

SEA TECHNOLOGY

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**Seafloor Mapping
Sonar Systems
Vessels**

**FEATURING:
Real-Time 3D Imaging
Aquaculture Bathymetry
Arctic Ships**

Echoscope^{4G} Surface

The Future of Visualization, Mapping Sonars

By Richard Adams

The uncertainty that lies below the surface of the sea provides a number of industries with incredible challenges when conducting their daily business. From offshore structure installation and inspection to the defense of ports and construction of national power generation assets, all subsea industries are plagued with a dynamic set of problems they must address.

The industry standard technology that is utilized for underwater inspection is the multibeam sonar, which was introduced to the market around 20 years ago. At the time, the multibeam was revolutionary because it could generate clearer images of the underwater environment than the precursor technology, the single beam. The multibeam, however, has limitations as its outputs require post-processing to render useful 3D images of the area being inspected and cannot image moving objects. Many subsea applications require technology that can facilitate real-time 3D decision making of both static and dynamic operations.

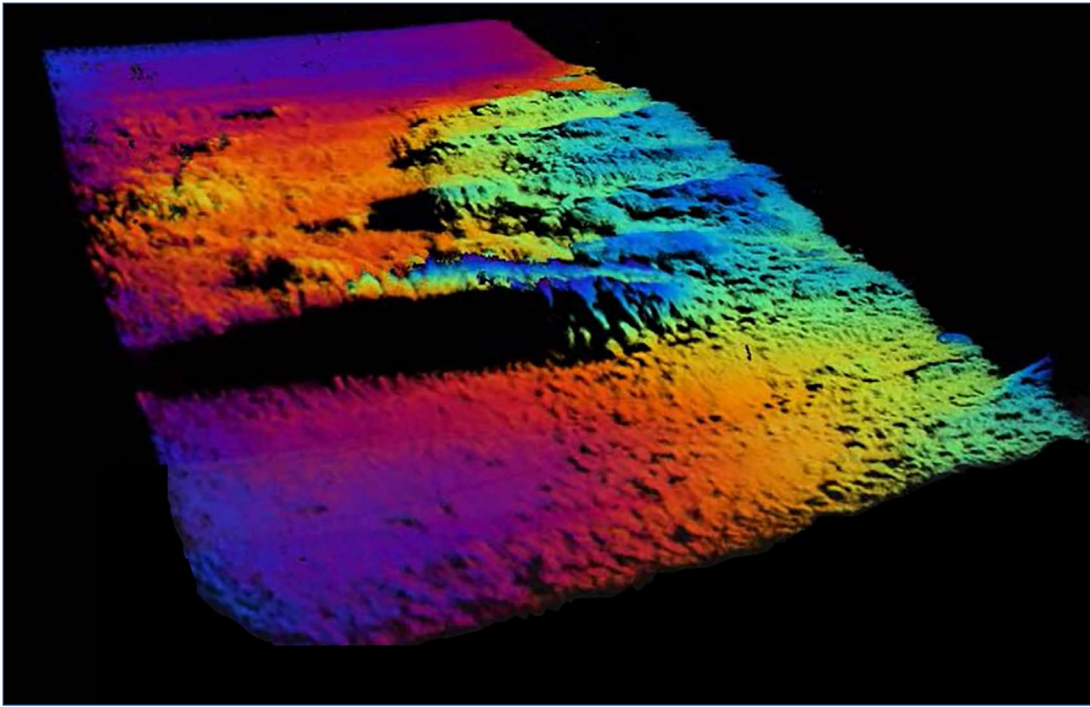
Background

Coda Octopus Products Ltd. has recognized this market requirement and has been at the forefront of marine survey operations for nearly 25 years. The company started as a pioneer of digital acquisition and processing for geophysical survey, and this innovation and emphasis on research and development (R&D) has characterized the company ever since. Coda Octopus has continued to lead the geophysical acquisition and processing market with its GeoSurvey, DA and Survey Engine product ranges. In addition, it has developed a range of patented real-time 3D volumetric sonar systems marketed under the brand name of Echoscope. This technology allows the user to generate a real-time 3D image of the underwater environment, even with low- or zero-visibility conditions, and has been successfully used on a wide variety of complex subsea projects and operations across the globe, including in oil and gas applications, breakwater construction, asset placements and landings, port and harbor security, defense, mining and diving applications. Our real-time 3D and geophysical product ranges are complemented by GNSS-aided inertial navigation systems. The F180 series, for example, has a proven track record in the marine survey industry for accuracy and reliability and is found on survey vessels across the world.

Our third generation of real-time 3D sonar products includes the standard Echoscope and Echoscope C500. They have a standard depth rating of 600 m and can be supplied with 3,000-m ratings; we also have the capability to take these down to 6,000 m on request. We continue to innovate and develop new application products within the real-time 3D sonar arena. All of our real-time 3D sonars transmit a large volumetric pulse of sound energy that generates typically more than 16,000 beams for every acoustic transmission or “ping.”



Echoscope^{4G} Surface real-time 3D sonar.



The Latest Generation

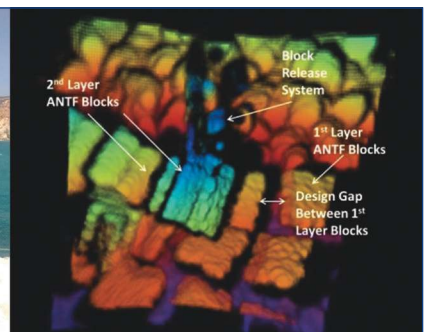
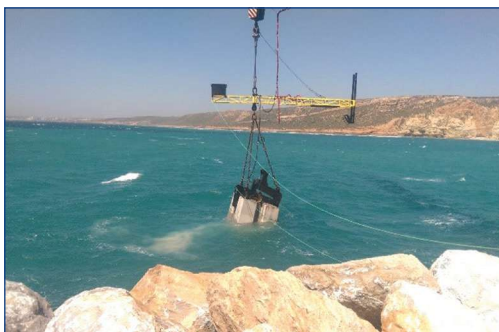
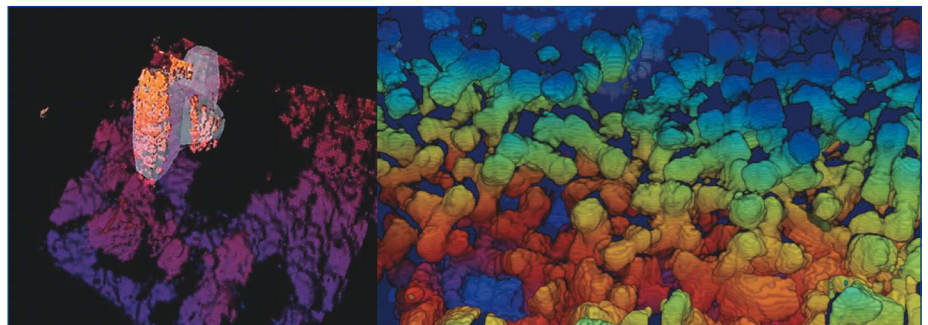
We have taken significant steps forward in innovating the fourth generation (4G) of the Echoscope and have launched the new Echoscope^{4G} Surface sonar in January 2018. The Surface was presented to the general public for the first time at Oceanology International 2018 in London, where it was met with excitement from customers from a variety of subsea industries.

The reimagined, reengineered and repackaged Echoscope^{4G} Surface comes in a new form factor and is 50 percent lighter, 40 percent smaller and draws 30 percent less power than our third-generation (3G) of technology. This new Surface product is designed for underwater operations not exceeding 20-m water depth. The new Surface is also more a plug-and-play application, as it requires less tuning than the older Echoscope.

Benefits of the Surface for shallow-water applications and small platform operations are huge, all without compromise on image fidelity and performance or capability. The Echoscope^{4G} Surface generates true real-time 3D images and mapping equal to the larger Echoscope.

Technology

The Echoscope offers simultaneous imaging and mapping, generation of survey-grade mosaics and bathymetry of subsea areas without any post-processing, and



(Top to Bottom) Real-time 3D bathymetric data. Real-time 3D block tracking and 3D as-laid survey. Safi wire crawler crane/Echoscope antifer block data.

visualization of both static and moving objects. With the recent introduction of our XD model, we now provide wide-swath volumetric mapping over and above real-time 3D camera imaging and high-resolution 3D real-time inspection.

There are many benefits over conventional multibeam systems, including “eyes” underwater even in poor-visibility conditions; the ability to visualize moving objects

in 3D, so precise control of dynamic operations is possible; the ability to instantly visualize complex structures; and the ability to generate survey-grade bathymetric data without post-processing.

The patented Echoscope range of real-time sonars is more than visualization tools, as they enable the capture of hydrographic-quality data in real time from the same sensor. This allows an operator to use the sonar for a multitude of purposes, such as visualization of a valuable asset on the seabed and simultaneous use of data to provide an as-built or as-laid survey.

The new Echoscope^{4G} Surface is available in single-, dual- and triple-frequency models offering unique combinations of frequency at 240, 315 and 630 kHz and opening angles of 90° by 44°, 50° by 50° and 24° by 24°.

This combination of frequencies and opening angles enables the Echoscope^{4G} Surface to be deployed in a wide range of operations and tasks.

Software

Our standard USE software operates with all of our sonar systems. USE offers additional features to enhance operations, including the ability to insert georeferenced models to enhance and visually augment the acoustic sonar data, the ability to operate with and without GNSS position and motion data, and the ability to export raw or binned point-cloud data for processing in third-party hydrographic software.

We have further developed our proprietary visualization software to add the ability to track targets for the breakwater construction market and our construction-specific software CMS. This software enables both the visualization of large concrete blocks as they are placed in the water and automatic tracking and overlay of a 3D model of the block to assist the operator with accurate placement of the block. Our software also records the as-laid x, y, z position and the orientation of each block, building up a 3D model of the constructed breakwater. The

versatility of the sonar/hardware combination has been validated by block design consultants.

Applications

Coda Octopus has successfully demonstrated the Surface during a U.S. Navy training exercise in 2018 as part of a Naval Sea Systems Command (NAVSEA) 3D HUD System. The greatly reduced weight, size and power requirements of the Surface are ideally suited for launch on small rapid-response rigid inflatable boats (RIBs) and additional inflatable craft used in law enforcement, salvage and underwater construction. During the live demonstration, tethered divers were able to hand carry the near-neutrally buoyant Echoscope^{4G} Surface underwater and use it in two critical operational modes: navigation (first-person, real-time 3D navigation and scene awareness) and observation (third-person, real-time 3D scene observation).

With the ability to visualize and map data and image moving objects in 3D under the water in low- or zero-visibility conditions, our range of sonars have a large number of market applications across the world. One of our key markets has been subsea construction, such as imaging and survey of dredging and construction sites, ROV-based oil and gas projects for key infrastructure installation and installation of breakwater construction. The ability to “see” what is happening under the water can significantly improve the speed and safety of a project.

The new Echoscope^{4G} Surface has been designed with these types of shallow-water construction projects in mind, offering a cost-effective route to delivery. The new Surface system can be used with our proprietary software packages, USE and CMS software, giving the option of deployment on cranes, barges or survey vessels to image and map breakwaters, inshore bridges, piers and complex structures, providing real-time assessment of the accuracy of asset placement, damage to a structure and the effects of any environmental condition such as scour. Our breakwater customers,

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“The world of subsea engineering will always be challenging, but with the right approach, equipment and ability to visualize operations in real time and 3D, the challenges can be managed and reduced to acceptable levels.”

such as Van Oord and SGTM-STFA, have reported significant project success using the Echoscope. Van Oord has deployed it on a Kuwait National Petroleum Co. project to construct a port and breakwater. The breakwater was armored with 24,000 Core-Loc concrete blocks, and the Echoscope real-time 3D sonar was mounted on the installation excavator to provide imaging of each block. Productivity rates of up to 200 blocks per day were reported by Van Oord. On the Port of Safi project in Morocco, the operator SGTM-STFA installed three separate Echoscope systems on wire crawler cranes. By removing the requirement to use divers to monitor the blocks underwater, it was able to work 24-hr. shifts, thereby tripling the productivity rate on the site.

Future Developments

The launch of the new Echoscope^{4G} Surface is an important milestone for Coda Octopus, and we continue to innovate our products with the aim of standardizing real-time 3D solutions in the subsea market for various applications and different price points. The unique volu-

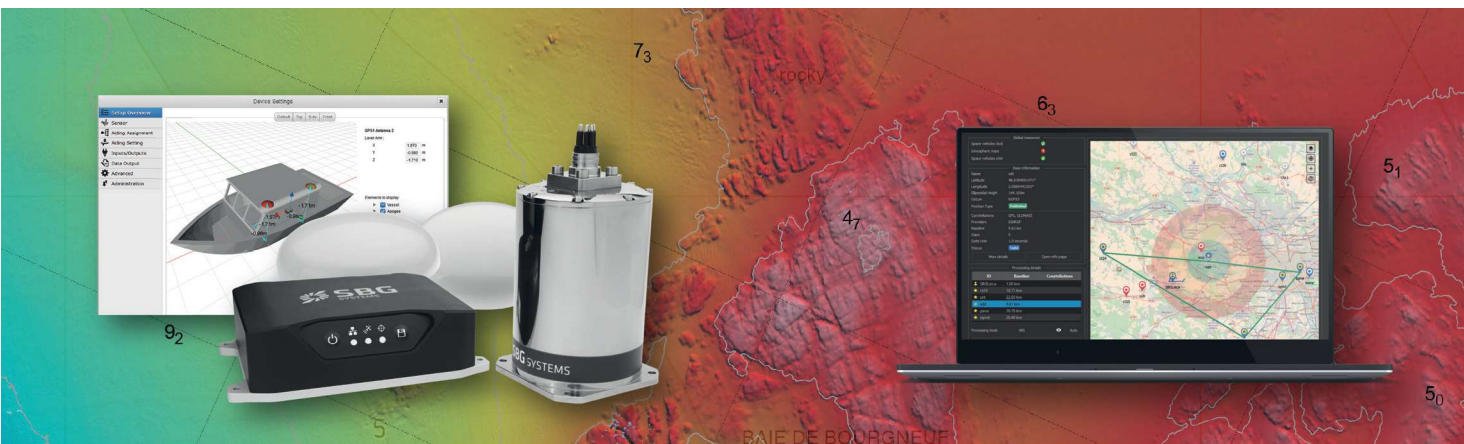
metric pulse, the wide field of view and volume of data generated by this unique technology make it well suited to autonomous operation, including assessment, identification and classification of unknown objects by autonomous underwater and surface vehicles.

The world of subsea engineering will always be challenging, but with the right approach, equipment and ability to visualize operations in real time and 3D, the challenges can be managed and reduced to acceptable levels. The new Echoscope^{4G} Surface is an example of how Coda Octopus will continue to innovate and develop both hardware and software to continue to be at the forefront of subsea engineering and survey operations. **ST**

Richard Adams joined Coda Octopus Products Ltd. in 2014 and is now the sales director. He looks after the European, African and Asian markets.



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