BlueView TECHNOLOGIES

Application Bulletin

The Advantages of 2D Imaging Sonar

2D Imaging Sonar capture and record video-like "movies", even in low and zero visibility conditions.

Underwater environments are dynamic and complex. Getting a clear picture of the obstacles and movements of objects in this environment is critical when navigating and working underwater. The ability to see in this dynamic environment, even in low and zero visibility conditions is critical when you consider the risks to the people and equipment involved. Tracking moving and stationary targets in addition to navigation poses challenges that can be solved with new 2D imaging sonar technology.

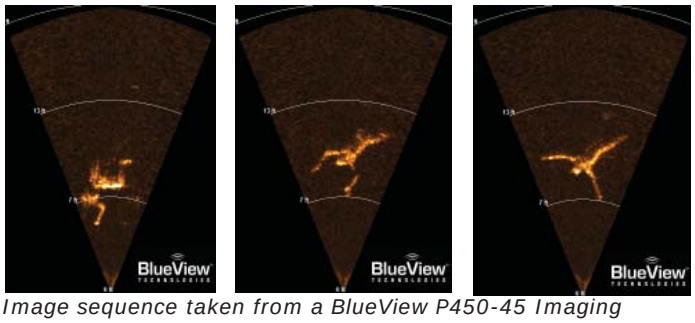


Image sequence taken from a BlueView P450-45 Imaging Sonar clearly shows a swimmer in motion.

The first step in solving these challenges is to understand the limitations of traditional mechanical scanning sonar. The notion that all sonar are the same is incorrect. There are vast differences between the traditional mechanical scanning sonar and new 2D imaging sonar. The scanner mechanically rotates a single, narrow sonar beam. The resulting imagery is static, like a still image photograph. The scanner can capture very detailed imagery of stationary objects and structures, but moving objects appear as blurs or "sonar smears" across the image. Additionally, 2D scanners do not operate well while in motion as stationary objects will appear as blurs and smears. The limitations now become evident, real-time navigation through complex underwater environments is difficult and time consuming when using a mechanical scanner.

Scanning sonar picture vs. streaming sonar imagery

Imagine trying to navigate an ROV around the fragmented and twisted structure of a downed oil rig or a complex maze of bridge footings and pilings to perform a mission critical task while the current is sweeping debris and objects into your path. Using a traditional 2D scanner for this purpose would be challenging, stopping and holding the ROV in position while the scanner sweeps the area to generate an image in itself is challenging, and then trying to navigate using a picture that does not provide an accurate, up-to-date image could put the ROV at risk.

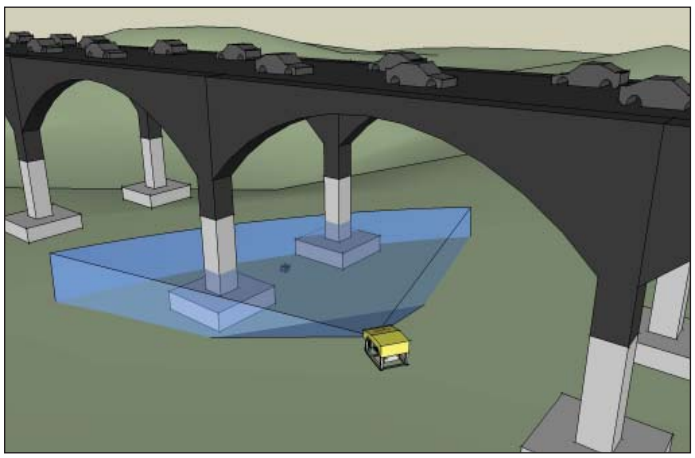
2D Imaging Sonar, sometimes referred to as "acoustic cameras" operate differently and provide distinct advantages in the situation previously described. Able to operate from both moving and stationary positions, 2D imaging sonar capture data within a defined field-of-view (like a slice of pie), while the "top-side" software processes the data rapidly to generate a real-time sonar "movie" viewable from a laptop or PC. Moving objects can now be seen clearly as they move into, through, and out of the field-of-view.

Hot Tip

2D imaging sonar are available with a variety of "field-of-view"options, typically expressed as an angular degree. Unlike mechanical scanning sonar that physically sweep the area covered with a single, narrow beam, imaging sonar use hundreds of beams simultaneously. With no moving mechanical parts, 2D imaging sonar are less likely to breakdown and require less servicing to maintain proper operation.

Real-time ROV navigation

The advantages of real-time video-like imagery when navigating is fast, accurate visual feedback of situations as they occur, even in low and zero visibility conditions. Rather than flying through complex, dynamic environments using only still images ROV pilots can now see objects and structures as they move through their



planned path to targets using a 2D imaging sonar. Moving obstacles can be seen and avoided, minimizing the risk of collision. Additionally BlueView 2D Imaging Sonar can be synchronized with an on-board video camera for simultaneous sonar and camera views of the scene. A practical application would be to utilize the 2D Imaging Sonar to detect a target that is impossible to see with a video camera due to water turbidity. The video-like sonar imagery is used to navigate to the target, once there the target can be verified with the video camera.

Hot Tip

The level of detail that you can capture and see in any sonar image is a function of the operating frequency of the sonar. In short you can detect objects at greater distances with a low frequency sonar but you will have less detail, consequently you can get extreme detail with sonar that operate at high frequency levels but you will have a shorter range of operation. When choosing 2D Imaging Sonar look for a variety of options so you can choose the sonar that best fits your needs.

Fast, easy underwater inspections despite water clarity level

While most sonar function regardless of water clarity levels, 2D Imaging Sonar can optimize underwater inspections in low or zero visibility conditions by providing real-time data and imagery. Additionally the sonar will operate while in motion on an ROV enabling efficient coverage of wide areas and/or large structures quickly, saving time and money. Operators can quickly assess environment changes as well, enabling a timely, appropriate response.

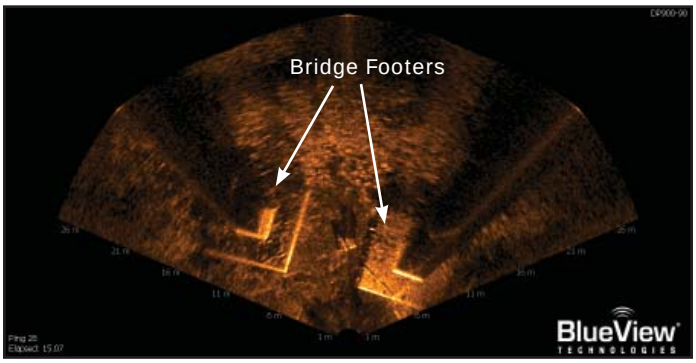


Image captured using a BlueView P900-130 Imaging Sonar on a moving micro ROV shows bridge footers during an inspection.

Consider a harbor security patrol that is monitoring cruise ships as it enters and departs from a busy port. The harbor security team can quickly scan the hull of the ship using a 2D Imaging Sonar attached to an ROV searching for abnormalities (fuel leaks, bilge discharge, IED detection), and inspect the harbor floor for evidence of illegal dumping. The high portability and immediate feedback delivered by the 2D Imaging Sonar enable quick response to these situations.

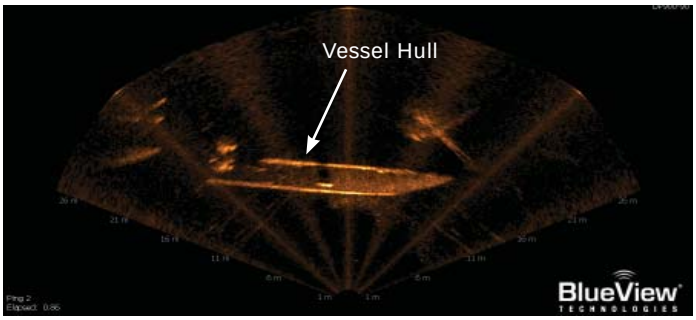


Image captured using a BlueView P900-130 Imaging Sonar on a micro ROV shows a vessel hull during an inspection.

Hot Tip

Integrating the 2D Imaging Sonar to an ROV is an effective way to create a highly mobile search and inspection tool. Combining an ROV's mobility with a 2D Imaging Sonar that can scan while in motion results in a mobile acoustic camera that can navigate around a site or structure to capture imagery and data, even in low and zero visibility conditions. When choosing an ROV and 2D Imaging Sonar combination ensure that the size and weight of the sonar will not have adverse effects on the mobility of the ROV.

Effective search and recovery activities with improved safety

Hazardous water conditions typically are associated with tragic events resulting in loss of property and unfortunately sometimes lives. The ability to safely and

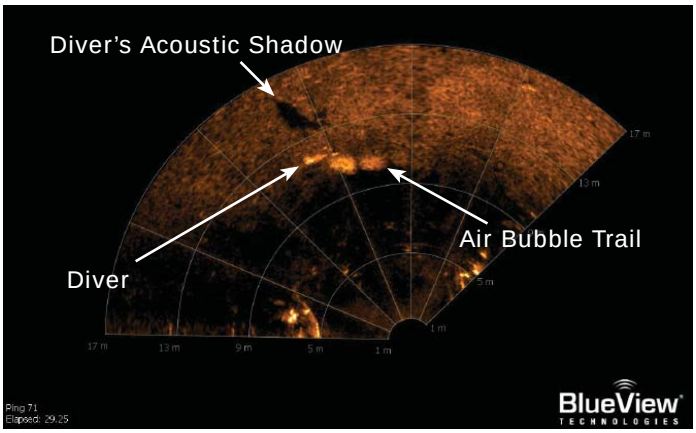
quickly search areas under turbid water conditions is critical to avoid further losses and locate assets. A 2D Imaging Sonar system can be safely deployed from a surface vessel with the operator utilizing a "topside" laptop or PC to view detailed underwater scenes in real time. The video-like imagery enables the operator to cover wide areas quickly and easily, and can spot moving objects that may be caught in the flow of especially turbid sections. To minimize exposure divers can enter the water to recover targets located by the 2D Imaging Sonar and identified with an ROV camera. The 2D Imaging Sonar system can then be used to monitor diving activities and identify potentially hazardous objects and/or structures that can injure divers during the operation.

Hot Tip

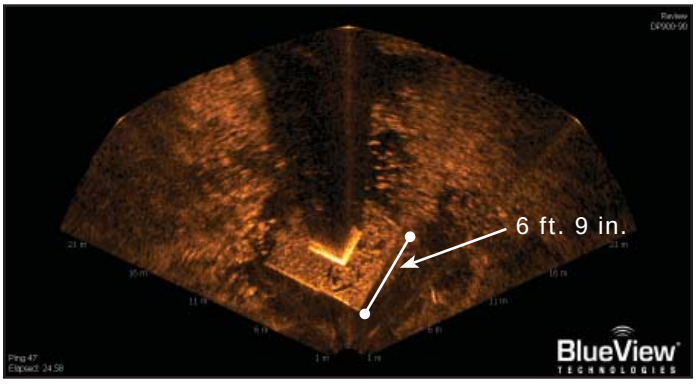
When deploying the 2D Imaging Sonar from a surface vessel pay particular attention to the angle of the sonar head to avoid surface reflection signals that will interfere with your sonar imagery. A 2D Imaging Sonar head used in conjunction with a digital pan and tilt mechanism will allow you to adjust the angle of the sonar head with the same "topside" laptop or PC Be sure that the angle of the sonar head is such that the top of the sonar beam remains at a minimum of 3 feet below the water surface to avoid surface reflections and ensure the best possible imagery.

Real-time monitoring of job site activities

Verifying the completion and/or progress of underwater activities can be challenging. Water clarity, the ability to approach a worksite safely, ensuring accurate data collection, and costly return-to-site calls can result in untimely project delays. When verifying underwater activities such as the construction of a new pier, the ability to verify piling placements at specific distances, monitor scour and/or wash-out, a 2D Imaging Sonar can provide a quick and easy solution.



Monitoring the activities of divers, ROVs, and the placement of critical equipment in real time improves safety and operational efficiency. Visualizing the dynamic underwater environment becomes critical as multiple targets move in close proximity to one another. The ability to see real time position changes of multiple targets in motion can help avoid unwanted contacts and/or help guide objects to desired locations. This is especially critical in low and zero visibility conditions where the 2D Imaging Sonar becomes a critical monitoring tool.



The acoustic data captured by the 2D Imaging Sonar can also deliver accurate point-to-point measurements. Using the same software operators can verify the distance between any two points within the imagery. In a practical application a technician operating the 2D Imaging Sonar can check the distances between newly installed pilings using on-screen point-to-point measurements to verify correct placement, even in low and zero visibility conditions.

Synchronize video, 2D imaging sonar and GPS data for improved post job analysis

Accurate synchronization of video, sonar and GPS data is helpful during post analysis to determine the location and characteristics (size, location, direction, time, etc.)

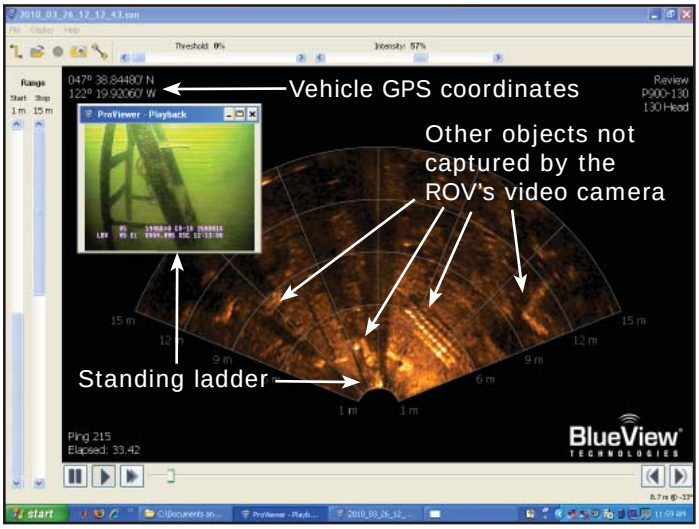


Image captured using a BlueView P900-130 Imaging Sonar and a video camera on a micro ROV while in motion. The standing ladder in the immediate forground appears in both the video and sonar imagery. The video camera is limited by water clarity and cannot capture other objects seen in the sonar imagery.

of detected objects and/or structures. The convenience of having all three sensing tools working in sync makes post process work faster, easier, and improves accuracy. With synchronization, a technician can determine exactly where and when a target had been detected, and determine heading of a moving target(s), and identify the target even in low and zero visibility conditions. This capability is especially effective for port and harbor security to detect, identify and track potential threats since these sensors are also synchronized in real-time .

Conclusion

The best tool for solving underwater imaging challenges is a well-informed, well trained, and properly equipped workforce. Knowledge of the differences, advantages and disadvantages of available sonar systems is the first step in solving your underwater imaging challenges.

When choosing between traditional mechanical scanning sonar or a 2D Imaging Sonar consider the following:

1) The underwater environments you typically work in – visibility, dynamics, etc.

2) The type of work to be performed immediately and will in the future

3) How the work will be performed – will it require monitoring to ensure safety and completion?

4) Will an ROV be involved? How complex and hazardous is it's navigation to the worksite?

5) What do you need to see to ensure that the job is done effectively?

6) What information do you need to provide to your customer that the job has been done correctly and is complete?

If you work in dynamic underwater environments, perform work that is complex and requires monitoring, utilizes an ROV to inspect and/or perform mission critical tasks, need solid evidence that the job was done right, or need to provide documented proof of completion to your customer or organization, 2D Imaging Sonar is the right choice.

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