

## Glossary of Terms

<b>absorption loss</b>	The energy lost by a propagating wave to the medium in which it is traveling.
<b>acoustic energy</b>	The energy carried by a sound wave.
<b>acrosstrack</b>	See athwartship.
<b>active sonar</b>	A device that makes remote measurements in a water medium by transmitting sounds and processing their echoes off remote targets.
<b>alongtrack</b>	Direction parallel to a ship's keel and its direction of motion.
<b>amplitude</b>	The measured size of the oscillations of a wave.
<b>analog signal</b>	A measurement that is continuous in time.
<b>angle of incidence</b>	The angle at which a sound pulse strikes a medium, usually measured with respect to the perpendicular.
<b>athwartship or acrosstrack</b>	The direction that is perpendicular to a ship's keel.
<b>attenuation</b>	Any loss in energy of a propagating wave.
<b>backscattering strength</b>	The fraction of incident energy per unit area that is directed back from the ocean bottom in the direction of the projector.
<b>bathymetry measurement</b>	See echo sounding.
<b>beam</b>	Used to describe focusing of acoustic energy by a hydrophone system or of sensitivity to received acoustic energy within a narrow solid angle.
<b>beam forming</b>	The process of using projector arrays and hydrophone arrays to produce narrow transmit beams and receive beams.
<b>beam pattern</b>	A description of the focusing of transmitted or received acoustic energy within a beam as a function of angle. Also called a power pattern or directivity pattern.
<b>beam stabilization</b>	See motion compensation.
<b>beam steering</b>	The process of using time delays or phase delays to direct the beams of a hydrophone array at specific angles.
<b>beam width or beam solid angle</b>	A measurement of the size of the main lobe of a beam pattern. Measured at the half power point.
<b>bearing angle</b>	The angle between the direction to a bottom echo and the athwartship direction, measured on the sea floor.

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<b>Bearing Direction Indicator (BDI)</b>	One of two algorithms used by the SEA BEAM 2100 to convert steered beam data into Time of Arrival (TOA) and Direction of Arrival (DOA) measurements for bathymetry. See also WMT.
<b>center of mass</b>	A point in space within an object about which its weight is evenly distributed and about which it will rotate.
<b>compressional wave</b>	A wave that propagates through a medium such that oscillations occur in the direction of propagation Compare to translational wave.
<b>constructive interference</b>	The overlap of two or more wave patterns in phase, such that their peaks and troughs coincide creating new, higher peaks and new, deeper troughs, respectively.
<b>degrees of freedom</b>	The number of different ways in which an object may move, including both translational and rotational motion.
<b>destructive interference</b>	The overlap of two or more wave patterns out of phase, such that the peaks of one wave line up with the troughs of another, effectively canceling them.
<b>detection threshold</b>	A predicted amplitude value applied to the values in a time slice to eliminate the noise from the true echoes of the sea floor.
<b>digital signal or discrete signal</b>	A representation of an analog signal by periodic measurements of its amplitude with a frequency sufficient to uniquely identify the signal's analog qualities.
<b>direction angle</b>	The angle at which the axis of a beam is directed, and where it has peak sensitivity (in the case of a hydrophone array) or where it transmits peak energy (in the case of a projector array).
<b>directivity</b>	A measure of the degree to which a beam pattern is focused, such that narrow beam patterns have high directivity and wide beam patterns have low directivity.
<b>directivity patterns</b>	See beam patterns.
<b>discrete Fourier Transform</b>	A Fourier Transform that is accomplished by means of a sum of discrete values, rather than by using an integral.
<b>Dolph-Chebyshev shading</b>	A shading technique that generates uniform, low level side lobes in a beam pattern.
<b>dynamic threshold</b>	The computation of detection thresholds for individual time slices based on the specific content of each time slice.
<b>echo</b>	The acoustic energy of a sound that has “bounced” off a remote target.
<b>echo sounder</b>	The instruments used to make bathymetric measurements, for example, SEA BEAM 2100.

<b>echo sounding or bathymetry measurement</b>	Remote measurement of the depth of the ocean floor.
<b>element spacing</b>	The distance between projectors or hydrophones in an array.
<b>ensonify or illuminate</b>	To bathe a target or area on the sea floor with transmitted sound.
<b>far field</b>	A regime in which the distances to objects of remote sensing is much larger than the size of the device doing the remote sensing, allowing a simplification of the mathematics involved through approximation. In a sonar, far field approximations are valid if the ocean depth is much larger than the size of the sonar.
<b>Fast Fourier Transforms (FFT)</b>	An algorithm used to solve a discrete Fourier Transform with minimal computation time.
<b>first side lobes</b>	The first and strongest side lobes outside of the main lobe of a beam pattern.
<b>frequency</b>	The number of oscillations of an acoustic wave that pass an individual hydrophone each second.
<b>heave</b>	Ship motion in the vertical direction.
<b>hydrophone</b>	A device that “listens” to sounds in water by converting the physical oscillations it experiences due to impinging sound waves into voltages.
<b>illuminate</b>	See ensonify.
<b>isotropic expansion</b>	The expansion of transmitted energy such as a pulse of sound, such that it is propagating equally in all directions.
<b>isotropic source</b>	A source of an isotropically expanding signal, such as a single small projector.
<b>half power point</b>	The point on the main lobe of a beam pattern at which it is transmitting or receiving at half of its peak power.
<b>high-resolution angle estimation</b>	The process by which the steered beam data is used to estimate the angles of echoes to a high degree of accuracy. Part of BDI processing.
<b>hydrophone array</b>	A group of hydrophones that collectively process incoming signals, usually with the purpose of beam formation and beam steering.
<b>impedance</b>	A measure of the “resistance” of a material to a wave propagating through it. For sound waves, the impedance is a product of a material’s density and the sound speed within it.
<b>interference</b>	The interaction of wave patterns from more than one source, which causes new wave patterns. Can be constructive, destructive, or a combination of both.

<b>launch angle</b>	The angle between the vertical and the direction of arrival of an echo, including offsets due to pitch.
<b>line array</b>	A projector or hydrophone array where the elements of the array are arranged in a line.
<b>local speed of sound</b>	The speed at which a sound wave will travel in a medium. In water, the sound speed is a function of the salinity, pressure, and temperature of the water, but is independent of the characteristics of the sound itself.
<b>main lobe</b>	The part of a beam pattern into which the bulk of energy is transmitted to or received from.
<b>maximum response axis (MRA)</b>	The angle of a beam pattern at which maximum power is transmitted or received.
<b>mounting angle</b>	The angle at which a hydrophone array is fixed to the bottom of a ship, measured such that a horizontal array has a mounting angle of zero.
<b>motion compensation or beam stabilization</b>	The process by which the motions of a survey vessel are removed from sonar data to make bathymetric measurements in the Earth-centered coordinate system.
<b>multibeam sonar</b>	An instrument that can map more than one location on the ocean floor with a single ping and with higher resolution than single-beam echo sounders.
<b>noise discrimination</b>	A process by which noise is ignored and signals are extracted from a noisy sonar input.
<b>noise level</b>	The magnitude of unwanted spurious signals in the sonar input.
<b>non-specular regime</b>	The situation where the echoes from the bottom are scatter-dominated, usually where the sonar is at an angle to the perpendicular to the sea floor.
<b>passive sonar</b>	Listening devices that record the sounds emitted by objects in water (seismic events, ships, submarines, and marine creatures, which all emit sounds on their own).
<b>peaks</b>	Maximum values of the amplitude of a wave.
<b>phase delay or phase difference</b>	The fractional number of oscillations of a wave as it propagates some distance.
<b>phase shift</b>	A change in the phase of a signal applied to compensate for a phase delay.
<b>ping</b>	A short pulse of sound generated by an active sonar for undersea measurement.

<b>ping cycle</b>	A continuous cycle for a depth sounder used to collect a series of depth measurements as the ship it is mounted on travels.
<b>ping time</b> or <b>ping interval</b>	The amount of time required for return echoes and processing between the transmission of pings.
<b>peaks</b>	The high pressure regions in the series of pressure oscillations that make up a sound wave.
<b>pitch</b>	Rotation of a ship about the across-track dimension.
<b>power</b>	The energy of a sound wave per unit time. Computed as the square of the amplitude of the wave.
<b>principle of reciprocity</b>	A transducer instrument acting as a hydrophone will produce a beam pattern identical to that of it acting as a projector.
<b>projector</b>	A device that transmits sound into water.
<b>projector array</b>	A group of projectors that collectively produce sounds, usually with the purpose of beam forming and beam steering.
<b>resolution</b>	A characteristic of a sonar that is determined by the size of the beam solid angle.
<b>roll</b>	Rotation of a ship about the along-track dimension.
<b>roll bias</b>	An offset angle in the roll direction that depends on the ship configuration but is stable over short periods of time. Measured during calibration of a sonar system and applied to all measured angles.
<b>roll offset angle</b>	The combination of all angles about the along-track dimension, including time-dependent roll, roll bias, and mounting angle.
<b>salinity</b>	The relative salt content of the ocean, part of sound velocity profile computations, usually in parts per million (PPM).
<b>sampling rate</b>	The time between digital measurements of an analog signal.
<b>scatter</b>	Energy that bounces off a target in all directions (in other words, is not reflected).
<b>selected beam</b>	An operator-selected angle at which the echoes received by the sonar are reported as a function of time. This allows an examination of the quality of sonar returns.
<b>shading</b>	A technique whereby the signals to or from particular elements of transducer array are reduced such that side lobes in the resultant beam pattern are reduced.
<b>shading value</b>	A factor applied to the signal from a particular transducer element in a shading scheme.
<b>side lobe</b>	Smaller lobes of the beam pattern in which sensitivity rises and falls at large angles from the beam axis in an endless series.

<b>side lobe level</b>	The magnitude of the first side lobe in a series of side lobes, usually expressed as a fraction of the peak of the main lobe.
<b>sidescan sonar</b>	A sonar that measures the strength of echoes from different locations of the ocean floor, revealing information about the composition of the material there.
<b>signal-to-noise ratio</b>	The ratio of the received signal strength to the noise level, which gives a measure of the detectability of a signal.
<b>signal excess (SE)</b>	The amount by which the return signal exceeds the minimum signal level required for detection.
<b>single-beam depth sounders</b>	Echo sounding devices that make one-per-ping measurements of the ocean depth at many locations.
<b>sonar</b>	A device used to remotely detect and locate objects in the water using sound.
<b>sonar devices</b>	A family of instruments that use sound for remote-sensing in a water environment.
<b>Sonar Equation</b>	A mathematical expression that relates all the factors involved in the acoustic echoing process.
<b>sound speed</b>	The speed at which sounds propagate in a medium.
<b>sound velocity profile</b>	Description of the sound velocity as a function of the depth at a given location.
<b>specular regime</b>	The situation where the echoes from the bottom are reflection-dominated, usually where the sonar is near perpendicular to the sea floor.
<b>spreading loss</b>	Drop in energy per unit area as a propagating pulse front expands.
<b>start and stop gates</b>	Operator-selected values that bracket the times at which the sonar processing should pay attention to the echoes. Start and stop gates can be unique for each beam angle.
<b>surge</b>	Translational motion in the alongtrack direction.
<b>swath</b>	A contiguous area on the ocean bottom, usually a strip of points in a direction perpendicular to the path of the survey vessel.
<b>swath width</b>	The dimension of the swath in the athwartship direction (perpendicular to the path of the ship), which can be measured either as a fixed angle or as a physical size that changes with depth.
<b>sway</b>	Translational motion in the across-track direction.
<b>target strength</b>	A term for the backscattering strength when dealing with discrete objects, such as a mine or a submarine.

<b>time delay</b>	The amount of time required for a wave to propagate between two locations.
<b>time shift or phase shift</b>	A translation of a signal in time used to make up for a time delay.
<b>time slice</b>	A discrete time interval containing all of the information received by all of the hydrophones in an array in one digital time sample.
<b>time spacing</b>	The interval between discrete digital time samples. See also sampling rate.
<b>towfish</b>	A device that is towed in the water somewhat below the surface of the water behind a survey vessel.
<b>transducer</b>	A general term for devices that convert energy from one form to another, including both hydrophones and projectors.
<b>transmission loss</b>	Combination of spreading loss and absorption loss of a sound wave.
<b>translational wave</b>	A wave that propagates through a medium such that oscillations occur perpendicular to the direction of propagation.
<b>transmitted source level (SL)</b>	A measure of the amount of acoustic energy put into a signal by the projector.
<b>troughs</b>	The low pressure regions in the series of pressure oscillations that make up a sound wave; minimum values of the amplitude.
<b>unstabilized beam</b>	A beam for which no adjustments for a ship's motion are made.
<b>wavelength</b>	The physical distance between peak amplitudes in a wave.
<b>Weighted Mean Time (WMT)</b>	One of two algorithms used by the SEA BEAM 2100 to convert steered beam data into Time of Arrival (TOA) and Direction of Arrival (DOA) measurements for bathymetry. See also BDI.
<b>yaw</b>	Rotation of a ship about the vertical dimension.

