Echoscope PIPE® CIVS DUO

The Best of Both Worlds - Precision Close-In, Performance at Range

Bringing Together the Range and Versatility of the Echoscope PIPE® Medium-Frequency 375 kHz Technology Block with the Close-In, Ultra-High-Resolution Imaging Capabilities of CIVS

Echoscope PIPE® CIVS DUO (Close-In Visualization) combines the proven capabilities of the Echoscope PIPE® platform with the ultra-high resolution of Close-In Visualisation Sonar (CIVS) technology. Rather than being a standalone sonar, CIVS DUO functions as a technology block integrated within the existing Echoscope PIPE® system, bringing together the range and versatility of the medium-frequency 375 kHz technology block with the close-in, ultra-high-resolution imaging capabilities of CIVS.

Built on the Echoscope PIPE® (Parallel Intelligent Processing Engine) platform, CIVS DUO inherits the full suite of advanced PIPE capabilities, while offering unparalleled levels of resolution at close range for inspection and monitoring operations. Using an innovative patented beamforming approach, CIVS DUO generates a seamless image by combining up to nine tightly focused image tiles into a single wide, unified field of view (FoV). This enables operators to benefit from both exceptional image detail and surrounding subsea coverage simultaneously.

By integrating both technologies into one solution, CIVS DUO removes the traditional compromise between image detail and operational range. Operators can seamlessly switch between ultra-high-definition close-range visualisation and real-time 3D volumetric imaging at ranges of up to 120 metres, providing enhanced situational awareness across the full operational envelope. This enables immediate decision-making during UXO Operations and Interventions, close-up Critical Asset Inspections and Underwater Vehicle Operations.

Echoscope PIPE® CIVS DUO users can also benefit from our Sequencer technology, which allows them to use a single device for multiple purposes simultaneously. Sequencer allows you to configure multiple sets of acoustic parameters and processing steps, which will be run concurrently and provide separate data streams that can be used for different purposes. CIVS DUO can make full use of Sequencer's capabilities, allowing the user to collect long range contextual data while also gathering tightly focussed close-in data on a specific area of interest.

Echoscope PIPE® CIVS DUO also incorporates our patented ERSA (Enhanced Resolution Split Aperture) beamforming technology (patent US12,566,264), enabling significantly improved beam detection accuracy, angular precision, and target localization performance across the entire swath — including at extreme steering angles where conventional beamforming approaches typically experience degradation in resolution and phase coherence. By utilizing advanced split-aperture processing techniques, ERSA maintains high-fidelity target definition, improved edge-of-swath performance, and enhanced volumetric consistency throughout the full acoustic field of view.

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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 adjustments in real-time.

PIPE: 3D MATT
This module allows targets within the field of view to be tracked automatically, reporting the current location of assets and targets to third party applications over UDP at user-configurable intervals.

PIPE: FANS
This module provides an intuitive multibeam-style interface that generates multiple FAN geometries simultaneously, delivering a familiar operator experience with capabilities beyond traditional multibeam systems.

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 sonar system

Some of the innovative *Echoscope PIPE® CIVS DUO* features available are:

CIVS Technology Block
Utilize the CIVS Technology Block, allowing for ultra-high resolution 3D volumetric imagery powered by nine individual tiles, giving the operator unprecedented clarity of underwater targets and features

Multiple Capabilities, Maximum Flexibility
The best of both worlds - take advantage of standard 375 kHz technology block for inspections and surveys, and CIVS technology block equipped for ultra-high resolution imagery of finer subsea details like damage or parasitic packages, providing the power to meet multiple requirements simultaneously

Ultra-High Dynamic Range
Ultra-High Dynamic Range delivered by the full floating-point processing resolution

8 Points Per Second
Ability to process over 8 data points per second to provide highly detailed and precise point cloud data updated at up to 50 Hz. (depending on the insonified scene)

Improved Image Processing
Delivering greater flexibility and tunability, including enhanced noise rejection and filtering options, customizable sidelobe clipping and broad selection of array shading options

Customized Sequences
Ability to create customized sequences of up to 10 difference pings, each with it's own set of transmit, beamforming and output options, allowing complex environments to be optimally imaged

Multiple Output Datasets
Ability to transmit multiple different output datasets to different users, allowing a range of tasks to be performed concurrently

Real-Time XYZ Data Output
Delivered directly from the sonar without the requirement for Coda Octopus Top End Software

Advanced Beamforming Mode
This allows 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 on the fly)

Multiple Automatic Target Tracking (3D MATT) Capabilities
When utilizing 3D MATT Module, Echoscope PIPE® provides tracking of multiple targets from one or more sonars in real-time, with real-time control of tracking parameters and processing of a target's location, status and quality with visualization simultaneously

ERSA (Enhanced Resolution Split Aperture) Beamforming
ERSA enhances image accuracy by computing angles of arrival of echo returns, resulting in improved beamwidth compared to standard beamforming. ERSA is recommended for solid structure surveys, such as harbor walls or bridges, as the processing will remove additional aliasing from echo events in noisy environments.

Diver Augmented Vision Display (DAVD) Compatibility
When integrating Coda Octopus' DAVD system, the Echoscope PIPE® provides real-time high-resolution 3D images of live underwater operations including inspections, salvage, interventions, tracking and navigation whilst recording a documented dive record. This allows real-time 3D data to be relayed directly to the diver via the DAVD Head Up Display (HUD).

Object Detection
Utilizing the 375 kHz technology block, CIVS DUO can utilize Object Detection to support underwater vehcile deployments. Object Detection will process Echoscope® data in a 3 x 3 grid on a fixed time interval, then providing a color range threat indicator which can be used appropriately for a variety of Applications, such as Object Avoidance, Vehicle Navigation and Input to 3rd Party Decision Making Systems

Above and Below the Waterline Imagery
CIVS DUO is fully capable of survey and mapping Applications, providing ultra-high resolution data of the subsea environment, especially when complemented by above-water data from our Echoscope® AIR LiDAR 2.0, which gives a complete and seamless above-and-below the waterline imagery, therefore producing a unified digital twin of assets or structures such as ships, offshore platforms or marinas, providing accurate detection of defects, structural damage or possible threats

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Echoscope PIPE® CIVS DUO is an ideal tool for near-field real-time 3D visualization in Applications including:

UXO Operations and Interventions

With the Echoscope PIPE® CIVS DUO, Operators gain a greater level of confidence by having the ability to visualize subsea objects such as mines, IEDs or other threats and further investigate unknown potential hazards . CIVS DUO can identify mines both floating in the water column or embedded in the seabed, and when mounted to a ROV/AUV, there is a further increased level of safety to the operator, as they can identify potential threats in a real-time 3D scene.

Close up Inspection and Intervention Operations

Echoscope PIPE® CIVS DUO plays a significant role in close up inspection of subsea assets. It is used for the real-time inspection and monitoring of all types of subsea infrastructure and vehicles, including inspecting ship hulls for parasitic packages, or detecting cracks, corrosion or deformation in subsea structures, such as bridges or pipelines. Unlike optical cameras, CIVS DUO is effective in murky or turbid environments, allowing you to conduct operations irrespective of water conditions

Monitoring Interventions by ROVs

The most notable Application for CIVS DUO is detailed inspections, where the sonar platform is not surveying at speed past the target, but is instead hovering or looking at the target of interest. This is common methodology in ROV Operations, and CIVS DUO will provide the absolute highest resolution real-time 3D image of the target, while also supporting real-time navigation and obstacle avoidance. in both manned and automated routine inspections. This removes the human element of the inspection thereby reducing risk to personnel and supporting safer, more effective subsea operations

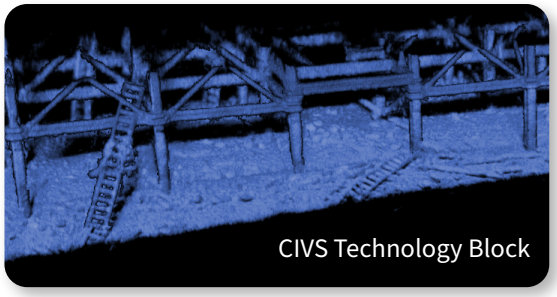
Dive Support Operations

When integrating Coda Octopus' DAVD system, the Echoscope PIPE® CIVS DUO provides real-time high-resolution 3D images of live underwater operations including inspections, salvage, interventions, tracking and navigation whilst recording a documented dive record. When integrated with the Handheld Frame, the Diver can carry the CIVS DUO like a flashlight, this allows real-time 3D data to be relayed directly to the diver via the DAVD Head Up Display (HUD) providing a first person perspective of the subsea environment in all water conditions (including zero visibility,) as well as providing the 3D data to topside operators to monitor the subsea environment for threats.

For a number of applications, the ability to truly identify targets or perform accurate measurements in three dimensional space in challenging underwater conditions has remained a technological gap, and one in which optical and laser solutions cannot fully satisfy given their reliance on clear water visibility conditions. CIVS DUO fills the gap with high-density MHz-range 3D acoustic data. By splitting the full field of view into separate volumes, CIVS DUO vastly reduces the likelihood of acoustic interference or erroneous returns in any individual tile, but importantly, the recombination of the volumes allows a much greater 3D image field of view than would be achieved using standard sonar principles. Any combination of sonar parameters can be easily setup in the system to cover most applications and CIVS DUO is equally capable of both Real-Time 3D monitoring of moving objects, as well as ultra-high resolution close-up 3D mapping when combined with appropriate positioning and attitude sensors.

The most notable application for Echoscope PIPE® CIVS DUO is perhaps detailed inspections where the sonar platform is not surveying at speed past the target, but instead is hovering or looking at the target of interest. This is common methodology in ROV and Diver Inspections and CIVS DUO will provide the highest resolution Real-Time 3D image of the target. This makes CIVS DUO the ideal tool for near field real-time 3D visualization for applications such as UXO Operations and Interventions, Close up Inspection and Intervention Operations, Monitoring Interventions by ROVs and Dive Support Operations.


375 kHz Technology Block


CIVS Technology Block

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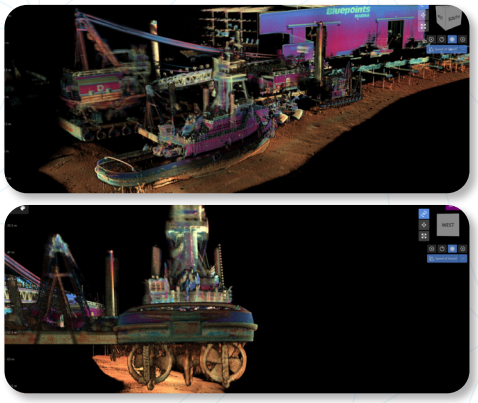
While the most notable Application for Echoscope PIPE® CIVS DUO may be detailed inspections, CIVS DUO is also fully capable of survey and mapping Applications, providing ultra-high resolution data of the subsea environment, especially when complemented by above-water data from our Echoscope® AIR LiDAR 2.0, which gives a complete and seamless above-and-below the waterline imagery, therefore producing a unified digital twin of assets or structures such as ships, offshore platforms or marinas. This is particularly valuable for Critical Asset Inspection, routine Care and Maintenance or Mapping Applications, as it enables accurate detection of defects, structural damage or possible threats (such as parasitic packages), regardless of water conditions or light levels.



The Echoscope PIPE® CIVS DUO can be deployed on a wide range of platforms, including:

- Manned Survey Vessels
- Unmanned Survey Vessels
- Workclass and Inspection ROVs
- AUVs

	/Echoscope PIPE NANO Gen Series	Echoscope PIPE® C500	Echoscope PIPE®	Echoscope PIPE® CIVS Technology Block
				
Maximum Range*	Up to 100 m High Definition	Up to 150 m High Definition	Up to 150 m High Definition	Up to 35 m Ultra-High Definition
Form Factor**	Ultra-Compact 267 mm x 182 mm x 133 mm	Compact 266 mm x 301 mm x 124 mm	Standard 361 mm x 301 mm x 162 mm	Can be installed on a C500 or a Full-Size
Depth Rating	All systems are available as 'Surface' variants, rated to 40m depth, or as 'Deepwater' variants which can be certified to 250 m, 600 m, 3000 m or 4000 m depth rating			

*C500 and PIPE® Series sonars are available with a range of different projectors and frequency options. Actual working range and resolution will depend on the options selected.

**Specialised form factors are available for AUV deployments and for wide-band projector options. Please contact Coda Octopus for more details of the full range of form factors available.

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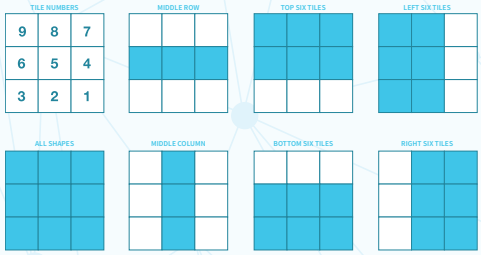
	Mid-Frequency Technology Block	CIVS Technology Block
Center Frequency	375 kHz	1 MHz
Adaptive Frequency Band	315 - 425 kHz	900 kHz - 1150 kHz
Maximum Number of Beams	Up to 256 x 256	Up to 128 x 128 for each tile Up to 384 x 384 for a full 3x3 tiled field of view
Maximum Range*	120 m (384 ft)	35 m (115 ft)
Minimum Range	0.5 m (1.64 ft)	0.1 m (0.33 ft)
Range Resolution	1.6 cm (0.6")	
Angular Resolution (ERSA)	Up to 0.1°	
Update Rate (Ping Rate)**	Up to 50 Hz	Up to 110 Hz***
Angular Coverage (User Selectable	54° x 54° - 46° x 46°	15° x 15° per image tile, with tiles arranged in a 3x3 grid to provide a complete 45° x 45° for full 3x3 tiled output. Other shape options include: 
Beam Spacing Density	Up to 0.18° x 0.18°	Up to 0.11° x 0.11°

* The actual working range will depend on the target's size, reflectivity and the level of detail for the Application.
** The maximum achievable ping rate is dependent on the maximum range requested and the number of tiles per tile image. A complete 45° x 45° image can be generated at up to 5 Hz, whereas the Middle Row or Middle Column can be images at rates over 15 Hz, and are therefore capable of capturing high-resolution close-up motion of moving targets.
*** Up to 110 Hz is range dependent

	Echoscope PIPE® C500 Dual Frequency	Echoscope PIPE® Dual Frequency
Dimensions (H x W x D) (Excluding connectors and handles)	232 mm x 301 mm x 154 mm (9.13 in x 11.85 in x 6.06 in)	328 x 301 x 151 mm (12.9 x 11.9 x 5.9 in)
Weight in Air	15.16 kg (33.5 lbs)	21.7 kg (47.8 lb)
Power Consumption**	2 - 4 A at 24 V DC	3 - 6 A at 24 V DC

**An up to 10 A inrush for less than 2 µs may occur on start up

Depth Rating	40 m (131 ft)	250 m (820 ft)	600 m (1968 ft)	3000 m (9842 ft)	4000 m (13123 ft)

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