

The World's Most Advanced Real Time Sonars

First Real Time 5-Dimensional ("5D") and 6-Dimensional ("6D") Sonars



Triple Frequency



Dual Frequency

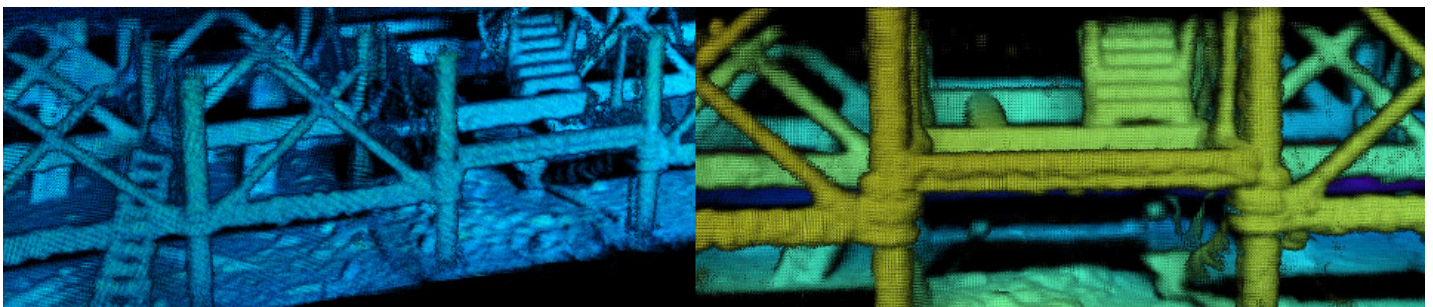


AUV

Multiple Parallel 4D Data Sets Simultaneously for Different Requirements of Underwater Operations in Real Time

Coda Octopus' 5D and 6D Echoscope PIPE® sonar series ("PIPE" sonars) significantly advances its previous real time 3D sonar series with several revolutionary innovations. At the heart of the 5D and 6D sonars capability is our Parallel Intelligent Processing Engine ("PIPE") which significantly increases the amount of data that can be processed and displayed in real time. It is designed to allow independent users, within the same underwater operations, access in real time to multiple parallel and sequential 4D Imaging Outputs. The 4D imaging Outputs can be matched to individual users' requirements by using different acoustic parameters (such as different frequency, range, filters and processing), thus providing a true multi-sensor platform from a single sonar deployment.

The Parallel Intelligent Processing Engine can capture, process and display in real time significantly higher data density with multiple parallel outputs and much higher ping rates. In addition, increased processing capability allows more advanced beamforming algorithms including phase-based processing resulting in more accurate bottom detection. An innovation of the PIPE series includes 3D full time-series data offering the capability to process up to 164 million data points per ping (256x256x2500), to generate 4D images with typically several hundred thousand 4D points per ping (depending on the insonified scene).



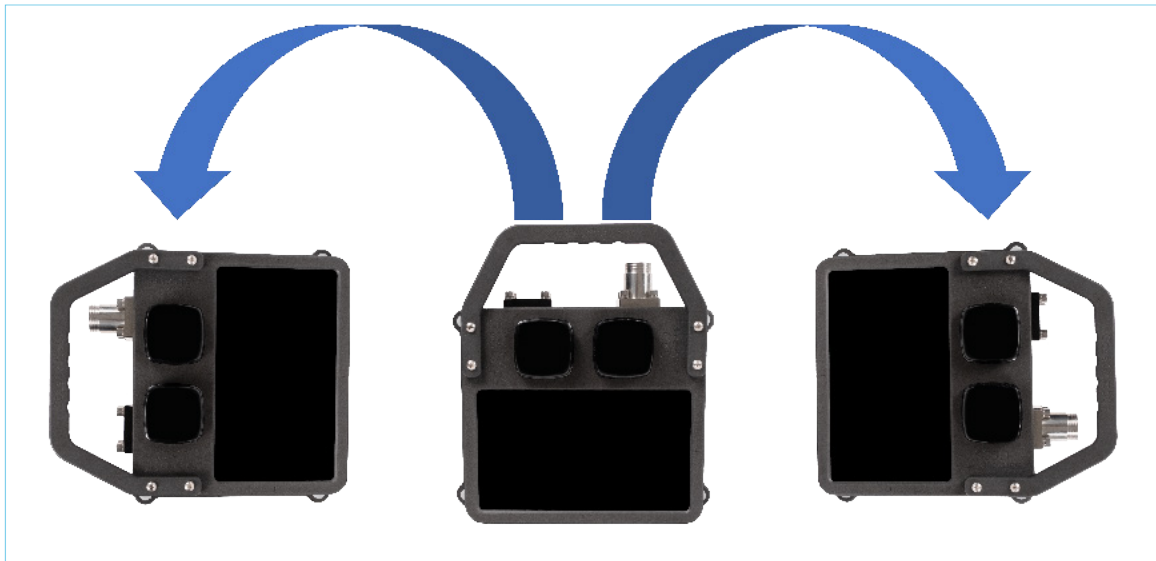
Coda Octopus' PIPE Sonars are 5D and 6D sonars because:

- PIPE sonars can capture and process the full time series backscatter 4D acoustic data (256x256x2500 data points) thus providing 5D data
- PIPE sonars can capture and process multiple 5D images in parallel with different processing parameters thus providing 6D data

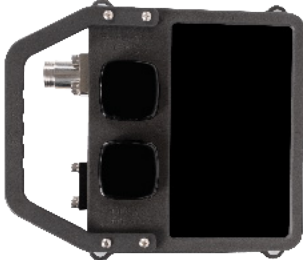


About the Echoscope PIPE® C500

The Echoscope PIPE® C500, part of our compact sonar series, offers real-time 3D/4D/5D/6D capabilities. With a focus on compactness in size, weight, and power, it provides an affordable alternative to the full-sized Echoscope PIPE®. While the C500 may have reduced vertical resolution when mounted with the connector facing up or down, it maintains equivalent resolution horizontally to the full-size Echoscope PIPE®. Despite its small size, the C500 offers competitive pricing and flexibility, suitable for various surface and underwater vehicles. Users can adjust for reduced vertical resolution by rotating it, enabling higher resolution across-track for mapping applications. Optimization is achieved by rotating the connector left or right to compensate for the reduced vertical resolution.

▼ Rotating the connector to optimize Echoscope PIPE® C500's resolution













▼ Beamwidth comparison between Echoscope PIPE® C500 and full-sized Echoscope PIPE®





<p>Echoscope PIPE® C500 Up to 1.2° x 0.6° Beamwidth</p>  <p>Connector Left/Right for:</p> <ul style="list-style-type: none"> ● Pier and Wall Survey ● Bridge Inspection ● Subsea Asset Placement 	<p>Full-sized Echoscope PIPE® Up to 0.6° x 0.6° Beamwidth</p> 	<p>Echoscope PIPE® C500 Up to 0.6° x 1.2° Beamwidth</p>  <p>Connector Up/Down for:</p> <ul style="list-style-type: none"> ● Forward-looking Navigation ● Seabed Mapping ● Target Tracking
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PIPE Features

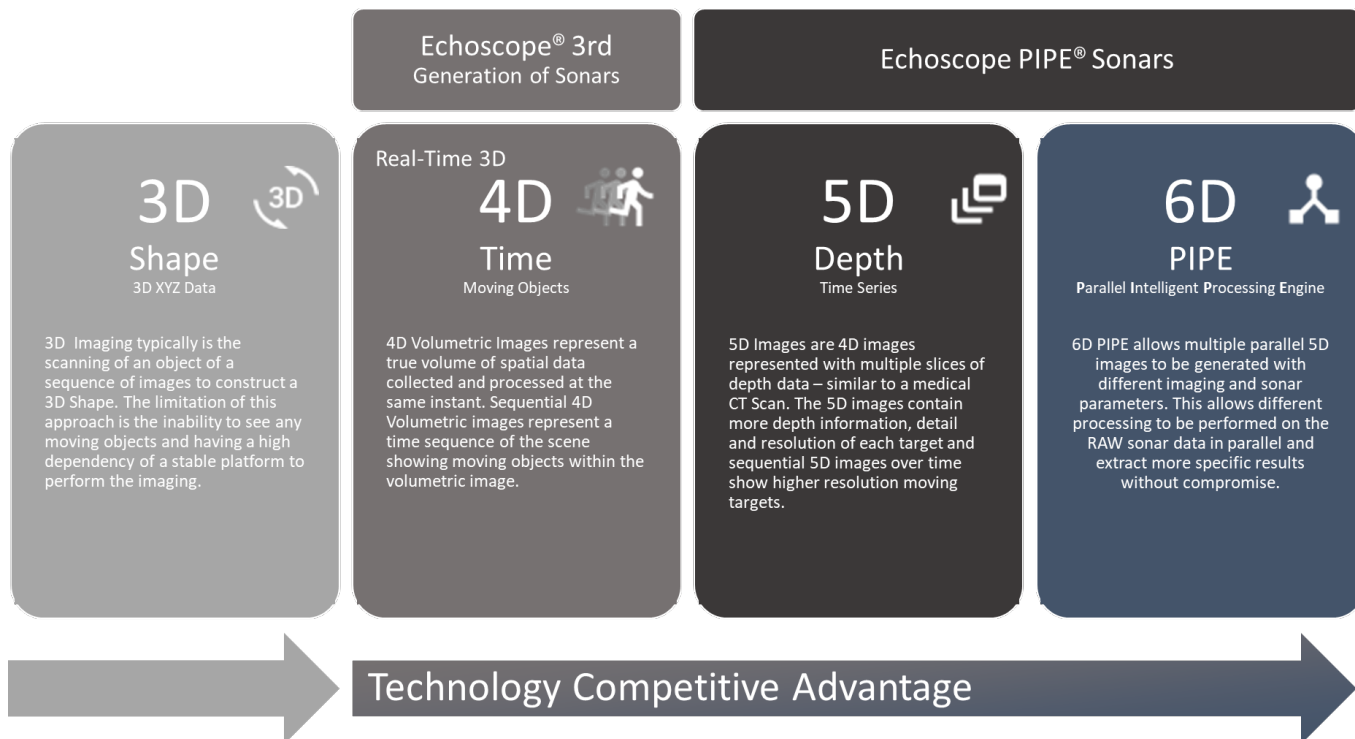
Some of the new and innovative PIPE features, selectable in real-time, are:

	Improved Beam Detection through phase-based processing (split-aperture), greater dynamic range and incorporating full floating-point processing resolution
	Improved Image Processing with greater control and capability over image processing, greater selection of noise suppression, user selected sidelobe rejection filter and extensive array shading
	Increased Beam Density up to 256x256 compared to 128x128 (in our previous generation of sonars)
	Advanced Beamforming Mode allowing users to change beamforming method. Field of View (FoV) Focusing and Beam Density (number of beams applied to an underwater target to maximize the resolution and image definition)
	Live Real Time XYZ data point output using Coda Octopus top end software. Live Real-Time XYZ data point output also available direct from sonar with new OEM Option
	Ability to swap configuration sets instantly ping-to-ping to achieve dynamic frequency, field of view and other capture and processing functions
	Multiple real time 4D images with different capture and process parameters which can be accessed and displayed in independent views of the survey operations in real time
	Parallel Processing and Display of Real Time Images
	Availability of Full Time Series 3D Backscatter Range and Intensity Data comprising millions of data points per acoustic ping
	Fine Split Aperture ("FSA") This method enhances the accuracy of the Split Aperture mode through applying direction of arrival discrimination based on beam spacing and can support higher ping rates. The Fine Split Aperture (FSA) mode can operate in horizontal, vertical and combined horizontal and vertical modes. In the combined mode, two sub-modes are available: Nominal (FSA), or Hybrid (FAT_FSA). The hybrid sub-mode returns FSA and FAT data and uses the intensity field's least-significant bit to identify which (1-FSA, 0-FAT).

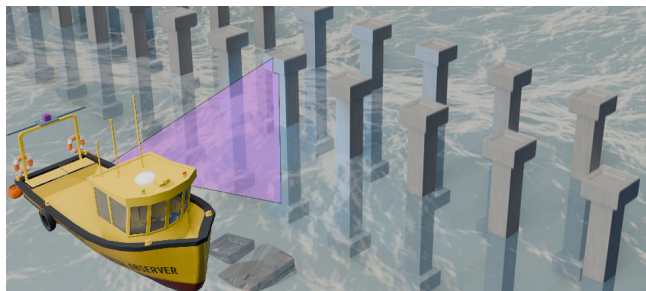
Echoscope PIPE® Features available with 4G USE® software:

	PIPE: Core Module This module is common to all Echoscope PIPE® sonar systems and provides the core functionality including enhanced dynamic range, improved image processing and advanced beamforming with dynamic frequency and beam density adjustment in real-time.
	PIPE: SEQUENCER Module This module allows users to create a sequence of up to 10 different parameter sets for acoustic capture and processing including different frequencies allowing hands free multi-application data collection from a single deployed sonar system.
	PIPE: FULL TIME SERIES Module (5D Capability) This module provides the ability to capture and record raw 3D Full Time Series Data up to 81 million data points per acoustic ping. This FTS capability is highly beneficial for seabed coverage surveying and volumetric analysis of water column data.
	Multiple 4D and 5D Images and RAW Data (6D Capability) This module offers the ability to log RAW acoustic data and process multiple 4D images and 5D images with different imaging and acoustic parameters offline. With RAW data processing the user is in control of reprocessing any recorded data to extract required results and is highly beneficial on autonomous platforms with no human in the loop for QC and data visualization in real-time.

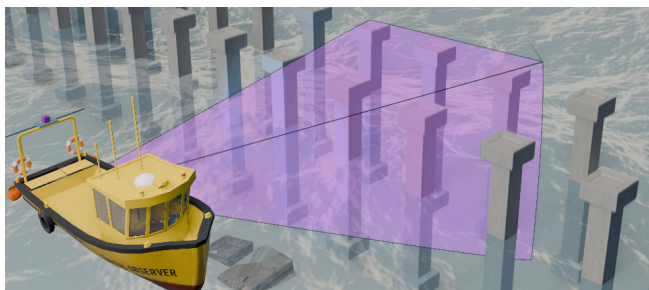
Evolution of 5D and 6D Sonar



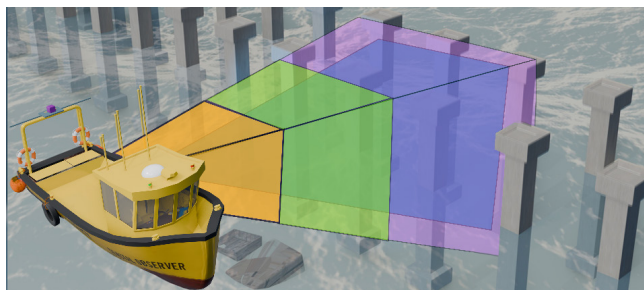
Real-Time Imaging Sonar Systems Comparison



▲ **Multibeam Echosounder**





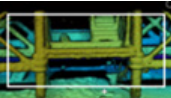
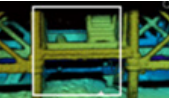
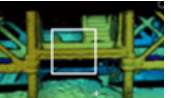
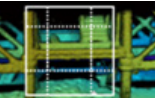


▲ **Echoscope 4G®**



▲ **Echoscope PIPE®**

Acoustic Projector Types

Description	XD Low-Frequency	Mid-Frequency	High-Frequency	XL Wideband
				
Centre Frequency	240kHz	375kHz	630kHz	450kHz
Frequency Range	220kHz – 280kHz	315kHz - 425kHz	550kHz - 700kHz	315kHz - 700kHz
Maximum range [^]	150 m (492 ft)	120 m (394 ft)	80 m (262 ft)	120 m (394 ft)
[^] The actual working range will depend on the target's size, reflectivity, and the level of detail required for the application				
Transmit (Tx) Field of View	90°x40° 	52°x52° 	25°x25° 	52°x52° 
Switchable Coverage (Shapes)	Horizontal – Fixed Vertical – Adaptive	Fixed	Fixed	52°x52°, 52°x25°, 25°x52°, 25°x25°

Key Differences between Echoscope PIPE® (Full-Sized) and C500 (Compact)

Description	Echoscope PIPE® (Full-Sized)	Echoscope PIPE® C500 (Compact)
Angular Beamwidth	Up to 0.6° x 0.6°	Up to 0.6° x 1.2°
Dimensions (H x W x D) (Excluding Connectors and Handles)	Dual Frequency: 328 x 301 x 151 mm (12.9 x 11.9 x 5.9 in) Triple Frequency: 361 x 301 x 162 mm (14.2 x 11.9 x 6.4 in)	Dual Frequency: 232 x 301 x 146 mm (9.1 x 11.9 x 5.7 in) Triple Frequency: 265 x 301 x 157 mm (10.4 x 11.9 x 6.2 in)
Weight in Air	Deepwater Dual Frequency: 21.7 kg (47.8 lbs) Surface Dual Frequency: 12.1 kg (26.7 lbs) Deepwater Triple Frequency: 22.3 kg (49.2 lbs) Surface Triple Frequency: 12.7 kg (28.0 lbs)	Deepwater Dual Frequency: 15.1 kg (33.3 lb) Surface Dual Frequency: 9.6 kg (21.2 lb) Deepwater Triple Frequency: 15.7 kg (34.6 lb) Surface Triple Frequency: 10.2 kg (22.5 lb)
Power Consumption	3 - 6 A at 24V DC ** An up to, 10 A inrush for less than 20 µ may occur on start-up.	2 - 4 A at 24V DC ** An up to, 10 A inrush for less than 20 µ may occur on start-up.

Echoscope PIPE® C500

Technical Specifications

Performance (by Model)	Dual Frequency	Triple Frequency
Acoustic Projectors	Mid-Frequency (375 kHz) High-Frequency (630kHz)	XD Low-Frequency (240kHz) Mid-Frequency (375 kHz) High-Frequency (630kHz)
Adaptive Frequency Band	375kHz: 315kHz – 425kHz 630kHz: 550kHz – 700kHz	240kHz: 220kHz – 280kHz 375kHz: 315kHz – 425kHz 630kHz: 550kHz – 700kHz
Number of beams (Density)	Up to 256 x 256	
Number of Values Per Beam	2,500 (Dependent on Features Purchased)	
Maximum range*	120m (394ft) at 375 kHz 80m (262ft) at 630 kHz	150m (492ft) at 240 kHz 120m (394ft) at 375 kHz 80m (262ft) at 630 kHz
Minimum range*	0.5m (1.64ft)	
Range resolution	3cm (1.2in)	
Update rate (ping rate)	Up to 50Hz	
Angular Beamwidth	Up to 0.6° x 1.2°	
Angular Coverage	315kHz – 425kHz: 54°x54° – 46°x46° 550kHz – 700kHz: 33°x33° – 25°x25°	220kHz – 280kHz: 100°x44° – 76°x33° 315kHz – 425kHz: 54°x54° – 46°x46° 550kHz – 700kHz: 33°x33° – 25°x25°
*The actual working range will depend on the target's size, reflectivity, and the level of detail required for the application.		
Physical		
Dimensions (H x W x D) (excluding connectors and handles)	232 x 301 x 146mm (9.1 x 11.9 x 5.7in)	265 x 301 x 157mm (10.4 x 11.9 x 6.2in)
Dimensions (H x W x D) (including Echoscope® Protective Cover)	242 x 311 x 149mm (9.5 x 12.2 x 5.9in)	270 x 311 x 160mm (10.6 x 12.2 x 6.3in)
Weight in Air	Deepwater: 15.1 kg (33.3 lb) Surface: 9.6 kg (21.2 lb)	Deepwater: 15.7 kg (34.6 lb) Surface: 10.2 kg (22.5 lb)
Power Consumption	2 – 4 A at 24 V DC **An up to 10 A inrush for less than 20 µs may occur on start-up.	
Depth Rating	We supply Echoscope PIPE® C500 Sonars rated at 40m (131ft), 250m (820ft), 600m (1,968ft), 2000m (6,561ft), and 4000m (13,123ft) – check your packing list containing your Product Certificate which provides details such as depth rating and weight of the actual system purchased. Failure to keep within this depth rating can irretrievably damage the unit.	

Echoscope PIPE® C500 AUV Technical Specifications

Performance (by Model)	40m Rated	250m Rated	600m Rated	3000m Rated
Acoustic Projectors	XD Low-Frequency (240kHz) Mid-Frequency (375 kHz) High-Frequency (630kHz)			
Adaptive Frequency Band	240kHz: 220kHz – 280kHz 375kHz: 315kHz – 425kHz 630kHz: 550kHz – 700kHz			
Number of beams (Density)	Up to 256 x 256 x 2,500			
Number of Values Per Beam	2,500			
Maximum range*	150m (492ft) at 240 kHz 120m (394ft) at 375 kHz 80m (262ft) at 630 kHz			
Minimum range*	0.5m (1.64ft)			
Range resolution	3cm (1.2’')			
Update rate (ping rate)	Up to 40Hz			
Angular Beamwidth	Up to 0.6° x 1.2°			
Angular Coverage	220kHz – 280kHz: 100°x44° – 76°x33° 315kHz – 425kHz: 54°x54° – 46°x46° 550kHz – 700kHz: 33°x33° – 25°x25°			
Software Compatibility	4G USE® 2.1 or Later			
*The actual working range will depend on the target’s size, reflectivity, and the level of detail required for the application.				
Physical				
Dimensions (h x w x d)	40.1 x 20.0 x 15.8 cm (15.8 x 7.9 x 6.2 in)			
Weight in Air	15.7 kg (34.6 lb)			
Power Consumption	2 - 4 A at 24V DC			
Depth Rating	40m	250m	600m	3,000m

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