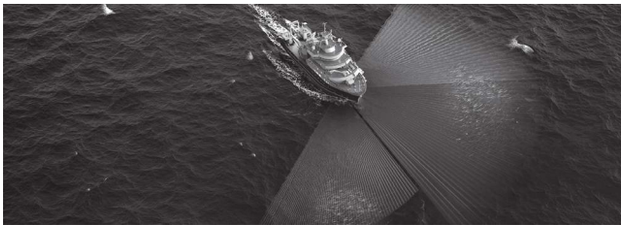
SIMRAD 70 YEARS 1947-2017

General Catalog

UNDERWATER SCIENCE PRODUCTS



TECHNOLOGY FOR SUSTAINABLE FISHERIES

TRANSDUCERS

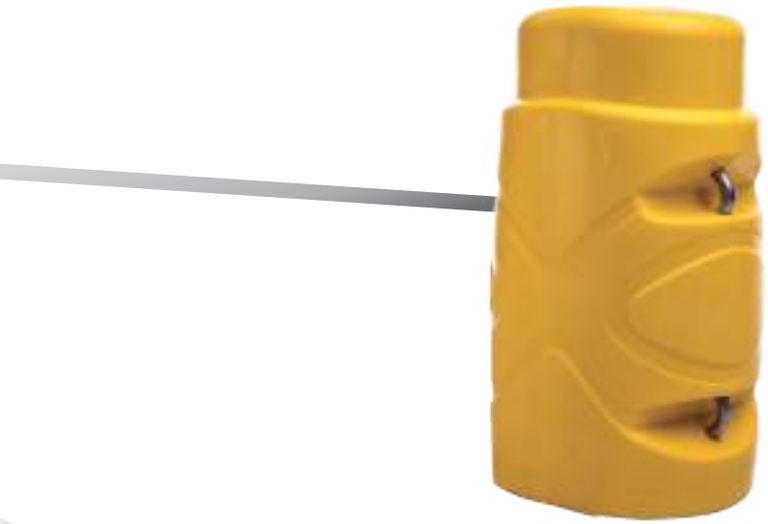
Transducers are the core of all SIMRAD products. The ability to efficiently convert the digital signal to sound in water, and vice versa, is of great importance of any acoustic system. Because of this, SIMRAD designs and produces our own transducers in order to secure the best performance in all our products.

OMNIDIRECTIONAL SONARS

In SIMRAD omnidirectional sonars up to 480 elements are used to create multiple beams, covering 360° horizontally and 180° vertically. All elements are designed and produced in-house, thus the production of a single transducer will take several days.

ECHO SOUNDERS

A good transducer makes a good echo sounder. SIMRAD produces a variety of transducers with centre frequencies spanning from 12 kHz to 333 kHz, and most of these come in a split beam configuration with multiple receiving channels. SIMRAD uses only ceramics and composite material in our transducers and the production is done using the latest in ceramic cutting machines and production facility.



WIRELESS SYSTEMS

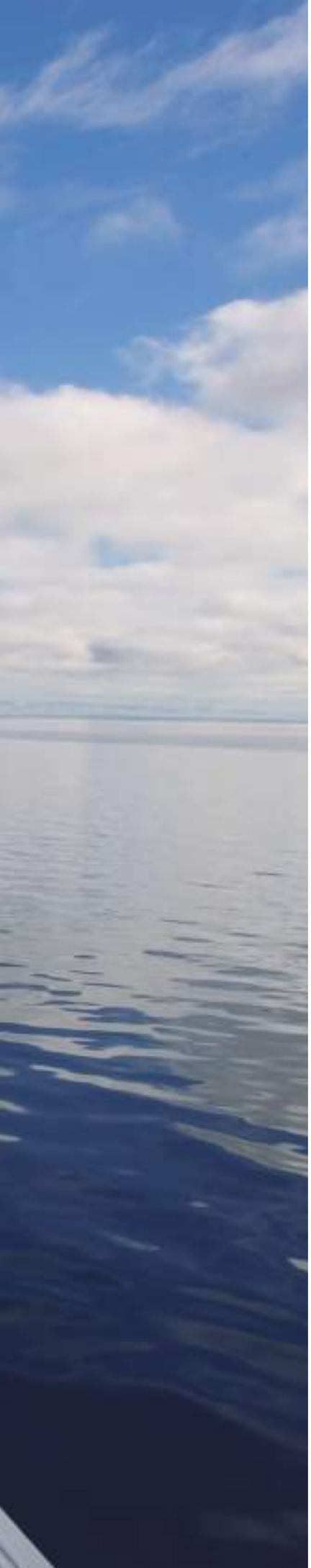
Wireless trawl sensors communicate acoustically to the vessel and between sensors. To be able to do this a transducer is needed to convert electrical signals into acoustic signals and vice versa. Small transducers in various frequencies are then placed inside the net sensor. Also, under the vessel a hydrophone is placed to be able to communicate with the sensor. A hydrophone is only listening, it is not transmitting.

3RD WIRE SYSTEMS

A 3rd wire system gives you real time information from the trawl. Along with other sensors, the trawl sonar is scanning the opening of the net, providing information of fish entry and trawl behaviour. Of course, it also has a SIMRAD transducer inside!

MULTIBEAM SYSTEMS

A scientific multibeam transducer consists of 800 individual elements that create configurations of multiple beams based on the user requirements. Combined elements are used to form beams in the shape of a FAN or MATRIX, allowing for real time 3D and 4D information to be collected.



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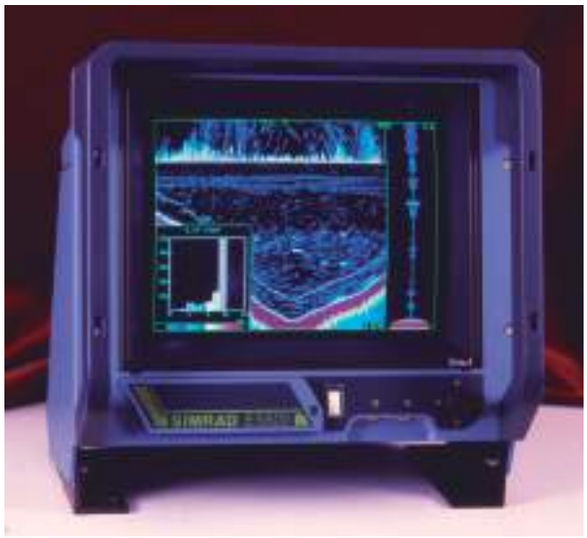
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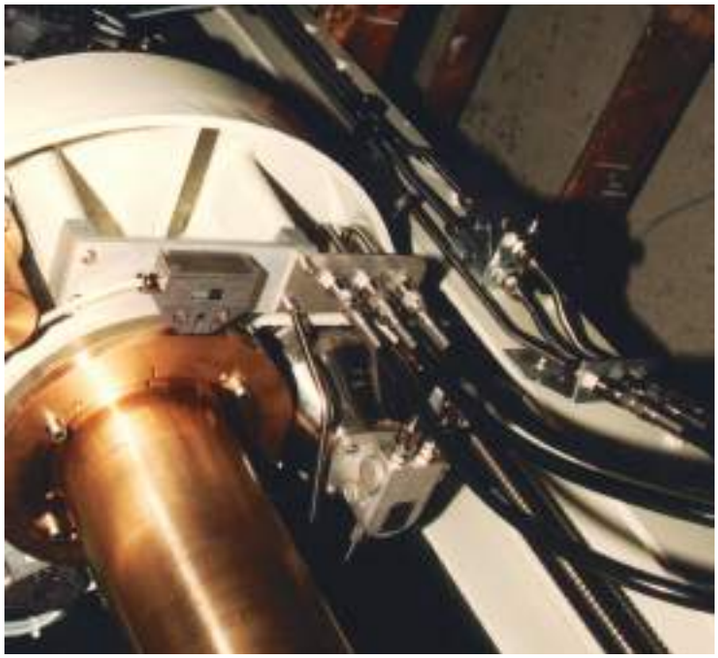
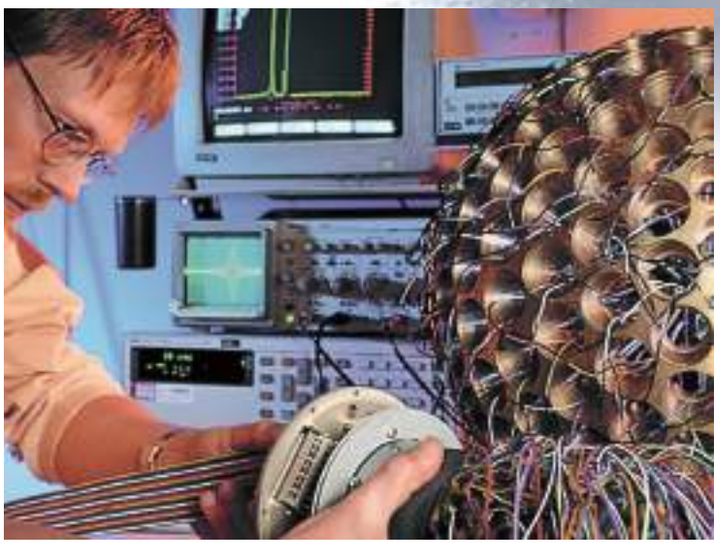



SIMRAD



SIMRAD

70 YEARS OF INNOVATION

Since SIMRAD introduced the sonar technology to the commercial fishery in Norway in the 1950s, the products have always evolved around *sound in water*. Through a close connection with the scientific community, important developments such as instruments for quantification of biomass, fish size estimation and tools for species identification has been commercialized and introduced to scientists worldwide.

SIMRAD's slogan is “Technology for sustainable fisheries” and we live by this slogan every day. We believe that a sustainable fishery is dependent on accurate tools to quantify and understand the marine ecosystem, and the SIMRAD products have always been in the forefront on providing for this.

Sustainability in this context also involves the environment, and all SIMRAD products are designed to facilitate efficient surveys. Scientific Multibeam Systems are used to increase sampling volume with less ship time needed to achieve the survey goal. Trawl monitoring systems are used to monitor trawl behaviour, as we believe optimal trawl performance also leads to reduced fuel consumption, less impact on the fauna and the right species and the right amount in the catch.

Following the current mantra in management and research communities, SIMRAD now offers products for *ecosystem monitoring*, ranging from small plankton to large mammals. As the focus shifts from single fish stock management towards looking at the whole food web, SIMRAD shall continue to develop new and refine existing tools for mapping the marine ecosystem.

PHILOSOPHY AND VALUES

A tool must work every time you need it and this is the foundation of our design work. We know, after 70 years in the same business, what it takes to make a reliable, high performance affordable tool for the scientist.

All SIMRAD products shall reflect our set of common values. One of our core values is innovative and this is the basic of the SIMRAD soul. We always strive to find new ways to make your life at sea easier by refining the tools you use. After 70 years in the business we still come up with new and refined products.

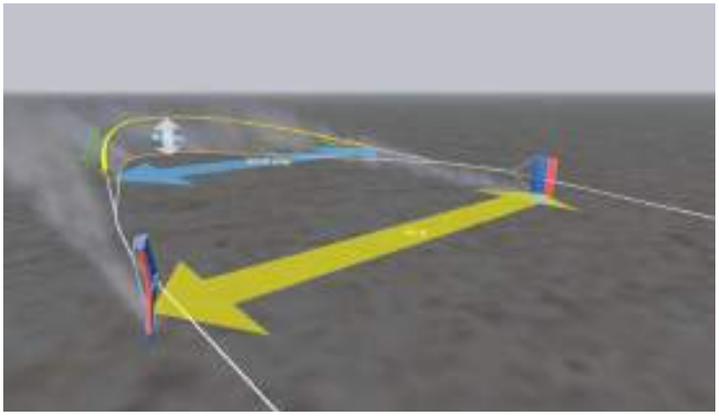
A collaborative and reliable partner is always important for any projects. Even more so when you work at sea or in remote areas. Regardless of the environment you operate in you shall never be in doubt that your SIMRAD equipment will perform.

Determined we shall continue to refine existing products and come up with new ones. All with the same goal; to improve the acoustic tools available for our valued users.

DETERMINED

We are known for our drive and persistence. We always strive to meet our customers' expectations. We set ambitious goals for ourselves and we are driven towards them with a clear and constant focus.

WHAT WE START, WE FINISH. WE DO NOT GIVE IN.



INNOVATIVE

Always performing better is a vital part of who we are. We constantly innovate and implement improvements in all parts of our business - from our products, through our processes, to our customers' experiences.

WE RELENTLESSLY PURSUE IMPROVEMENTS, NEW IDEAS AND NEW SOLUTIONS.

RELIABLE

Our customers and partners can trust SIMRAD to deliver, always. Dealing with SIMRAD means dealing with reliable people, a reliable corporation and reliable products. SIMRAD is a responsible organization characterized by integrity and concern for health, safety and the environment.

WE ARE RELIABLE PEOPLE. WE ARE RESPONSIBLE CITIZENS.

COLLABORATIVE

Collaboration is fundamental to our business. We exchange ideas among ourselves, with our suppliers and partners, and we cooperate closely with our customers. We work as teams, we share knowledge and we value team success - to the benefit of our customers and our own competitiveness.

WE COLLABORATE AS INDIVIDUALS AND AS AN ORGANIZATION.

The SIMRAD brand name is owned by the Kongsberg Group, a Norwegian technology company. The Kongsberg Group has a strong position in the maritime sector through its company Kongsberg Maritime (KM), where the SIMRAD branded products are sold.

Today KM manufactures a great variety of products, such as acoustic systems for mapping and positioning purposes, AUVs (Autonomous Underwater Vehicles), dynamic positioning, MRUs (Motion Reference Units), high accuracy GPS positioning systems, Engine control systems, Bridge Navigation systems as well as all the SIMRAD products.

1947
SIMRAD foundation

1951
First SIMRAD Echo sounder

1958
First fishery research sonar and echo sounder, Simrad 580-10

1968
First generation EK scientific echo sounders with calibrated output at 12,18, 38 and 120 kHz

1970
Rack version of EK sounder, EK-S and the first analogue Echo integrator Simrad QM

HISTORY

SIMRAD was founded in 1947 by Mr. Willy Simonsen. The name SIMRAD derives from “SIMonsen RADio” and, as the name indicates, it all started with radios. But this shortly developed into echo sounders and sonars. Today SIMRAD is recognized all over the world for premium performance products and manufactures sonars, echo sounders and net monitoring equipments.

1980
EK400 and digital echo integrator Simrad QD

1984
Simrad ES400 First split beam echo sounder

1989
SIMRAD EK500. First echo sounder with high instantaneous dynamic range

2002
First composite transducer

2003
EK60 introduced with BI60 post processing software, computer style, with frequencies 12 to 400 kHz

2005
Simrad ME70, first scientific multibeam echo sounder

2006
Simrad MS70, first scientific multibeam sonar

2013
RAW data output on omni directional sonars

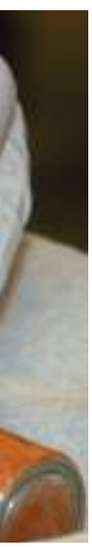
2015
Simrad EK80, first scientific wideband echo sounder

2016
WBAT, first wideband autonomous echo sounder

2017
TD50, first real time 3D visualization software

TRANSDUCERS

SIMRAD is one of the very few producers of transducers. The transducer is an important part of an echo sounder's performance. A transducer is the combination of a microphone and a loudspeaker, all in one. The transducer is converting electrical energy into sound waves and vice versa. What you see on the echo sounder screen is actually echoes from transmitted sound.



FROM ELECTRICITY TO SOUND

The transducers' ability to convert electrical energy into sound depends on how it is built. The more efficient it converts, the better the transducer is. There are several ways to make a transducer with different materials that can be used. Today, ceramic is the best material to use seen from a performance view. Other materials such as nickel or ferrite have a lower price but will not convert electrical energy as efficient as the more costly ceramic material. The way the material has been used in the production also matters to the final performance. The latest on the scene is to produce the transducers using composite technology, which is a special way of designing a ceramic transducer. The advantages are that the transducer has an efficiency of up to 75%, meaning if you put 1000W into the transducer 750W comes out into the water. The same conversion is valid when the signal comes back and it is vital for detection of weak targets even when using low powered transceivers.

The transducer also needs to be designed in a way that avoids ringing. Unlike a church bell that continues to ring after a strike, the transducer needs to shut off immediately after one ping in order not to disturb the next ping. SIMRAD's design and choice of material ensures a ring free transducer.

SPLIT BEAM, BROADBAND AND DEPTH RATED TRANSDUCERS

SIMRAD transducers are designed to work optimally across a large bandwidth and in demanding environments. We can divide the features of the transducers into three main categories:

"We are at the forefront of performance through innovative design and a unique production technology"

KJELL GJESTAD
Value Chain Manager

SPLIT BEAM TRANSDUCERS

A Split Beam transducer is made to send out one beam and receives the echo in three or four channels. Variations in phase of the returned echo enable us to locate the target within the acoustic beam. Once you know the location of a target you can make up for variations in the beam patterns, and in the end you can record calibrated target tracks within the acoustic beam. SIMRAD commercialized this technology in the 1980's and our EK split beam echo sounders are now used to record data for marine resource management worldwide.

COMMONLY USED SPLIT BEAM TRANSDUCERS

MODEL	PART NUMBER	NOMINAL FREQUENCY	NOMINAL OPENING ANGLE	MATERIAL
ES18	KSV-088694	18 kHz	11°	Ceramic
ES38-7	321842	38 kHz	7°	Ceramic
ES70-7C	KSV-203678	70 kHz	7°	Composite
ES120-7C	KSV-204580	120 kHz	7°	Composite
ES200-7C	KSV-203003	200 kHz	7°	Composite
ES333-7C	322598	333 kHz	7°	Composite

WIDEBAND TRANSDUCERS

A Wideband transducer can transmit and receive on a wide frequency range, for example 45-90, 90-170 or 160 to 260. This means that with 3 transducers you cover a frequency range from 45 to 260 kHz. To make a transducer that is capable of doing this, composite technology is our preferred production technique. While composite transducers have the highest bandwidth, some tonpilz transducers might still have some bandwidth available as seen in the ES38-7 in the table below.

When the Simrad wideband transducer is combined with Simrad wideband transceiver it is possible to make sweep transmissions where the frequency continuously increases throughout the transmitted pulse - also known as a chirp. It is also possible to transmit on several discrete frequencies, one at a time. Advanced users may define an arbitrary signal, such as a dolphin's click. This opens up a whole new world in interpretation of the echo, taking a great step forward towards the goal of providing a species identification echo sounder, or "ecosounder".

COMMONLY USED WIDEBAND TRANSDUCERS

MODEL	PART NUMBER	FREQUENCY	NOMINAL OPENING ANGLE	MATERIAL
ES38-7	321842	35 to 45 kHz	7°	Ceramic
ES70-7C	KSV-203678	50 - 90 kHz	7°	Composite
ES120-7C	KSV-204580	85 - 170 kHz	7°	Composite
ES200-7C	KSV-203003	160 - 300 kHz	7°	Composite
ES333-7C	322598	250 - 500 kHz	7°	Composite

DEPTH RATED TRANSDUCERS

Sometimes collecting data from a vessel simply does not do the job for you. Perhaps you need to get the transducer closer to the target for better resolution, or perhaps you want to deploy echo sounders in the deep for long term collection of data. SIMRAD has for many years built transducers for applications like this. Our series of depth rated transducers have standard depth rating to 1500 meters, but should you for some reason need to go deeper feel free to contact us.

A new range of compact depth rated transducers (model name ending in DK) has been developed for platforms where size is an important factor.

DEPTH RATED TRANSDUCERS*

MODEL	PART NUMBER	NOMINAL FREQUENCY	NOMINAL OPENING ANGLE	MATERIAL
ES38-DD	KSV-113392	38 kHz	7°	Ceramic
ES70-7CD	335039	70 kHz	7°	Composite
ES120-7CD	324410	120 kHz	7°	Composite
ES200-7CD	KSV-207134	200 kHz	7°	Composite
ES333-7CD	312902	333 kHz	7°	Composite
ES38-18DK	399916 / 421537**	38 kHz	18°	Ceramic
ES200-7CDK	401103 / 418812**	200 kHz	7°	Composite
ES333-7CDK	401204 / 418813**	333 kHz	7°	Composite

* Standard depth rating: 1500 meters. Other depth rated transducers available on request.

** Split beam version / Single beam version

DID YOU KNOW...?

The physical dimensions of a transducer can be explained as a function of the beam opening at a given operating frequency. Traditionally 7° opening angle has been the standard for marine surveys, but for applications where size and weight is of great importance you can reduce the size of the transducer by allowing a larger opening angle of the acoustic beam. The effective transducer face circular area is calculated from the general formula:

$$A \cong \left(\frac{\lambda}{2\beta}\right)^2 \times \pi$$

Where

A =effective transducer circular area

λ =wavelength

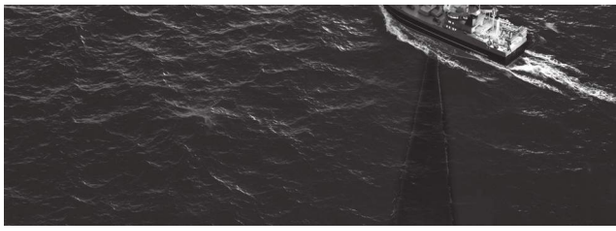
ß =beamwidth in radians (-3 dB points)

In the table below some parameters from the traditional Simrad research transducers are given, where the maximum and minimum source level (SL) is calculated from the available power settings on the Simrad EK80 echo sounder and the near field is calculated by the formula:

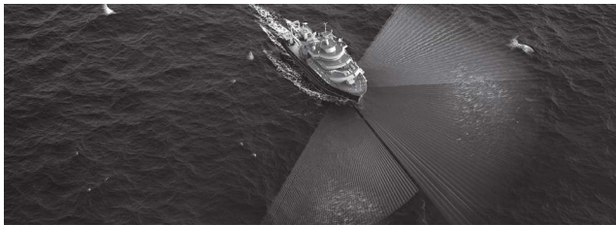
$$Near\ field \cong \frac{A}{\lambda}$$

FREQUENCY	WAVELENGTH	BEAMWIDTH	MAX/MIN SL	EFFECTIVE TRANSDUCER CIRCULAR AREA	TRANSDUCER NEAR FIELD
18 kHz	83 mm	11°	225/215 dB	1479 cm^2	178 cm
38 kHz	39 mm	7°	229/219 dB	820 cm^2	208 cm
70 kHz	21 mm	7°	227/217 dB	242 cm^2	113 cm
120 kHz	13 mm	7°	222/212 dB	82 cm^2	66 cm
200 kHz	8 mm	7°	220/212 dB	30 cm^2	39 cm
333 kHz	5 mm	7°	212/209 dB	11 cm^2	24 cm

SINGLE BEAM SYSTEMS



MULTIBEAM SYSTEMS



SONARS

CATCH MONITORING SYSTEMS

APPLICATIONS

"The new wideband echo sounders provide significant information about some of the basic backscattering properties of a target, which leads to improve target characterization."

LARS NONBOE ANDERSEN
Product Manager
Underwater Science

SINGLE BEAM SYSTEMS

The foundation of any survey

Calibrated split beam echo sounders operating at multiple frequencies are the basis of any quantitative survey. The first SIMRAD EK echo sounders with calibrated output were introduced in 1968. Since then, the equipment and techniques have evolved but the basic of multifrequency remains the same.

Through the introduction of scientific echo sounders capable of transmitting sound pulses with variable frequency, SIMRAD now takes research to the next level. These sounders can be used as narrowband (CW) in some situations, and as wideband in other.

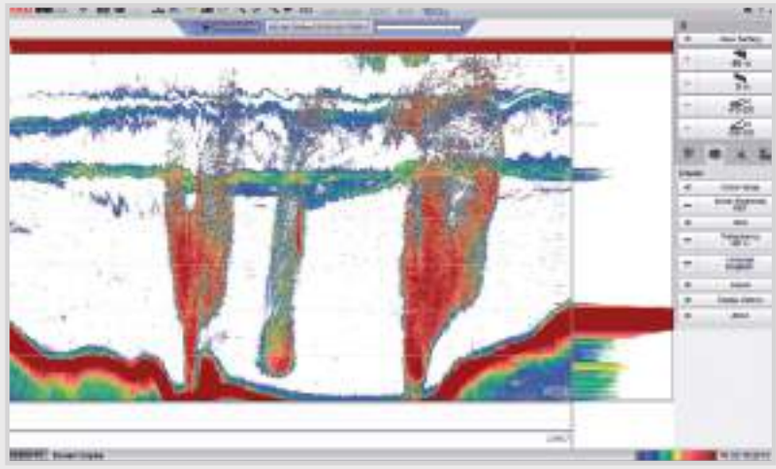
We envision the EK scientific echo sounders to be the basic research tool for any underwater science application, a system that can be adapted to match any situation and any environment.

SIMRAD EK SYSTEMS

EK is our common name for all single beam echo sounders designed for research applications. The first EK sounder was introduced in the 1960's, and already back then the focus was to create a quantitative sounder that could measure biomass.

All EK systems share some common features such as built-in calibration and split beam capabilities with full beam compensation for accurate TS measurements. The focus when designing the EK system is that you should be in full control of all sounder parameters. That is why there are no automated settings in the acquisition SW. A skipper might want optimal settings displayed at all times to get a good picture of the fish, but a sudden change in ping rate or duration might corrupt a survey, with data no longer comparable.

Another common feature is a standardized RAW data format, which means that you can compare data across platforms. In many cases you need to combine your vessel data with data collected from profiling platforms to get TS measurements or measurements from deep scattering layers, and those times it is good to know that the sounders use the same currency. Simrad RAW data is an open, well documented format, as can be expected from a scientific system.

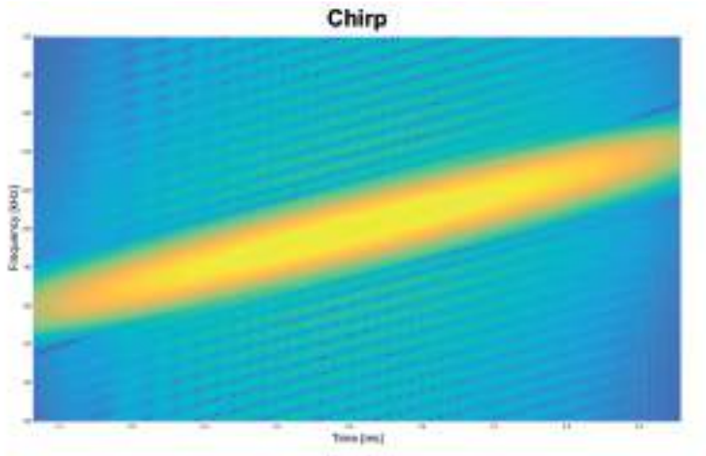


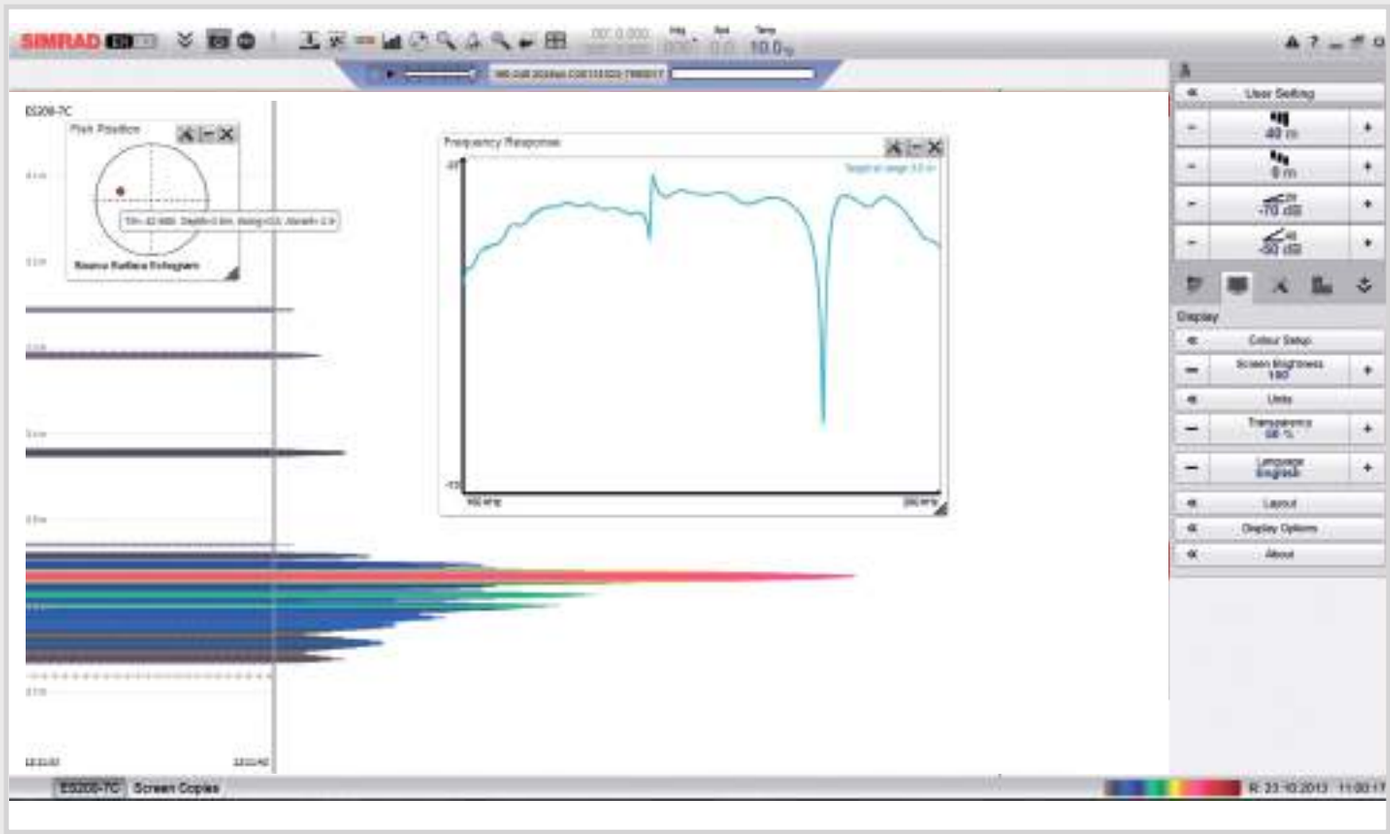
In this EK80 screen capture you see hard bottom in deep red colour, herring schools releasing gas that slowly drifts towards the surface and a substantial layer of plankton and small jelly fishes.

WIDEBAND ECHO SOUNDERS

The new series of EKs has wideband capabilities. That means that you can transmit a signal that varies across the transmission, called a chirp. The most common way to operate the sounder is to use a linear chirp. In an EK80 chirp you either utilize the entire effective frequency band of the transducer, or you can choose to limit the bandwidth.

Due to advanced matched filtering techniques you can correlate the returned signal with what you sent out, and the result is improved range resolution of single targets. Also, as resolution is now a function of bandwidth rather than pulse length, chirp allows for long range performance without scarifying the resolution. When you have very weak targets in the near vicinity of strong ones, such as small fish close to bottom, you might want to use a different pulse shape. A dolphin's click is shorter, but still spans over a large bandwidth and might be better suited for such environments. The EK80 is prepared for such requirements, and as the SW continues to be developed, new functions would be available.



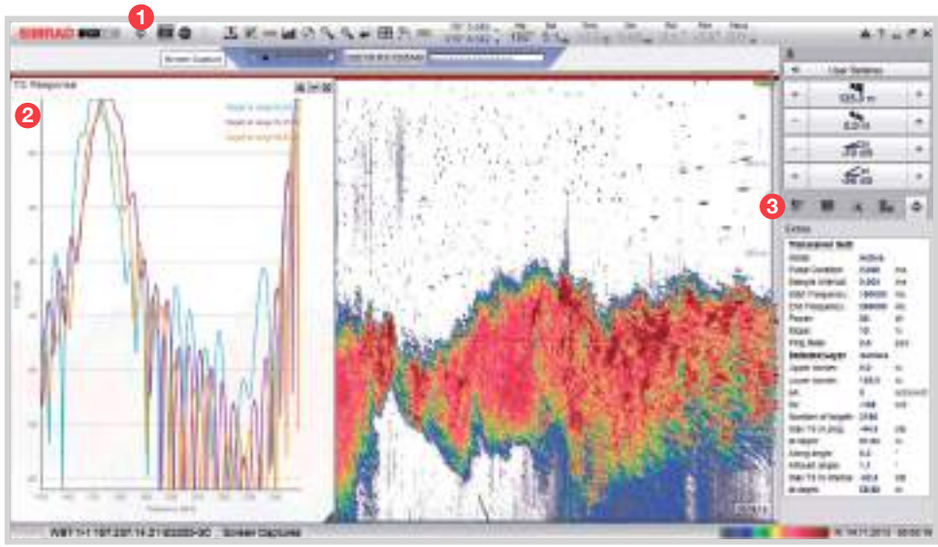


Range resolution and target ID are improved. Echo from a 38,1 mm tungsten sphere is measured, and you can clearly see how the target strength changes with frequency. This frequency response is unique to this particular target, and corresponds well with the theoretical curves. Resolution is excellent, and you can clearly see the knot on the fishing line where the suspended sphere is attached to the line, around 10 cm from the sphere itself.

EK80 SOFTWARE

The Simrad EK80 system consists of an acquisition software, one or more wideband transceivers, and transducers. When used with the EK80 real time acquisition software, the system is operated by a Windows™ based processor. Also, the system normaly requires input from auxiliary sensors such as GPS and motion sensor.

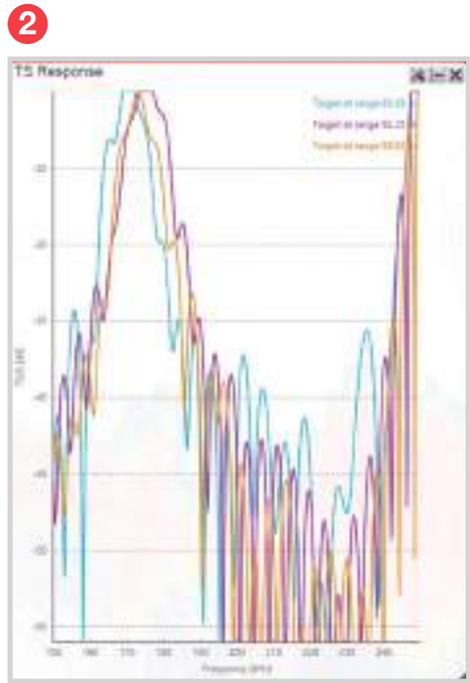
The EK80 SW is the command and storage centre of the system. This is where the user sets the parameters of the transmission and the data you want to record. The EK80 also has advanced tools for replaying and visualization of RAW data. Biomass in predefined layers is automatically calculated, and the SW has lots of new tools such as frequency response across the frequency band and a neat little zoom tool that can be used to inspect details.



Frequently used buttons and numerical displays such as ship heading, roll, pitch and heave are always shown on top of the EK80 SW. The EK80 has new tools that can be used to inspect and display data, when clicking on the magnifying glass you would for instance get access to a zoom tool that can come in handy when creating screen shots to use as examples.

All settings needed to operate the EK80 SW are distributed under five main tabs for easy operation:

- The OPERATION menu is the place where you have all settings that are directly influencing the RAW data you record, such as transmission settings and settings related to RAW data recording.
- The DISPLAY menu comprises settings that regulate how the SW appears on your computer right now.
- The SETUP menu includes installation and calibration settings
- The ACTIVE menu contains settings and calculations for the active channel or layer. Layer definition, biomass calculation parameters and TVG settings are all set up here.
- The EXTRAS menu, which is displayed here, shows numerical details from the transmission, as well as the results from the active layer.



TS response for resolved targets is calculated and displayed as a function of frequency in real time in the EK80 SW. In this capture you can see three objects passing the single target criteria, all being picked out of a dense mackerel school at 81, 91 and 98 meter range. In the tool menu you can also set the parameters of what is to be recognized as single targets.

WIDEBAND TRANSCEIVER (WBT)

The Wideband Transceiver is designed for applications where performance is the top priority. The WBT has four 500 W channels that can either work independently with single beam transducers, or together with a split beam transducer. The WBT is optimized for applications where power consumption and size is not critical, typically on board a research vessel or a platform with power and and high speed Ethernet communication available.

The WBT transceiver is capable of operating on entire band from 10 kHz to 500 kHz, only limited by the transducer's bandwidth.

WBT MINI

As a compact version of the Wide Band Transceiver, the WBT Mini presents an energy efficient and splash proof design. The frequency range (30-500 kHz) and the output power are lower than in the WBT. In return it offers very low power consumption, perfect for platforms with limited available power and space.

The WBT Mini also has built-in multiplexing on each transceiver channel, allowing for alternation between two 4 channel split beam transducers, or a combination of 3 channel split beam and single beam transducers.

WBT TUBE

The WBT Tube is a 4000 meter depth rated version of the EK80 WBT family. The tube contains two built-in transceivers that rely on external power. It is connected to the EK80 processor through Ethernet.

EK80 PORTABLE

The EK80 Portable system has all the tools needed for your survey but in a small size. The EK80 software runs on an internal processor with built-in GPS, all controllable from your phone or tablet through WIFI connection. The WBT mini transceiver allows for a compact, energy effective solution, with up to two selectable transducers connected at the same time.

SIMRAD EK MISSION PLANNER

PLAN YOUR MISSION

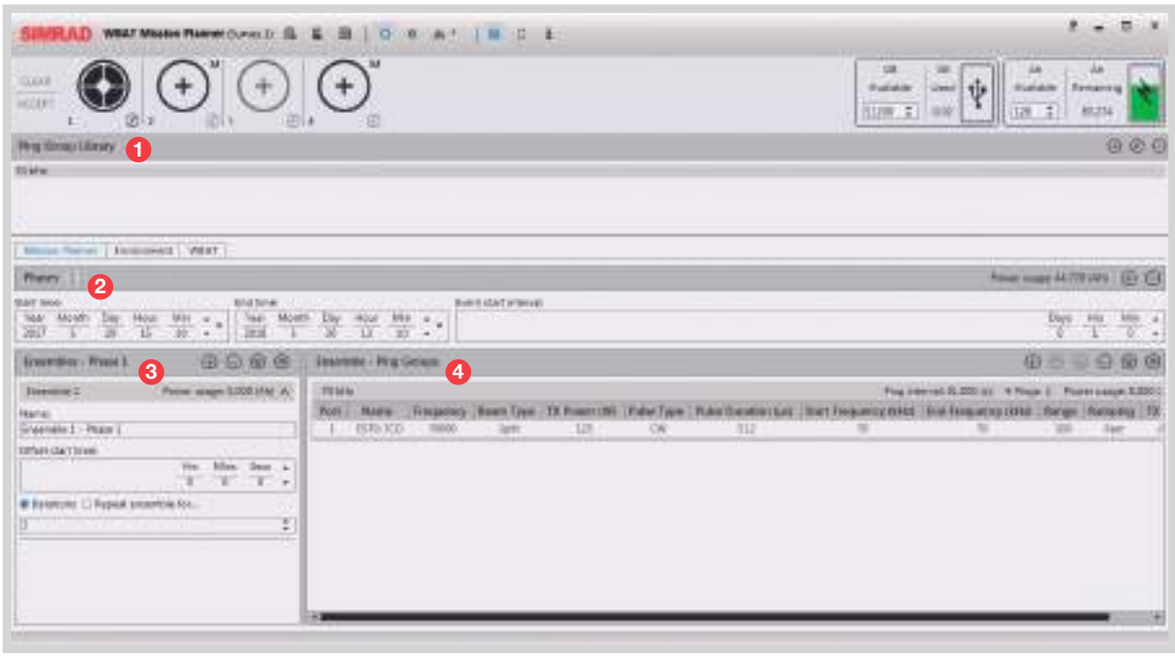
The EK80 Mission Planner is, as the name implies, a software used to plan a mission from deployment to recovery.

All details regarding when the sounder should wake up, how long it should transmit and when it should go to sleep can be set before deployment.

In the Mission Planner the user can set as many phases as the survey requires. This could be helpful if you want the transmission scheme to change throughout the deployment. You might want to do CW most of the time, while doing chirp in shorter periods to look at frequency response of targets.

After carefully planning the deployment, all settings are uploaded to the transceiver. The unit is then ready to be deployed, and the only remaining task is to click on the Activate mission button.

Apart from uploading the setup for a predefined mission, the settings created in the Mission Planners can be used in an “interactive mode” that allows the user to redefine some of the parameters even after the deployment.



1

PING GROUP LIBRARY
The ping group library contains a collection of your personal ping groups defining what the transceiver will do when it wakes up.

2

PHASE(S)
The Phase defines when and how often the transceiver should wake up during a deployment period. A mission plan must contain at least one phase. Multiple phases are also allowed. At certain intervals within a Phase the transceiver will wake up and record data as specified by the mission plan.

3

ENSEMBLES
An Ensemble is a collection of one or more Ping Groups from the Ping Group Library. Within an Ensemble, it is possible to choose several Ping Groups, for instance one for “active” CW followed by “active” FM followed by a “passive” CW ping. An Ensemble can be executed a number of times or for a period of time.

4

PING GROUPS
A Ping Group defines ping parameters, such as its frequency, power, pulse type and pulse length.

WIDEBAND AUTONOMOUS TRANSCEIVER (WBAT)

The EK Wideband Autonomous Transceiver is made for applications where it is necessary to gather scientific data from other platforms than traditional research vessels. Typically this involve long term monitoring or monitoring in places where it would not be pratical, or in some cases not even possible, to use a research vessel. As the WBAT has a standard depth rating of 1500 meter, it can also be used to profile layers in depths where hull mounted echo sounders cannot reach with high frequencies.
An autonomous EK system consists of an autonomous transceiver, one or more transducers, and a mission planner. The data from the system can also be viewed and calibrated with the EK80 SW as the RAW data format are the same.

The WBAT uses the same technlogy as the WBT wideband transceiver, but has been redesigned to be more compact and energy efficient. The four independent channels can be used as multiple single beam channels, or working together with a split beam transducer. With the built-in multiplexer you can also use two split beam transducers together using sequential pinging.

Although operating without the EK80 SW, the WBAT collects data in a format, and of a quality to be expected from any EK system. This means that the data coming from different sources can be easily integrated. Being part of the EK80 family, the WBAT is capable of split beam, the Autonomous EK is capable of split beam, which means that it can be calibrated to the same standards and with the same techniques as the EK80.

The pressure rated housing itself, along with the connections and the internal battery are already proven Kongsberg Maritime technology. The Kongsberg transponders are used globally in the oil and offshore industry, with the highest requirements for quality and safety found anywhere in the marine business. Coupled with more than 70 years of experience with underwater acoustics, the end result is reliable echo sounders that the customer can count on.

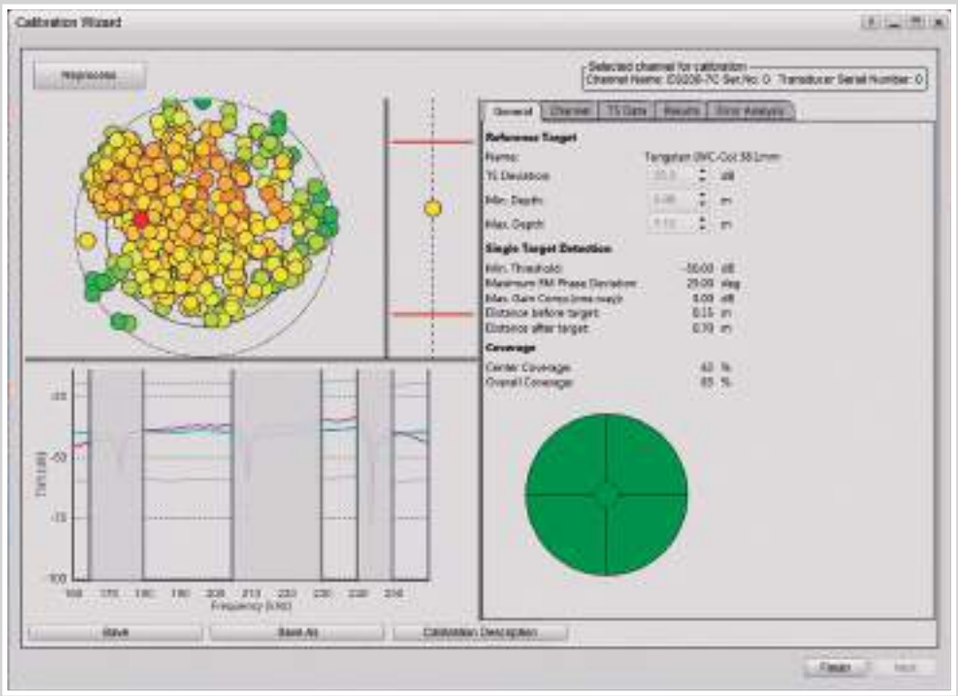
WBT MINI AUTONOMOUS MODE

As an option, the WBT Mini can also be operated in autonomous mode. In this configuration, the transceiver is preprogrammed with the EK Mission Planner. It can either operate according to a preset mission plan or interact with an external processor through the RS422 connection. The internal microprocessor can also be set up to send back compressed data suitable for satellite transmission, perfect for unmanned surface vehicles and other platforms where the user needs real time data.

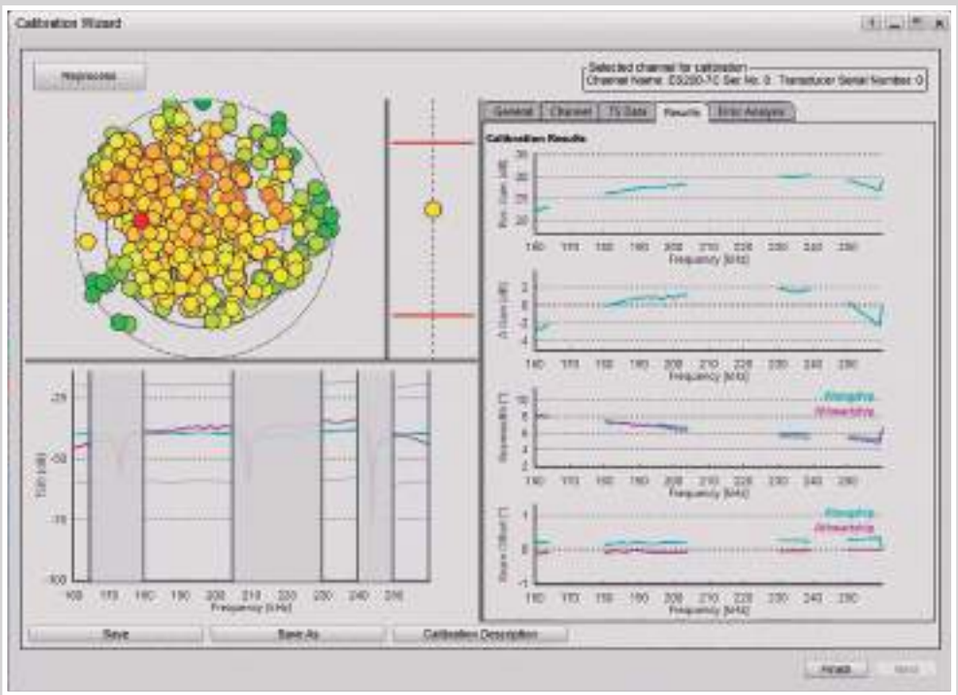
CALIBRATION

All Simrad echo sounders should be calibrated in field by the user at regular intervals. Above all, calibration is required to collect quantitative data.
There is however another good reason why you should calibrate your system frequently. A calibration is your best insurance that the system is working as expected. If a connection is unstable, or a channel in your transducer has malfunctioned, you will know instantly.

With the introduction of chirp you introduce new challenges around calibration, as both the frequency and the beamwidth change during transmission. The EK80 SW has the calibration functionality built-in. It takes care of all of this for you, calibrating the entire bandwidth with split beam techniques also for chirp transmissions.



The EK80 calibrates the full beamwidth of the split beam transducer, and across the frequency range of the transmission. There will always be areas where the calibration sphere has "nulls", frequencies where the sphere has very low target strenght. While it is these nulls that allow you to identify the particular target, these areas are not usable for calibration, and the EK80 SW lets you adjust the frequency ranges that are to be used for the particular calibration. The new and improved EK80 SW is designed to be intuitive and easy to use, and this does of course also apply to the important calibration procedure.



After you have collected data across the beamwidth it is time to view the data and apply the calibration. Note the three rings in the target detection window, where the centered ring represents the beamwidth at the center frequency of the transmission. The outer and inner rings represent the opening angle at the start and stop frequency. Only target detections that have been seen across the frequency band is accepted for the calibration. If the results appear to be within the expected variance you save the data, click the "Finish" button and the system is calibrated.

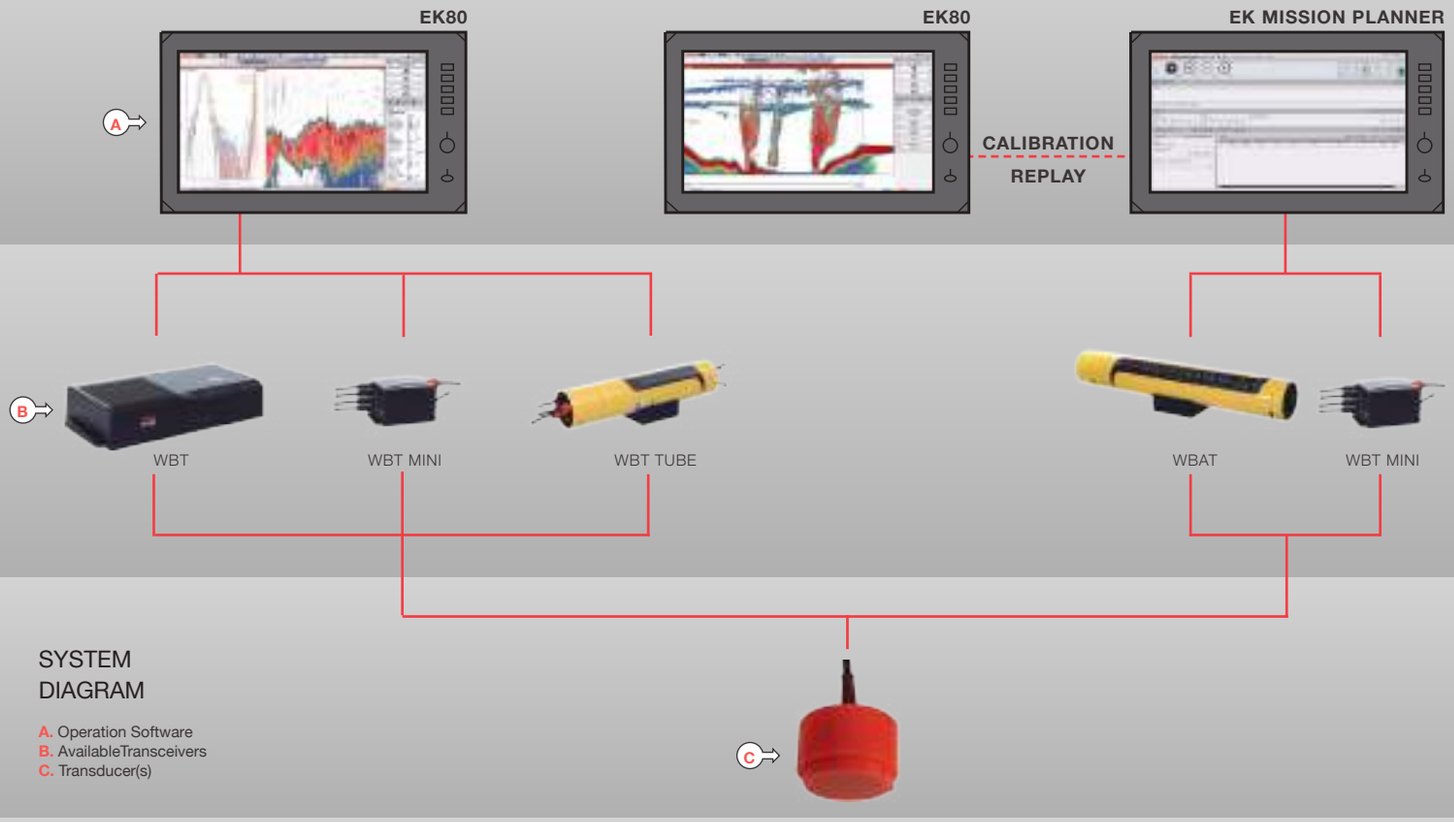
EK TRANSCEIVERS SPECIFICATIONS

	WBT	WBT Mini	WBT Tube	WBAT
Frequency Range	10-500 kHz	30-500 kHz	30-500 kHz	30-500 kHz
Pulse Duration	64-16384 µs	64-2048 µs	64-2048 µs	128- 2 µs
Pulse Forms	CW, FM (up and down sweep), Custom (future option)	CW, FM (upsweep)	CW, FM (upsweep)	CW, FM (upsweep)
Transmit Power	2000 W @55 Ω	1000 W @55 Ω	1000 W @55 Ω	1000 W @55 Ω
Number of Channels	4	4 (8 with MUX)	8 (16 with MUX)	4 (8 with MUX)
Transducer options	Single, Split	Single, Split	Single, Split	Single, Split
Internal memory	N/A	512 GB (Aut. Ver.)	N/A	512 GB (Aut. Ver.)
Depth / Width / Height	213 / 438 / 84 mm	145 / 223 / 123 mm	701 / 144 / 144 mm	166 / 166 / 1000 mm
Weight air/water	4.9 kg	5.4 / N/A kg	14.1 / 3.6 kg	25/12
Voltage requirement	12-15 VDC	12-16 VDC	12-16 VDC or 20-50 VDC	14 V (internal battery)
Power consumption 38/120/333 kHz	20 / 10 / 5 W	6 / 3 / 3 W	6 / 3 / 3 W*	6 / 3 / 3 W
Passive/Standby	4 W	2 / <0.02 W	2 W* / N/A	2 / 0.02 W
Maximum current	5 A	2.5 A (Peak)	2.5 A (Peak)	2.5 A (Peak)
Power source	External	External	External	Built-in battery
Operational temperature	-15 to +55 °C	-15 to +55 °C	-5 to +35°C	-5 to +35°C
Storage temperature	-20 to +70 °C	-20 to +70 °C	-20 to +55°C	-20 to +55°C
IP/Depth rating	N/A	IP67	4000 m	4000 m
Enclosure Material	Aluminium	Aluminium	Aluminium	Aluminium
Compass safe distance standard/other	30 cm	N/A	N/A	N/A
External Interface	Ethernet, Digital sync I/O	Eth/serial	Ethernet	Serial

*WBT tube has two transceivers available. Consumption and power requirements are given for one transceiver.

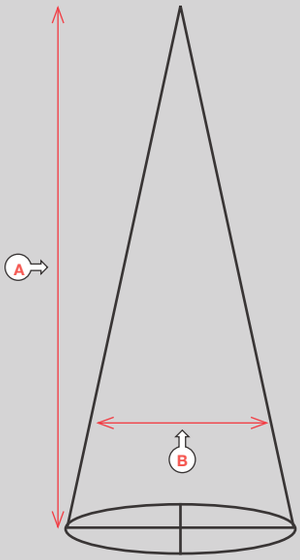
EK80 REAL TIME SYSTEM

EK80 AUTONOMOUS SYSTEM



SYSTEM DIAGRAM

A. Operation Software
B. AvailableTransceivers
C. Transducer(s)



FOOTPRINT ON DIFFERENT TRANSDUCER BEAMWIDTHS

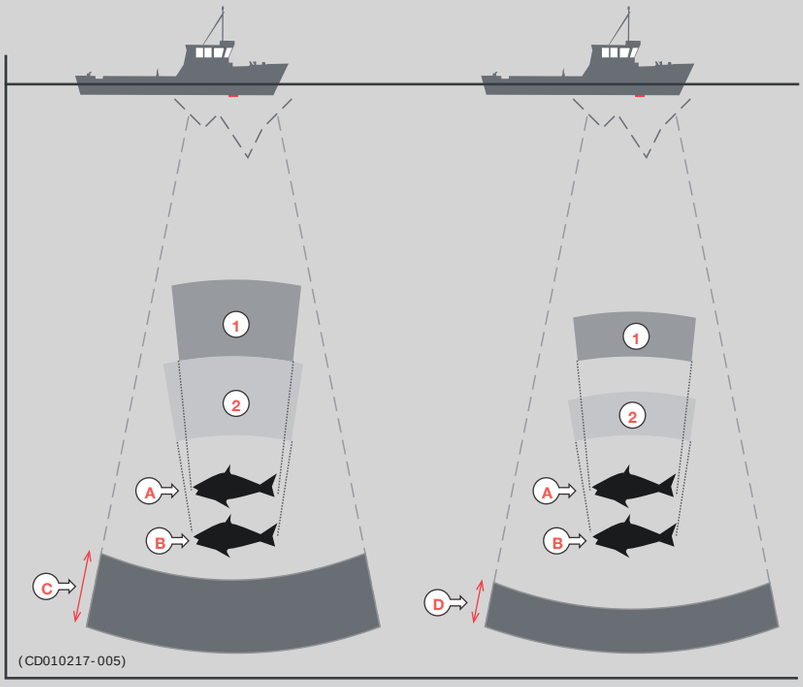
			10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
A		Meters	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
		Feet	33	66	98	131	164	197	230	262	295	328	361	394	426	459	492
		Fathoms	5	11	16	22	27	33	38	44	49	55	60	66	71	77	82
B	7°	Meters	1	2	4	5	6	7	9	10	11	12	13	15	16	17	18
		Feet	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	10°	Meters	2	4	5	7	9	11	12	14	16	18	19	21	23	25	26
		Feet	6	11	17	23	29	34	40	46	52	57	63	69	75	80	86
	13°	Meters	2	5	7	9	11	14	16	18	21	23	25	27	30	32	34
		Feet	7	15	22	30	37	45	52	60	67	75	82	90	97	105	112
	30°	Meters	5	11	16	21	27	32	38	43	48	54	59	64	70	75	80
		Feet	18	35	53	70	88	105	123	141	158	176	193	211	228	246	264

RANGE RESOLUTION ON VARIOUS TRANSDUCERS

Range resolution in CW mode is given as half the pulse length. Range resolution in chirp mode however, is given by the bandwidth (BW), not the pulse duration:
Range resolution=c/2xBW

As an example, an EK80 transmission could use 100 kHz bandwidth. Assuming a sound speed (c) of 1500 m/s, this will give a range resolution of about 8 mm, far better than in CW. Range resolution from the composite transducers is in brackets in the table below for comparative purposes.

	64µS	128µS	256µS	512µS	1024µS	2048µS	4096µS	8192µS
18 kHz				40 cm	75 cm	150 cm	300 cm	600 cm
27 kHz				40 cm	75 cm	150 cm	300 cm	600 cm
38 kHz			20 cm	40 cm	75 cm	150 cm	300 cm	
50 kHz		10 cm	20 cm	40 cm	75 cm	150 cm		
70 kHz		10 cm (2 cm)	20 cm (2 cm)	40 cm (2 cm)	75 cm (2 cm)	150 cm (2 cm)		
120 kHz		10 cm (1 cm)	20 cm (1 cm)	40 cm (1 cm)	75 cm (1 cm)			
200 kHz	5 cm (0,8 cm)	10 cm (0,8 cm)	20 cm (0,8 cm)	40 cm (0,8 cm)	75 cm (0,8 cm)			
333 kHz	5 cm (0,5 cm)	10 cm (0,5 cm)	20 cm (0,5 cm)	40 cm (0,5 cm)	75 cm (0,5 cm)			



The left vessel uses a long pulse duration (C). As you can see, this causes the echoes from the two fishes (A) and (B) to merge.

The right vessel uses a shorter pulse duration (D), and the two fishes will then appear as two separate echoes on the echogram.

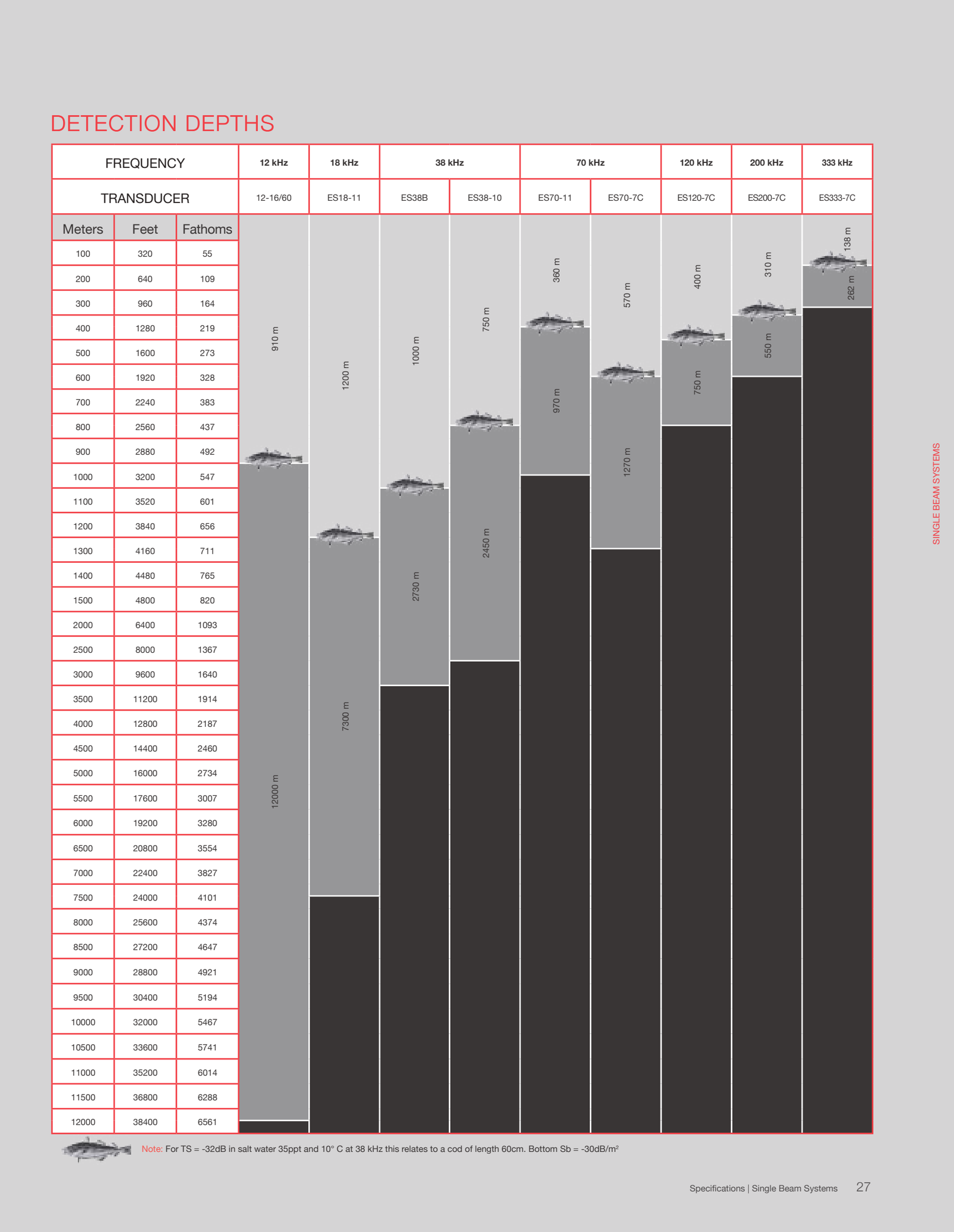
Thus, short pulses will provide the best resolution and separation of individual fishes, but the echo sounder is more sensitive to noise.

Two targets need to be min. 1/2 pulse length apart, in order to be seen as two targets. This can be measured in cm. (table above).

This is however not the case with chirp where resolution is given by the utilized bandwidth, with range resolution shown in brackets.

DETECTION DEPTHS

FREQUENCY			12 kHz	18 kHz	38 kHz		70 kHz		120 kHz	200 kHz	333 kHz
TRANSDUCER			12-16/60	ES18-11	ES38B	ES38-10	ES70-11	ES70-7C	ES120-7C	ES200-7C	ES333-7C
Meters	Feet	Fathoms									
100	320	55									
200	640	109									
300	960	164									
400	1280	219									
500	1600	273									
600	1920	328									
700	2240	383									
800	2560	437									
900	2880	492									
1000	3200	547									
1100	3520	601									
1200	3840	656									
1300	4160	711									
1400	4480	765									
1500	4800	820									
2000	6400	1093									
2500	8000	1367									
3000	9600	1640									
3500	11200	1914									
4000	12800	2187									
4500	14400	2460									
5000	16000	2734									
5500	17600	3007									
6000	19200	3280									
6500	20800	3554									
7000	22400	3827									
7500	24000	4101									
8000	25600	4374									
8500	27200	4647									
9000	28800	4921									
9500	30400	5194									
10000	32000	5467									
10500	33600	5741									
11000	35200	6014									
11500	36800	6288									
12000	38400	6561									



Note: For TS = -32dB in salt water 35ppt and 10° C at 38 kHz this relates to a cod of length 60cm. Bottom Sb = -30dB/m²

"The scientific multibeam systems represent outstanding innovation in transducer technology, mechanical design, beam forming, and signal processing solutions."

LARS NONBOE ANDERSEN
Product Manager
Underwater Science

MULTIBEAM SYSTEMS

Take your survey to the next level

Multibeam systems have been used for decades to detect, inspect and map bottom and manmade structures in the water, but the application within fishery and ecosystem surveys is relatively new.

With the introduction of the first quantitative Multibeam systems in the world, SIMRAD has added new dimensions to biological surveys, providing 3D and even 4D data from the marine ecosystem.

The combination of high resolution quantitative data, extremely low side lobes and no cross talks between the beams has already proven to strengthen our understanding of marine life.

SIMRAD ME SYSTEM

SIMRAD ME70 SCIENTIFIC MULTIBEAM ECHO SOUNDER

A scientific multibeam echo sounder can be seen as many EK sounders spread out in a fan of beams. Where the EK provides multifrequency analysis, the ME70 adds to the picture with morphology and volume information, improved horizontal resolution and in general, it samples more cubic of water along the survey line.

What makes the ME70 truly unique is that it combines the quantitative element from the split beam sounders with the resolution and the extended sampling volume from the multibeam world. As each beam is configured as split beam, standard split beam calibration techniques can be applied to the entire swath. When you have the system calibrated, you can both visualize and quantify your targets.

The combination of multiple, narrow beams with low side lobes strengthen your capability to measure targets in the acoustic dead zone close to the sea bottom. In addition to the obvious fish and marine mammals, other targets such as methane gas seeps and seafloor vegetation can be measured with calibrated backscatter values. The increased sampling volume from a swath system also addresses the acoustic dead zone in the upper layers of the water column as the fan of beams cover approximately 10 times the width compared to the 7° single beam.

MORPHOLOGY AND BEHAVIOUR

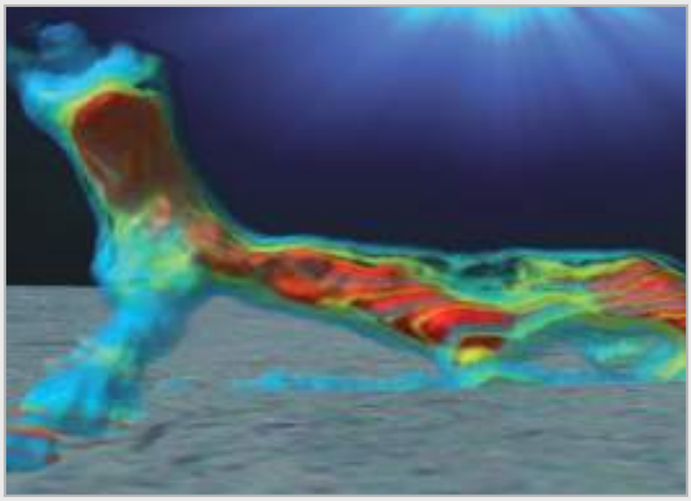
Much information can be derived from understanding the morphology of schooling fish. Perhaps most obvious; your estimation of the size on that particular school will improve. However, school morphology can also improve your species identification as various fish show different characteristics in the way they interact both within the school and together with the surrounding environment.

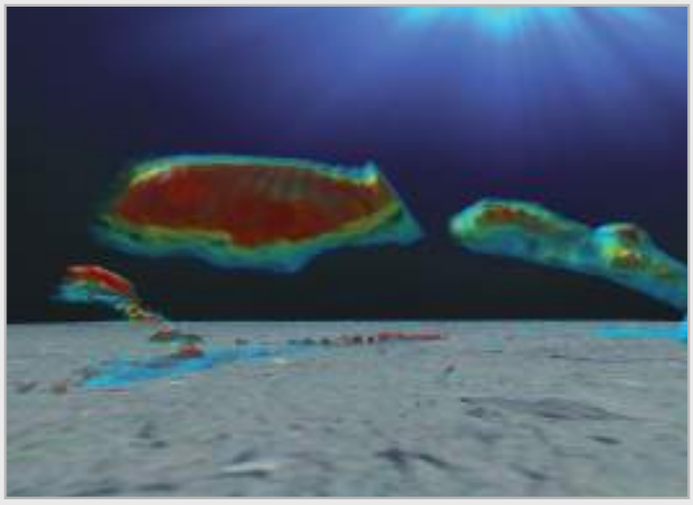
Predator/prey, or who is feeding on who, is also important information when you assess the ecosystem. The ME70 offers extremely low sidelobes and high dynamic range, something that is vital when it comes to measuring a fish close to bottom, or plankton near a school of fish. The two way side lobe suppression offered by the ME70 means that a school of fish will not be smeared out across the swath, but rather show the real boundaries of the school. The same applies for marine habitats where the bottom echo is the dominant scatterer. Thanks to the advanced beamforming and side lobe suppression techniques of the ME70, the bottom echo would not shadow other smaller targets.

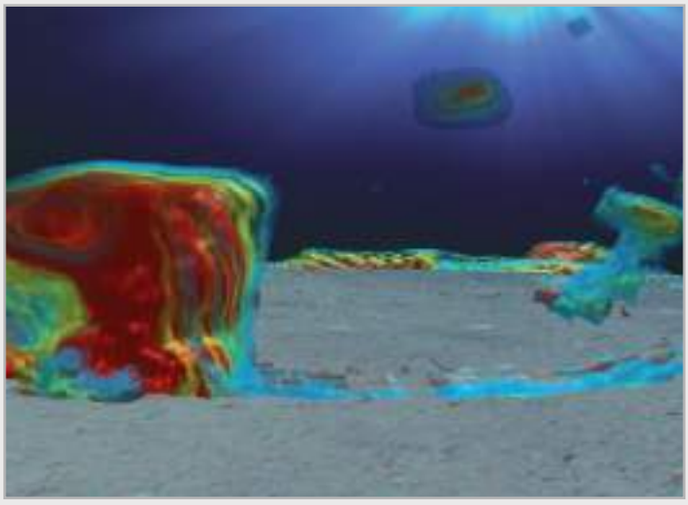
To investigate a complete marine ecosystem is a challenge. Using single beam acoustics can be compared with looking through a peephole, whereas the ME70 widens your vision and is more like looking through a window. The 3D information given by the ME70 adds spatial resolution and improves your stock assessment.

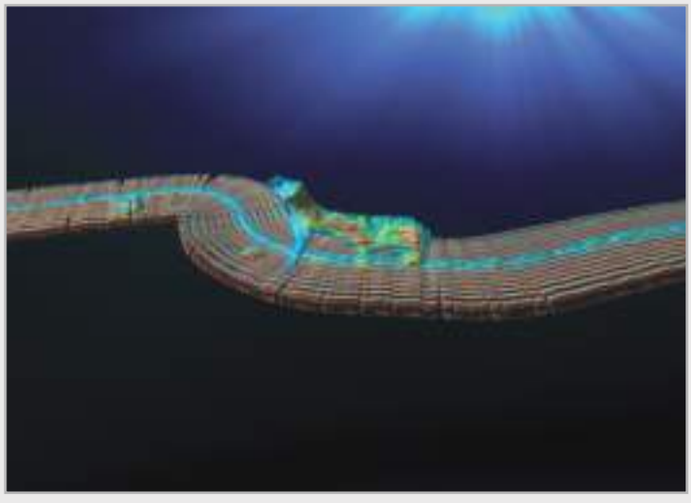
This picture shows a school of sand eel close to the bottom. The sand eel typically burrows in the sand to escape predators during daytime, while at night time it feeds on plankton and other small creatures. You can actually see how the school maintains contact with the sand even when the main population feeds in the water column. The only reason we can record such details near the bottom is the ultra-low sidelobes coupled with the advantages of frequency rotation between the beams.

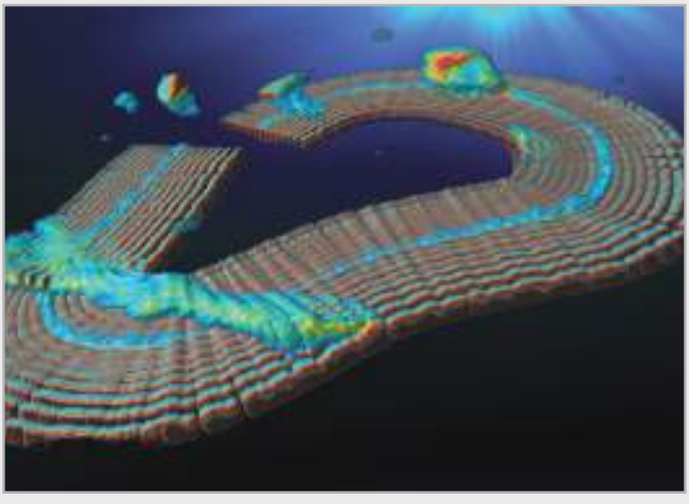
This data were recorded with the ME70 and has since then been processed and visualized by a third party software. As with all SIMRAD RAW data, the ME70 data format is open and well documented.











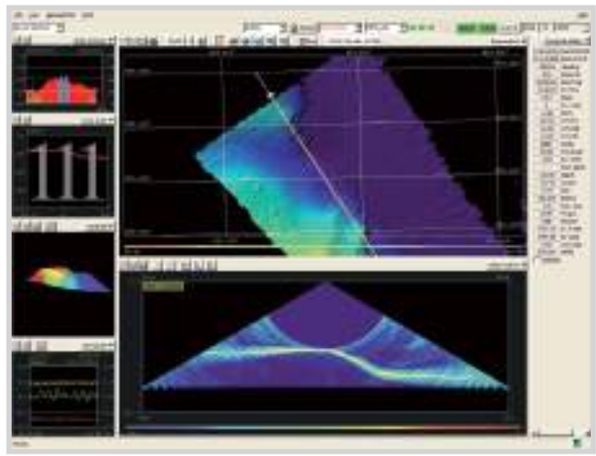
SIMRAD ME SYSTEM

ME70 BATHYMETRIC OPTION

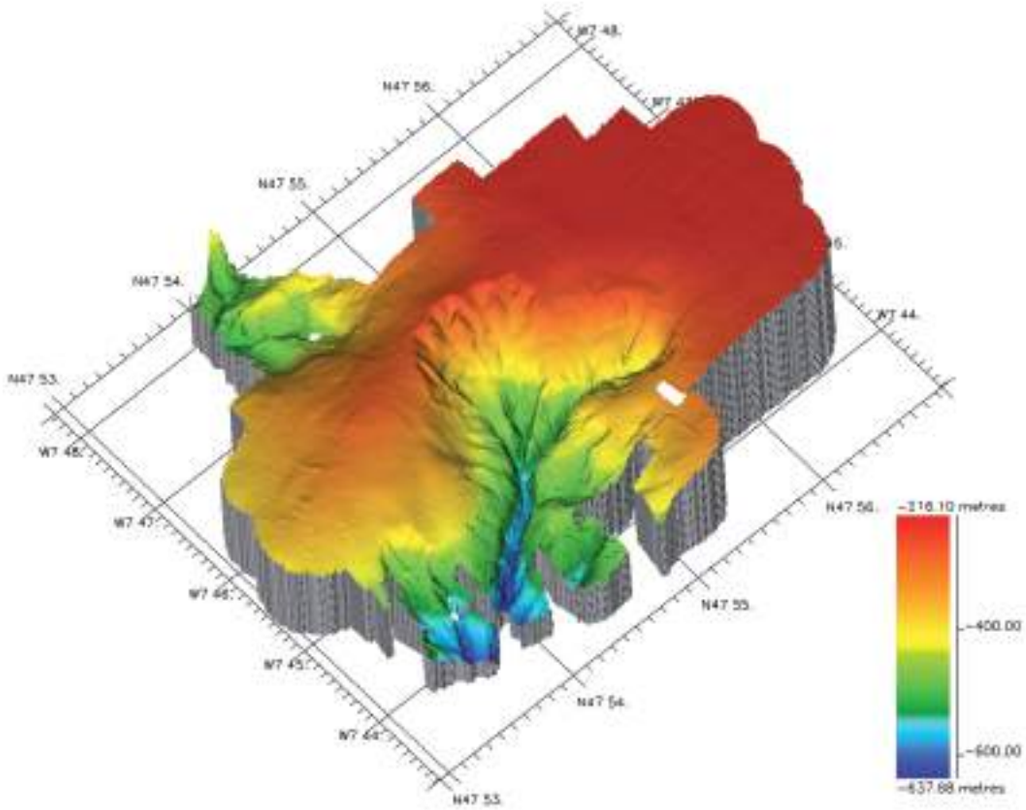
The seafloor is an important component of the marine ecosystem. Perhaps you are looking at vegetation that grows on the bottom or fish that thrive near the bottom. Or perhaps the bottom structures themselves are of interest to the assessment such as presence of coral reefs in the area.

The advantages of using a multibeam system when studying the seafloor are obvious, multiple detection points from an array of narrow beams are better than a single, wide beam. With the introduction of the ME70 scientists can now survey the seafloor while doing quantitative studies for biology at the same time. The ME70 is calibrated with a sphere with known target strength, and backscatter data can therefore be compared across various study areas.

If you want one multibeam system to do both quantitative water column work and bottom mapping, the ME70 is your only logical choice. The system can provide IHO S44 Order 1 data, and fulfils the demanding LINZ order 1 survey specification to be met in full. The bathymetric system includes a special bathymetric processor unit for bottom detection, ray tracing, extra motion correction, and x,y,z data generation developed by the hydrographic department of Kongsberg Maritime.



Kongsberg's own Seafloor Identification System (SIS) is also included in the delivery, adding an extensive set of graphical displays for data quality control, as well as system calibration, data cleaning, gridding, and visualization.



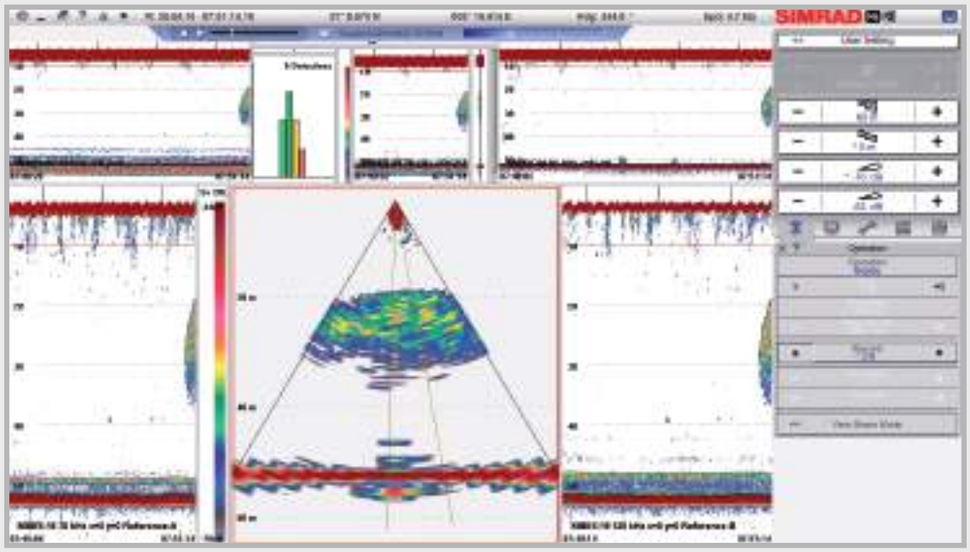
EXTERNAL SENSORS AND GEOMETRICAL MEASUREMENTS OF VESSEL

The multibeam echo sounder needs the following information from external sensors to function correctly:

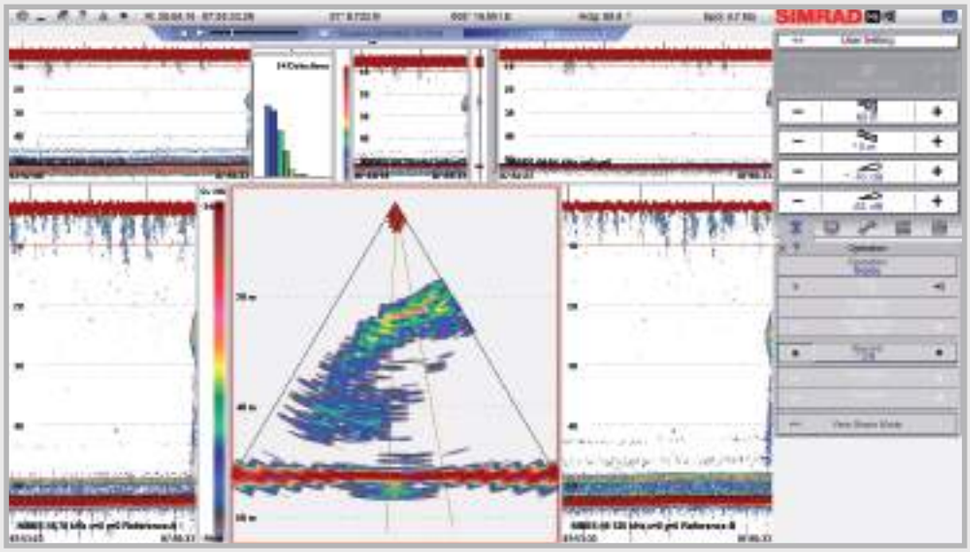
- Position
- Heading
- Vessel motion: pitch, roll and heave
- Sound velocity at the transducer depth
- Sound velocity profile through water column
- Potentially others, such as very accurate time stamp

Which sensor to use depends on the survey requirements. Kongsberg Maritime's Seapath 300 family provides a combined motion sensor and GPS that produces position, heading, and vessel motions from one integrated device. Upon request, we can suggest external sensors that fulfill the particular survey needs.

It is also recommended to do a very accurate measurement of the vessel including transducer position inside the hull. The need for accuracy varies with user need, but we always recommend to use land surveying techniques that can be performed by third party companies.

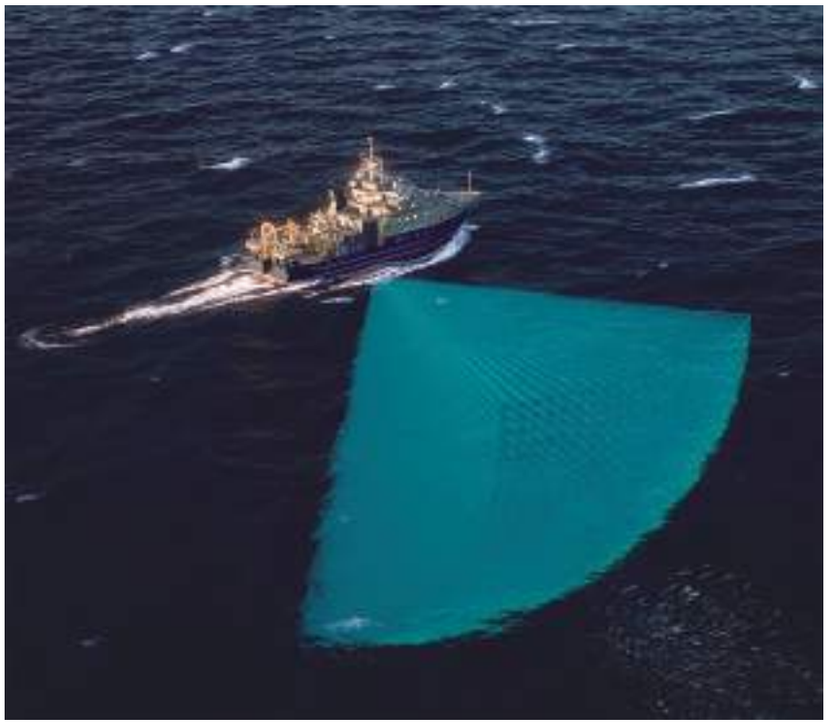


Here we have a screenshot from the ME70 acquisition software. On the centre of the image we see the combined swath of beams athwartship. The software is flexible: it not only shows the individual beams of your choice, but you can also see split beam information, such as size, from each beam.



In this screenshot we can see another school, but this one displaying very different schooling behaviour. Understanding the school's morphology has never been so easy.

SIMRAD MS70 SCIENTIFIC MULTIBEAM SONAR

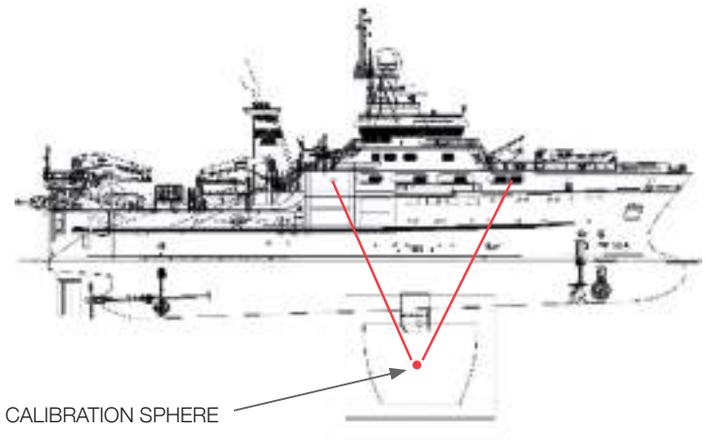


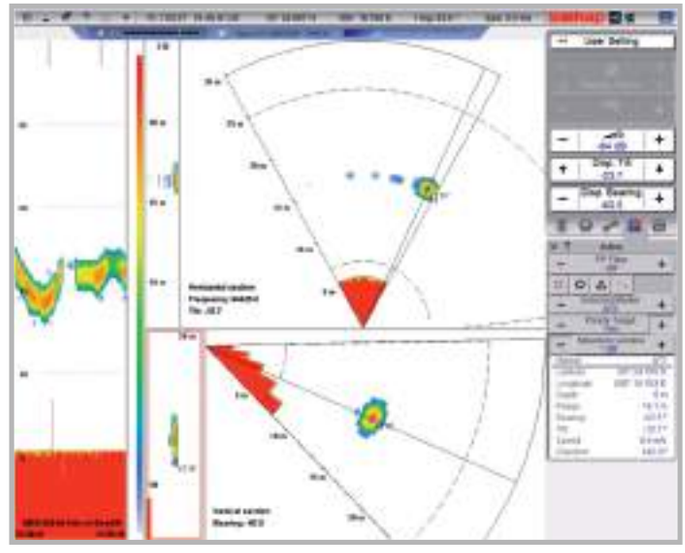
The MS70 provides an acoustic matrix of stabilized and calibrated beams for biomass estimation and study of school behaviour. Advanced beam forming is used to form 500 beams, spread out 60° horizontally by 45° vertically. As a result of this optimized horizontal transmission of narrow beams, the MS70 allows the user to detect and characterize schools of fish even very close to the sea surface.

Where the ME70 adds a third dimension to your survey, the MS70 adds a 4th dimension. When you add up distance, vertical and horizontal swath of beams in addition to time from multiple transmissions, in reality what you have is an acoustic camera. As a school of fish changes shape and density constantly, the MS70 is the best possible tool to understand these dynamics with remote sensing.

As with all Simrad scientific systems, a calibration utility is implemented as a special built-in function in the SW. The sonar is calibrated using a reference sphere that needs to be located on the side of the ship.

During the calibration process, the MS70 automatically generates 500 split beams in order to measure the target position within each beam. Individual gain parameters for each beam are adjusted to provide calibrated target strength and volume backscattering strength.



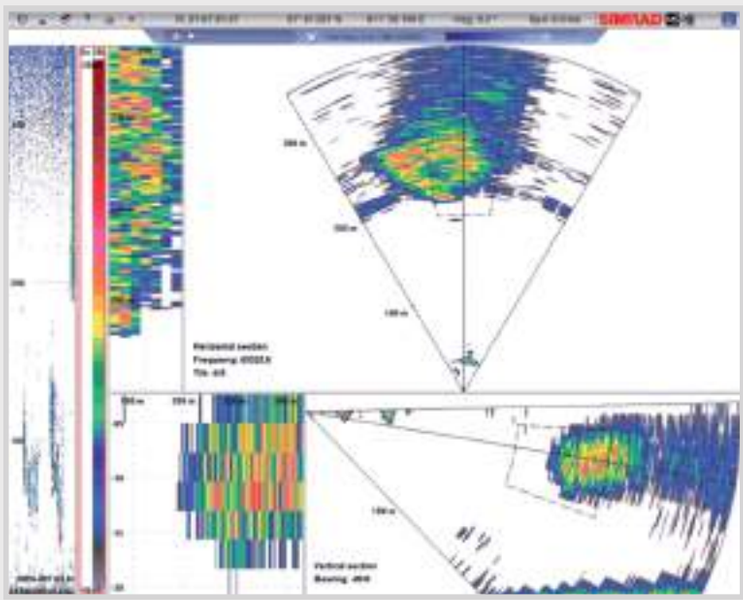


THE CHALLENGE OF STUDYING SCHOOLING FISH CLOSE TO SURFACE

Low sidelobes are important for at least two reasons. The obvious one is to avoid that a strong target in the side lobes are mistaken for weak targets in the main lobe. Secondly, you do not wish to see strong bottom echoes from the sidelobes.

Surface is a very strong reflector, and the two-way vertical side lobe suppression of the MS70 secures that reflections from the surface does not contribute to the school estimate. Also, the frequency band of the system is distributed out across the matrix, with minimal leakage between the many beams.

The frequency bandwith is distributed between the 500 beams.



This screenshot shows a school of herring. Even though the MS70 detects and records data from all 500 beams, only two sectors can be shown in a traditional 2D view. One is a horizontal slice, while the other is a vertical slice through the matrix. In addition to that, you can have a zoon view and an echogram from the single beam shared by the two sectors.

SIMRAD TD SOFTWARE

SIMRAD TD50
MULTIBEAM 3D VISUALIZATION SOFTWARE

The Simrad TD50 enables live streaming of 3D data generated by scientific multibeam systems. The Simrad TD50 software reads the incredibly clean raw data from the ME70 and MS70 in real time, and delivers accurate live visualisation of the oceanspace beneath the vessel to the scientific lab as well as any other location onboard wtih network access. Previously this data had to be post-processed before the 3D potential of the system was realised.

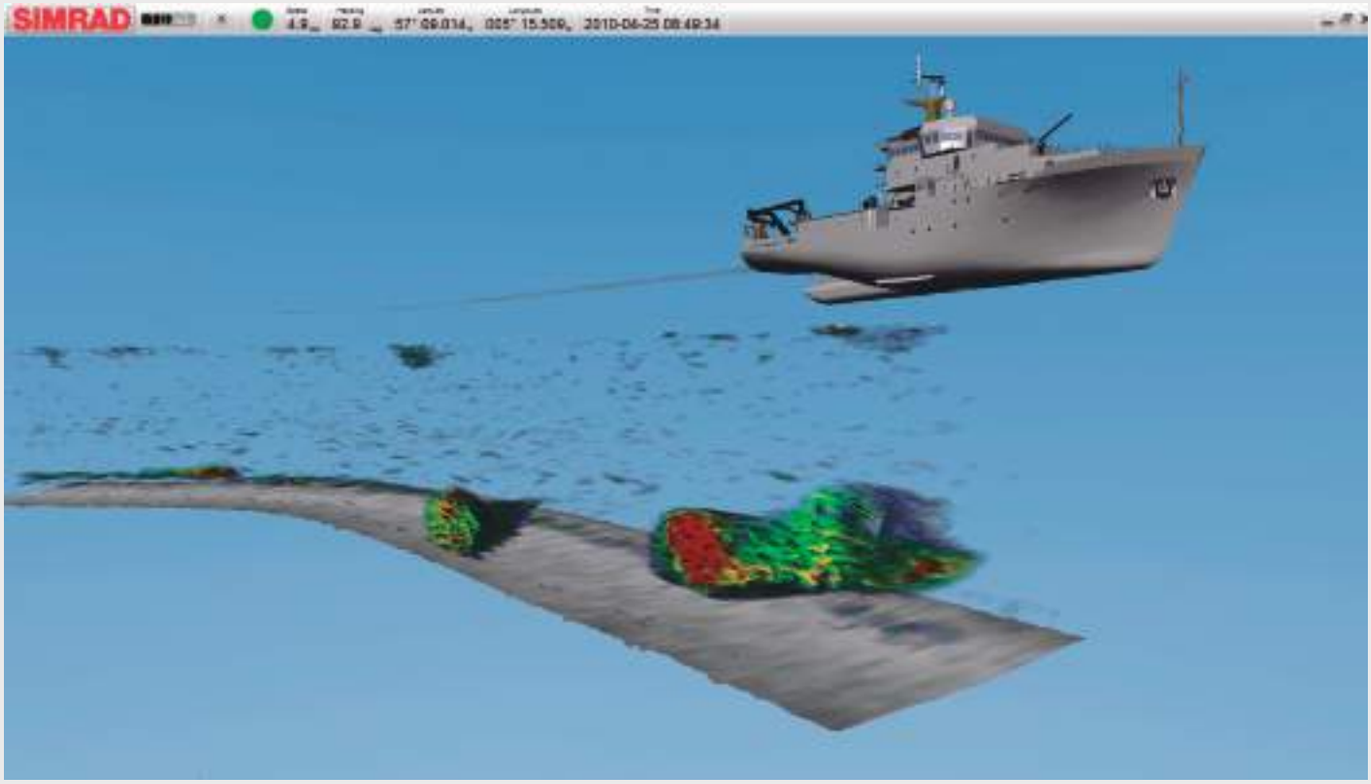
Accurate 3D visualisation gives users a better understanding of the marine ecosystem by i.e. enabling precise measurement of schools of fish rather than estimating size and shapes based on models. Additionally, 3D view of bottom topography and the relating bottom habitats further enhances the understanding of the marine ecosystems. When accurate 3D visualisation is delivered in real-time, the benefits are significant.

The TD50 provides researchers and vessel crew with a highly effective decision tool, allowing for informed decisions to be taken immediately.

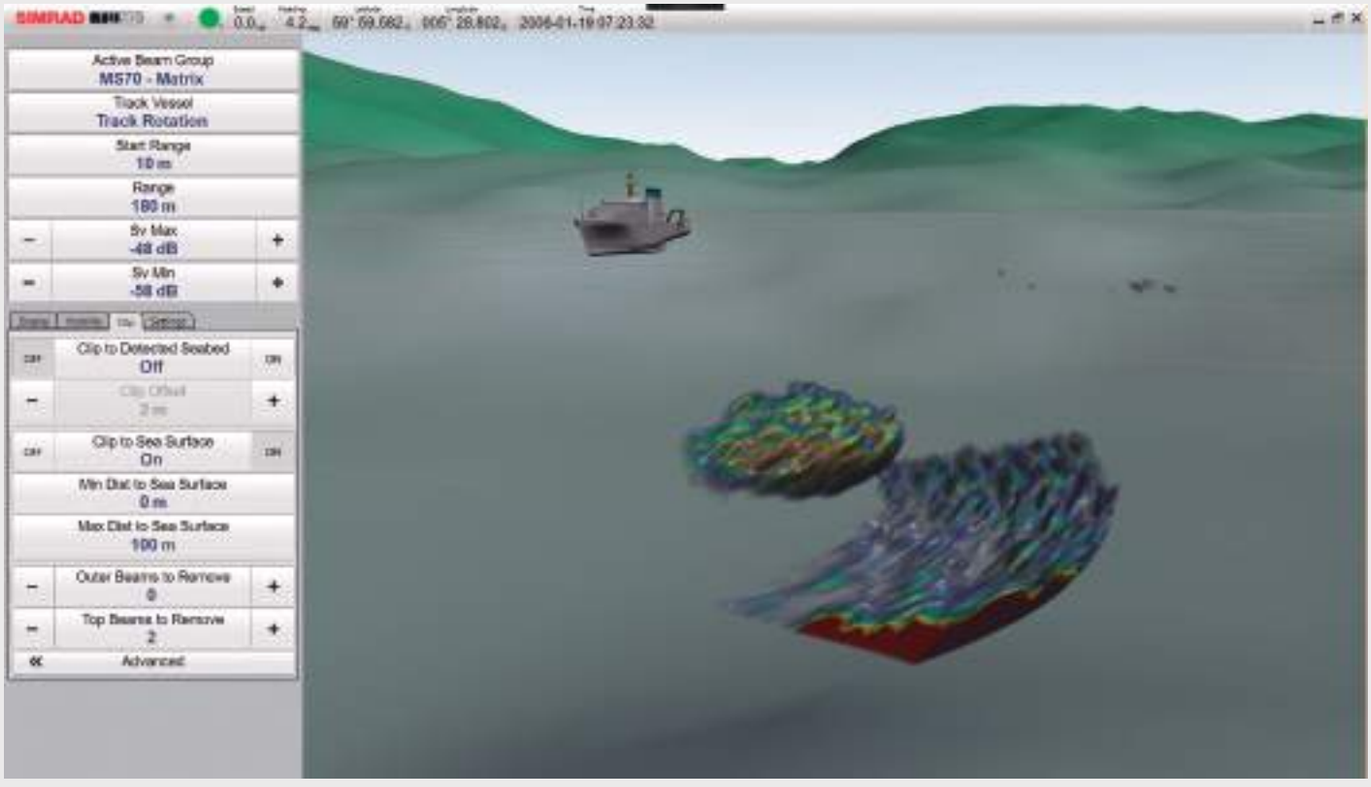
The system is especially relevant to projects using adaptive sampling, as the live 3D stream of the survey area enables researchers to see specific attributes as the vessel passes over them, allowing action for further inspection to be taken immediately.

SITUATIONAL AWARENESS

The live 3D stream can be delivered to multiple locations on board which allows for better interaction between scientists and the vessel operators. This is typically important in demanding operations where the vessel interacts with objects in the water column. Research vessels engaged in active sampling of biology such as trawling can also improve their capabilities, with the Simrad TD50 system effectively providing a 'long range camera' below the surface.



The Simrad TD50 Multibeam 3D Visualisation Software is shown presenting sand eels on sand bottom. The raw data is taken from the Simrad ME70 Scientific multibeam echo sounder on M/S Simrad Echo.

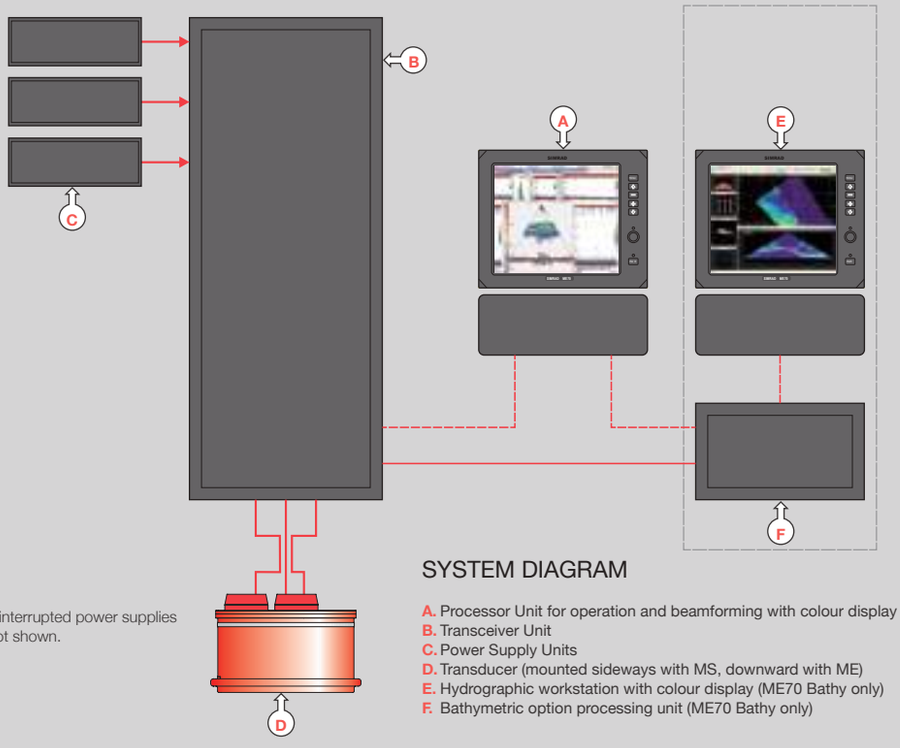


The TD50 can also import and display a chart overlay. This picture shows TD50 with MS70 data, Vessel, a school of fish and bottom backscatter is shown to give full situational awareness.

MULTIBEAM SPECIFICATIONS

	ME70	ME70 BATHY MODE	MS70
Beam organization	Fan		Matrix
Operating sector	2 to 140°	120°	60° x 45° (H x V)
Minimum beamwidths	2° x 2°	3° x 2° (along x athw.)	4° x 3° (H x V)
Operating frequency	70-120 kHz		75-112 kHz
Max no. beams	45 split beams	81 split beams	500
Beam stabilization	Roll & pitch		Roll
SIDELOBE SUPPRESSSION			
Sidelobe levels	-35 to -70 dB	-35 x -25 (along x atw.)	H: -35 dB, V: -25 dB
Pulse duration	64 to 5120 µs	64 to 5120 µs	2-10 ms
DYNAMIC RANGE			
Max. source level	225 dB	216 dB	206 dB
TRANSCEIVER UNIT			
TX/RX channels	800 individual channels		
Modulation	CW or chirp		
Communication	2 x 1 Gb Ethernet lines		
Physical size	1200 x 600 x 900 (H x B x D)		
TRANSDUCER UNIT			
Number of elements	800 individual elements		
Material	Ceramic polymer composite		
Physical size	Circular, 670 mm, H; 400 mm		

SIMRAD SCIENTIFIC MULTIBEAM SYSTEMS



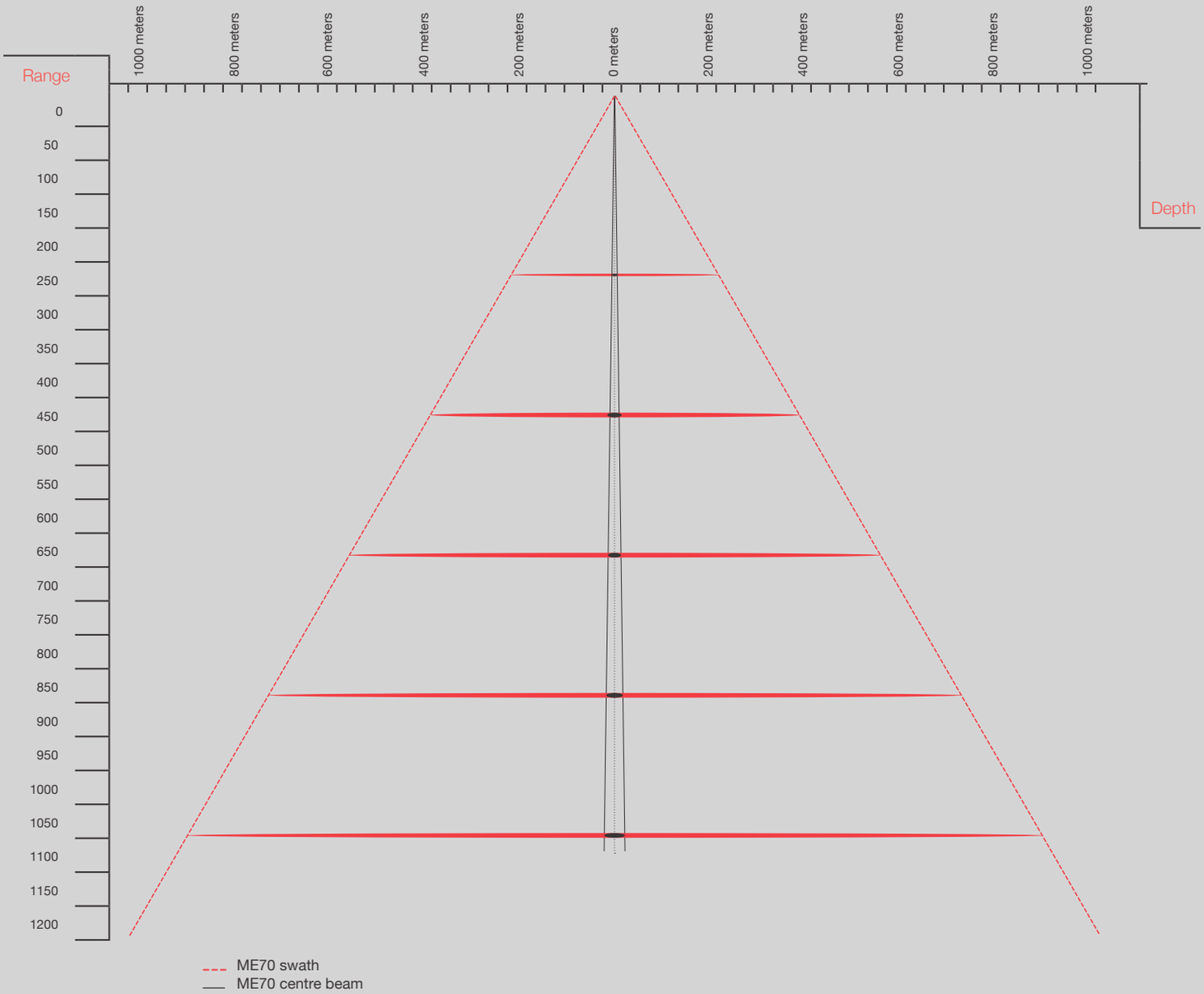
Interface capabilities, uninterrupted power supplies and power cables are not shown.

SYSTEM DIAGRAM

A. Processor Unit for operation and beamforming with colour display
B. Transceiver Unit
C. Power Supply Units
D. Transducer (mounted sideways with MS, downward with ME)
E. Hydrographic workstation with colour display (ME70 Bathy only)
F. Bathymetric option processing unit (ME70 Bathy only)

INCREASED EFFECTIVE SAMPLING VOLUME

A scientific multibeam echo sounder can be seen as many EK sounders spread out in a fan of beams. With more narrow beams spread out in a wide swath, you increase both your resolution and sample volume at the same time. The system can be configured to fit your preferences. Below, we can see a 60° swath and its corresponding sampling volume.



"Our sonars are based on:
- Efficent transducers with
- Clean beams and
- Complex signals with advanced signal processing
The Simrad sonars are designed and produced in house, which means that we have full control of the product."

OLE BERNT GAMMELSEATER
Product Manager
Sonars

SONARS

Already a success!

The first Simrad sonars introduced on research vessels were purchased for the Norwegian vessels “Johan Hjort” and “G.O. Sars” back in the late 1950’s. These were combined sonars and echo sounders, considered very advanced at that time. Since their introduction, the sonars have evolved to become highly efficient tools to detect any object in the water column.

In addition to finding and tracking objects in the water column, the Simrad sonars are now being converted into scientific tools, with the introduction of RAW data output and new calibration techniques.

The sonar is also the Captain's eyes under water, valuable during fishing operations or when navigating in confined waters.

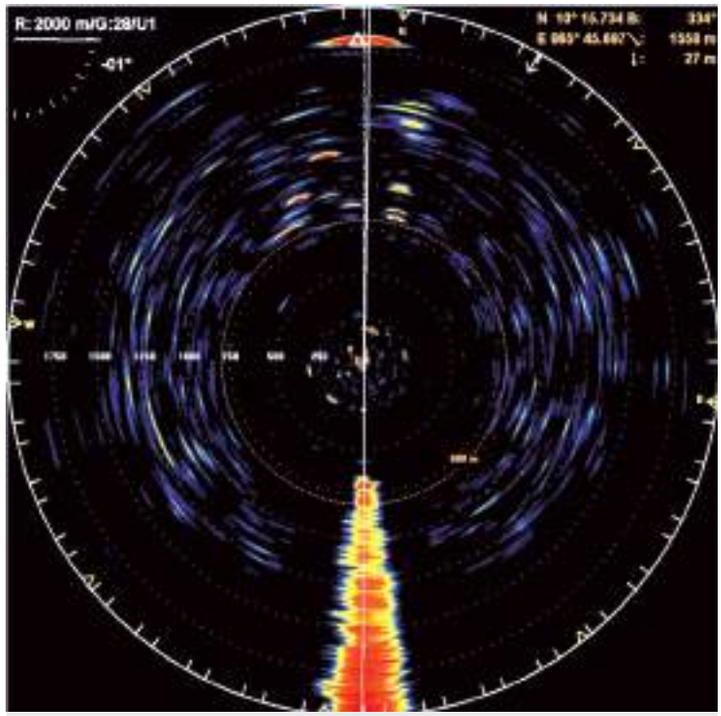
SIMRAD
SU
SONAR

SIMRAD SU90 SONAR

The SU90 Sonar is made with no compromises. The number of channels has been increased by 50% compared to the SX90 Sonar giving the sonar an even better performance in selectivity and range. Its operational frequency is 20 to 30 kHz. The narrow opening angle (4,9° at 30 kHz) and the increased source level (3dB) makes the SU90 the most powerful and highest resolution low frequency sonar on the market today.

The narrow beam makes the SU90 even more ideal for searching fish close to the bottom or close to the surface at long ranges. Also it will give a far better vertical view with less “bottom climbing” that is seen on sonars with a wider beam. The SU90 is equipped with the celebrated signal processing seen on the SX90 such as Hyperbolic FM transmission giving the user a clutter free picture with very high resolution in range.

The higher source level (3dB higher than SX90) will increase the detection range and enhance the detected echoes in general. How much longer range is almost impossible to calculate as temperature layers, salinity, bottom hardness, target strength and sea conditions will never be the same for a good comparison. However, the sonar will have a longer range than the SX90.

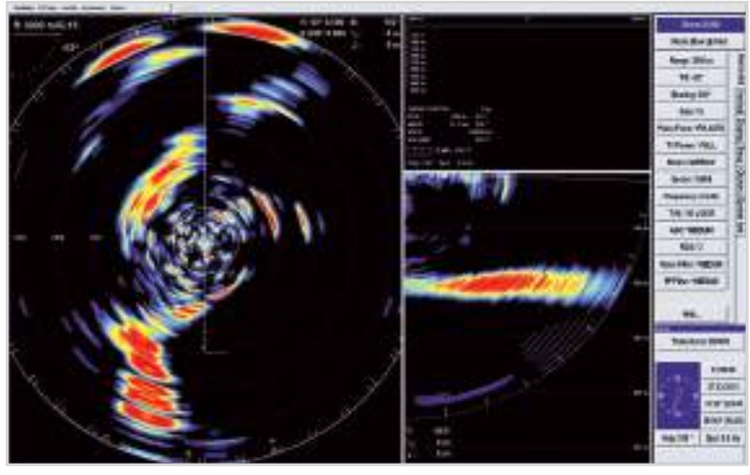


SU90 Sonar Ultimate!

When high performance is the only criteria, such as long range, high resolution, narrow beam high source level, the SU90 is the sonar for you. We have made no compromises, only had performance in mind when designing the sonar.

HIGH POWER. HIGH RESOLUTION. NARROW BEAM. NO COMPROMISE.

The SU90 is the latest omni sonar from SIMRAD. It is the 4th generation windows operated sonar. SIMRAD will now have two low frequency sonars on the market, the highly acclaimed SX90 and the new implacable SU90 for customers who place performance before price.

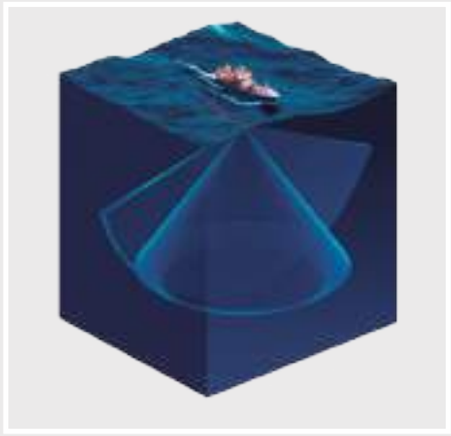


1

TILT AND GAIN
The tilt of the horizontal beam the information on the left top part shows gain setting.

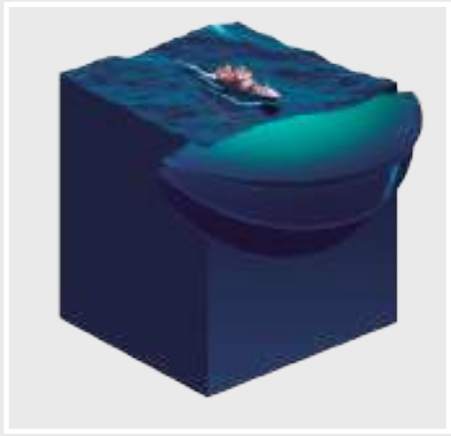
2

PURSE SEINE AND TARGET INFORMATION
This window displays information from depth sensors, shows target depth and estimated school size.



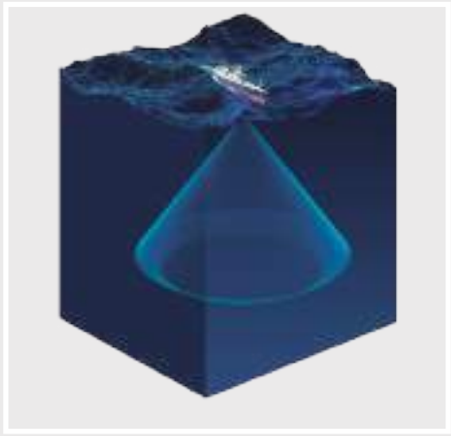
HORIZONTAL AND VERTICAL BEAMS

The combination of vertical and horizontal presentations shows the schools of fish both from above and from the side at the same time. It is not necessary to go over the target to see the vertical distribution on the echo sounder.



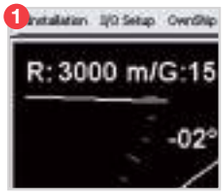
BOW UP/180° VERTICAL

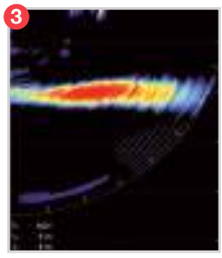
The vertical slice is made “tippable”, and by selecting a 60° tip angle (or less), a full 180° coverage is obtained. The tip angle can be adjusted from +10 to -90°. This mode is ideal when you are trawling for fish on deep water.

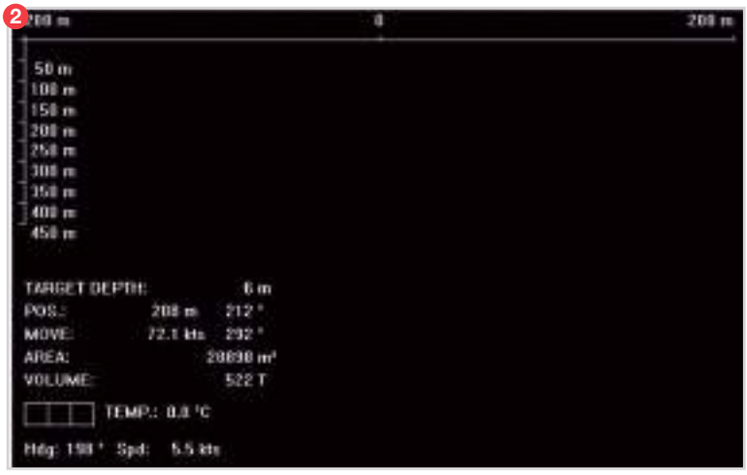


BEAM STABILIZATION

When the beam stabilizer is activated, both the horizontal and vertical beams are electronically stabilized for roll and pitch. The full circle beam stays on the target independent of the vessel movement, even in rough seas.







3

THE VERTICAL VIEW

On the SU90 the vertical view is even more useful as the narrow beam will avoid “climbing bottom” problem found on sonars with wider beams. This is extra beneficial when searching for fish close to the bottom.

4

THE MENU

The menu is the same as on all SIMRAD Sonars, easy to use and well organized with the most needed functions easy available. You can choose up to 12 different languages.

5

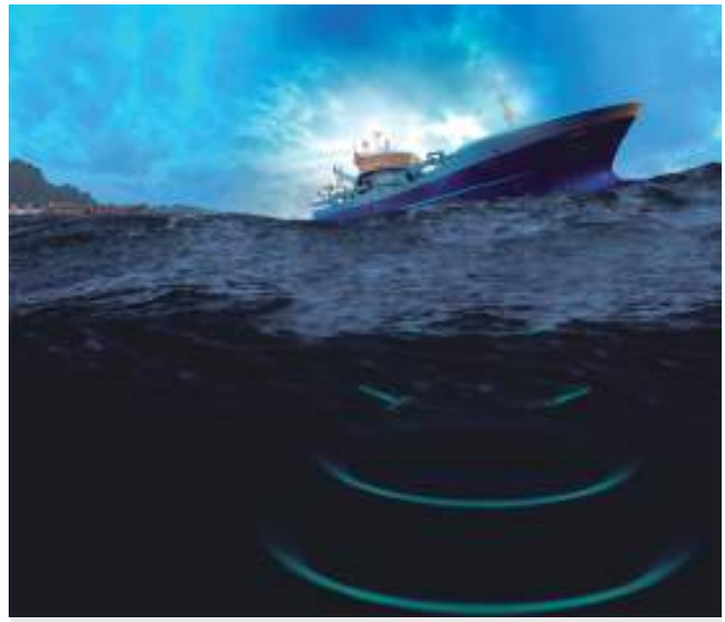
Navigation information and hull unit position information.

SIMRAD SX SONAR

USER SELECTABLE FREQUENCIES BETWEEN 20 - 30 kHz PREVENT INTERFERENCE FROM OTHER VESSELS

The SX90 is a low frequency, high-definition, long range sonar that utilizes the latest high-end computer to process data from the transducer. The SX90 is specially designed for vessels where high resolution combined with long range is needed. With the state of the art processor there are several unique possibilities for advanced signal processing. Three different vertical beam widths, single or dual vertical view and 180° tiltable vertical view are available. At 30 kHz operating frequency, the vertical beam width is only 7,1°.

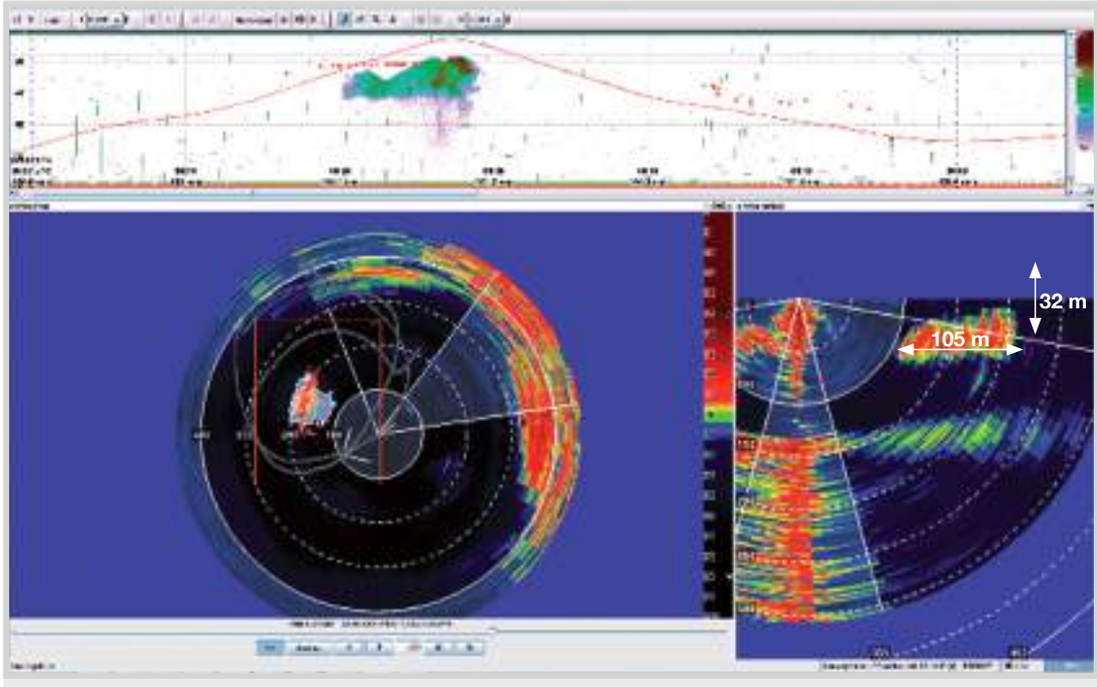
The Simrad SX90 Sonar offers unique features such as full circle beam stabilization for easier fish detection in poor weather and 11 different sonar operating frequencies with 1 kHz separation to avoid interference from other sonars. The long range and higher definition of the SX90 will improve your catching abilities and help to make better use of your time at sea. Great emphasis has been placed on giving the best possible overview in the search and catch situation. In addition, full screen echo presentation, resizable windows, off center, zoom and dual operation are standard functions on all sonar models. You can evaluate one school while tracking two other targets, giving you full control of schools and net from detection to catch.



Multi frequency 20 to 30 kHz!

Fishing in the same area as others can be a challenge as other vessels might have sonars transmitting on the same, or close to the frequency you are using. With multi frequency from SIMRAD you are able to tune your sonar for maximum performance and avoid interference from other vessels. With 11 different frequencies with 1 kHz separation, interference is no longer a problem.

Only a wideband transducer can be used to be able to transmit and receive at such a wide spread band of frequencies. SIMRAD design and produce our own transducers for this purpose.



PROCESSING OF RAW DATA

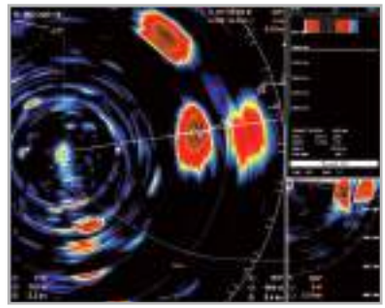
As all Simrad scientific systems, the omni directional sonars can output RAW data for scientific purposes. The RAW data can be read and processed by third party processing SW such as Echoview or LSSS (PROFOS).

In this example a screenshot from LSSS (PROFOS) is shown where the data are integrated with single beam data.

SCREEN RECORDINGS FROM SIMRAD SX90 SONAR

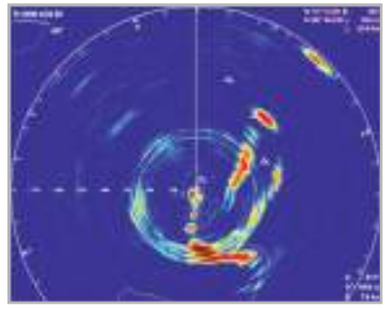
HERRING

On this picture, the sonar has detected three schools of herring. The skipper has decided to catch the school with highest density. The closest school has the most density. The sonar is in “Automatic Target Tracking” mode and shows the track from the school and vessel. In the lower left corner numbers show the school’s traveling course and speed. (2,2 knots and 179°)



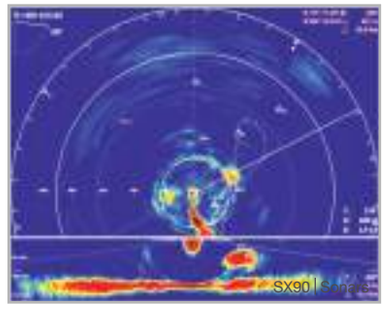
MACKEREL

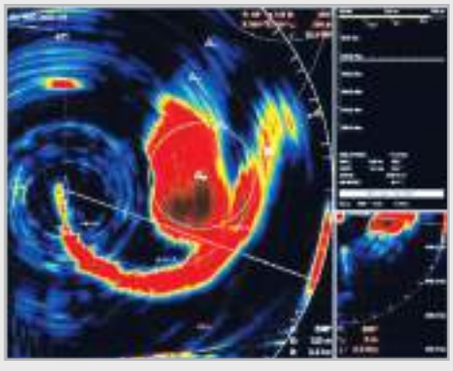
School of mackerel detected at 40° starboard and marked as “6”. Sonar is operated in “Bow Up” mode with “Full Screen”. Range is 2000 meter and tilt is set at 5°. Range to school is 1952 meter and depth is indicated to be 93 fathoms saying that the mackerel school is on the bottom. Echoes between the mackerel and the vessel is wake from pair trawlers coming towards the vessel.



MACKEREL

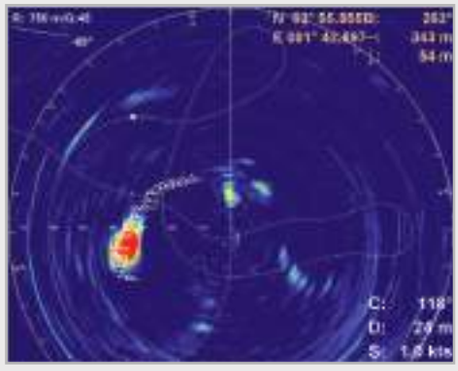
This is later in the same scenario as above. The vessel is close to the school of mackerel only about 250 meters away. “Bow Up/180°” Vertical” is used. The vertical view shows the school at about 50 fathoms depth. The variation in bottom shows uneven spots with hard and soft bottom.





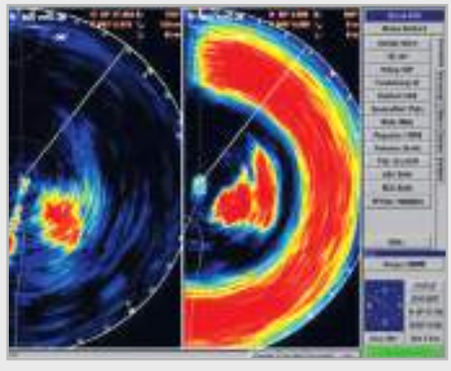
OFF CENTER PRESENTATION

Offset the vessel to any screen position and enlarge the echoes for more detailed information.



FULL SCREEN PRESENTATION

In full screen presentation, the echo presentation will be extended to cover the entire display area.



“TWO SONARS IN ONE”

In the dual mode, each sonar presentation can be set up as if you were using two different sonars simultanously. Individual frequencies, tilt angles, ranges, gain and filters can be used.

SC90, THE WORLD'S FIRST COMPOSITE OMNI SONAR

As the industry first, again, SIMRAD presents the SC90 composite sonar. The composite omni transducer is a result of SIMRAD's continuous improvement of its transducer design, material and production method.

The composite transducer is more complicated to produce than traditional transducers with large investments in the production line. Today, SIMRAD has one of the most sophisticated transducer production line and design department in the industry.

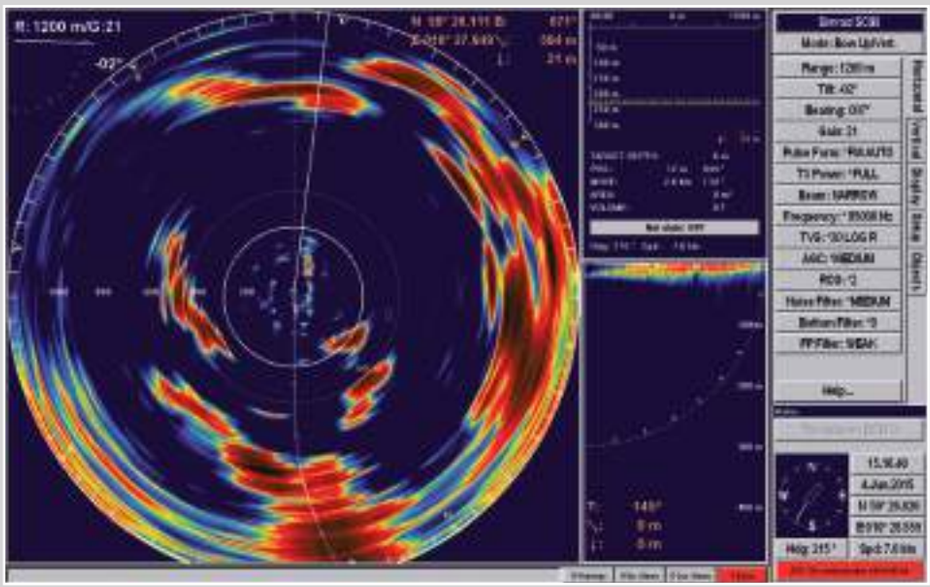
The advantage in a composite transducer is first and foremost the efficiency compared with other materials and production methods. More of the power put into the transducer during transmission is converted to sound in water and more is also converted back to electricity with the return echo. The more efficient a transducer is the more powerful the equipment connected to it will be.

A composite transducer will also be able to transmit on a wider frequency band, giving many future possibilities for the SC90 to transmit on several frequencies and also wideband chirp transmission.

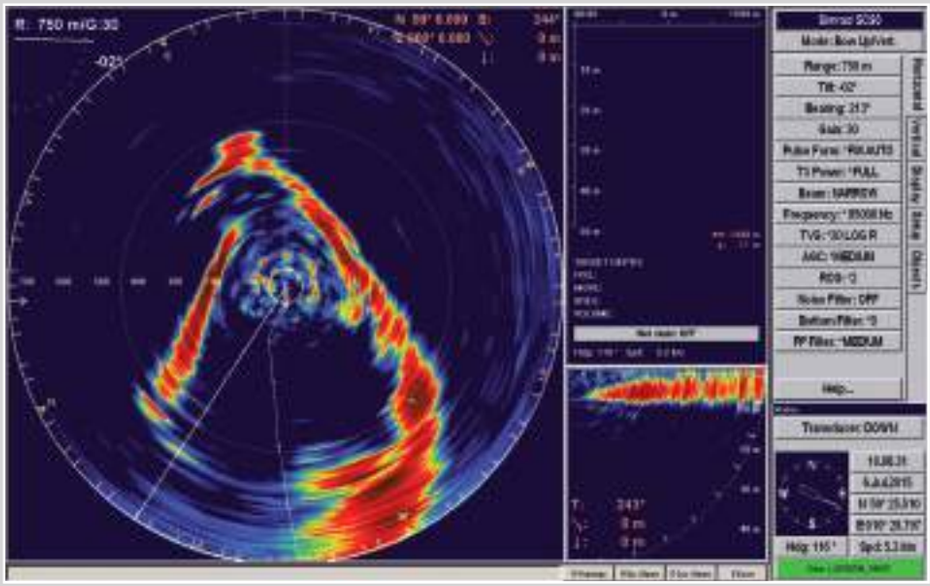
The SC90 is a 85 kHz mid frequency sonar with high efficiency, high power transmission. The SC90 is ideal for fish like Tuna, Mackerel, Herring and fish close to surface, bottom or close to the vessel. It comes with all the standard Simrad features such as FM transmission, fully 360° stabilized, vertical view, easy operation, dual mode, 60° tilt and clutter free picture.

If you have today a Simrad SH90 sonar, the upgrade path is short and easy. A change of transducer, computer and transceiver PCBs (printed circuit boards) are all that is needed avoiding the change of the big and heavy hull unit, transceiver cabinet, cabling, etc. This fits right into the long SIMRAD strategy for our existing customers; if you have a Simrad sonar it should always be as easy and cost efficient as possible to have the latest development and technology regardless when you bought the sonar.

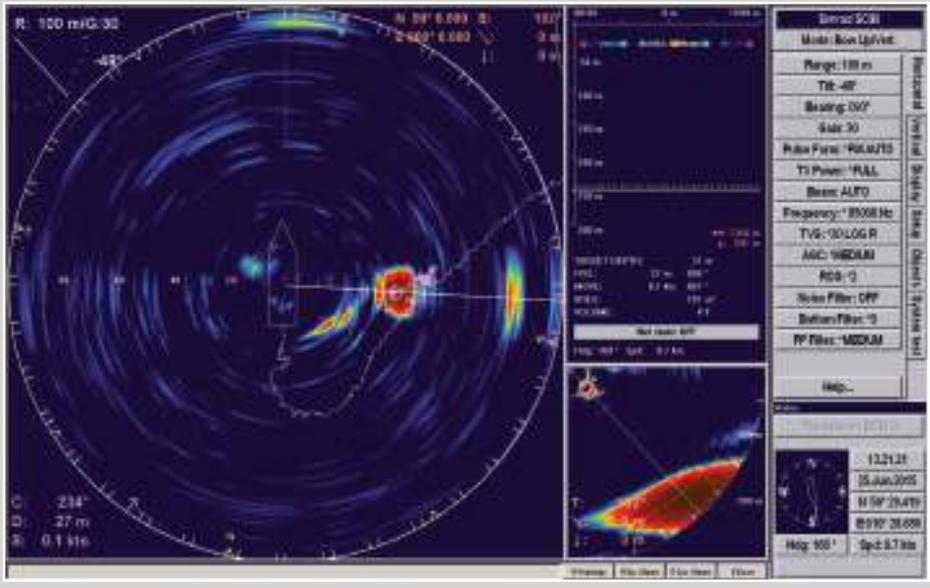
The SC90 makes a perfect partner to the low frequency sonars SX90 or SU90. Follow the school from long range all the way into the vessel. With the range capabilities of the SC90 it is also a perfect backup if something happens to the low frequency sonar, like impact to the transducer or strike by the purse seine wire.



The SC90 has range capabilities that will make it a perfect back-up sonar as well as a stand-alone search sonar. Combined with a low frequency sonar you will be able to follow the school all the way in to the vessel. The resolution on the SC90 is unmatched for the frequency and the composite transducer will give you all the power needed to detect even the weakest targets.



The completely noise free capability of the SC90 makes it easy to see wanted targets and avoid spending time interpreting the sonar picture. Even in shallow water, the picture is clean and easy to understand.



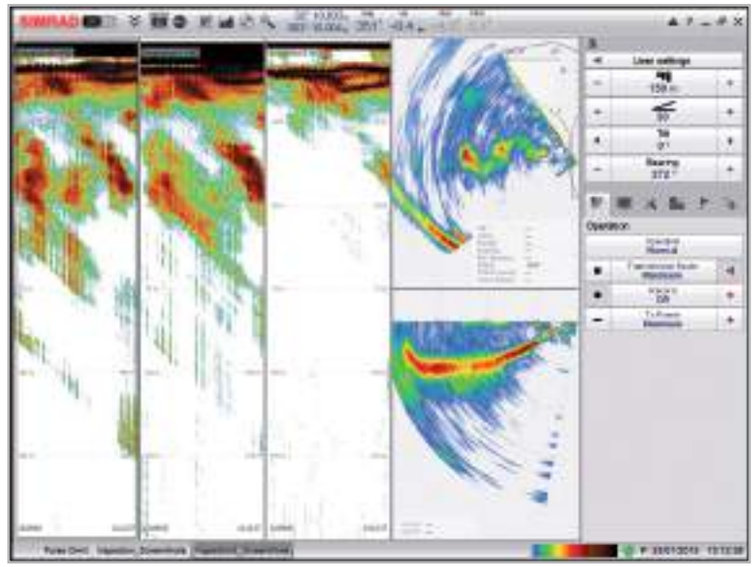
In short range, which is the reason to have a second sonar, the sharp well defined echoes due to the very high resolution are important. Like in the case to the left, it is very useful to have a well defined “backside” of the school, especially for purse seiners, in order to get a general feeling of the size of the school before setting the net.

SIMRAD SN SONAR

SIMRAD SN90, FULL OVERVIEW AND DETAILED INSPECTION

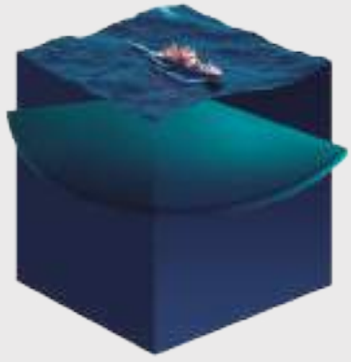
The game changing SN90 is the latest Sonar development from SIMRAD. The SN90 transducer can be installed without a retractable hull unit to the side of the keel facing sideways. The 256 individual beams have a horizontal coverage area of 160° and the vertical beam width is typically 6° (varies with the frequency from 5° to 8°). The beams are tilt able from 0° down to 90°.

In addition to this, five steerable inspection beams of 5°x5° can be used for more detailed inspection of a school like observing fish behaviour, target strength and biomass. This will enable the user to run alongside a school of fish and observe, like a horizontal echo sounder, and analyse the school without passing over it. Fish avoidance is then minimized allowing for a better estimation of school size and biomass.

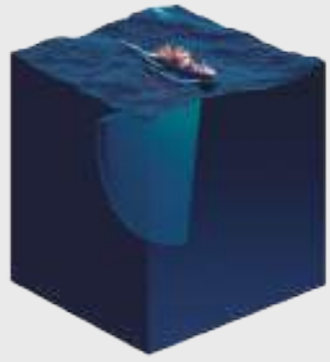


Up to five inspection beams (three shown here) can be trained and tilted individually while maintaining the overview with the horizontal fan and vertical slice.

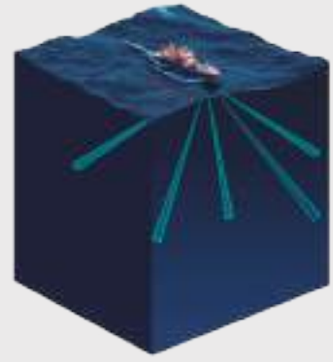
Installed looking to the port side of the vessel together with horizontal looking ES70 echo sounders previously installed.



The SN90 has a 160° fan that is tiltable from 0° down to 90°. This will enable to see the purse seine during the whole setting of the net.



The SN90 has one vertical slice that can be trained in any direction within the fan. This will give full control of the edges of the school during setting of the net.

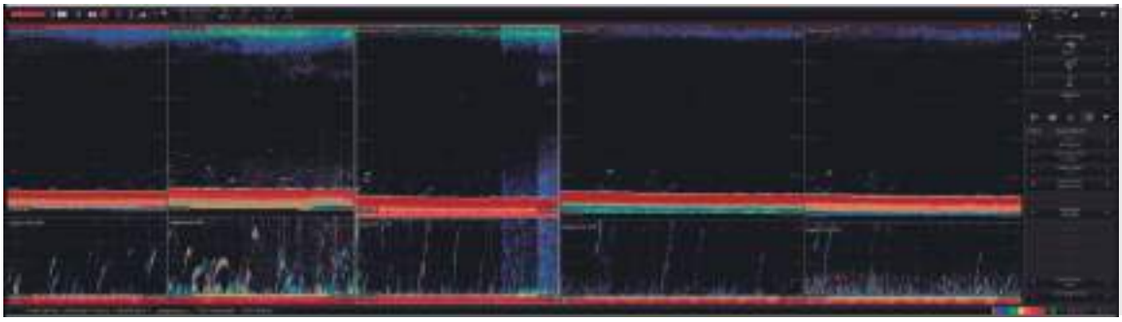


The SN90 has five individually steerable inspection beams that can be trained and tilted with any frequency between 70 and 110 kHz. The inspection beam will give a detailed high resolution echogram.

FORWARD LOOKING SONAR

Simrad SN90 can be configured as a forward looking multibeam sonar. The unique flexibility of the SN90 enables it to be used at almost any vessel depending on how the transducer is installed. The display software is then oriented forward during installation. The SN90 transducer can be fixed to the hull or bulb like a regular echo sounder's transducer or mounted on a hull unit when fishing in ice or other hazards. The sonar beams are pointing forward only in a 120 degree swath, taking the propeller noise out of the equation.

A full vertical slice as well as five inspection split beams can be individually trained and tilted to the user's needs. Stack the five beams on top of each other or spread them out to inspect to any side. A bottom detector and bottom expansion has been included in the presentation of the 5 inspection beams. This will enable the user to detect fish close to the bottom forward of the vessel and have more time to decide before the fish reaches the trawl. The SN90 is a chirp wideband sonar/echo sounder transmitting and receiving between 70-110 kHz.



The picture to the left is from F/V "Ramoen" using five inspection beams forward with bottom lock and bottom expansion. This makes it easier to turn onto the fish even if they are close to the bottom.

The SN90 mounted forward for pelagic and bottom targets. The uniqueness in the SN90 is its capability to detect fish close to the bottom and general extreme resolution. It can be compared with an echo sounder pointing forward. All beams are transmitted and received in each ping, giving a fast update rate and are steerable in any direction within the swath.

SONARS SPECIFICATIONS

PROCESSING UNIT

Voltage	110/220 VAC			
Consumption	5 A			
Processor type	ENIX4	ENIX4	ENIX8	ENIX4
Operating system	Windows XP			
Display output	Dual			
Serial interface I/O	Four serial ports			
Ethernet interface	Two			
Display resolution	1280 x 1024			
Operating ranges	150 to 4500 m*	150 to 4500 m*	50 to 2000 m	50 to 2000 m

TRANSCEIVER UNIT

Voltage	110/220 VAC			
Consumption	750 VA	750 VA	400 VA	750 VA
Operating Frequency	20 to 30 kHz (1 kHz step)	20 to 30 kHz (1 kHz step)	70 to 110 kHz	85 kHz
Modulation	CW and Hyperbolic FM	CW and Hyperbolic FM	CW and Hyperbolic FM	CW and Hyperbolic FM

BEAM

Horizontal coverage	Omni	Omni	160°	Omni
Vertical Tilt	+10° to -90°	+10° to -90°	+10° to -60°	+10° to -90°
Vertical beam width	See table below	See table below	6,0°	8,0°
Transceiver channels	256	384	256	480
Pitch & Roll Stabilisation	Included			
External Pitch & Roll interface	MRU Kongsberg Seatex format (Optional)			
Scientific Data Output	Optional			

HULL UNIT

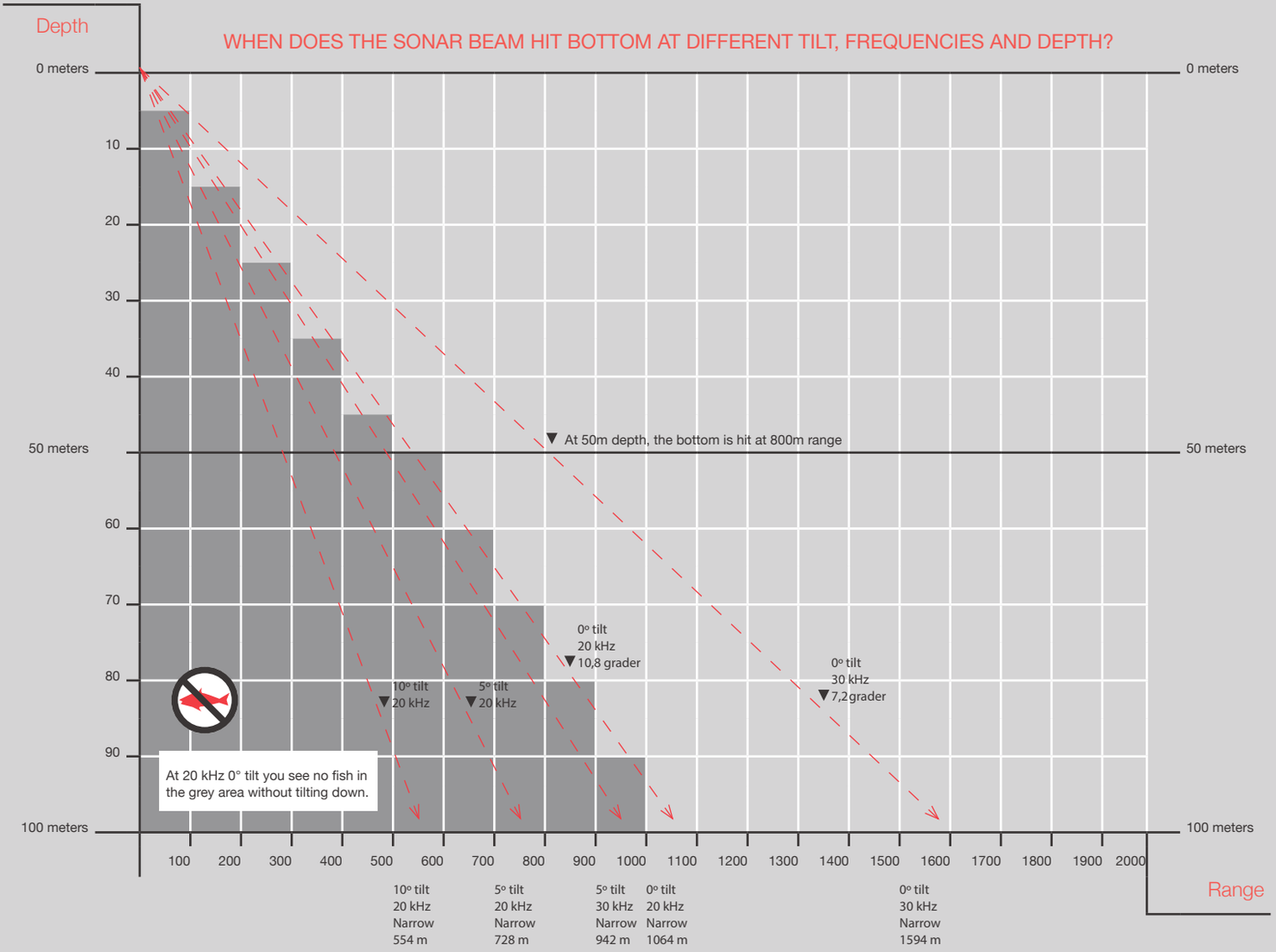
Voltage	230/380/440 VAC 3 Phase	230/380/440 VAC 3 Phase	N/A	230/380/440 VAC 3 Phase
Consumption	3000 VA - 1100VA	3000 VA - 1100VA	N/A	1100 VA
Selectable Transducer Position	Yes	Yes	N/A	Yes
20 knots hull unit	Yes	No	N/A	Yes
1.6m Transducer lowering	SX93 Hull Unit	SU93 Hull Unit	N/A	N/A
1.2m Transducer lowering	SX92 Hull Unit	SU92 Hull Unit	N/A	N/A
1m Transducer lowering	SX95 Hull Unit	N/A	N/A	Yes

*Optional extended range 6000 to 8000 m, requires export license in selected countries.

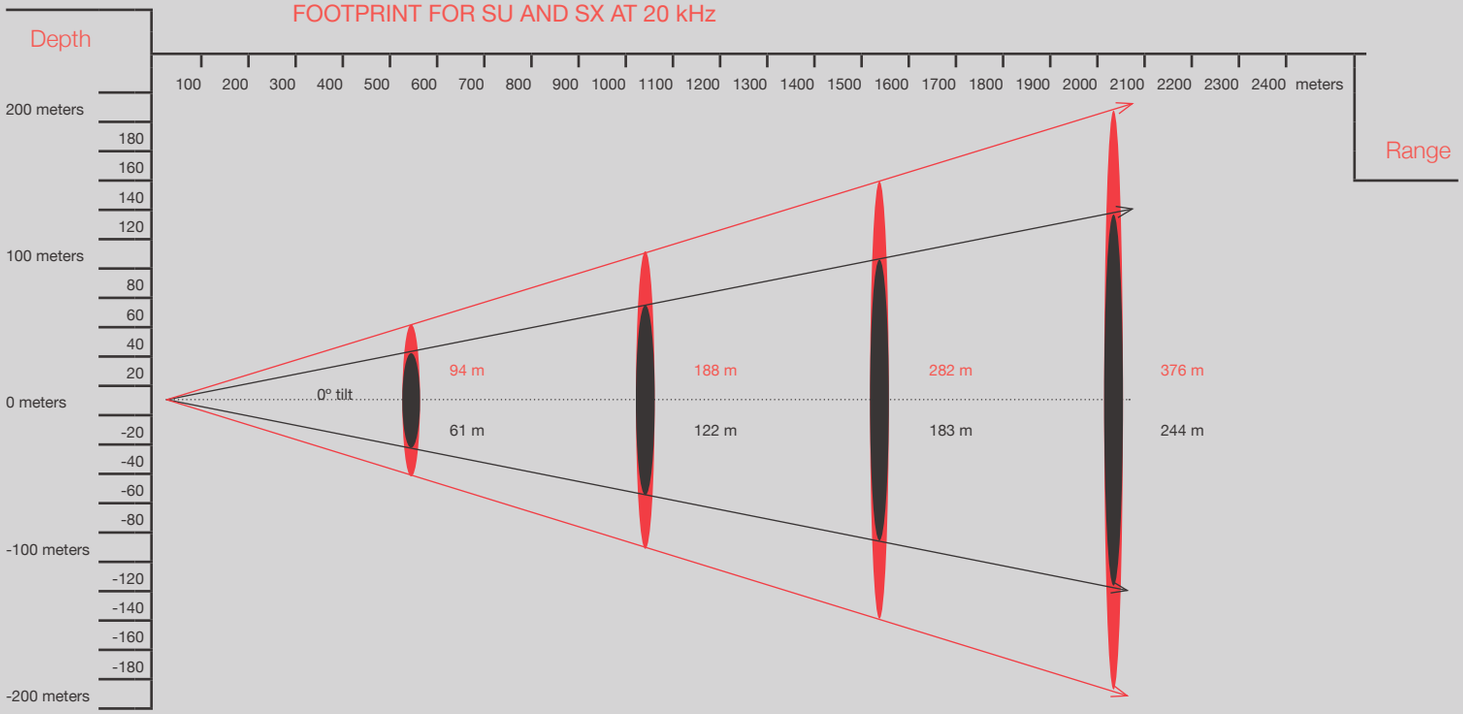
OPENING ANGLES ON SX AND SU SONARS

	SX90			SU90		
	WIDE	**NORMAL**	**NARROW**	**WIDE**	**NORMAL**	**NARROW**
20 kHz	14,8°	11,0°	10,7°	10,7°	7,8°	7,2°
21 kHz	14,1°	10,5°	10,2°	10,2°	7,4°	6,9°
22 kHz	13,5°	10,0°	9,7°	9,7°	7,1°	6,5°
23 kHz	12,9°	9,6°	9,3°	9,3°	6,8°	6,3°
24 kHz	12,3°	9,2°	8,9°	8,9°	6,5°	6,0°
25 kHz	11,8°	8,8°	8,6°	8,6°	6,2°	5,8°
26 kHz	11,4°	8,5°	8,2°	8,2°	6,0°	5,5°
27 kHz	11,0°	8,1°	7,9°	7,9°	5,8°	5,3°
28 kHz	10,6°	7,9°	7,6°	7,6°	5,6°	5,1°
29 kHz	10,2°	7,6°	7,4°	7,4°	5,4°	5,0°
30 kHz	9,9°	7,3°	7,1°	7,1°	5,2°	4,8°

WHEN DOES THE SONAR BEAM HIT BOTTOM AT DIFFERENT TILT, FREQUENCIES AND DEPTH?



FOOTPRINT FOR SU AND SX AT 20 kHz



BASIC SONAR THEORY

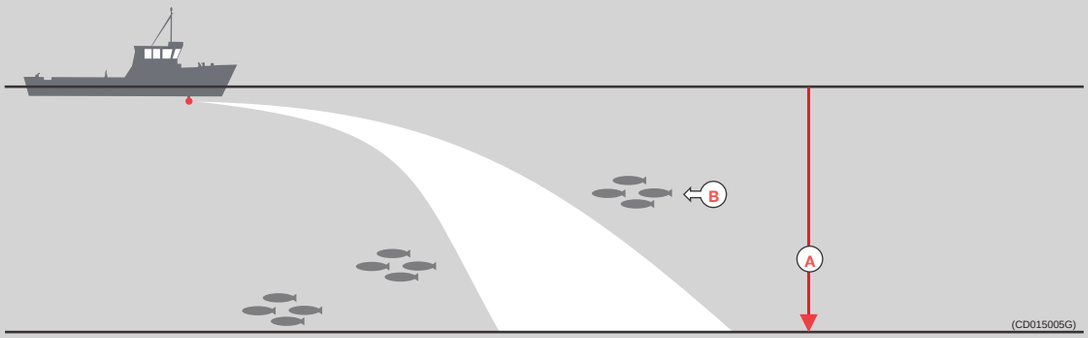
A sonar can sometimes be a challenging tool to operate. There are never two days at sea that are the same, weather, water temperature, bottom conditions, fish behavior, temperature layers, plankton layers, ships noise, sonar settings etc all influence the performance of a sonar.

The horizontal transmission of sound is defined by SIMRAD as a sonar. If transmitted vertically, then it is defined as an echo sounder. Sending sound vertically is not as challenging as sending it horizontally and therefore an echo sounder performance can be compared from day to day or between vessels. On a sonar this is not true.

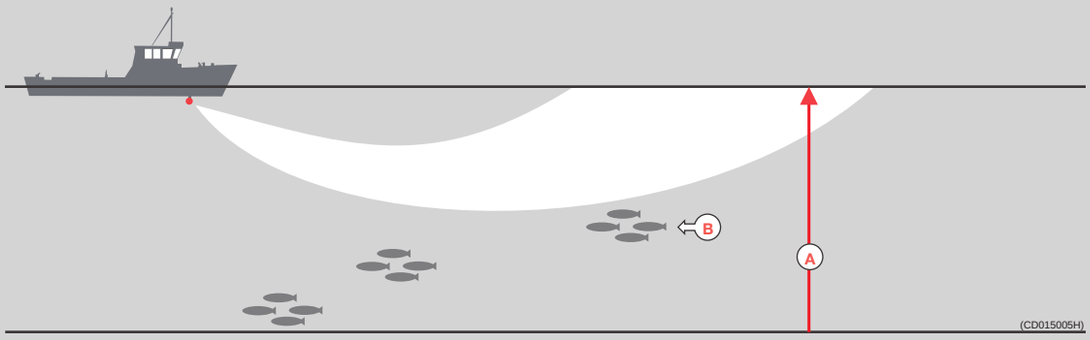
Even between vessels fishing on the same fishing grounds, sonar can perform differently. Ships noise, electrical and/or acoustic, is different from vessel to vessel, transducer installation is different from vessel to vessel, filter settings and general sonar operation is different from vessel to vessel and will affect the sonar performance.

On this page we have made some illustrations to consider when operating a sonar. There are many more but these are the most common ones that will change from day to day and between vessels.

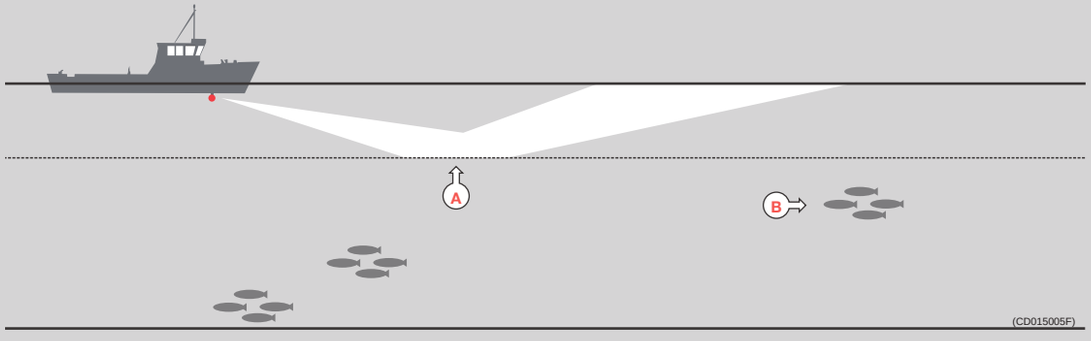
With decreasing temperature (A) the beam will bend towards the bottom shortening the range (B).

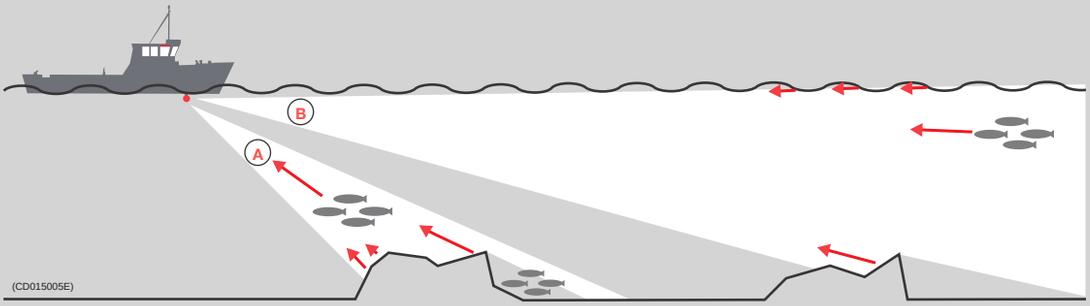


With increasing temperature (A) the beam will bend towards the surface shortening the range (B).



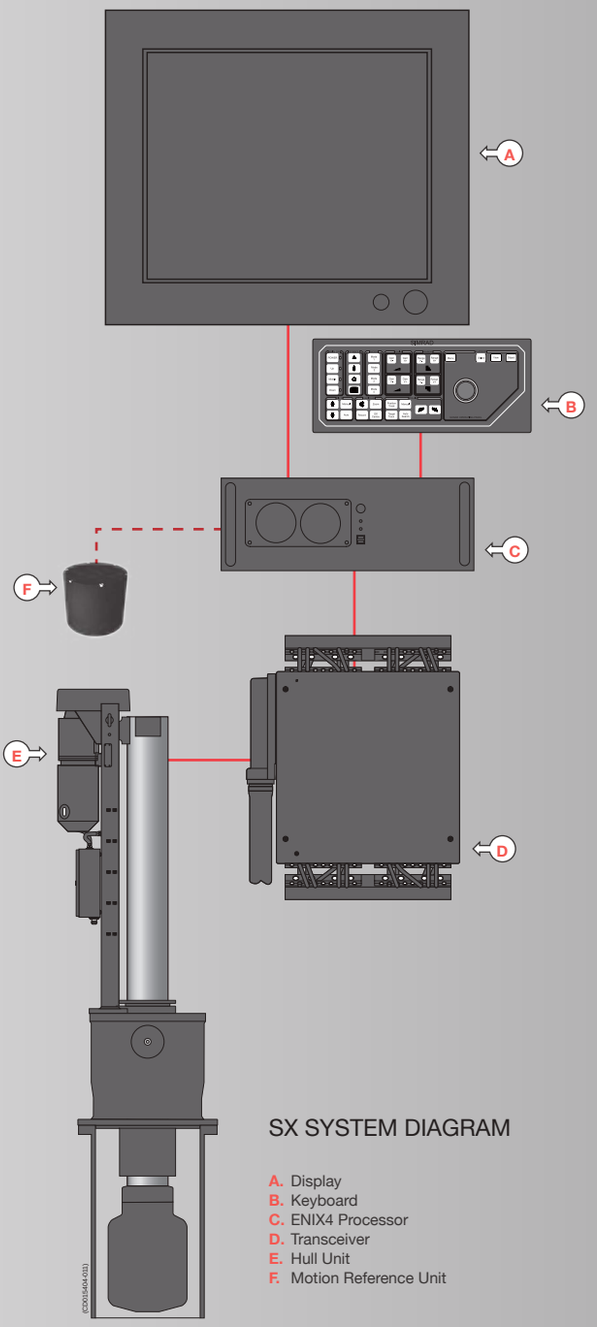
With a temperature layer (A) the beam can create a “sound channel” and increase the range (B) on certain tilt angles.





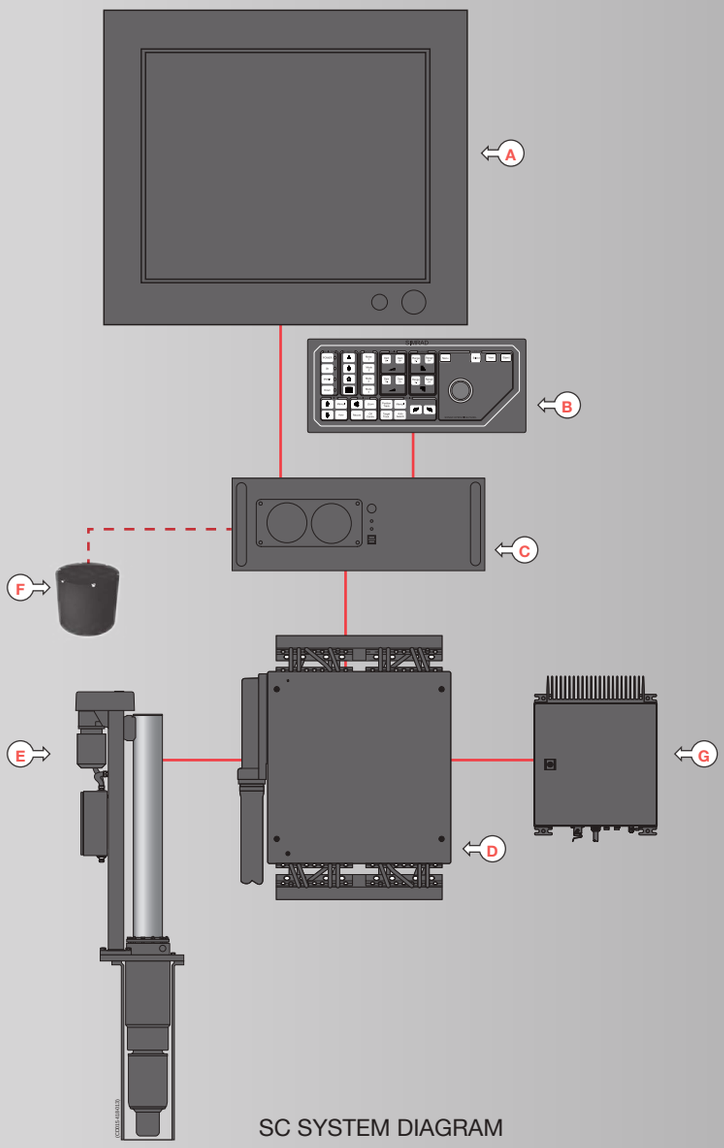
Depending on the tilt, echoes from other than fish will be detected. Bottom and surface is among those which generate the most echoes. Sometimes if weather is rough it is difficult to separate fish from surface echo and sometimes if fish is close to bottom or the bottom is rocky it is difficult to separate fish from bottom. A Simrad Sonar has the best filter available to assist in separating fish from unwanted echo.

Propeller noise is caused by cavitation as illustrated in below picture. A clean propeller will still cavitate but much less than a propeller with marks and damages. Also, a large propeller will cavitate much less than a small due to the lower RPM.



SX SYSTEM DIAGRAM

A. Display
B. Keyboard
C. ENIX4 Processor
D. Transceiver
E. Hull Unit
F. Motion Reference Unit



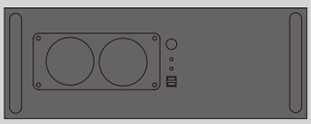
SC SYSTEM DIAGRAM

A. Display
B. Keyboard
C. ENIX4 Processor
D. Transceiver
E. Hull Unit
F. Motion Reference Unit
G. Transceiver Power Supply

PROCESSOR UNIT

Width: 600 mm
Height (with shock absorbers): 410 mm
Depth: 640 mm
Weight: 24 kg

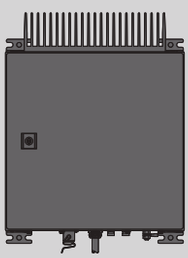
(Shipping dimensions)



POWER SUPPLY UNIT

Width: 600 mm
Height (with heatsink and brackets): 410 mm
Depth: 220 mm
Weight: 22 kg

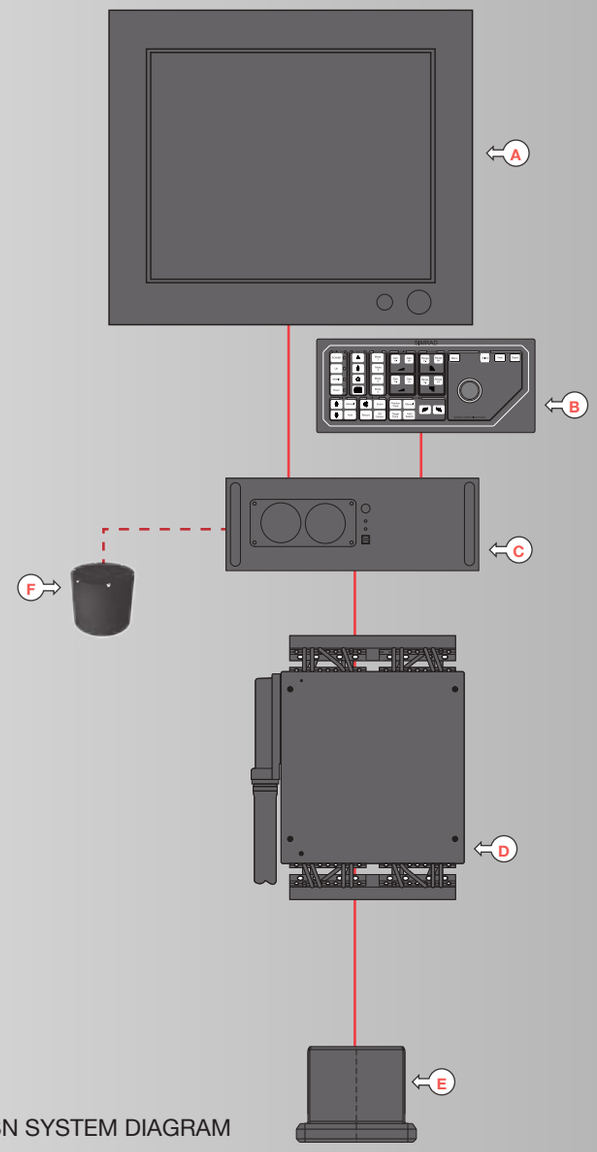
(Shipping dimensions)



OPERATING PANEL

Width: 320 mm
Height: 230 mm
Depth: 51 mm
Weight: 4 kg

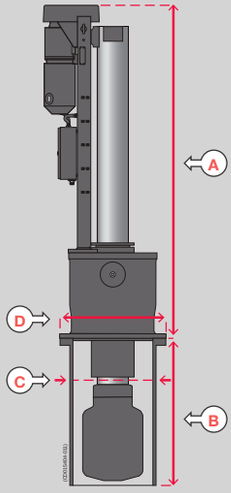
(Shipping dimensions)



SN SYSTEM DIAGRAM

A. Display
B. Keyboard
C. ENIX8 Processor
D. Transceiver
E. Transducer
F. Motion Reference Unit

HULL UNIT
SX - SU



(SX92/SX93/SX95)

A. Height over trunk:
SX92 - 2120 mm
SX93 - 2520 mm
SX95 - 1645 mm

B. Height of trunk:
SX92 - 930 mm
SX93 - 930 mm
SX95 - 910 mm

C. Trunk diameter:
SX92 - 610 mm
SX93 - 610 mm
SX95 - 508 mm

D. Flange diameter:
SX92 - 761 mm
SX93 - 761 mm
SX95 - 580 mm

(SU92/SU93)

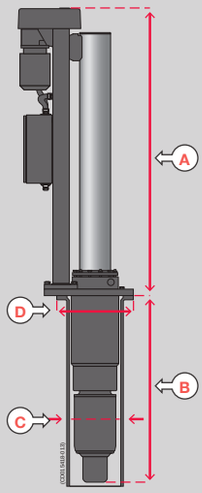
A. Height over trunk:
SU92 - 2120 mm
SU93 - 2520 mm

B. Height of trunk:
SU92 - 1110 mm
SU93 - 1110 mm

C. Trunk diameter:
SU92 - 610 mm
SU93 - 610 mm

D. Flange diameter:
SU92 - 761 mm
SU93 - 761 mm

HULL UNIT
SC



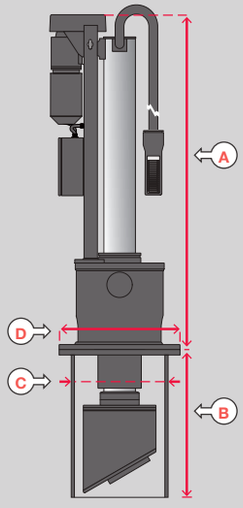
A. Height over trunk:
SC90 - 1390 mm

B. Height of trunk:
SC90 - 970 mm

C. Trunk diameter:
SC90 - 273 mm

D. Flange diameter:
SC90 - 370 mm

HULL UNIT
SN



A. Height over trunk:
SN92H: 2120 mm

B. Height of trunk:
SN92H: 930 mm

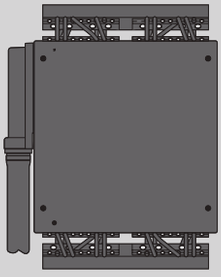
C. Trunk diameter:
SN92H: 610 mm

D. Flange diameter:
SN92H: 761 mm

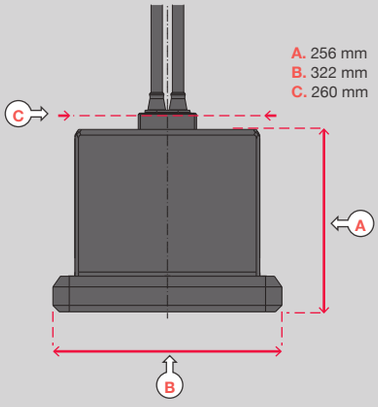
TRANSCEIVER UNIT

Width: 670 mm
Height: 760 mm
Depth: 580 mm (Excluding climate door)
Weight: 108 kg

(Shipping dimensions)



TRANSDUCER
SN



A. 256 mm
B. 322 mm
C. 260 mm

"Our goal is to set a new standard in catch monitoring, whether it is a wireless sensor or with cable. We believe the best example of this is the versatile PX Sensor family"

THOR BÆRHAUGEN
Product Manager
Catch Monitoring Systems

CATCH MONITORING SYSTEMS

Control trawl performance and catch behaviour

Accurate position and performance of the sample trawl is important for many surveys. Information about spread and height tells you how much water volume you sample, and correct geometry is important for efficient trawling. Other sensors, such as bottom contact, tilt, roll and height sensors on the doors add more information, so that you can have full knowledge of your trawl behaviour.

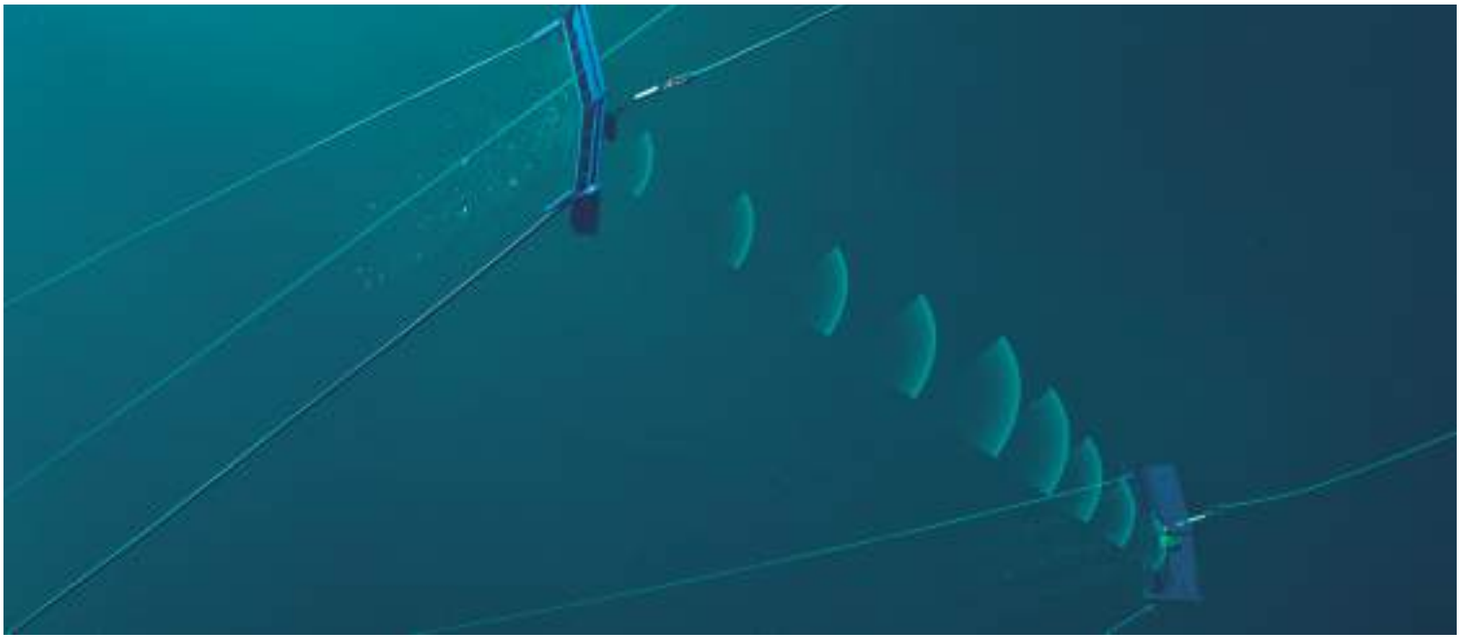
Today SIMRAD has a range of Catch Monitoring products, both wireless and cable based, which can be combined. Interfacing Simrad Catch Monitoring Systems to other equipment gives you full control from setting to catch thus enabling you to fish more efficient, safer and environmental friendly.

SIMRAD CATCH MONITORING SYSTEMS

SIMRAD developed and introduced the first wireless catch sensor more than 40 years ago. Not very late, it also introduced the 3rd wire systems. Since then, SIMRAD manufactures, and keeps developing, a wide range of catch monitoring systems so that the skipper can have full control of the catch process, while enhancing efficiency and respecting the environment.

Wireless sensors are developed for fitting in all different fishing scenarios. For example, in bottom trawling, whether it is single, twin, triple or more, wireless sensors are placed on the gear and doors and communicate acoustically with the vessel. Depending on where they are placed, they can send to the skipper some vital measurements like spread between doors, the fish entering the trawl opening, the filling of the net or the distance from the doors to the bottom - that will prevent them from damaging the fauna -, amongst many others.

The 3rd wire is a communication and power cable connected to a scanning trawl sonar placed on the net's headrope. This type of system can be used in pelagic fishery in combination with wireless sensors. These sensors can then communicate with the trawl sonar and the data will go through the 3rd wire up to the vessel. The advantage of combining both wireless and 3rd wire systems is that down by the trawl the environment for wireless communication is perfect, since there is no propeller noise or long distances. For this specific situation, a 3rd wire winch will be needed.



ACTIVE HYDROPHONE WITH EXCELLENT SENSITIVITY

Active hydrophones have pre-amplifiers built-in. SIMRAD offers three different active hydrophones:

PURSE SEINE HYDROPHONE

The hull mounted hydrophone for purse seining operations has a 90° horizontal beam and a 30° vertical beam to provide the PI50 with optimal reception from the sensors on a purse seine.

This specific beam pattern is especially suited for purse seining and the wide coverage area reduces the need for careful alignment.

TRAWL HYDROPHONE

The hull mounted hydrophone for trawling operations has a 50° horizontal beam and a 30° vertical beam to provide the PI50 with optimal reception from the sensors on a bottom or pelagic trawl.

This specific beam pattern is especially suited for trawling and the wide coverage area reduces the need for careful alignment.

NEW GENERATION SENSOR RECEIVERS

In the latest years, the fast evolution of wideband electronics has been met by Simrad's engineers as an opportunity to develop two new sensor receivers that can cover almost all fishing operating scenarios because they can receive multiple signals from many sensors.
The new Sensor Receivers can receive data from all the PX family catch sensors including the TrawlEye.

SR70 RECEIVER UNIT

This is a versatile and powerful sensor receiver that can have up to four separate hydrophones connected simultaneously. Four connected hydrophones ensure a stable communication in all kinds of situations, even during steep turning of the vessel, where the SR70 will automatically switch and select the hydrophone with the strongest signal. Besides, in combined vessels, hydrophones can be mounted in different directions to suit both purse seine and trawling operations, all of them connected to a single unit.

SR15 RECEIVER UNIT

The SR15 Receiver is a compact and cost-effective receiver unit that has one single hydrophone connected.

To process the data and run the visualization software (TV80) a powerful small marine computer is available from Simrad. You can also use your own computer. We recommend you to ask your Simrad dealer first since TV80 software runs on powerful computers.

PORTABLE HYDROPHONE

A portable hydrophone is also available. It is designed as a temporary measure until a fixed hydrophone can be installed at the vessel's next planned dry docking. It has an omnidirectional beam and a 50 meter integrated cable.

The cable is sheathed in polyurethane providing robust external protection to compliment its 150 kg tensile strength.

The cable is supplied on a reel for convenient retrieval and storage, and is equipped with a plug for easy attachment to the Receiver Unit.

SIMRAD
PX
SENSOR

THE PX FAMILY, SENSORS MADE TO WORK!

The PX sensor family comes in two different bodies and 8 different HW configurations. At the same time, each sensor can read up to 5 different measurements. A standard sensor will have 2 data readings and the user can purchase a license for up to 3 additional functions. All available functions can be user programmable according to the matrix below using the TV80 software.

The complete PX sensor family is depth rated to 1000m including the depth sensors and seine sounders.
Previous PX Multisensor can be easily upgraded to the new PX Multisensor MK2. The difference between MKI and MK2 is the number of functions: MKI has a maximum of 2 and MK2 has a maximum of 5 function readings.

The PX Universal comes either as a Standard sensor or as a Multicatch sensor. The Standard sensor can measure height of the door, distance to bottom on trawl or purse seine. The Multicatch can be configured as a catch sensor or a depth/ temperature sensor.

SENSORS		FUNCTIONS						
Name	Part no.	Battery Status	Catch	Depth	Echogram	Geometry	Geometry Diff	Height
MK2	421180	■				■	■	■
MK2 Trd Lid	421294	■						■
MK2 D1000/T	421293	■		■		■	■	■
PX TrawlEye	399967	■			■			■
PX TrawlEye D/T	406399	■		■	■			■
PX Universal	400943	■		■				■
PX MultiCatch D/T*	418419	■		■				
PX MultiCatch C/T*	418520	■	■					

*MK1 sensors can be upgraded to MK2 sensors

Remember: Port door is always the reference!

FUNCTIONS							SENSORS	
Pitch	Roll	Spread	Temperature	Twin Spread	Remote Geometry	Remote Spread	Part no.	Name
■	■	■		■	■	■	421180	**MK2**
■	■	■		■	■	■	421294	**MK2 Trd Lid**
■	■	■	■	■	■	■	421293	**MK2 D1000/T**
■	■						399967	**PX TrawlEye**
■	■		■				406399	**PX TrawlEye D/T**
■	■		■				400943	**PX Universal**
■	■		■				418419	**PX MultiCatch D/T***
■	■		■				418520	**PX MultiCatch C/T***

SIMRAD PX TRAWLEYE

WIRELESS ECHO SOUNDER FOR PELAGIC AND BOTTOM TRAWLS

The Simrad PX TrawlEye provides a real time echogram from the trawl via a wireless link. In addition to the high resolution echogram the PX TrawlEye sends up the battery status so you can plan when to charge the sensor.

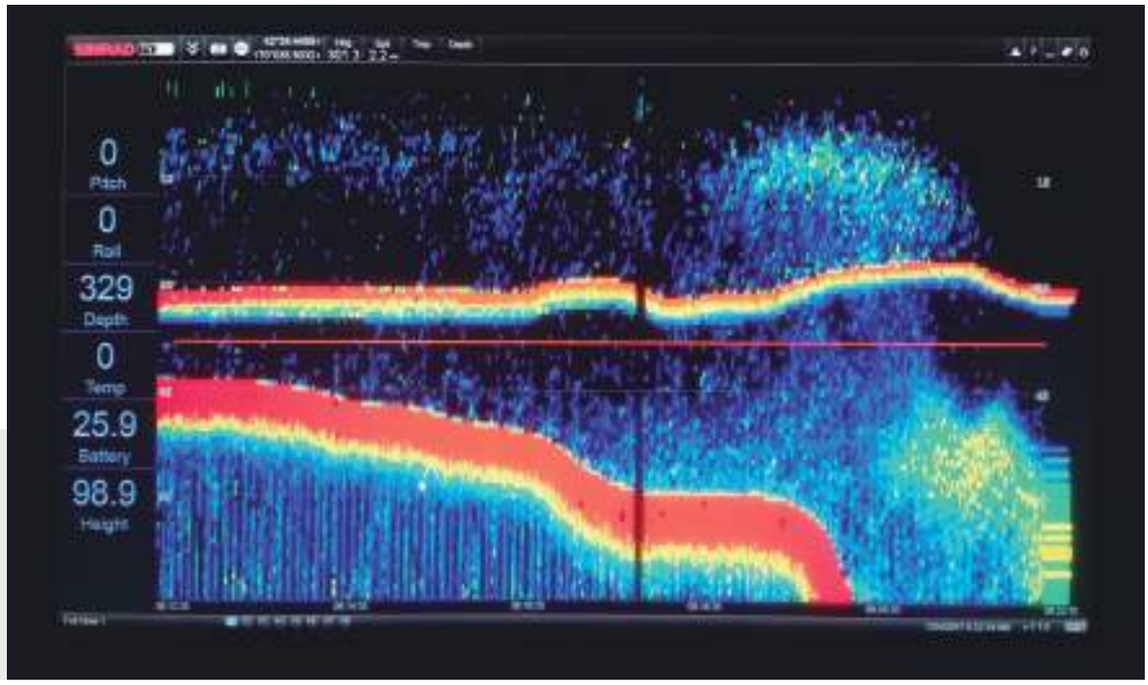
To ensure long range communication and optimum alignment between sensor and vessel the PX TrawlEye also sends up roll and pitch information, enabling you to detect if you have a bad alignment and/or if the TrawlEye was tangled in a mesh or similar while shooting your trawl.

The TrawlEye can be received through Simrad hydrophones or even non-Simrad types, provided that the frequency is similar. Both the SR15 and the SR70 sensor receivers can be used with the PX TrawlEye.

The PX TrawlEye is equipped with a composite echo sounder transducer enabling advanced LFM pulses, Linear Frequency Modulation, also called chirp.

The PX TrawlEye can be configured to suit various fisheries using the TV80 software to program update rate (0.5s – 8s), pulse length, pulse type, sounder gain, echo range, communication power, etc.

The PX Deployment Pack is designed to provide easy access and replacement of the PX TrawlEye, whilst still ensuring a safe and sturdy installation.



The picture to the right is Kobe Fishery in the Pacific. Note the fish going under the footrope, any information is important to act!

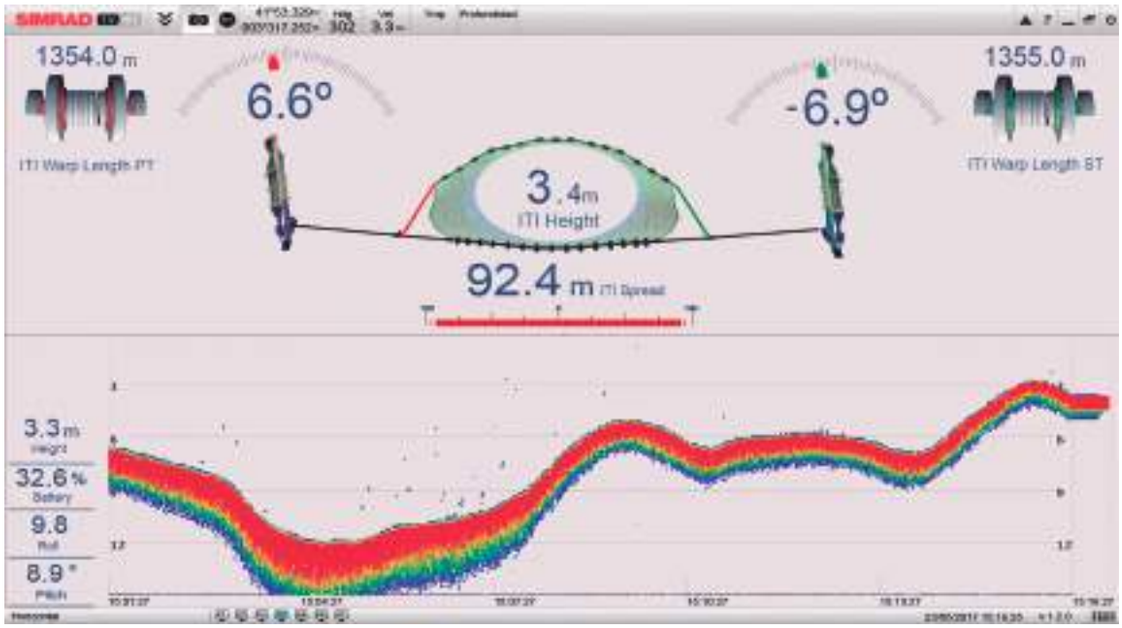
TV80, MAKING SENSOR DATA UNDERSTANDABLE

With the introduction of multi-function catch monitoring sensors, the challenge is how to show the information in a friendly way for the skipper, who wants to receive the relevant information in a quick look on the screen. The TV80 is designed to fulfil this concept.

The TV80 can work with a single or dual monitor configuration and can display information simultaneously from all existing Simrad Catch Monitoring Systems, ITI, PI, FS and SR. This feature provides an easy update path for Simrad customers, in spite of the system they are using or want to use. In addition to the data supplied by Simrad Catch Monitoring Systems, the TV80 accepts data from other sources like GPS receivers, echo sounders, heading sensors, winch sensors, etc.

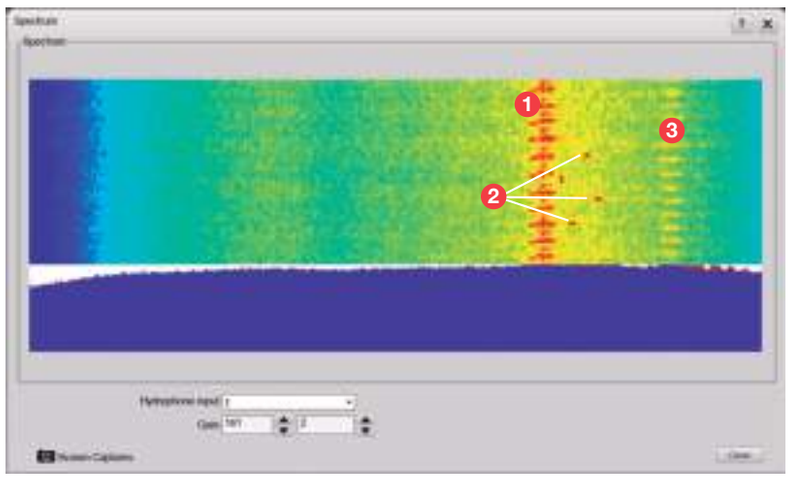
The user can create his own layout of up to four independent views to fit his operating scenario. He can also decide what information is going to be presented on every view. Each view is assigned to a function key, allowing a fast and efficient swap between predefined views with a single keystroke.

The TV80 has a built-in recording function for all the received data. The user can either use the recorded data to replay or export it to a compatible CSV file format for later analysis or study.



FREQUENCY SPECTRUM

The acoustic communication link between the receiver and the sensors could be challenging in a fishing vessel, due to propeller, pumps, compressors and other electric systems onboard generating noise. When the noise is in the same frequency range than the sensor, the result is unstable or even gives no data readings. The TV80 has a built-in spectrum analyzer that shows the signals coming through each hydrophone. With this advanced tool, the user will be able to identify the noise and find the cleanest frequencies. Programming the communication channel of the sensors in the “quiet” frequencies to assure a stable



Spectrum example with PX sensors configured away from the echo sounder interference

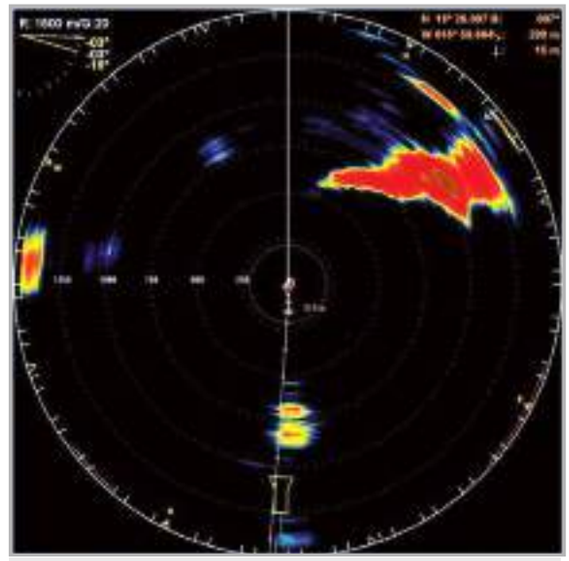
1 PX Trawl Eye signal 2 PX sensors (three different channels) 3 Echo sounder interference

SIMRAD ITI SYSTEM

SIMRAD ITI POSITIONING SYSTEM

Knowing the geographical position of your trawl, doors or any underwater object is of general interest for any fisherman. With the Simrad ITI system, this is fully possible with high accuracy. The system will enable you to position several points by adding position sensors, for example on the headrope, each door or codend. The system uses split beam technology known by Simrad users since the mid 80's and has been available as a compact sensor since the 90's.

By adding the ITI system to your existing Simrad Trawl Monitoring system, you will have all the information needed to fish close to obstacles, steer your trawl to the target or simply map your hauls on a chart plotter for later reference.

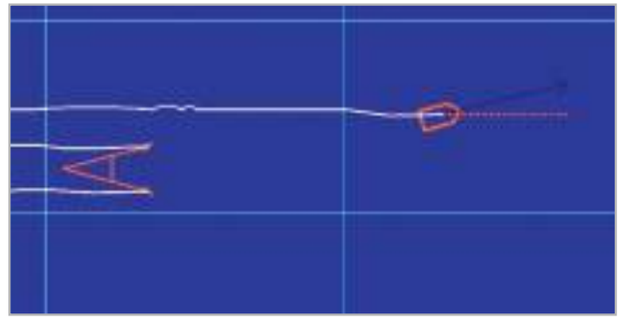


When connecting the ITI positioning system to a sonar, aimed trawling is possible. Aimed trawling increases efficiency and time at sea. The above picture shows a school of sardines aligned to the trawl opening on a pelagic vessel fishing in Mauritania. The positioning system is here connected to a Simrad SX93 sonar.

YOUR WARPS WILL NOT NECESSARY TELL YOU WHAT SIDE YOUR TRAWL IS!

Every skipper is convinced of what side of the vessel the trawl is. Just a quick view to the warps and that's it.

Not always what you see in the warps is giving you the right information. Even using the ITI positioning system alone might not be enough. It is easy to make a very costly decision when trawling in an area with obstacles like wrecks or rocks.



In a bird's-eye view it looks like the trawl is on the port side and the warps are giving the same information when the skipper looks at them. In order to make a solid decision of where the trawl is, the skipper has to look at the COG and the heading of the vessel.

Placing the information on a chart plotter, the situation can be the opposite of what was initially thought. Here it is clear that the trawl is on the starboard side as a plotter records history and only plots COG.

FM90 MULTIBEAM TRAWL SONAR

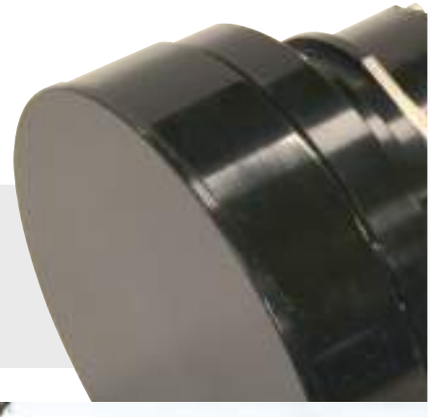
SIMRAD invented the “3rd wire” trawl sonar back in the early 80’s. Back then nobody could foresee the impact this has had to the pelagic and semi pelagic fishing industry. Imagine back then, nobody had a “3rd wire” winch and nobody had handled this type of equipment before, making the learning curve steep. But as with everything, if you see the benefit with something, you go the extra mile to be able to benefit from it. For the pelagic and semi pelagic industry the trawl sonar is so important that you will not go out fishing without it.

Traditionally the trawl sonar has been a scanning search light sonar installed in the vertical plane. The advantage with a search light sonar is the resolution, the disadvantage is its real time capabilities. It takes time to scan a trawl opening and time is valuable. The FM90 will instantly give you a picture of the net opening and fish enter. The challenge up until now has been the ability to detect fish and the net geometry when the net is getting closer to the bottom. The FM90 has solved this using all the multibeam technology and knowledge within the SIMRAD organization.

FM90 TRAWL UNIT

The FM90 Deployment Pack has a yellow top and black bottom to confirm correct orientation prior to launching and to assist in visual sighting during recovery. It also has improved hand holds to assist handling even with gloves on. The strain relief can be accessed using standard tools without opening the entire Deployment Pack and the unit is quick filling and draining.

The transducer of the FM90 has no moving parts thus being less vulnerable to damage and less maintenance is needed.



SIMRAD FX SYSTEM

REAL-TIME INFORMATION FOR REAL-TIME DECISIONS

The real-time aspects and advantages of the FX80 take the speculation and guess work out of the equation.

The FX80 system is the natural choice to get real-time, high resolution information from the trawl. The core of the system is a digital HUB that can receive information from various sensors and then communicate the signals through a wire to the vessel.

One of the primary design criteria of the Simrad FX80 system was to make it work on existing 3rd wire cables. The use of existing copper core coax cables eases the cost and reduces the installation time.

The Simrad DFS75 Trawl sonar is integrated into the Simrad FX80 system to establish an efficient and accurate monitoring system. The combination of the high resolution images from the trawl sonar and the live video feed provides you with an unparalleled opportunity to identify and analyse both trawl movements and fish behaviour.

When addressing by-catch and avoidance issues, real-time video is and will be of significant importance. Trawl behaviour and fish behaviour can be viewed in real time. Accompanied by a high-density LED light, the camera is usually placed under the headrope or in the cod end, pointing with the desired angle. The camera sends its information to the FX80 Communication Hub inside the FX80 Deployment Unit, which is usually located near the headrope.

The entire Simrad FX80 system -with live video and high resolution sonar- is controlled from a standard Processor Unit provided by SIMRAD. It is small, but yet powerful, and contains no moving parts. The system design allows to use two displays. Many users prefer this configuration, as it allows them to use one display system for the trawl sonar presentations, and another for the live video feed.

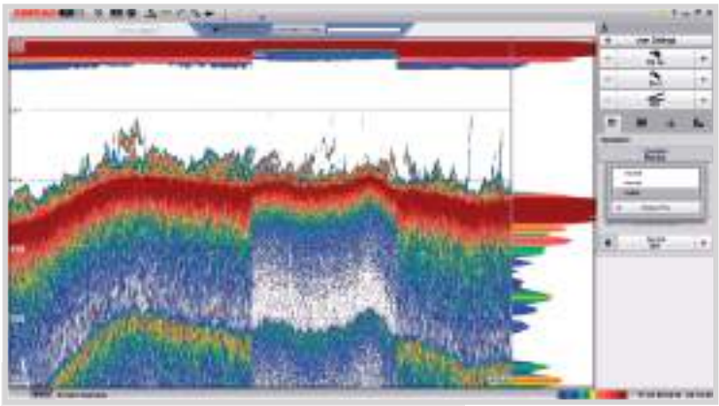
THE FX80 CAMERA UNIT

The camera unit of the FX80 system includes the camera itself, as well as artificial lighting (LED). The camera itself is based on a well proven high resolution underwater camera from Kongsberg Maritime. The cable from this unit to the trawl deployment package is included in the system, but you have to specify the length of the cable when ordering. Up to 600 meter is possible, and the camera unit is certified to be used down to 1800 meter depth.

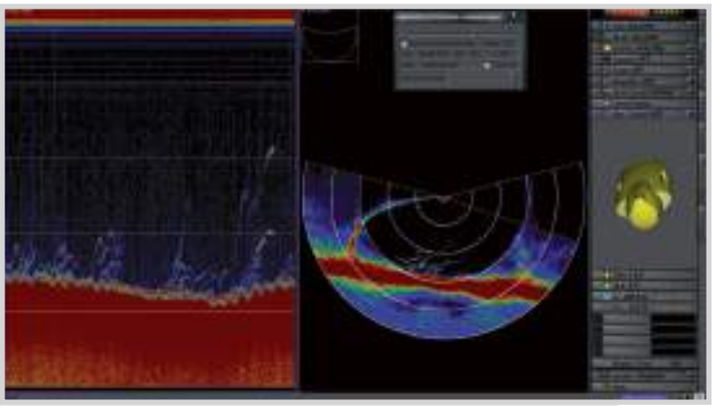
HIGH RESOLUTION, FAST PING RATE

In a wireless system you have to compromise on ping rate and data flow due to limits in battery. The FX80 system is different, and as long as you have the 3rd wire available, you can stream both live camera and trawl scanning sonar continuously at the same time.

A wireless trawl eye has to make the same compromise between how often can we update, and what resolution we can get. With the FX80 you do not have to make these decisions, power is available from the deployment unit, and the bandwidth is there.



Above you can see a single beam echo sounder “EK15” connected to the HUB with good resolution and relatively high ping rate. Other sensors are planned to be integrated in the future.



DFS75 scanning sonar is an important part of the FX80 system. The sonar scans the entire opening and gives information of trawl behaviour and fish entrance. The DFS75 is a new version of the popular FS70, digitalized and optimized for the FX80 system. The DFS offers twice the sampling rate compared to the FS, and the system can do CHRIP in addition to CW.

THE HEART OF THE FX80 SYSTEM

The FX80 trawl deployment unit is where all sensors are interfaced. The electronic HUB with Ethernet connections is built in the unit. The same goes for the DFS scanning sonar head. Optional and future trawl sensors, such as high resolution echo sounders, are also interfaced through this unit before signals are transmitted to the vessel for viewing and storage. The unit has the same 1800 meter depth rating as the camera unit.

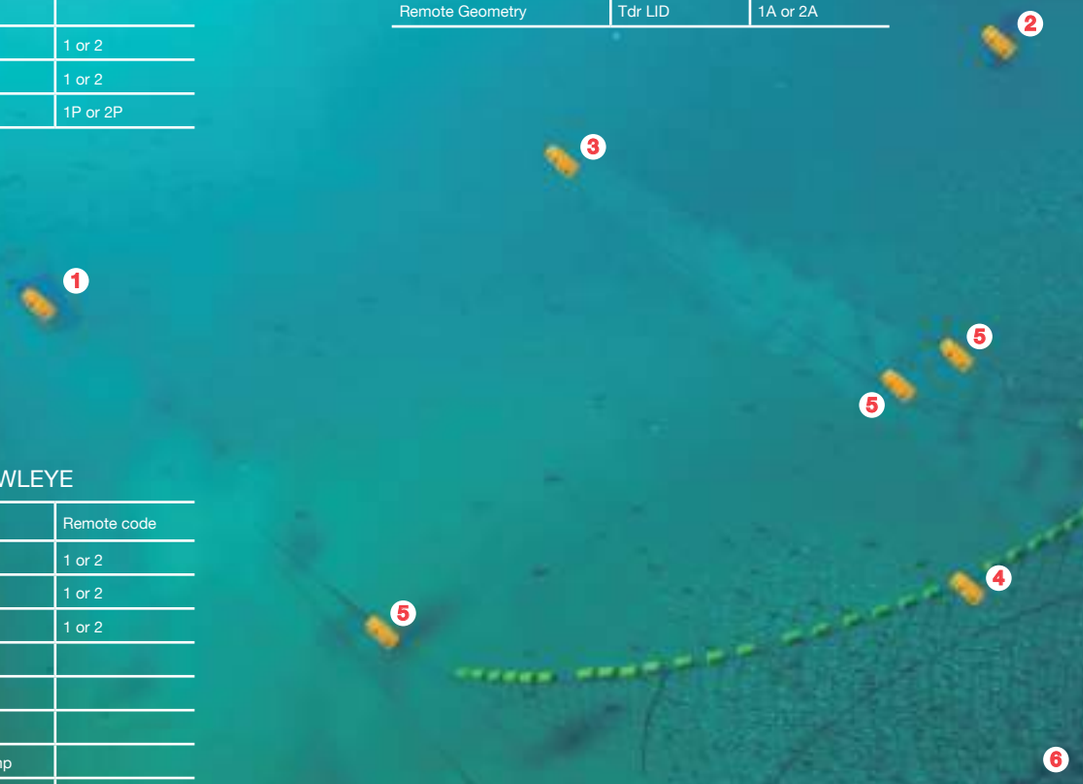
SENSOR LOCATION AND AVAILABLE FUNCTIONS

1 PORT DOOR

Function	Lid type	Remote code
Spread	Any	1 or 2
Spread XT	Any	1 or 2
Height	Any	
Roll	Any	
Pitch	Any	
Temperature	D1000/Temp	
Depth	D1000/Temp	
Battery status	Any	
Twin Spread (Twin trawl)	Any	1 or 2
Twin Spread XT (Twin trawl)	Any	1 or 2
Remote Geometry	Tdr LID	1P or 2P

2 STARBOARD DOOR

Function	Lid type	Remote code
Height	Any	
Roll	Any	
Pitch	Any	
Temperature	D1000/Temp	
Depth	D1000/Temp	
Battery status	Any	
Remote Spread	Any	1A or 2A
Remote Geometry	Tdr LID	1A or 2A



4 HEADLINE / TRAWLEYE

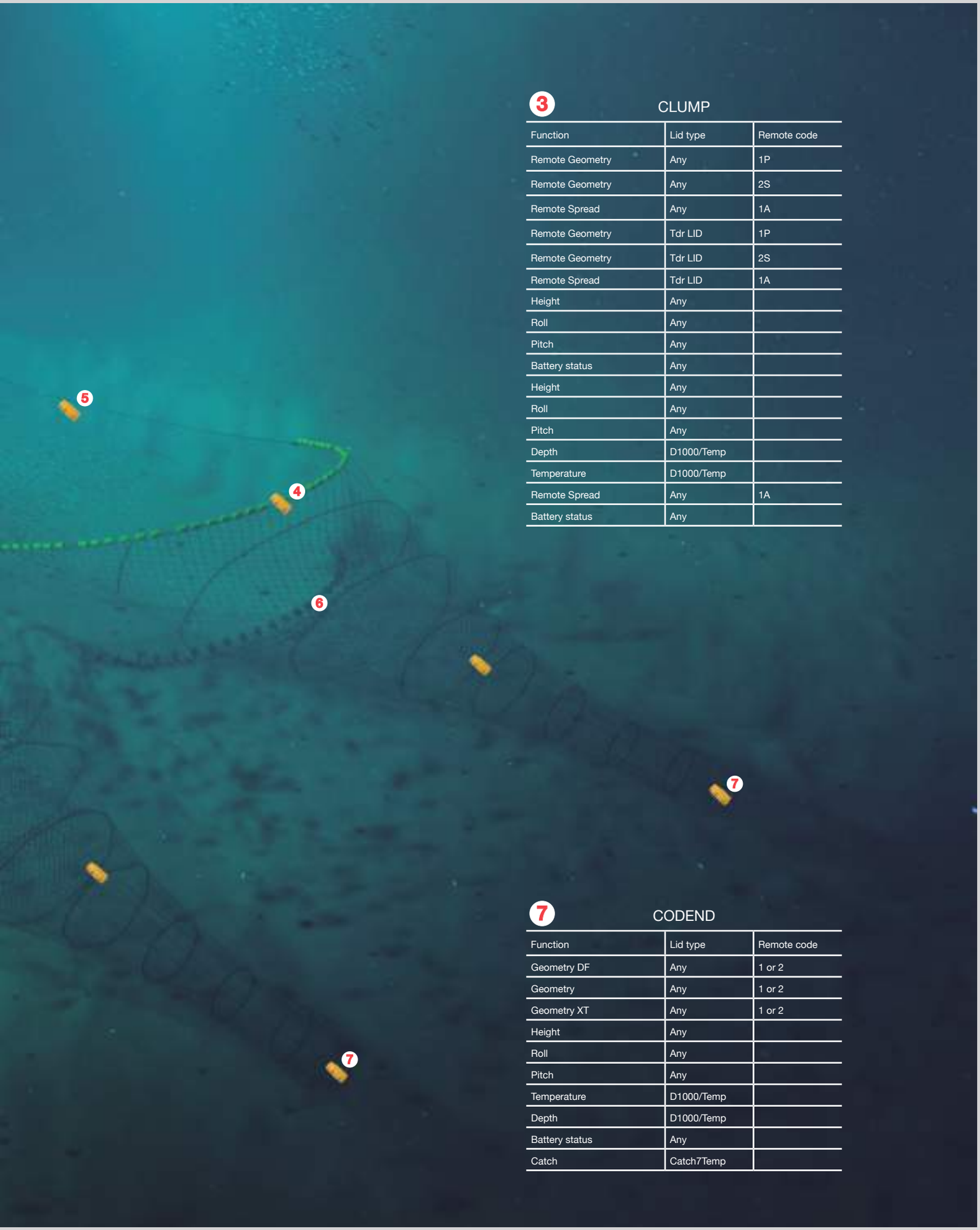
Function	Lid type	Remote code
Geometry DF	Any	1 or 2
Geometry	Any	1 or 2
Geometry XT	Any	1 or 2
Height	Standard	
Roll	Standard	
Pitch	Standard	
Temperature	D1000/Temp	
Depth	D1000/Temp	
Battery status	Any	

5 INTERMEDIATE

Function	Lid type	Remote code
Geometry DF	Any	1 or 2
Geometry	Any	1 or 2
Geometry XT	Any	1 or 2
Height	Any	
Roll	Any	
Pitch	Any	
Temperature	D1000/Temp	
Depth	D1000/Temp	
Battery status	Any	

6 FOOTROPE

Function	Lid type	Remote code
Height	Any	
Roll	Any	
Pitch	Any	
Temperature	D1000/Temp	
Depth	D1000/Temp	
Battery status	Any	



3 CLUMP

Function	Lid type	Remote code
Remote Geometry	Any	1P
Remote Geometry	Any	2S
Remote Spread	Any	1A
Remote Geometry	Tdr LID	1P
Remote Geometry	Tdr LID	2S
Remote Spread	Tdr LID	1A
Height	Any	
Roll	Any	
Pitch	Any	
Battery status	Any	
Height	Any	
Roll	Any	
Pitch	Any	
Depth	D1000/Temp	
Temperature	D1000/Temp	
Remote Spread	Any	1A
Battery status	Any	

7 CODEND

Function	Lid type	Remote code
Geometry DF	Any	1 or 2
Geometry	Any	1 or 2
Geometry XT	Any	1 or 2
Height	Any	
Roll	Any	
Pitch	Any	
Temperature	D1000/Temp	
Depth	D1000/Temp	
Battery status	Any	
Catch	Catch7Temp	

TRAWL SENSORS SPECIFICATIONS

	PX UNIVERSAL			PX MULTISENSOR		ITI		
	DEPTH	**CATCH**	**STANDARD**	**MULTISENSOR MK2**	**TRAWLEYE**	**SPREAD**	**COMBI**	**TRAWL EYE**
Communication Frequency	43,5-49,5 kHz	40-70 kHz	43,5-49,5 kHz	43,5-49,5 kHz	25-49 kHz	27-33 kHz	27-33 kHz	27-33 kHz
Echo sounder / Transverse working frequency	N/A		70 kHz	70 kHz	200 kHz	104 kHz	104 kHz	120 kHz
Maximum Communication Distance	2500 m			2500 m	2000 m[3]	2500 m		
Depth Rating	1400 m[1]			1400 m[4]	1400 m[4]	1800 m		
Maximum number of measurements	5			5		1		
UPDATE RATES								
Slow	5,5 s. approx.				2/4/8 s.			
Normal	14 s. approx.			15 s.	1,1 s.	From 8 to 120 s.[2]		
Fast	34 s. approx.				0,5 s.			
MAXIMUM BATTERY LIFE								
With one measurement (hours)	100	150	100	150	20-100 [5]		40	
With two measurements (hours)	N/A	N/A	80	110	20-100 [5]			
CHARGING TIME								
Up to 70% of total capacity (hours)	1			3	2	1,5		
Up to 100% of total capacity (hours)	4				3	3		
WEIGHT								
In Air	4,3 kg	4,3 Kg	7 Kg	7,5 kg	7,5 kg	9 kg	9 kg	10 kg
In Water	1,5 kg	1,5 kg	2,7Kg	4,5 Kg	4,5 Kg	4,5 kg	3 kg	3,7 kg
Door Spread Maximum Range				600 m	N/A	N/A	300 m		
Geometry Maximum Range				N/A	600 m	N/A			
Acoustic Depth / Height Maximum Range			100 m	100 m				100 m

(1) Except PI D300 which is 1000 m.
(2) Depending on the number of sensors activated, their distance to the vessel and the interrogation rate selected by the user.
(3) Depending on sea conditions, noise level, sensor alignment, output power.
(4) Note: depth lid only goes to 1000 meters
(5) Depending on output power and update rate.

TRAWL UNITS SPECIFICATIONS

	SR15	SR70	FX80	ITI
PROCESSING UNIT				***
Voltage	110/220 VAC		115/230 VAC	110/220 VAC
Consumption	5 A.		100 VA	90 W
Processor type	Standard PC computer		Standard PC computer	Built in
Operating system	Windows™ XP, Vista, 7		Windows™ XP, Vista, 7	
Display output	Single		Dual	Single
Serial interface I/O	One RS232		One RS232	Four NMEA ports
Ethernet interface	One		One	Optional
Display resolution	Standard XGA		Standard XGA	VGA 680x512 (Hs 29,45kHz - Vs 57Hz)
TTM / BRIDGE UNIT				
Voltage			110/220 VAC	
Consumption			150 VA	
Communication link			With third wire	
WIRELESS SENSORS TX/RX UNIT			(Built in the Deployment package)	*
Voltage	24 VDC **			
Consumption	250 mA.			
Hydrophone connection	1		Up to 2 (Fore and Aft)	Up to 3 - Automatic selection
Hydrophone type	Single Beam with preampliffier		No	2 Way Split Beam
Frequency range	43,5-49,5 kHz		40 kHz	27-33 kHz
Serial interface I/O	1 RS232			4 NMEA ports
Ethernet interface	1			Optional
Bearing to sensor measurement	No		No	Yes
Distance to sensor measurement	No		No	Yes
Maximum range to sensors ***	2500 m.		2500 m.	4000 m.
Sensor compatibility	PS, PI, PX, FA701		PS, PI, PX	ITI
RX Channels	6		6	10
Sensor types	Depth, Temperature, Spread, Catch, Rip, Height, Pitch angle, Roll angle, Geometry, Bottom contact, Seine sounder		Depth, Spread, Catch, Rip, Height, Pitch angle, Roll angle, Bottom contact, Geometry, Temperature	Depth, Temperature, Spread, Catch, Height, Grid angle, Trawl eye

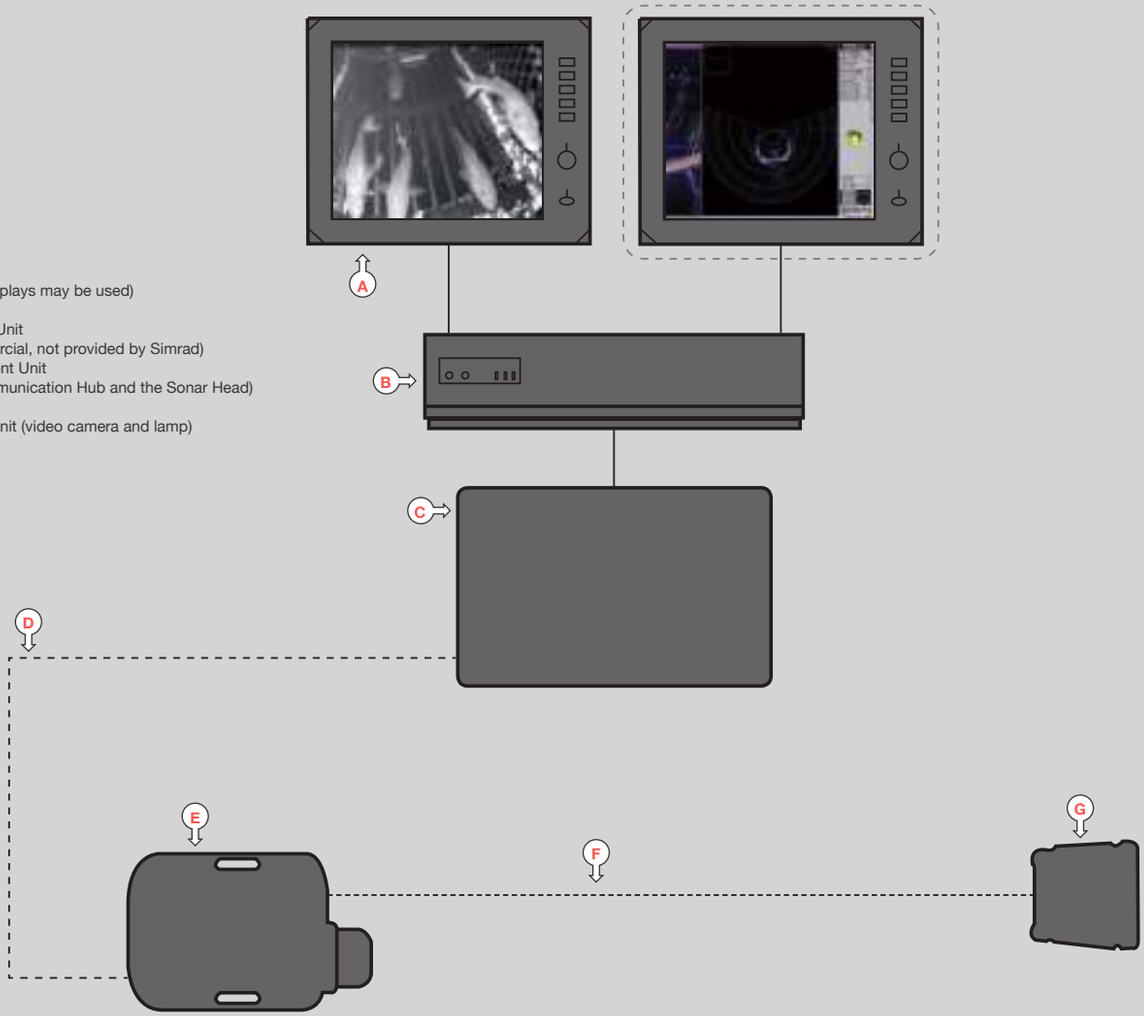
UNDERWATER UNIT	FM90	FX80	PX TRAWLEYE
DEPLOYMENT PACK			
Material	Polyurethane with S.S. Fasteners	Polyurethane with S.S. Fasteners	Polyurethane with S.S. Fasteners
Dimension L x W x H in cm.	84 x 41 x 30	79 x 43 x 27 / 53 x 53 x 23	49,5 x 35,5 x 17
Weight (complete system in air)	35,5 Kg	28 Kg / 12 Kg	12,5 Kg
TRAWL SONAR HEAD			
Head type	Multibeam with down/up sounder	Analog Vertical with Echo sounder	Wireless
Vertical transducer frequency	200 kHz	120 kHz or 330 kHz	200 kHz
200 kHz/120 kHz Head Beam width ****	3° x 20°	5° to 40°	N/A
Up Sounder/330 kHz Head Beam width *****	25° x 20°	1,9° to 20°	N/A
Echo sounder frequency	200 kHz	200 kHz/chirp	200 kHz
Echo sounder transducer beam width	10° x 20 °	10° x 20°	33°
Depth rating	2000 m.	2000 m.	1000 m.
Sensors built-in	Depth, Temperature, Pitch and Roll	Depth, Temperature, Pitch and Roll	Roll/Pitch

* Built in the processing unit.
** 115/230 VAC to 24 VDC Adaptor included with the delivery.
*** Detection range depends on transducer installation, ambient noise level, temperature gradient and sensor alignment.
**** 200 kHz Head Beam width for FM90. 120 kHz Head Beam width for FS70 and PX TrawlEye.
***** Up Sounder Beam width for FM90. 330 kHz Head Beam width for FS70 and PX TrawlEye.

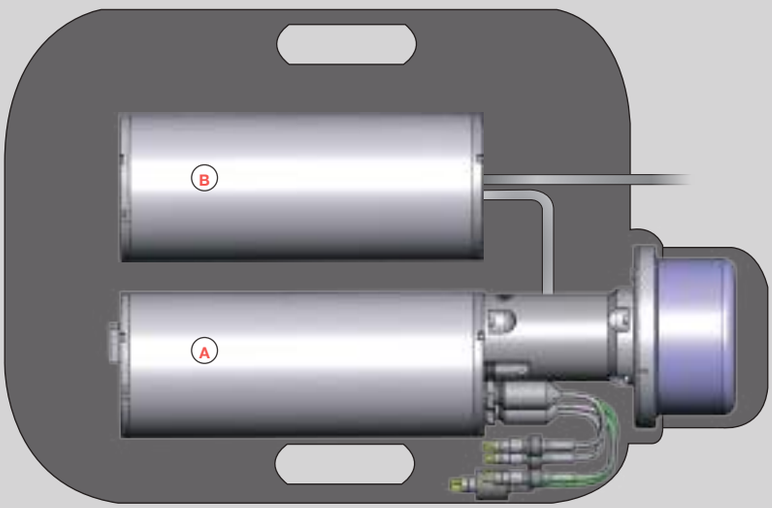
FX80 CONFIGURATION

SYSTEM DIAGRAM

A. Display (two displays may be used)
B. Processor
C. Bridge Control Unit
D. 3rd wire (commercial, not provided by Simrad)
E. Trawl Deployment Unit
(holds the Communication Hub and the Sonar Head)
F. 4th wire
G. FX80 Camera Unit (video camera and lamp)



FX80 TRAWL DEPLOYMENT UNIT



A. DFS70 Head
B. Digital Hub

CATCH MONITORING COMPONENTS TYPICAL CONFIGURATION

SYSTEM DIAGRAM

A. Display
B. Keyboard and trackball
C. Processor
D. SR15 Receiver
E. SR70 Receiver
F. Hydrophones
G. Sensors charger

SIMRAD ITI SYSTEM TYPICAL CONFIGURATION

SYSTEM DIAGRAM

A. Display
B. Keypad
C. Transceiver
D. Transducer
E. Trawl Sensor
F. Doors Sensor
G. Sensors charger

"Our goal is to provide solutions that give the most extensive overview of the aquatic ecosystems."

TONNY ALGRØY
Global Sales Manager Research

Image courtesy of Saildrone Inc.

APPLICATIONS

Towards the future

Acoustics can be a very powerful tool when used wisely. By measuring the intensity and directionality of the returned sound you can estimate biomass and number of fish over a large area. Standardized biomass survey from vessel mounted echo sounders and sonars is the most common way of carrying out such investigations, and might continue to be so with the introduction of supplemental tools such as scientific multibeams and omnidirectional sonars.

However, technology developments continue to build the case for alternative acoustic platforms as these become smaller, smarter and with better capabilities and endurance. We envision a future where drones serve as extensions to the large research vessels, increasing the overall acoustic effort but also increasing the user's ability to measure the ecosystems in their natural state.

ECOSYSTEM MONITORING

The instrumentation of the water column and the seafloor has already started. Through large ocean observation systems scientists and managers can now monitor the status and health of the world oceans.

With the introduction of the Autonomous EK echo sounder system it is now easier to make your own scientific platform, floating or moored, as the system itself needs no interface to science computer or external power to be able to collect high quality data for extensive periods.

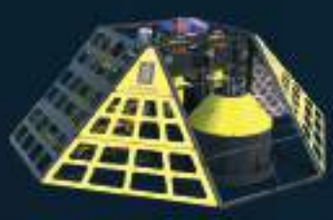
Saildrone is an example of an autonomous surface vehicle well suited to carry out acoustic surveys. The EK80 is a fully integrated part of the sensor payload, and the deep keel allows for good data even in poor weather conditions

Seaglider™ is a long endurance autonomous underwater vehicle (AUV) capable of carrying a wide range of sensors. Rather than an electrically driven propeller, the vehicle uses small changes in buoyancy and wings to achieve forward motion.

An AUV can navigate with reference to the surface or the bottom and can get very close to targets of interest to provide optimal high-resolution recording conditions for sensors.

Drifting buoys are already collecting oceanographic data for research purposes. The new compact EK80 versions can easily be integrated in a buoy, allowing for long term biomass monitoring.

The advantages of using profiling systems is that you can measure the target strength of individuals, even in dense aggregations. Also, you can reach depths that you cannot do from the vessel with higher frequencies.



The K-Lander is a flexible sensor carrier platform. A robust stainless steel frame, engineered with a trawl-resistant design allows easy integration of diverse sensors for specific monitoring applications.

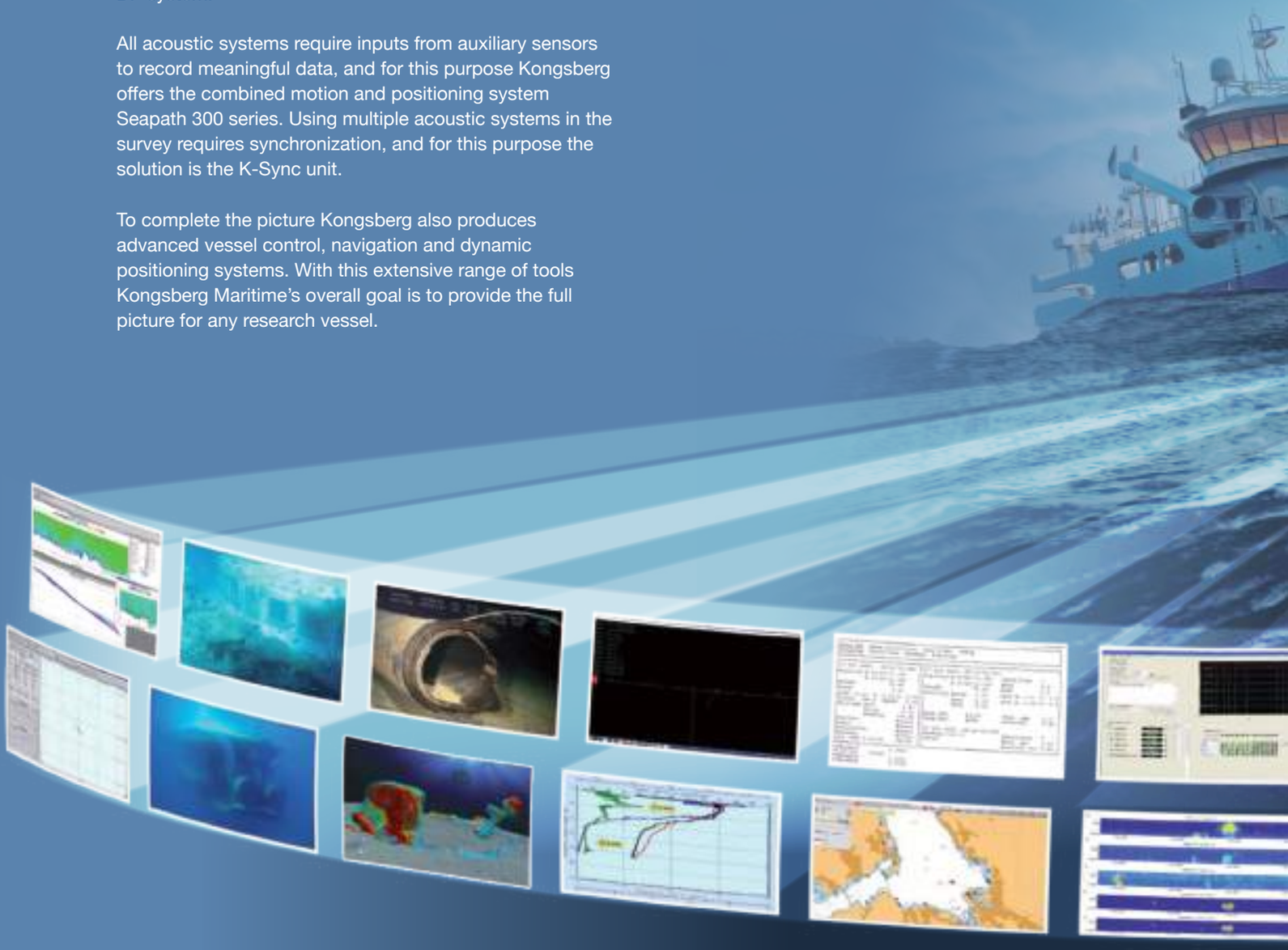
THE FULL PICTURE

A complete overview of the marine ecosystem can only be obtained through a combination of tools and techniques. Using the vessel as the main platform, Kongsberg Maritime offers the complete suite of hydroacoustic systems tools for your surveys.

Sub bottom systems are used to profile the layers below the bottom, while hydrographic multibeam systems allow for high resolution mapping of the seafloor. The range of Simrad acoustic systems targets objects in the water column, from the difficult areas close to surface down towards bottom and fish habitats. Through the HiPAP system acoustics is also used to position ROV's and other objects, in addition to giving important input to the vessel DP system.

All acoustic systems require inputs from auxiliary sensors to record meaningful data, and for this purpose Kongsberg offers the combined motion and positioning system Seapath 300 series. Using multiple acoustic systems in the survey requires synchronization, and for this purpose the solution is the K-Sync unit.

To complete the picture Kongsberg also produces advanced vessel control, navigation and dynamic positioning systems. With this extensive range of tools Kongsberg Maritime's overall goal is to provide the full picture for any research vessel.



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