart Plotter via NMEA data.

Mastering Sonar
While Sonar is an incredibly effective tool, the captains who use it recognize that it's just one tool in a toolbox they've stocked with many years of experience, and like any other tool, it requires hands-on training to use to its full advantage. Your familiarity with the fishing grounds plays a critical role in utilizing the information your Sonar provides. For example, if you have knowledge that fish tend to gather in a specific spot at a certain time, your decision to make a set there should be based on that experience. When fish aren't visible and your prime fishing spots have been exhausted, Sonar enhances your chance of a successful expedition.

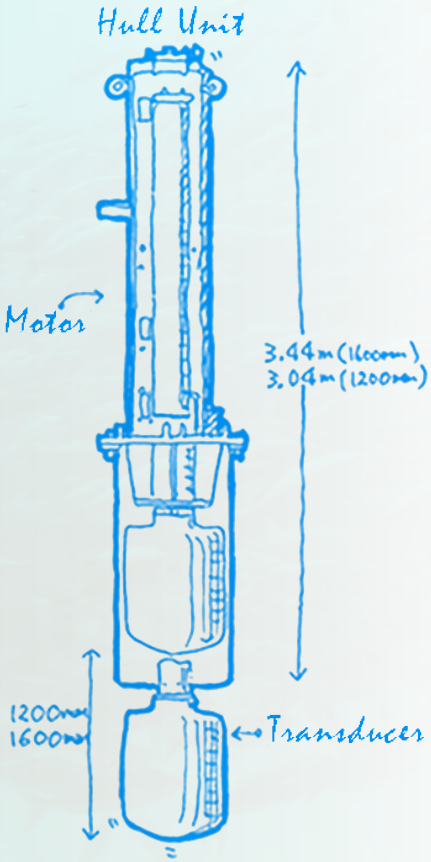
Mastering Sonar is a learned skill, and you have to get hands-on with it to appreciate its value. It's essential to practice using your Sonar. Once you've put in the work, it will significantly enhance your expertise.

Anatomy of a Sonar

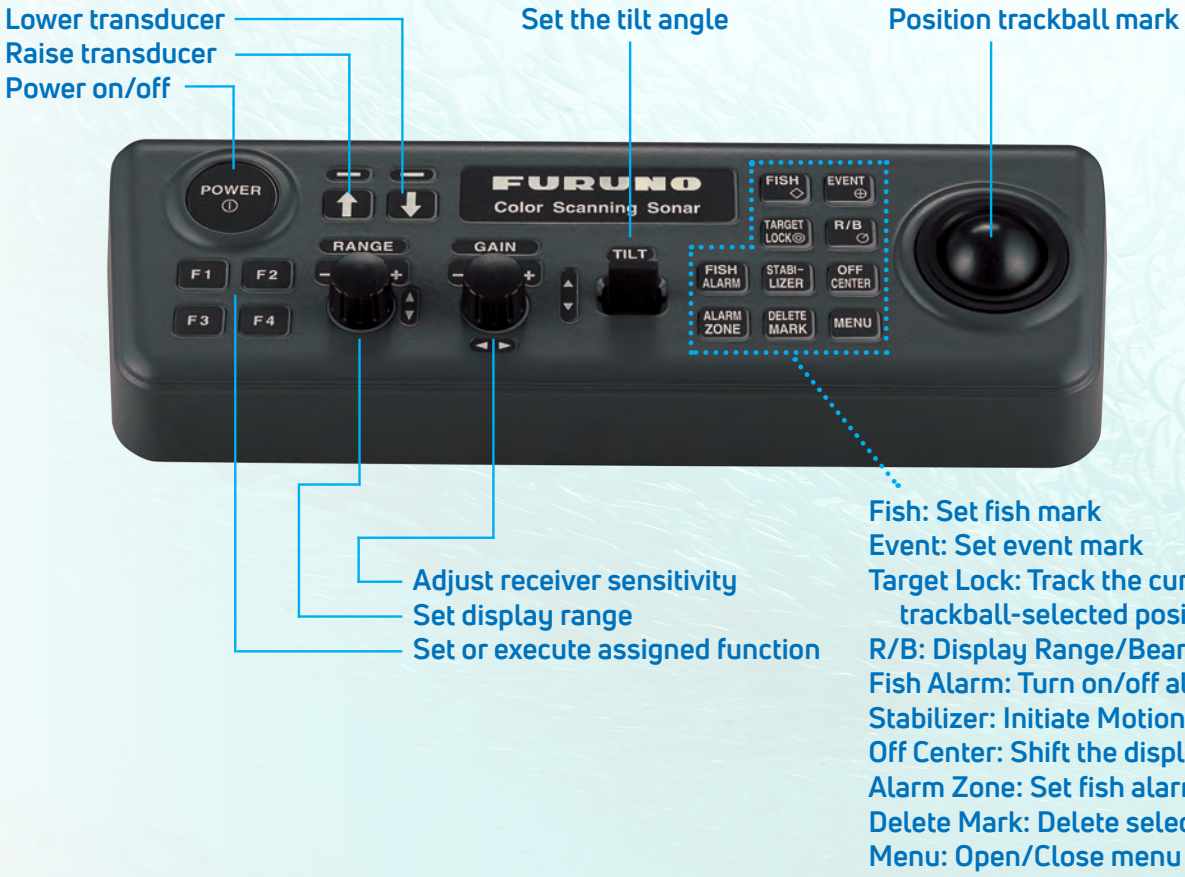


A typical Sonar installation consists of a monitor, control unit, transceiver, and the hull unit containing the transducer. Some models may feature a separate processing unit. The transducer is lowered into the water through a hull tube installed at the bottom of the vessel. When the vessel is moving at high speed, objects in the water can damage the transducer. Water resistance will also reduce the speed of the boat and increase fuel consumption. Therefore, it is recommended to retract the transducer when travelling at high speed and only lower it when searching for fish

The hull unit of a typical Searchlight Sonar has a travel range of 25 to 40 cm, while hull units of a typical Scanning Sonar vary from 40/60cm for small configurations to 130/160cm for larger boats. Generally, the longer the stroke (shaft length), the less the transducer is affected by surrounding air bubbles.



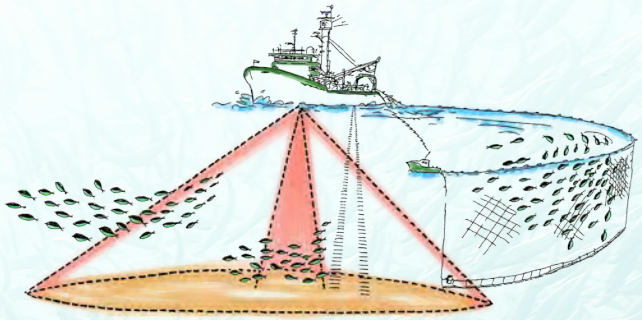
Scanning Sonar Controls:



Searchlight Sonar Controls:

1. Power on/off
2. Raise/lower transducer
3. Adjust receiver sensitivity
4. Select training sector width
5. Select center bearing for training sector
6. Select detection range
7. Control scanning center direction
8. Move cursor/select menu item
9. Change display mode
10. Toggle between full and 1/2 range scan
    Reverse scanning direction
    Change train speed
    Activate/deactivate tracking function
11. Execute assigned function
12. Adjust screen/panel brilliance
13. Place event mark
14. Display Range/Bearing
15. Open system menu

What types of boats use Sonar?

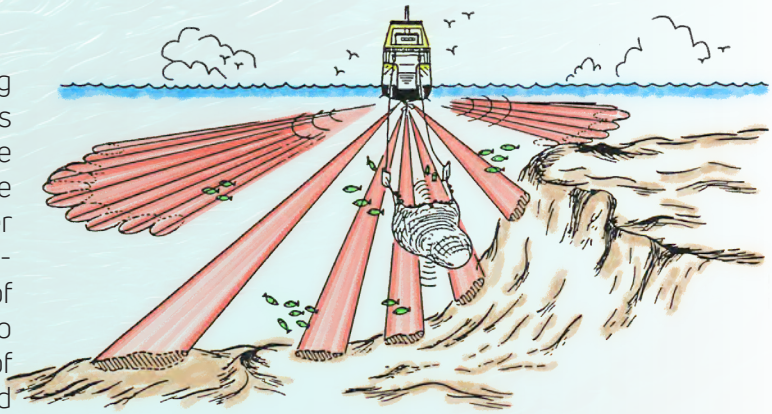


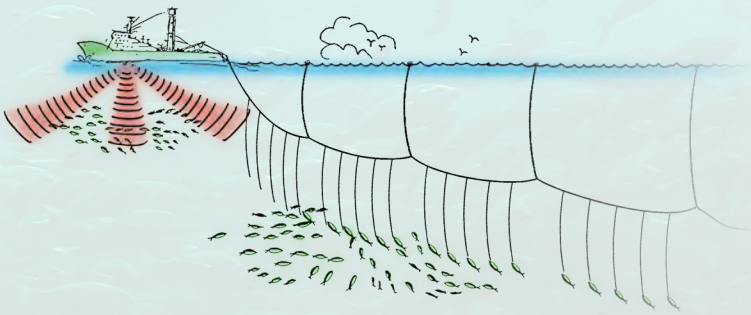
Purse Seiners

Purse seiners are commonly used to harvest salmon, sardines, and herring. A seine net is set out in a semi-circle with a running line connected to the end of the net to help keep its shape. As fish enter the shape, the net is closed to create a full circle. At the same time, the purse line gathers up the bottom of the net, forming a pouch that traps fish within the purse.

Net Trawlers

Trawlers use a cone-shaped net in mid-water or along the ocean bottom to capture pelagic species such as brownies, greenies, and hake or groundfish like sole and rockfish. A trawler often has two net reels at the vessel's stern, one for bottom trawling and the other for mid-water trawling. A head rope sensor is connected to the net to monitor the catch. The bottom of the net opening is weighted down and floats fixed to the top of the mouth to keep the net open. The sides of the net are kept open using specialized boards called otterboards. As fish enter, the vessel's forward motion funnels them to the back of the net.



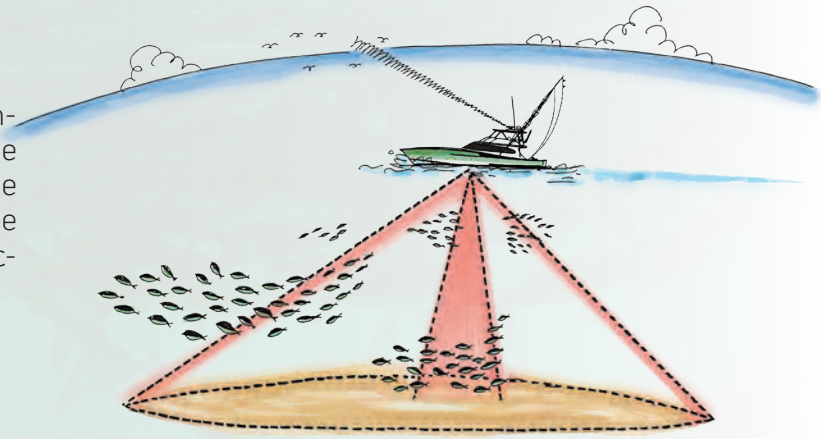


Long Liners

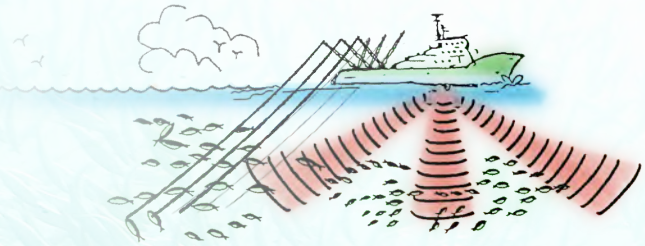
Long-line vessels use baited hooks attached to ground lines, which are deployed as the vessel moves ahead. Buoys are attached to the line to keep it afloat, and the gear is left to soak until it is ready to be retrieved. As the lines are hauled in, hooked fish are gaffed and brought aboard for storage or processing.

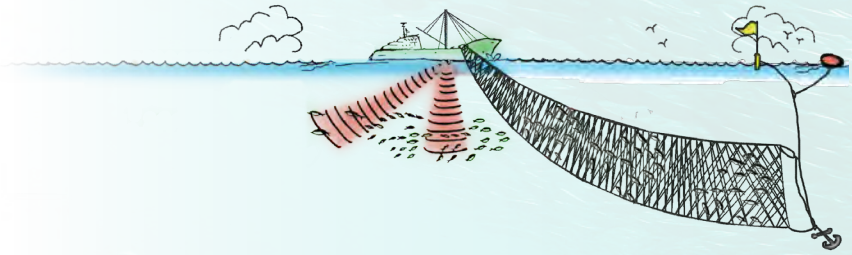
Sportfishing Vessels

While the captain is trolling, they're keeping a watchful eye all around the vessel, looking for birds on the Radar, and for signs of their target species on the Omni Sonar. Just as on a commercial vessel, big-game sportfishing requires a very specialized set of skills acquired over years of experience.



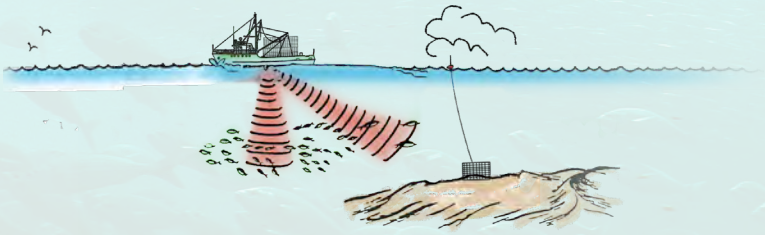
Trollers
Trollers use lines and lures to harvest salmon, tuna, lingcod, and halibut. A troller will typically fish with six or more lines and over 100 hooks in the water at a time. Lures or bait attached to leaders are attached to the lines, which are spread out to prevent the hooks from becoming tangled. Fish are landed with a gaff or net. Trolling vessels typically clean their catch at sea and either ice it or freeze it, depending on the vessel. Some trolling vessels operate offshore for extended periods, spending up to a full month at sea.

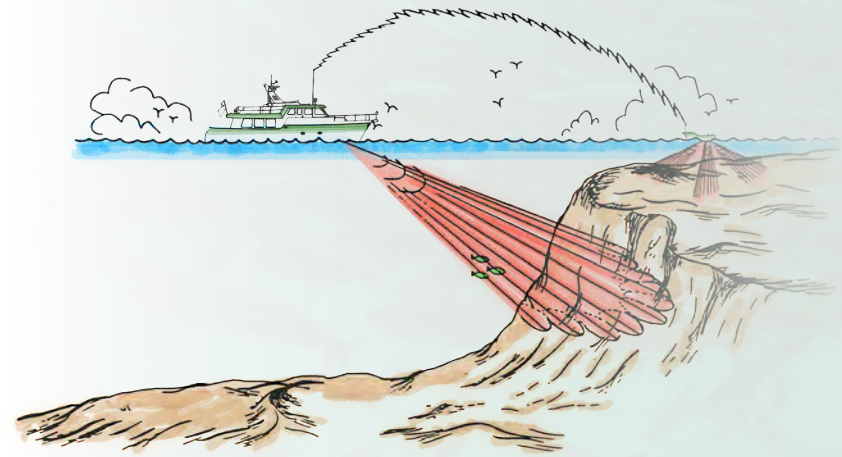




Gill Netter
Targeting herring and salmon, Gill Netters use purpose-built vertical nets that hang from a line of floats. As fish swim through the net, they are wedged (wrapped in the net), tangled (held by the teeth or spines), or, most often, gilled (caught by the mesh slipping behind the gills). Depending on many factors, gillnets may be set in a straight line, in a curved shape, or in another specific pattern to maximize the catch. Fish are removed from the net individually as it is hauled in.

Trap Vessel
Used for setting baited pots or traps for catching lobster, crab, and similar species, trap setters rely on their knowledge of the seafloor to find their targets. Captains look for areas with a hard bottom where their target species can be found utilizing a Multibeam Sonar such as WASSP to maintain detailed charts. Trap setters range from smaller open boats operating inshore to larger decked vessels of 20-50 meters.





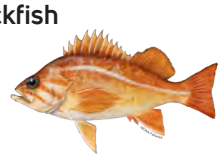
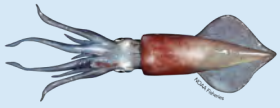
Cruisers
Even when they're not fishing, cruisers need to be aware of the bottom conditions at all times. Searchlight Sonar is an ideal solution to understand the conditions around the vessel. Larger vessels take advantage of the wireless WASSP system to scout ahead with the tender and chart the safest routes for the mothership in uncharted waters or when the bottom gets dicey. WASSP beams the data directly back to the cruiser so safe passage can be guaranteed.

Frequency by Target Species

Some frequency ranges are more suited to specific applications than others, and for this reason, Furuno offers the commercial and serious sport fisherman a choice when it comes to selecting frequency. Here are some of the common frequencies fisherman use for best results when targeting certain species. Note that these frequency recommendations are subject to fishery, depth, water salinity, and other factors that may affect your Sonar's performance.

Species	Fish Finder Frequency	Searchlight Sonar Frequency	Omni Sonar Frequency	Sector Scan Sonar Frequency
Albacore 	88-107 kHz	150 kHz	85 kHz	113 kHz
Anchovy 	120-200 kHz	88 kHz	55 kHz	113 kHz
Crab 	50-200 kHz	-	-	-
Haddock 	42-65 kHz	88 kHz	85 kHz	113 kHz
Hake 	38-120 kHz	88 kHz	85 kHz	113 kHz
Halibut 	28-50 kHz	-	-	-
Herring 	120-200 kHz	88 kHz	55 kHz	113 kHz
Mackerel 	120-200 kHz	150 kHz or 180 kHz	85 kHz	113 kHz or 162 kHz

Illustrations courtesy of NOAA - https://www.fisheries.noaa.gov/species-directory

Species	Fish Finder Frequency	Searchlight Sonar Frequency	Omni Sonar Frequency	Sector Scan Sonar Frequency
Pollock 	38-70 kHz	88 kHz	85 kHz	113 kHz
Red Snapper 	200 kHz	150-180 kHz	85 kHz	162 kHz
Rockfish 	42-65 kHz	88 kHz	85 kHz	113 kHz
Sablefish 	42-65 kHz	60 kHZ	55 kHz	60 KHZ
Salmon 	150-200 kHz	150 kHz or 180 kHz	-	162 kHz
Shallow Cod 	38-70 kHz or 145-175 kHz	60 kHz	55 kHz	60 kHz
Spur Dog 	200 kHz	-	-	-
Squid 	180-250 kHz	240 kHz	-	-
Billfish 	28-60 kHz	150 kHz or 180 kHz	85 kHz	113 kHz
Tuna 	88-107 or 120-200 kHz	150 kHz or 180 kHz	85 kHz	113 kHz or 162 kHz

Illustrations courtesy of NOAA - https://www.fisheries.noaa.gov/species-directory

Sonar FAQ's

We've gathered a short list of frequently asked questions about our Sonars and provided the answers in this section. If you have a question that is not answered in this book, you can visit us on the web at www.FurunoUSA.com and click on Support. You can browse through our comprehensive library of answers to questions, or search for your answer by model, topic or keyword. If you can't find the answer you're looking for, you can always send an Email directly from our web site to our technical support staff. A knowledgeable technician will respond with your answer, generally within 48 hours.

Q: Can I operate my CH250 sonar while it is in the retracted position?
A: Some Sonars can be operated very effectively as a down sounder (Fish Finder).

Q: Does Furuno offer any dual frequency sonars?
A: Furuno offers the CH300 series of dual frequency sonars, along with many dual frequency echo sounders, fish finders, and depth sounders. For a complete list of our dual frequency products please visit our website at www.FurunoUSA.com.

Q: Where is the best location to mount my sonar's motion sensor?
A: We have found that mounting either the MS100 or BS704 motion sensor as close to the hoist unit as possible provides the best overall performance of the sonar.

Q: When using a sonar for navigational purposes, what frequency is the best choice?
A: We recommend the higher frequencies when navigating. The higher frequencies have a narrower beam width, which provides better bottom resolution.

Q: May I operate my Sonar in the down position at any speed?
A: No, critical damage will occur if the sonar dome is extended into the water at speeds above 12 knots. Care must be taken to instruct your captain as to the proper use of your sonar.

Q: Does the sonar hoist have to be installed above the water line?
A: No, it is not absolutely necessary. However, it is highly recommended that the installation be above the water line. If it is to be located below the water line, you should have some type of tank made or gate valve to keep water out for service purposes.

Q: What is the difference between an Echo Sounder and a Sonar?
A: An echo sounder, a.k.a. fish finder or depth sounder, let's you view the seabed currently under the vessel utilizing a fixed mount transducer. A sonar enables you view the waters forward, port, starboard or aft of the vessel utilizing a hoist operated transducer element which scans 360 degrees. The sonar user also has the ability to adjust the tilt of the transducer element.

Note that some manufacturers use the term "Sonar" when referring to a fixed mount transducer application.

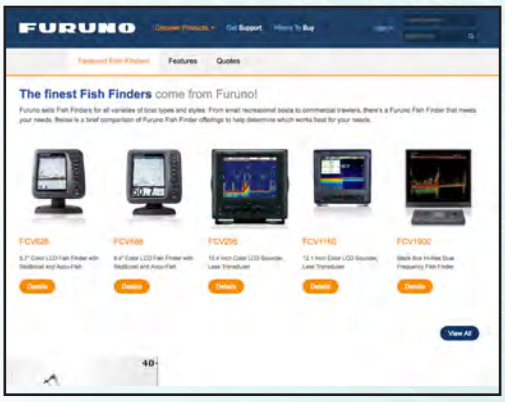
Q: My DFF3D shows Port and Starboard echoes reversed. Can I fix this?
A: Your transducer is installed backwards. Access the TRANSDUCER SETUP menu in the MULTIBEAM SONAR menu and turn "Transducer mis-mount correction" to ON . This will correct the problem.

Q: I have heard the term Black Box when referring to some of your products. What is a Black Box unit?
A: The term Black Box indicates that the monitor or display portion of the system is selected and supplied by the customer, rather than being included as part of the Furuno system. Furuno has a variety of Black Box products including Radar, Sonar, Fish Finders, etc. The Black Box technology offers greater flexibility in meeting your installation and space requirements.

(Note: Furuno usually denotes Black Box versions by including "BB" in the model number.)

For more FAQ information, visit our web site at www.FurunoUSA.com/Support

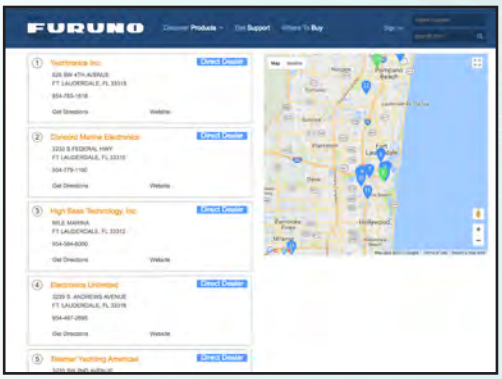
Additional Resources



www.FurunoUSA.com:

Visit our website at www.FurunoUSA.com for the most up-to-date information on the entire line of Furuno products.

All of our Sonar product pages have complete specifications and manuals, making it simple to select the right model for your boat.



Authorized Furuno Dealers:

Your local Furuno dealer is perhaps your most valuable resource when it comes to answering questions about the electronics that are right for you. To find your nearest Furuno dealer, simply go to our web site at www.FurunoUSA.com and click on Where To Buy. Enter in your zip code and you will receive a complete list of Furuno dealers in your area.

FURUNO

When you're serious about fishing

GET PAID.

With all this power, you'll find, pinpoint & increase your catch like never before.

FCV1900 TruEcho CHIRP™ Fish Finder

Top Picture: Elevation
Bottom Picture: Hardness

WASSP Gen 3 3D Multi Beam Sonar

CH500/600 Searchlight Sonar

Maximize your time at sea & hit your quota by targeting your catch with Furuno.

FCV1900 delivers 1-3 kW output power at 15-200 kHz freq. range	FCV1900G tracks fish size using CHIRP™*	3rd gen WASSP specifically designed for fishing operations	WASSP 120° swath displays water column, bottom contour, and hardness	CH500/600 series offers fast scan speed and high-res images

*FCV1900G with TruEcho CHIRP™ Compatible transducer

TruEcho CHIRP

wassp® MULTIBEAM

SEE IT ALL

SearchLight SONAR

Get the whole story at furunousa.com