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AquaEye

Product Reviews of AquaEye by Voda Safe

While I am personally capable of performing product reviews I usually do not. It has always seemed to me to be a conflict of interest. Yes, if you have a product that benefits our divers I want to see it. I want to advertise for you as well. But your product must live up to the claims or provide a level of risk management that benefits our dive teams. Not all do…

Last year a new company came to market called AquaEye. At the time they had presented the device to lifeguards groups and reading the literature, it appeared to be an extraordinary tool for them. They posted across numerous social media groups and found our divers among the others. Being protective of our PSDivers, I watched them for a while and paid attention to those who were asking about the product and the interaction between them and the company.

When it seemed like it was a legit product. I contacted them and asked a number of questions. That led to more questions and a decision to conduct an in-depth review of the product.

We discussed the opportunity to do some product testing and I developed a bank of questions / tests to see how the AquaEye would work for dive teams. I set up a trusted dive team to conduct the tests but we have not yet had the opportunity. Miscommunication and timing was an issue. BUT – I persisted and found teams who had seen and demoed the product.

I contacted a number of them and asked them to write their own reviews. I put together a long list of questions that required interaction with the device and sent it out as a guide. They have all been pretty consistent and I invited you to read them all here.

The device is reminiscent of hand-held sonar. It functions very similarly as well. A signal is sent out and when it returns to the unit, it has an algorithm that deciphers the return into potential human targets.

The claim is you can take the unit, hold it underwater and scan a large area and immediately find a target and send swimmers out for recovery or rescue.

Who wouldn't like that!

Having taught open water rescue for years at a large local lake I immediately saw the potential for this for lifeguards providing services on open water locations.

As I understand it, this device is ready to use out of the box. It does have some limitations but where it shines bright is from shore based operations where the user wades into water around waist deep. The unit must be underwater to work and the view screen is on top of the unit so you can see it looking down.

The unit currently has a depth limit of about 15 feet. For scans it has a long range of 165 feet. Medium range is 65 feet and short range 25 feet. It uses a horizontal sonar signal that emits from the "head" of the unit and is visualized on a view screen as a series of Xs and Os.

The algorithm in the device separates targets into most probably body locations and with practice can even allow you to map out an underwater

environment. This last step does require some training and understanding of sonar as well as personal experience with the AquaEye unit.

Using the device in deeper water is possible but problematic in that the unit must be underwater and held relatively steady during a side to side scan. Swimming on the surface or floating with a BCD is possible but problematic.

Because it throws a horizontal beam, it ability to be used in an ocean or deep water environment may be limited. But standing in waist deep water and scanning a pond, lake or irrigation waterway it would be an invaluable tool.

One comment that was made was that it felt like a Fisher Price toy because of the color and outer shell material but it is a far cry from a toy. The device DOES work for what it was intended to do.

For lifeguards this could immediately be an invaluable tool used to rescue or locate a person underwater. For a dive team it takes a bit more understanding and time learning to interpret the data. This is not a flaw in the device but rather, I believe, a way to use a tool that is slightly different from its original intention.

- **Hand-held Sonar Device Weight - 3 Lbs. Battery Life Between Charges - 2-3 weeks in regular use or 8 hrs of continuous use.**
- **Active Sonar Range - 50m or 164ft.**
- **Submersible - up to 5m or ~ 15ft**
- **Capable of conducting a 360° scan in as little as 3-5 minutes with a search area coverage of ~ 85,000 sq. ft or 2 acres.**

Currently the company is developing a training program for the AquaEye is gathering intel and information by training with dive teams. They get good marks for the efforts and are learning a lot about our particular needs. They are working on a training video using live training footage and hope to have an interactive social media forum of users available in the near future.

One question that came up a lot was upgrading. Right now the plan is to use the blue tooth capability in the unit to provide a user based software upgrade via an app. The device is still the 1.0 version and as it is, still works. The data and use by dive teams is affording the company a lot of ideas to improve and as they get the software worked out and updated, the 1.0 version should be good to go for years.

Depth limitations of around 15 feet is not a problem when using from a shore based operation and if staying within the 15 foot range and with clear enough

water, a diver could swim to the target. Visibility would only be a problem when attempting to view the screen. Heavy turbidity or dark tannins could cause a problem with viewing the screen underwater.

Deeper waters will be a problem. The unit is designed to be used so that it sends out a horizontal beam and the return is viewed on a screen on top of the device. The deeper the water is the greater the angle of the beam to the bottom. The trigonometry of this at 45 degrees makes the limit of easy deep scanning at around 60 feet. – You will not be able to see the screen.

Deep water also causes another issue with stability. The beam needs to be relatively consistent as it scans. Bobbing up and down in open water with swells would make the reading a bit off. Though, a stable floating platform the user could lie on might make a small difference. So if you were offshore and had flat conditions it is conceivable something as simple as an air mattress towed a short distance behind the boat could provide a stable base. But you will not be able to overcome the 45 degree angle limit to scan deeper water.

The company is still developing and all the ideas and desires the teams are inputting are being taken seriously. As they build, their technology should adapt making this an even more functional device. Ideally we would like to see a deeper depth rating for the device and the ability to swim to a target while scanning. Right now it is ideal for shallower waters and has the potential to save a serious amount of search time in zero visibility.

The unit cost at the time of writing is just under $5,000 making it pretty affordable for most teams. They currently offer a maintenance program for a fee as well that covers a variety of things.

I have not held one nor have I tested one myself. What follows are reviews performed by a variety of dive teams and their comments. We chose to do this in a big way – it is a lot of reading – but feel this will give you the most rounded view of a new product that has the potential to save you a LOT of time and greatly lessen the risks associated with your diving.

We have included additional product information about the AquaEye as well as a response from the company to our questions.

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Dive Safe!

Mark Phillips
Editor / Publisher

AquaEye Review

In the fall of 2020, I had the opportunity to use for test and evaluation the AquaEye by Voda Safe. Prior to the test the company presented us with an online meeting to go over the unit and explain the operation. The representatives I spoke to throughout the process were friendly, knowledgeable in the unit, had a lot of experience as lifeguards in various areas, and were very receptive to all input on how to improve their product.

Overview
The unit was developed by engineers who also worked as lifeguards, as a way of finding drowned persons quickly to affect a rescue.

The AquaEye unit has the form and size of a Dustbuster, or other hand held vacuums, is waterproof to 20 feet and is positively buoyant. It has only two controls, a trigger to activate the sonar scan and a thumb button to change the various modes. It has an automatically illuminated LCD display screen where scan information is displayed. It charges via an included wireless charger dock and the battery is not user serviceable. Battery life is more than adequate, even after several hours of testing the battery life indicator did not drop below 70%.

The AquaEye could be best described as a handheld scanning sonar which through an internal algorithm sorts out sonar returns, identifies targets consistent with a body (identified on the screen as an X), other objects (identified as an O), and gives the user the

bearing and distance to the targets. Scans can be done in a 180 degree arc in long (150 meter), Medium

(75 Meter), and short (20 meter) ranges. The unit has to be in the water to operate, and for most applications the operator will need to be in the water at the surface, firmly anchored was shown to be best.

Testing
I was involved in testing the unit with several other dive teams from the South West Michigan area, and had an opportunity to use the unit with my own team in various situations. A submerged diver on SCUBA was used as a target, water temps were a seasonally balmy 45-50F. Tests were conducted with multiple operators, in real life situations that we envisioned its use.

Being on the Lake Michigan shoreline, we have many drownings and calls for missing swimmers along our sandy beaches. (See data at Great Lakes Surf Rescue Project https://glsrp.org/.) While we were hoping for

wave action, unfortunately conditions were completely flat. A diver rested on bottom in a few feet of water in various positions while several operators scanned using the AquaEye after wading out to waist deep water we were able to mark the diver's position repeatedly no matter how she was positioned repeatedly, each time within 3 minutes of use. The operator was able quickly to direct a surface swimmer to the diver or go to the location themselves. The diver was located at ranges from 3 to 150 meters.

We then put the diver amongst large rocks along a seawall/pier in 15 feet of water. We routinely have to dive in the rocks and holes along the pier head to search for victims, and traditional sonar has not worked well for us here. The operator while holding onto a ladder in the water along the pier we were able to mark the diver, but we also got false marks which were person sized rocks. This, although not perfect, would give a diver areas to check instead of checking the entire pier blindly. We also received a line of X's (positive marks) which coincided with the edge of the pier, but we could quickly interpret those from their distance and location on the screen as the pier itself.

We moved inland to a marina, which had pilings, docks, and seawalls but most of the boats were out for the winter. We were able to locate the submerged diver consistently and quickly. Again, we received marks which were the dock pilings, but from interpreting the display screen, those could not only be ruled out as the victim but we were able to use those as reference points for other marks on the screen.

We moved to a slow moving river with medium vegetation and submerged trees and other obstacles. The diver moved to various spots and was easily located with scans from the unit. The only times we were unable to mark the diver on the unit, was because the diver was not in line of sight of the unit.

On a later day of testing I provided the unit to two Public Safety Divers, who had no previous training or experience with the AquaEye. I gave them a 30 second overview of the operation of the AquaEye and told them to try it out. They were in a bowl area of a lake which is nearly 200m across, 15' deep, and has thick weeds coming from the bottom. Each diver was able within 5 min of use of the unit to locate the other diver in various positions and depths.

Ultimately playing a game of Hide and Seek and trading off each time the unit led one to the other. While the operator was standing on a sandbar next to a steep drop off the other diver went to a training platform at 37 feet amongst floating 35 gallon barrels. The operator was able to repeatedly mark the diver.

On a subsequent training, I gave the same 30 second briefing on the use of the unit to several other Dive Team personnel, who then used the unit while divers were training on a submerged vehicle. As long as the diver was not hidden from line of sight by the car from the AquaEye, the unit was able to pinpoint their position.

Conclusion

Ultimately in our testing we found the unit to be easy to operate, rugged enough, and repeatedly did what the manufacturer advertised. While intended for use by lifeguards, I can see a use for Public Safety Dive Teams.

While the AquaEye in no way replaces sonar units, I believe it can augment searches of large areas that have no last seen point, especially in rescue mode while waiting for boat based sonar and experienced operators to interpret the scan to arrive and be deployed, or where launching a watercraft is not ideal. Such as beaches miles from the nearest boat launch, farm ponds, retention ponds, or other remote areas.

The unit can scan an area 150meters out in minutes which a tethered diver in conventional search patterns would take an hour, and as we all know less time under the water equals less risk. The unit is intuitive to use and training only takes mere minutes, where it takes a lot of time to train a sonar operator.

This being version 1 I can see room for improvements, and the manufacturer appears to be receptive and eager to hear suggestions. The manufacturer also has a service plan where the unit is serviced and the firmware updated annually. I personally would like it to be rated for a much deeper depth so a submerged diver could use it to scan and be guided to a victim at the bottom. While a MSRP of $4,760 USD seems high, it is easily in line with pricing of handheld thermal imagers fire departments use.

Bill Greene
PSSI Allegan County Dive Rescue Recovery Team
Allegan, MI

Aqua Eye Assessment

By Gerry Boylan

I am not used to assessing the viability or usefulness of a product but I will give this a shot. I am going to try to explain how it works, what practical applications it has, the possible applications for PSD teams, and the places where we see need for improvement.

Everyone's particular needs are different and hopefully you will be able to judge for yourself if it is the right tool for you.

How It Works.

Aqua Eye is a handheld sonar unit with built in metrics that determine whether the return image fits the criteria of a human body. By placing the unit about 1 foot underwater you pull the trigger and slowly pan from left to right for a 180 degree scan. The distance is about 50 Meters out and is tracked by an internal compass.

The return is in 2 formats, a screen showing possible targets and a screen of the return sonar image. You can toggle back and forth between the 2 screens and in a long-range, medium-range and close-range format. Once the target has been identified you can use the compass pointer and distance meter on the screen to swim to the target.

The units are Bluetooth but the apps to connect to the device have not been released yet and should be by the end of the year. The degree of the angle is 2 degrees wide by 38 degrees tall; the top of the range is even with the top of the unit and goes down from there, so holding it at the right angle for scanning is extremely important as is scanning slow enough to get a complete return.

Applications of Use.

The unit works best in areas with little or no obstruction and smooth bottoms. It will work in rivers, lakes or the ocean as long as you have a clear "Line of Sight: path to the victim.

Think of the image as the light from a flashlight, if you are pointing it at a tree, the light will show the tree, but not what is behind the tree. The sonar cannot go through obstructions, so if you have an uneven bottom choose your direction of scan carefully or do multiple scans past the obstructions or hills.

The scans seem to be more effective going from deeper to shallower rather than shallower to deeper. This is the perfect tool where lifeguards need to act quickly to recover missing swimmers, or dive teams that need to locate a victim within that golden hour and there is a fairly decent Point Last Seen.
This tool does not replace side scan sonar or fish finders but can allow you to narrow your search time dramatically by ruling out areas. I can think of at least a dozen searches this would have brought us directly to the victim within minutes. I can see it playing a big role in Ice Rescue/Recovery where the PLS is exact and the victim could be on top or on the bottom. We will try this out under ice later this month if we get good ice.

Opportunity For Improvement.

It is hard for divers to switch between the 2 types of

views. I would love to see another way to swap back and forth.

There is no memory to save a scan. Once you pull that trigger your old scan is gone forever. Once the Bluetooth application is available, this will be resolved.

There needs to be a bubble on top or on the screen to show you the proper scanning angle. If you are pointing down you will not get the long-range scan you are expecting.

The depth rating is 15 feet. You can scan down 150 feet, but you can't go down to 60 feet and scan around you.

I would love to see this have the following attachment:

A boat mounted attachment to scan at the right speed so you are not leaning over the side of the boat and trying to scan. The attachment would self-level and control the speed of the rotation.

An ROV attachment so you can scan and follow that scan hit with the ROV to the target.

A handheld automatic scanning attachment where you can pin it to the bottom and it would self-level and rotate at the proper speed. This would really help the divers in currents and rough waters.

GPS capability so you could see on a map what areas were scanned and what is missing, maybe with the Bluetooth app, there is that possibility.

My final assessment.

I believe this should be on every lifeguard chair at every beach across the nation. This thing has the capability to save lives as it is and without any improvements and would prevent many calls for recovery divers. As for PSD teams, I do see this as a huge advancement in tools we use. It is simple and easy to use and within price range. With a few improvements I can see this morphing into a widely accepted tool in the PSD community. As I said before it is not a replacement of our current tools, but it is another tool in the toolbox that can bring some of our calls to a much quicker end.

The manufacturer is currently putting $1.5 Million into R&D on the Aqua Eye and has been getting feedback from the teams that have been using it so I expect the next generation to be geared more towards PSDs and be able to handle the depths we need to take it to.
Mark,

Our teams found the Aqua Eye unable to stand up to extreme cold. Mother Nature provided us with surface temps between -10°F (-23°C) and -30°F (-34°C) at least that is what is believed to be the issue:

The scan was extremely slow *about 10 seconds per 10°, we all had a very hard time moving ourselves that slowly. Any faster and it would leave un-scanned areas, we also got many false hits, and with them all using the same symbol as a probable target rather than any indication of size of the object we found that it did not improve our search, or narrow our search field in any way.

I believe if the unit itself could handle operational dive depths than maybe it could have some use as a diver tool, however it is not at this time capable of that role. Hope other teams have better results, but for our harsh environment it was no-go.

We had a real mission this week and surface temps were -45 to -56°F with winds in excess of 30 mph, I don't think it's fair to Aqua Eye to use our test as a data set aside from temperature limitations; very few teams are forced to work in our extremes.

~ Brian Gates

AquaEye

Aquatic Dreams Diving

Aquatic Dreams Diving began discussions with AquaEye in early October to discuss the pros and cons of their product in order to determine its effectiveness for use by two teams we train and support.

We were able to receive demo units at the end of October for a 2 week testing period. We put the units through two similar series of tests in the two environments they would be deployed in to test how accurate the AquaEye was in locating divers and swimmers on surface first, then dummies and divers at depth.

The AquaEye itself is very easy to use. The sensor and screen are mounted on a pistol grip, allowing the operator to point the device and angle it as needed. The unit can switch between 3 modes: short, medium, and long range, depending on area to be searched, and we found that our best results were in the short to medium range. When using long range mode, the device worked as advertised but there was a lack of accuracy due to the large search area, so it was useful to use to narrow a search area and then switch to medium range as we got closer. The

unit has all measurements in metric, so team members that weren't used to this had to swap between metric and imperial. Searchers operate the unit by sweeping from left to right while holding the trigger. The unit will begin sending pulses and searchers will see all potential targets start to appear on screen. Once the sweep is complete and the trigger released, the system compiles the data and displays the final targets and relative position to searcher. Finally the units have both an "easy" or "smart" mode and an Echo mode that presents raw data from the sonar scans.

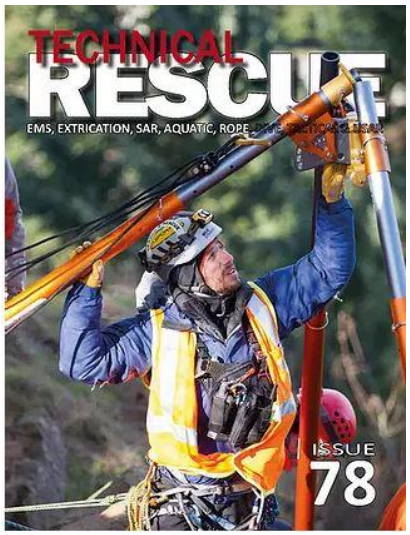
The smart mode uses the scans the sonar performs and runs it through a logarithm to compare what it's scanning against past known scans to create what it believes are "more valid" or "less valid" targets based on its database. This way it can point searchers where to perform primary searches versus secondary searches. Rather than letting the AquaEye do the evaluation for searchers, the person operating the unit can move from smart mode over to the Echo mode to see the raw data. This way searchers can see areas of more or less density to direct searchers to objects.

Our teams were split on which mode was more useful, based on how comfortable they were in reading data. Echo mode was useful when differentiating objects from potential bodies. In the smart mode, if a rock or log was of approximate size and shape of a human body, it did return a "more likely" result, which could present a false positive.

However, when reading in Echo mode, rocks were being seen as denser than bodies so we were able to eliminate them from searches. Logs were less dense than rocks but we did run into false positives with searching for them. Our takeaway from this was that the AquaEye is not full-proof. Instead it presents a list of targets to narrow searches and better utilize dive team resources.

When putting the unit through its paces, we began with targets floating on the surface to provide the easiest search a team may have. In these tests the unit operated successfully. In fact, one issue encountered during these tests were additional "more valid" targets than we had floating divers. We sent divers down to identify the target and found large concrete barrels on the bottom of the cove that it was picking up.

From this point we moved to targets underwater. We began with divers so we could track bubbles and see how easily a searcher narrowed in on the target. Our searcher had a towel placed over his head so he could not see the bubbles and influence the results. He was then directed to call out as he found valid targets. In these tests, as long as the searcher had a clear line of sight he was able to locate the sunken divers in every instance. We also had divers lay behind logs and next to the concrete barrier. In the case of testing at the dive park we used, we placed a diver against a sunken cargo van. In these tests, the diver was often in the shadow of the object in front of them and they did not



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pick up the target. This would most likely be solved by scanning from multiple angles to avoid the shadow effect.

We next replaced the divers as test subjects with a rescue dummy. Using the dummy we were able to recreate the results above but it took more work and more tries, as the dummy was not appearing as a "more valid" target. When running it in raw mode, the dummy appears much less dense than a live body. We attributed this to the fact that it is a dummy with wire frame skeleton so that accounted for our lack of raw data results and why the dummy was a "less valid" target than a live diver.

One of our last tests involved replicating a drowning incident that occurred on Lake Cumberland. The team was taken to the site of the incident and the team members that were involved in the recovery placed the dummy in the location the victim was recovered.

The search area was in the back of a narrow creek, approximately 45 feet deep and approximately 150 feet wide. Searchers had to scan from a floating dock located in the middle of the creek to locate the victim. They were able to scan and locate the dummy from both the floating dock and the side of the creek, deploy a diver, and recovery the victim.

Overall we were very happy with the performance of the AquaEye, within the scope of its abilities. A few things we had to consider:

The longer the range of the AquaEye, the less accurate is the scan. This is best deployed in short to medium range settings, though you could use long range to help narrow a search.

The scan is a beam so searchers may have to angle the AquaEye to catch the bottom of the search area in the beam to return a signal

The AquaEye does not register depth. It only operates in 2 dimensions. This helps put a diver near target, but not on target.

It may be difficult to gauge distance. We tried to walk a diver to the victim by having them swim and scan them as they were swimming. This worked about 50-75% of the time. A solution was proposed to deploy a range finder along with AquaEye to help gauge distance to put a diver on target quickly.

There is no export function to extract scans to a phone or tablet. We have been told this will be in an upcoming release.

The AquaEye is waterproof to a depth of 5 meters or around 16 to 17 feet. We would love to see a waterproof unit that is good at depth that may be deployed by a diver underwater. Knowing that each

team protocol may be different, we believe this may be a very good option to have in the event a searcher needs it

The AquaEye will not take the place of a side-scan sonar unit or provide the level of detail of some of those units, but it is not designed to. It works best as a rapid deployment tool or used where a boat may not be quickly deployable. We believe this device would shine in ponds, small bodies of water, creeks and coves, or other areas that can be searched quickly and either rule out areas or focus resources on more likely targets.

Below are the tests we ran at both locations and their results that we provided to AquaEye.

Test Weekend 1 – Lake Cumberland, KY
Test Case 1:

Details: Initial trial. We deployed a few team members floating on surface and had the team take turns scanning the victims to locate them on surface to get used to the unit and how it functioned.

Results: 2 team members were deployed approximately18 meters from shore. Each tester were able to orient on the divers floating on surface and the unit also picked up an additional target underwater, which we then dispatched divers to search for based on results from scan and they identified as a barrel filled with sediment.

Test Case 2:

Details: Deployed divers underwater to test before deployed water rescue dummy to see if testers can hone in on targets and we can verify with bubbles. this presented a useful second test (see results)

Results: We deployed 5 divers underwater plus the control (the now identified barrel). Divers were dispatched at varying distances between 18 and 30 meters and depth was approximately 5 meters. Unbeknown to us, 1 diver drifted close to another and were sitting next to each other.

On scans the AE reported 4 valid targets in Smart mode (3 divers and the control barrel). The two divers next to each other were reported as a "less valid" target. In echo mode, each divers and barrel were able to be identified. 2 divers together appeared as a large white blob, scanning the 2 people as one.

We pulled other divers from water and sent 2 test subjects again, this time holding hands stretched out, so they were approximately2 meters apart from one another. This still appeared as a less valid target and a larger blob on echo mode.

We then separated them approximately3 meters apart and they at this point appeared as 2 valid targets.

Test case 3:

Details: Deployed rescue dummy, known as Jody, as a drowning victim. Distance was increased (victim

was approximately25 meters from shore and in approximately20 feet of water.

Results: Teams took turns scanning. At this range and depth, it took them longer to complete multiple scans at various angles to try to read depth. At this point, the AE is being pointed toward open water (rest of lake) with no backdrop to return signals. Target was eventually located and diver dispatched.

Jody was not appearing as a valid "X" in smart mode.. only as an "O". In echo mode, dummy was appearing as a small yellow to red mark, most likely due to less density than a human. Dummy was located and brought up.

Second test was performed closer to shore but in a debris field (fallen trees, logs, branches) simulating drowning conditions, approximately15 meters from shore in 6 meters of water. Target was picked up immediately, this time as a valid "X" target and divers were directed to distance and found Jody next to fallen logs and trees.

Test Case 4:

Details: Simulating drowning from last month. We moved the team from initial test site to a spot farther in Lily creek with steeper walls, a large amount of rocks and debris underwater, and scene of another drowning. Test case is that a swimmer was swimming across creek, got tired, and drowned about 3 meters from shore, in about 8 meters of water. Victim fell among rocks and debris, and we are now shooting from boat to shore instead of shore to open water.

Results: This became a much harder search. In echo mode, the rocks presented multiple densities and problems, appearing as a mix of reds and whites. Also, because depth is greater, multiple scans needed to be performed at various angles. We received a less viable target "O" on multiple sweeps and scanner disregarded because in echo mode it mixed in with other colors. However, when he sent a diver to search, this was in fact the dummy and it was retrieved.

Test Case 5:

Details: Simulating another drowning. Victim was on floating dock in middle of Lily Creek and fell off dock, hitting his head as he fell on a boat. Victim sunk immediately. Team is now scanning at a 60-90 degree angle to try to locate as they are stationed on the floating dock as well. There is multiple debris fields here including sunken trees, roots, branches and anchors.

Results: Scanner was able to find a viable target on first sweep. Dispatched diver to a

depth of 11 meters and victim was found stuck under a tree where Jody slid after sinking and sliding on slope of bottom. Jody then retrieved.

Test Cases not Performed (yet)

Test Case 6: Searching for victim in vicinity of wreck. No easily accessible wrecks at testing area. This test will be performed this weekend at White Rock Park using school bus and cargo van as test sites

Test Case 7: Searching under waterfall. Water is low this time of year so there are no running waterfalls. However, in speaking with the team, they do not feel a waterfall generates enough aeration on Lake Cumberland that would substantially block a scan for a victim. Based on their experience, the waterfalls only cause bubbles the first few feet, and victims are normally not caught on the surface of a waterfall there. They fall to the bottom.

There was a discussion and there is a very large dam at the lake called Wolf Creek Dam, that supplies most of the power for Southern KY and Northern TN, and they have had victims get stuck in the eddies at the dam and the aeration there would block a scan. However, in the event of a drowning they can shut the dam down and it becomes still water which is then easily searchable.

Team Impressions

They do feel the long range scan worked the best, followed by medium scan. They felt the short range scan wasn't useful in the scenarios they have (but admit that it's not hurting to have it either).

They felt that if they had a laser rangefinder as part of their toolbox, it would make it much easier to direct divers to location. At that point they have an estimate of the scan and could shoot the diver to gauge distance.

They were spotty on directing divers by scanning them on the surface then rescanning until the target "X" and the diver "X" overlapped. We were unsure if this was due to user error or scanning but they found this to be difficult to do.

They did find putting a diver underwater kneeling and shooting was much more stable than trying to stand up in the waves and currents even in a lake. They stated they felt this resulted in more accurate searches.

They were evenly split on the failed searches and why they were not picking up the dummy. Some felt Jody did not have as much density as that of a person so that was to blame. Others felt it was due to human error reading the echo, and others felt it was getting used to the scanner and the angle of scan.

All felt that shooting from the boat or floating dock to the wall was much harder to pick out a valid target than shooting from a beach toward open water, but others felt that perhaps this lack of "wall" on the far side to bounce soundwaves back may make it less accurate.

This may require modifications to their SOP if they were to invest in one to try shooting along a wall rather than directly at one, etc. We will be retesting this functionality at White Rock Park where they have sheer walls on either side of the quarry.

One of their lead divers questioned the useful of this versus. a side or down-scan sonar such as a Hummingbird 360 for searching, but the chief pointed out that they may be different tools in the same toolbox and there is not one tool that will handle all situations they face.

Test Weekend 2 – White Rock Park, St. Paul, IN

Test Case 1:

Details: Initial trial. We deployed four team members floating on surface and had the team take turns scanning the victims to locate them on surface to get used to the unit and how it functioned.

Results: 4 team members were deployed approximately10 meters from shore. Tester was able to target 4 divers on surface using the AquaEye unit. 1 diver was sitting atop approximately where sunken cargo van was located so echo mode read 3 small targets plus one large target, superimposing diver and van as one item, as expected

Test Case 2:

Details: Deployed divers underwater to test before deployed water rescue dummy to see if testers can hone in on targets and we can verify with bubbles. This test recreated test case 2 from previous week.

Results: We deployed 2 divers underwater plus the identified cargo van. Divers were stationed between 10-15 meters from shore at approximately6 meter depth.

On scans the AE reported 2 valid targets in Smart mode and the van appeared as a less valid target. In echo mode divers appeared as small red and white circles while van was a very large white "blob". Second test sent a diver to lay directly in front of cargo van in view of AE at distance of approximately10 meters and depth of 6 meters.

AE on first scan did not register van as even a less valid target though it appeared in echo mode. On second scan at a slightly lower angle, penciling appeared on echo mode but van did appear as a less valid target.

Note that AE did not pick up on diver as target was too close to the van. Scan repeated until diver was about 3-4 meters away from van before it registered a second target.

Test case 3:

Details: Deployed rescue dummy Jody, as a drowning victim. Distance was kept at approximately 15 meters and depth of 6 meters. Victim was lying in a mud flat in a prone position.

Results: AE did locate dummy in smart mode on first try. First response diver was deployed at direction of tester and diver located dummy.

Second test was performed at approximately25 meters and depth of 7-8 meters. AE took 3 scans to locate Jody with angle of AE increasing with each scan to get used to angle that would hit bottom.

Test case 4:

Details: Deployed diver 50 meters from shore and at a depth of 8 meters. Tester was moved from water to dock, lying on belly and scanning with only AE in water.

Results: AE located diver on first scan. Test was repeated and replicated to verify it was reading diver. Same scans located cargo van which was located 10 meters in front of tester at 11 o'clock position. Test also located 2 divers approximately30 meters at 10 o'clock position diving along wall. Interesting to note that even in log range mode AE did not pick up sides of quarry.

Test case 5:

Details: AE was deployed from middle dock of quarry (approximately mid-way down length) and a basic 180 degree scan was performed in long range mode to see what AE would detect.

Results: AE picked up two first response divers that were fun diving between exercises. Otherwise, did not pick up any valid or less than valid targets. In echo mode, located school bus approximately50 meters away, large sunken boat, underwater platform, and a possible sunken car at 50-60 meters but it was not repeatable. It is very possible that the car is too degraded and falling apart to return a signature.
Test case 6:

Details: Final test was to test effect of aeration on AE scan. Quarry has 4 aeration units that are deployed in the park to keep water moving. They produce a cloud effect of bubbles at set points in the park. Divers were deployed on a search line that ran behind a cloud of bubbles at the 25-30 meter distance and at 6-7 meter depth.

Results: AE tagged both divers as a single valid target behind the aeration cloud. Aerator did not seem to hinder scan though it could be because there was not enough bubbles to disrupt scan. Divers were beside each other, accounting for the single target. It is unknown why in this test they appeared as a single valid target when other tests with two divers close to one another appeared as a less valid target.

Conjuncture is possibly one diver was behind other diver so in the sonar shadow.

Impressions and takeaways from 2nd day of testing

1. Testers again agreed that practice will make divers more comfortable in it's use and the angle of the beam to scan effectively.

2. Testers were able to locate targets from both water and on dock equally so it could be deployed by a trained lifeguard as effectively as a diver

3. It was universally agreed that a range finder would need to be deployed at the same time as the AE to be able to have shore based operations direct a diver to the proper distance, especially in times of stress or low visibility.

4. The White Rock team liked how easy it was to use and train a new person on the unit and how quickly they get results

5. It was felt that dummy Jody was much harder to locate in echo mode than a diver. Thought was possibly different density but target appeared often as blue and yellow with a little bit of red.

6. Owner of White Rock liked the ability to "map" quarry to get a read of the lake and know what is "normal" and what is not. Agreed that the more a scanner used the device the more they would know what was out of place and felt that the export feature to a smartphone would help create that map that could be referenced by multiple team members.

7. All team members were surprised that the AE did not pick up on walls of the quarry in echo mode. not sure why this was the case and if it was user error but even more experienced testers did not pick them up.

8. Due to smaller space to search, the mid-range mode seemed to work best for team with the ability to shoot in short range for more accuracy.

9. Team was unsure if temperature and density of water has an effect on the sonar beam? Water temp was 53 degrees with no thermoclines where last week water was 68 degrees. A similar question appeared: do thermoclines affect sonar beams? They do affect sound waves when using Full Face Mask and u/w communication systems so curious if this has any effect on sonar?

10. The tests at White Rock made Jamestown Dive team more sure that AE could be very useful in farm pond, retention pond, etc scenarios where someone has gone missing by one of these bodies of water. A diver could very quickly dismiss or confirm the pond as a search site.

November 2020 – Drop Ship Demo – Virtual Training for team conducted.

2 Different Test Days in Reverse Order.

Training Day 2

We completed our testing of the units at White Rock Park Quarry. We incorporated the chief of the Jamestown dive team and one of his divers as well as the owner of White Rock Park and a few of our first response divers from my team at the park and went through the following scenarios. Team feedback follows the scenarios:

Test Case 1:

Details: Initial trial. We deployed four team members floating on surface and had the team take turns scanning the victims to locate them on surface to get used to the unit and how it functioned.
Results: 4 team members were deployed approximately10 meters from shore. Tester was able to target 4 divers on surface using the AquaEye unit. 1 diver was sitting atop approximately where sunken cargo van was located so echo mode read 3 small targets plus one large target, superimposing diver and van as one item, as expected

Team Comments Here:

> **Phill:** 10/10 - AE Targets irregularities of sunken targets.

Test Case 2:

Details: Deployed divers underwater to test before deployed water rescue dummy to see if testers can hone in on targets and we can verify with bubbles. This test recreated test case 2 from previous week.

Results: We deployed 2 divers underwater plus the identified cargo van. Divers were stationed between 10-15 meters from shore at approximately6 meter depth.

On scans the AE reported 2 valid targets in Smart mode and the van appeared as a less valid target. In echo mode divers appeared as small red and white circles while van was a very large white "blob".

> **Phill:** Consistent findings – data ruled out car as target. Echo results as expected. Must pay attention to trigger pulled, memorized date before release of trigger and seeing analyzed data. If the AI rules out targets likely or less likely to be a person you may not get notification on target screen. Paying attention to scans in progress will alert you to look at echo map for more information.

Second test sent a diver to lay directly in front of cargo van in view of AE at distance of approximately10 meters and depth of 6 meters. AE on first scan did not register van as even a less valid target though it appeared in echo mode. On second scan at a slightly lower angle, penciling appeared on echo mode but van did appear as a less valid target. Note that AE did not pick up on diver as target was too close to the

van. Scan repeated until diver was about 3-4 meters away from van before it registered a second target.

> **Phill:** Consistent findings – proves scanning from multiple angles and directions is vital if targets are not identified within a few scans. Beam sweeping, focused beam angles and avoiding beam shadow are important operating procedures for best results.

Test case 3:

Details: Deployed rescue dummy Jody, as a drowning victim. Distance was kept at approximately 15 meters and depth of 6 meters. Victim was laying in mud flat in prone position

Results: AE did locate dummy in smart mode on first try. First response diver was deployed at direction of tester and diver located dummy.

Second test was performed at approximately25 meters and depth of 7-8 meters. AE took 3 scans to locate Jody with angle of AE increasing with each scan to get used to angle that would hit bottom –

> **Phill:** beams focus

Test case 4:

Details: Deployed diver 50 meters from shore and at a depth of 8 meters. Tester was moved from water to dock, lying on belly and scanning with only AE in water.

Results: AE located diver on first scan. Test was repeated and replicated to verify it was reading diver. Same scans located cargo van which was located 10 meters in front of tester at 11 o'clock position. Test also located 2 divers approximately30 meters at 10 o'clock position diving along wall.

Interesting to note that even in log range mode AE did not pick up sides of quarry.

> **Phill:** Solid echo return – algorithm rules out??

Test case 5:

Details: AE was deployed from middle dock of quarry (approximately mid-way down length) and a basic 180 degree scan was performed in long range mode to see what AE would detect.

Results: AE picked up two first response divers that were fun diving between exercises. Otherwise, did not pick up any valid or less than valid targets. In echo mode, located school bus approximately50 meters away, large sunken boat, underwater platform, and a possible sunken car at 50-60 meters but it was not repeatable. It is very possible that the car is too degraded and falling apart to return a signature.

> **Phill:** Good results – excellent results….

Test case 6:

Details: Final test was to test effect of aeration on AE scan. Quarry has 4 aeration units that are deployed in the park to keep water moving. They produce a cloud

effect of bubbles at set points in the park. Divers were deployed on a search line that ran behind a cloud of bubbles at the 25-30 meter distance and at 6-7 meter depth.

Results: AE tagged both divers as a single valid target behind the aeration cloud. Aerator did not seem to hinder scan though it could be because there was not enough bubbles to disrupt scan. Divers were beside each other, accounting for the single target. It is unknown why in this test they appeared as a single valid target when other tests with two divers close to one another appeared as a less valid target.
Conjuncture is possibly one diver was behind other diver so in the sonar shadow.

Phill: Further Aeration testing required but good results regardless.

Impressions and takeaways from 2nd day of testing

1. Testers again agreed that practice will make divers more comfortable in its use and the angle of the beam to scan effectively.

Phill: 100% agree

2. Testers were able to locate targets from both water and on dock equally so it could be deployed by a trained lifeguard as effectively as a diver

Phill: 100% agree

3. It was universally agreed that a range finder would need to be deployed at the same time as the AE to be able to have shore based operations direct a diver to the proper distance, especially in times of stress or low visibility

Phill: 100% agree and I failed to discuss range finder in virtual.

4. The White Rock team liked how easy it was to use and train a new person on the unit and how quickly they get results

Phill: Agreed – Onsite training and upskilling departments is important but not necessarily required. Operational tactics, scene size ups will dictate search patterns so understanding beam reach and beam shadow will set up the best beam sweep and scan angles.

5. It was felt that dummy Jody was much harder to locate in echo mode than a diver. Thought was possibly different density, but target appeared often as blue and yellow with a little bit of red.

Phill: exactly.

6. Owner of White Rock liked the ability to "map" quarry to get a read of the lake and know what is "normal" and what is not. Agreed that the more a scanner used the device the more they would know what was out of place and felt that the export feature to a smartphone would help create that map that could be referenced by multiple team members

> **Phill:** Mapping known hazards (pre planning) is an excellent pro active approach to know water hazards. Mapping is vital in local areas to understand What you see on AE on rescue day.

7. All team members were surprised that the AE did not pick up on walls of the quarry in echo mode. not sure why this was the case and if it was user error but even more experienced testers did not pick them up

> **Phill:** Assumption – pinged and echo rebounded with no variation or inconsistencies to sound wave so no echo result. Tavis / Carlyn?

8. Due to smaller space to search, the mid-range mode seemed to work best for team with the ability to shoot in short range for more accuracy

> **Phill:** More accuracy or larger echo display?

9. Team was unsure if temperature and density of water has an effect on the sonar beam? Water temp was 53 degrees with no thermoclines where last week water was 68 degrees. A similar question appeared: do thermoclines affect sonar beams? They do affect sound waves when using Full Face Mask and u/w Comm Systems so curious if this has any effect on sonar?

> **Phill:** Assumption is no effect…Carlyn / Tavis?

10. The tests at White Rock made Jamestown Dive team more sure that AE could be very useful in farm pond, retention pond, etc. scenarios where someone has gone missing by one of these bodies of water. A diver could very quickly dismiss or confirm the pond as a search site.

> **Phill:** Agreed – it is excellent in ponds and of very static water. Very good for ice rescue in tidal / moving water.

Hopefully this helps with results we've had. Definitely happy to discuss findings with you all and debrief if you want?

This past weekend we deployed the AE units to the team at Lake Cumberland for trials there in real-world scenarios. We held a short training session for the entire team on how it works and then we traveled by boat to a section of the lake called Lily Creek, which was the site of a drowning and recovery several years ago. It was deployed first from shore in a larger area to run through some scenarios, and then we moved to the site of the drowning to run exact replicas of this incident as well as a recent drowning a few months ago:

Training Day 1

Test Case 1:

Details: Initial trial. We deployed a few team members floating on surface and had the team take turns scanning the victims to locate them on surface to get used to the unit and how it functioned.

Results: 2 team members were deployed approximately18 meters from shore. Each tester were able to orient on the divers floating on surface and the unit also picked up an additional target underwater, which we then dispatched divers to search for based on results from scan and they identified as a barrel filled with sediment.

> **Phill:** Target never the less… other areas clean…..

Test Case 2:

Details: Deployed divers underwater to test before deployed water rescue dummy to see if testers can hone in on targets and we can verify with bubbles. this presented a useful second test (see results)

Results: We deployed 5 divers underwater plus the control (the now identified barrel). Divers were dispatched at varying distances between 18 and 30 meters and depth was approximately 5 meters. Unbeknown to us, 1 diver drifted close to another and was sitting next to each other.

On scans the AE reported 4 valid targets in Smart mode (3 divers and the control barrel). The two divers next to each other were reported as a "less valid" target. In echo mode, each divers and barrel were able to be identified. 2 divers together appeared as a large white blob, scanning the 2 people as one.

We pulled other divers from water and sent 2 test subjects again, this time holding hands stretched out, so they were approximately2 meters apart from one another. This still appeared as a less valid target and a larger blob on echo mode.

We then separated them approximately3 meters apart and they at this point appeared as 2 valid targets.

> **Phill:** Divers were 30 meters at depth so long range was used. The echo high density blobs were in long range view and could only be viewed in long range echo. Distances are to a larger scale on echo so greater distances between density objects is required to separate echo targets. If selecting long range scan, and scanned targets were within 20 meters (65ft), they would have been able to take a closer look by switching to medium echo. And understanding when scanning in long range you must switch to short range to see if any targets were present off screen in short range.

Test case 3:

Details: Deployed rescue dummy, known as Jody, as a drowning victim. Distance was increased (victim

was approximately25 meters from shore and in approximately20 feet of water.

Results: Teams took turns scanning. At this range and depth, it took them longer to complete multiple scans at various angles to try to read depth. At this point, the AE is being pointed toward open water (rest of lake) with no backdrop to return signals. Target was eventually located and diver dispatched.

Jody was not appearing as a valid "X" in smart mode.. only as an "O". In echo mode, dummy was appearing as a small yellow to red mark, most likely due to less density than a human. Dummy was located and brought up.

> **Phill:** Consistent finding and exactly the reason.

Second test was performed closer to shore but in a debris field (fallen trees, logs, branches) simulating drowning conditions, approximately15 meters from shore in 6 meters of water. Target was picked up immediately, this time as a valid "X" target and divers were directed to distance and found Jody next to fallen logs and trees.

> **Phill:** beam angle adjustment hit target in beams focus.

Test Case 4:

Details:
We simulated a drowning from last month. We moved the team from our initial test site to a spot farther in Lily creek with steeper walls, a large amount of rocks and debris underwater, and scene of another drowning.

Test case is that a swimmer was swimming across creek, got tired, and drowned about 3 meters from shore, in about 8 meters of water. Victim fell among rocks and debris, and we are now shooting from boat to shore instead of shore to open water.

Results: This became a much harder search. In echo mode, the rocks presented multiple densities and problems, appearing as a mix of reds and whites. Also, because depth is greater, multiple scans needed to be performed at various angles. We received a less viable target "O" on multiple sweeps and scanner disregarded because in echo mode it mixed in with other colors. However, when he sent a diver to search, this was in fact the dummy and it was retrieved.

> **Phill:** Trust AE's judgment and prioritize what it see's.

Test Case 5:

Details: Simulating another drowning. Victim was on floating dock in middle of Lily Creek and fell off dock, hitting his head as he fell on a boat. Victim sunk immediately. Team is now scanning at a 60-90 degree angle to try to locate as they are stationed on the floating dock as well. There is multiple debris fields here including sunken trees, roots, branches and anchors.

Results: Scanner was able to find a viable target on first sweep. Dispatched diver to a depth of 11 meters and victim was found stuck under a tree where Jody slid after sinking and sliding on slope of bottom. Jody then retrieved.

Phill: 60 to 90 scan…. Well done….

Test Cases not Performed (yet)

Test Case 6: Searching for victim in vicinity of wreck. No easily accessible wrecks at testing area. This test will be performed this weekend at White Rock Park using school bus and cargo van as test sites

Test Case 7: Searching under waterfall. Water is low this time of year so there are no running waterfalls. However, in speaking with the team, they do not feel a waterfall generates enough aeration on Lake Cumberland that would substantially block a scan for a victim. Based on their experience, the waterfalls only cause bubbles the first few feet, and victims are normally not caught on the surface of a waterfall there. They fall to the bottom.

There was a discussion and there is a very large dam at the lake called Wolf Creek Dam, that supplies most of the power for Southern KY and Northern TN, and they have had victims get stuck in the eddies at the dam and the aeration there would block a scan. However, in the event of a drowning they can shut the dam down and it becomes still water which is then easily searchable.

Team Impressions

1. They do feel the long range scan worked the best, followed by medium scan. They felt the short range scan wasn't useful in the scenarios they have (but admit that it's not hurting to have it either).

Phill: Consistent findings. – Sound wave discussion Carlyn / Tavis

2. They felt that if they had a laser rangefinder as part of their toolbox, it would make it much easier to direct divers to location. At that point they have an estimate of the scan and could shoot the diver to gauge distance.

Phill: Range Finder agreed. I use one and its proved AE accurate.

3. They were spotty on directing divers by scanning them on the surface then rescanning until the target "X" and the diver "X" overlapped. We were unsure if this was due to user error or scanning but they found this to be difficult to do.

Phill: It is difficult if beams focus is greater than 15'.

4. They did find putting a diver underwater kneeling and shooting was much more stable than trying to stand up in the waves and currents even in a lake. They stated they felt this resulted in more accurate searches

Phill: 100 agree. AE must be still to receive the echo.

5. They were evenly split on the failed searches and why they were not picking up the dummy. Some felt Jody did not have as much density as that of a person so that was to blame. Others felt it was due to human error reading the echo, and others felt it was getting used to the scanner and the angle of scan.

Phill: Potentially all of the above

6. All felt that shooting from the boat or floating dock to the wall was much harder to pick out a valid target than shooting from a beach toward open water, but others felt that perhaps this lack of "wall" on the far side to bounce soundwaves back may make it less accurate.. This may require modifications to the their SOP if they were to invest in one to try shooting along a wall rather than directly at one, etc. We will be retesting this functionality at White Rock park where they have sheer walls on either side of the quarry.

Phill: Solution – scan different beam angles

7. One of their lead divers questioned the useful of this versus a side or down scan sonar such as a Hummingbird 360 for searching, but the chief pointed out that they may be different tools in the same toolbox and there is not one tool that will handle all situations they face.

Phill: A point and shoot beam for the hard to reach and see and on scene in minutes.

8. The chief did ask me the possibility of speaking with you and if these are being sent on to other teams, to put him on a list to possibly get a unit one more time in the near future for a few days. He is going to talk to the team and see if they feel they are comfortable enough for a show and tell with the city council.

If so, they want to take the council members out on a boat and perform a few drills with them on the boat watching as they search, locate, and retrieve targets with the goal of the council seeing it's value and get them to pay for the unit rather than fundraising with the community. Chief is still talking this one through and I don't know all the details yet but I'm including this in the list of impressions and feedback.

Phill: Yes to other demo's - Doug's lead so I'll discuss .

We will be doing the same test cases this coming weekend at the rock quarry, substituting the car drill instead of a search from boat and I will provide feedback after that test as well.

AquaEye Review
PSDiver Tests and Questions

How easy to use out of the box?

Grab and Go?

Read ALL the instructions?

Quick glance at pics enough?

The unit is very simple to use. As a trainer, I had 1 hour training session with AquaEye. I spend 5-10 minutes talking to the dive teams to show them how to use it and they had enough basic knowledge to run scans. I gave the instructions to the chief and assistants while I ran through the module with the team and they were able to read through in the same time I gave an in-person training.

Team members that wanted to use Echo mode took more time to understand what they were seeing.

Out of the box preparation of unit
Ready to use?
Has to charge up?
Assembly required?

Unit came to me charged from another dept. so I cannot answer if a purchased unit is charged out of the box yet. No assembly required. Unit is sealed and one piece. Comes with a charger..

Will standard batteries work in a pinch?

No standard batteries that I could tell. Seems to be sealed though would need to get my hands on one again. Charger had a wall charger only. It would be nice to have a plug for truck or other adapter. Supposed to stay charged for long duration but I don't remember their specs.

3 Range options.

Default is long range – how long is long range?

Medium Range – what is the limit and does the range selection alter the view screen

Short Range – Same as above

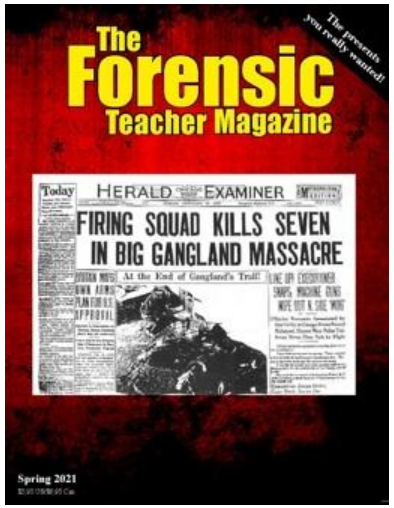
Long range is 50 meters. Medium is 20, short is 10 meters. I believe they said you have to be at least 5 meters in front of unit or it picks up penciling.

View screen does not alter but scan will change. A body shaped target goes from a small dot on long scan up to large oblong shape in short range in Echo mode. In smart mode, the x's and o's do not change size.

Sensor only works if the unit is fully submerged.
Does the unit have to be level?

How close does it need to be to the surface to be able to be seen?

How much does water turbidity affect the screen visibility at the surface?
Unit does not need to be level. Beam moves in horizontal beam from front of unit so the unit can



http://www.theforensicteacher.com

"target" or point at objects. Screen is not backlit so there must be light to see screen. We used it between 2 inches below water and 3 ft.

The unit scans with the trigger continuously held. How much does the user speed effect results

Scanning

Movement of the AquaEye from left to right and speed of movement is key to good scan. Device shows if there are "gaps" in the scan due to moving too fast. This was the biggest learning curve but since the device did give feedback, this helped.

Learning curve to get scan speed and angle correct?

See above about scanning speed. With the feedback of the unit the searchers were picking out targets within first 2-3 scans. Searching submerged objects took some more time than others but all searchers found targets same day of the trial run.

Use of Echo mode took much more time. Some searchers took to this easier than others, probably due to prior experience with reading scans from sonar.

Sonar angle effect from a beach.

How effective at distance and sloping contour bottom?

How effective with debris field in between unit and victim?

Depending on how quickly the bottom sloped, multiple scans were required to "find" bottom. Knowing the device sends a beam or pulse helps visualize how the beam will travel and adjust angle of scan.

Debris field is an issue. If the target is behind large objects or in the middle of brush, we had an issue locating. AquaEye confirmed our suspicions that the target was in the shadow of the other objects. Their example is a flash on a camera. Flash will not light up area behind a boulder or tree, so searchers had to adjust their search position to make sure they searched all areas.

When target was in between brush, if we shot from above directly down, we found the target. When shooting from shore we had some difficulty so had to change positions to get a good scan.

Sonar angle from deep water.

How effective if used in deep water to scan deep or deeper water?

How easy to use while treading water?

How easy / effective if holding the side of a boat with the user in the water?

Can it be used from the boat without jeopardizing the user (falling in)

We scanned from a floating dock directly down into the water at 60 feet depth. Target was identified within 2 scans. We were told the unit can hit objects as deep as 100-120 feet but we did not test this.

Unit is slightly positive buoyant so treading was easy from a function standpoint… however, if trying to direct a diver to the target, we had issues because it is assuming you are shooting from a static position. Unit has a compass or bearing indicator that indicates where you were point when you started your scan. If you have moved locations your starting point will be different than original scan and can throw the searches off

Heat map display of scanning area

Does scan range effect heat map?

What they call a heat map is a misnomer. It is a density scan of the water and objects in the water. The heat terminology is a holdover from their development days and they stated they will be updating.

There is a learning curve. Some basic knowledge of scans or sonar helps. If someone has not seen a scan like this they had difficulties at first and were better off sticking to smart mode.

The background is black. Depending on the density of the objects it went from green /blue/ yellow / orange / red / in order of density. Scan range does affect the map.

A body at short range appears much larger than a very small blip at long range. Searchers had to be aware of this and we would start in medium range if we could as best of both worlds, but if we were in long range, we had some difficulty seeing the body size target vs. a submerged van. This definitely took some time to get used to.

Section Scanning

How necessary in low or no debris area?

How necessary in medium debris area?

How necessary in high debris area?

In a low debris area we hit the entire area in one sweep and identified all targets in the area. This was very quick and easy.

In low/high debris areas, we found depending on what the debris was, if it was roughly human size the smart mode picked it up as a possible "more likely" target or did not pick up anything at all due to shadowing effect. For this reason we split searches into smaller areas and scanned from 2-3 angles to get a good scan.

Repeating scans is recommended – how much time does it take to learn the proper angle, speed and heat map settings in order to get consistent results in different environments?

This was very much up to the user. For the ones that were patient, they were getting good scans in a few sweeps and by the end of the day they were consistently getting results. We have a few people that didn't "get" it and had problems throughout the day. They were ones I had issues with teaching things like dive tables or other tech oriented lessons in the past so this may just not be in their area of expertise. The more we'd use one the more I think the team would be comfortable with it.

Unit only works in Line-of-Sight.

Is it apparent if there is something blocking the signal or does that require more learning curve?

The recommendation is to move to a different location to "see" past an object. How much time does it take to determine the scan is blocked? If there are multiple objects, can the unit discriminate enough for the user to know how far to move?

If necessary to move, does the display offer enough feedback to know which direction to move?

In dealing with shadowing, we used a cargo van for a test object. We wanted to see if a target is behind the object, or directly in front of it (resting against the object). If the target is behind the object, we did not get any response in smart mode.

Smart mode was looking for a body shaped target to locate. We did the sweep twice then move to Echo mode and performed the test. The van appeared in echo mode as a large white mass. When we moved to the side of the mass, we located the target. SOP may dictate 2 smart scans followed by an Echo scan to identify problems like this.

In dealing with the victim resting in front of the van, the smart mode did not pick up the target as the person blended in with the object. We moved to smart mode and did scan again. The van was seen but no body.

We moved the person out until we could locate them. Final estimate was body should be 3-4 ft away from object for sonar to detect them.

Our thought was that if a mass is located that may be hiding the target and no other viable targets located, treat the large mass as a potential search area and send a diver to investigate.

Other than drying it off and keeping it charged, are there any maintenance issues or storage issues that may need to be addressed?

No maintenance issues. Device seemed to be sealed. Company offers a yearly service option to send a loaner unit to team,

take unit and update firmware and any maintenance and return.

In shallow water (within depth limits of the unit) can it be diver deployed and lead a diver to a target?

This was our hope but unit is only waterproof to 15 or 16 ft. I can't remember exact. A freediver may be able to do this but no diver based searches. This was one of our recommendations to update future units to allow for this.

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AquaEye Review / PSDiver Tests and Questions

Oceanside Fire Department
Lifeguard Division

How easy to use out of the box?

Grab and Go?

The Aqua Eye unit needs to be charged via the charging dock to retain battery life for storage and deployment. May arrive with partial battery power.

Read ALL the instructions?

I recommend reading all instructions on any equipment that may be used for operations. To obtain optimal performance, user must have proficient knowledge of system and applications.

Test trainings have included a full manual review with Test Group A and a 60 second verbal instruction on use with Test Group B. Each test group was able to perform a proficient scan and locate the test target within a negligible time from each other.

Quick glance at pics enough?

Learning capabilities may vary among personnel. Manual illustrations are very well done and some may be able to understand by illustration alone. Train at lowest common denominator.

Out of the box preparation of unit

Ready to use?
Can be immediately deployed with sufficient battery power.

Has to charge up?
Yes. Battery should be fully charged to place in field units/ apparatus.

Assembly required?
None.

Between call storage

Able to set and charge in the back of the truck or trailer?

AC adaptor 120V.

Separate poser to charging station required?

See Above.

Charge on 12v system?

Negative

Will standard batteries work in a pinch?

Negative. Unit is sealed and internal battery must be recharged via charging dock.

3 Range options.

Default is long range – how long is long range?

50 meters

Medium Range – what is the limit and does the range selection alter the view screen

20 meters. No altered view screen.

Short Range – Same as above

10 meters. No altered view screen.

Sensor only works if the unit is fully submerged.

Does the unit have to be level?

No. Sonar beam may be tilted by wrist.

How close does it need to be to the surface to be able to be seen?

Water turbidity dependent.

How much does water turbidity affect the screen visibility at the surface?

Screen may be surface level as long as sensor is submerged.

The unit scans with the trigger continuously held.

How much does the user speed effect results?

User speed may negatively impact scans. Feedback bar shows gaps in scan when user moves too fast.

Long Range Scan?

Approximately 60 seconds for scan 180 degrees.

Medium Range Scan?

Approximately 60 seconds or less for scan 180 degrees.

Short range scan?

Approximately 60 seconds or less for scan 180 degrees.

Learning curve to get scan speed and angle correct?
Users were able to follow feedback bar on first use and obtain complete scan.

Sonar angle effect from a beach

How effective at distance and sloping contour bottom?

Used at boat launch for test. Slope not an issue at scan locations from dock and water edge.

How effective with debris field in between unit and victim?

Obstacles did not present on scan between test victim and unit. Concrete and wood piles did not show or presented with an "O" mark opposed to "X" for test victim.

Sonar angle from deep water.

How effective if used in deep water to scan deep or deeper water?
Unit only tested at surface and at 10ft of depth. Scans were effective shooting up the slope and down the slope.

How easy to use while treading water?

Unit has positive buoyancy. Very easy to scan while floating at surface. User's water ability will factor.

How easy / effective if holding the side of a boat with the user in the water?

Stability is important. Unit easily managed with 1 hand. Surface conditions may increase difficulty with rise and fall of vessel/ surf/ wake.

Can it be used from the boat without jeopardizing the user (falling in)?

Unit can be used over the gunwale. Fixed position needs to be maintained for distance and direction to target.

Heat map display of scanning area

Learning curve?
Easy. Helps confirmation of target density.

Ease of interpreting?
Easy. Intensity of sonar signal shown in color scale.

Background differentiation?

Black, blue, red, yellow, white color range from low to high respectively.

Does scan range effect heat map?

Yes. Switching to shorter range to increase display resolution.

Section Scanning

How necessary in low or no debris area?
How necessary in medium debris area?
How necessary in high debris area?

Sonar algorithm is specifically tuned to the density of a body. Not all submerged objects may provide target/ obstacle. Section scanning works well to confirm initial target hits.

Repeating scans is recommended – how much time does it take to learn the proper angle, speed and heat map settings in order to get consistent results in different environments?

Standard scanning methods have been used in surf, harbor, and pier areas. Consistent results found. Very little learning curve. Area familiarization and training with unit should be done at high probability locations. Knowing your area greatly improves efficiency of user.

Unit only works in Line-of-Sight.

Is it apparent if there is something blocking the signal or does that require more learning curve?

Not apparent of signal block or shadowing. Changing scan location is recommended.

The recommendation is to move to a different location to "see" past an object. How much time does it take to determine the scan is blocked?

If there are multiple objects, can the unit discriminate enough for the user to know how far to move?
With no target or object on screen in location where a verified submerged victim is, move to new location for scan.

If necessary to move, does the display offer enough feedback to know which direction to move?

No. New scan locations will be limited to environmental boundaries.

Other than drying it off and keeping it charged, are there any maintenance issues or storage issues that may need to be addressed?

None experienced. Assume wet and or extreme heat/ cold may create charging issues per all electronic devices.

In shallow water (within depth limits of the unit) can it be diver deployed and lead a diver to a target?

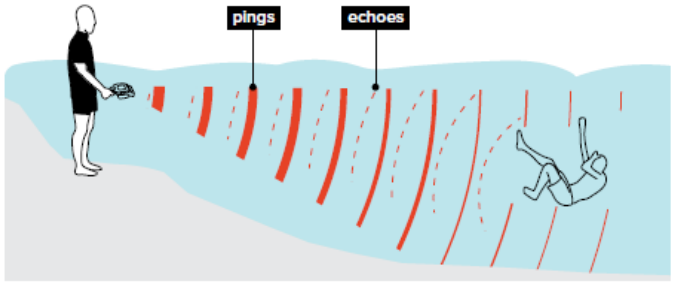
Yes and tested in 10ft fsw. Current Gen 1 unit is rated to 15 ft depth. Feedback to the company has already been made to increase depth rating to improve for scuba capabilities.

Lieutenant Blake Faumuina
Oceanside Fire Department
Lifeguard Division
301 N. The Strand
Oceanside CA, 92054

AquaEye®
Sonar Explained

AquaEye® uses active sonar to locate its targets.

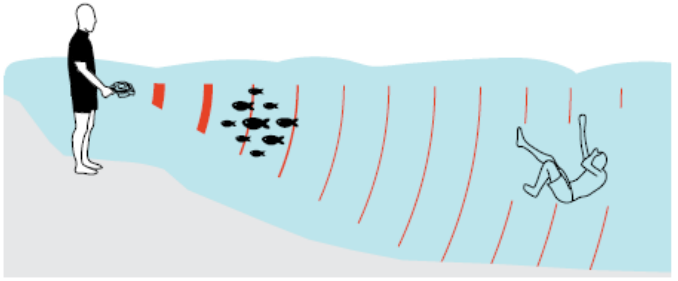
Active sonar works by sending out **pings**, bursts of sound underwater, and by listening to **echoes**, the sounds produced when those pings hit features underwater (e.g. rocks, vegetation, soil, sand, air and crucially people).



SONAR WEAKENS AS IT TRAVELS

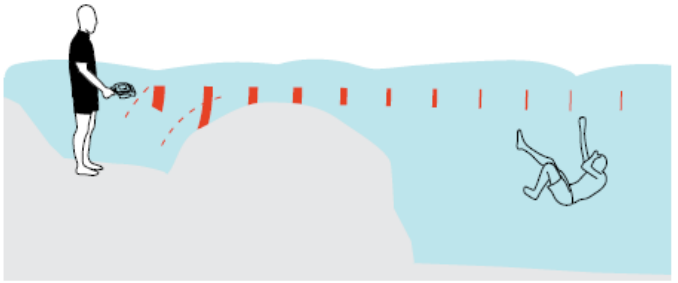
Pings produced by AquaEye® travel outwards, spreading over an increasingly large area. As pings travel, they get weaker: the further the object, the weaker the echo.

For support, contact VodaSafe at: support@vodasafe.ca



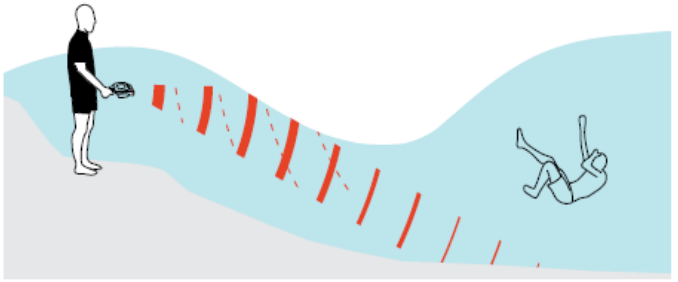
SONAR IS DAMPENED BY SMALL OBJECTS

Small floating objects (e.g. algae, suspended sediment, schools of fish etc...) can dampen the sonar pings as they move through the water. This results in weaker pings and weaker echoes being returned to AquaEye®.



SONAR CANNOT PASS THROUGH SOLID OBJECTS

Solid objects stop sonar pings in their trajectory. Pings bounce back from these solid objects, obscuring any targets directly behind them. Any obscured targets will remain undetected.



SONAR CANNOT PASS THROUGH AIR

AquaEye® must be fully submerged, and not surface, during use to effectively send pings and receive echoes, as sonar cannot pass through air. Similarly, large wave troughs or aerated water in turbulent conditions can significantly weaken or obstruct sonar pings.

AquaEye Review for PSDiver Magazine

Tony Reigle
Chief, Water Safety Division

Out of the box preparation of unit.

Ready to use?

Has to charge up?

Assembly required?

We used a demo version provided to us, ready to go. We have not received our own directly from the manufacturer yet, so we cannot answer the above questions accurately at this time.

Between call storage.
Able to set and charge in the back of the truck or trailer?

No

Separate charging station required?

Yes, and provided with unit.

Charge on 12v system?

Yes

Will standard batteries work in a pinch?

No, this unit is sealed, with no removable battery. One of the fundamental design flaws of this unit is the charger. It is a slim, flat charger that the unit simply lies on, similar to the newer wireless charger tech for smartphones. With that said, it does not lock in; therefore, if the charger is hung in a truck or trailer, the unit would not stay on the charger. Secondly, the charger itself is too slim. If you place the charger on a flat surface, and attempt to seat the unit flush on it, it will not charge due to the handle of the unit being longer than the underside of the unit needed for charging. To ensure the unit properly charges, the handle of the unit has to be over the edge of the surface/table so that the unit is able to sit flush. This creates a significant "snag" or "bump" hazard for the unit. Added to the fact that the unit does not lock into the charger, even securing the charger to the surface would still mean the unit could be bumped off accidentally. An option would be to "build" the charger up by finding wood or other material to raise it off the surface.

Sensor only works if the unit is fully submerged.

Does the unit have to be level?

Varies, see longer explanation below

How close does it need to be to the surface to be able to be seen?

Depends on water visibility

How much does water turbidity affect the screen visibility at the surface?

If there is no visibility, then unit would have to be taken out of the water to review screen/data.
The unit itself does not require it be to "level" to work. The scan "cone" will be the "cone" regardless. However, that "cone" starts straight out from the unit,

so, if you have it at an angle without knowing it, you could miss parts of the water column. We have made a request that there be an indicator added on the screen to give the user this immediate feedback… degree of up/down angle, so that we can more accurately know what depths of the water column have been scanned. This is quite critical as you may need to do 18 ft "sections" at a time in water depths of 30, 50, 100 ft. Without that indicator, there is no other way to know the angle. It would all be by "feel" of the user, if they feel they had it straight or not. Then, when we are purposefully trying to angle to down to scan at depth, we would not be able to measure, record, provide accurate data. The angle up and down indicator is a must have for those operating in depth.

The unit scans with the trigger continuously held. How much does the user speed effect results?

Long Range Scan
Medium Range Scan
Short range scan?

Speed affects results at every range. There is an indicator on the unit that fills in as the beam successfully returns to the unit. If the indicator is filled in at any given angle from left to right, it means a successful scan. If the indicator has gaps in that bar, then it means the beam did not successfully return to the unit at the angle of where those gaps are. This means that the user cannot accurately say there is or is not anything of interest at that given angle. In this instance, the user would need to rescan.

Learning curve to get scan speed and angle correct?

See above two comments. Scan speed, yes there is a learning curve to get comfortable with the slow scan speed, but at least there is immediate feedback if you are scanning too quickly and that a user needs to rescan.

Much easier learning curve. Without the up and down angle indicator, though, the learning curve for how level the unit is, and purposefully angling it for greater depths is much larger, and much more inaccurate.

Sonar angle effect from a beach

How effective at distance and sloping contour bottom?

How effective with debris field in between unit and victim?

Contour and debris both impact the effectiveness of the scan. The beam can only go straight out from the unit, so if there is a contour, the beam will not catch things in pockets or holes. You would not be able to know that is was happening by simply looking at the Xs and Os screen. However, this is where the ECHO map is helpful because it will show intensity of the bottom, then none when there is a drop in depth. We saw this in action when demoing our unit. The ECHO map showed an intensity range of roughly 10 feet and then nothing. This was because of a known drop off in that area. Once we walked out that 10 feet, and rescanned, we had a much more accurate and long range scan because we were actually capturing the

bottom after the drop off. This would be similar with debris.

If there is a large object(s), the beam would not be able to move around/over it. Instead the beam would be blocked. Again, this would not be known if only looking at the Xs and Os screen. Once switched to the ECHO map, there would be a noticeable absence of intensity behind the debris, suggesting that something was blocking the beam. Noting that intensity goes x amount of feet out, and then stops, would give you the distance of that object. This would inform needing to reposition and rescan from different angles.

Sonar angle from deep water.
How effective if used in deep water to scan deep or deeper water?

It is effective once you understand the scan "cone". Again though, while the scan beam itself is effective within that "cone", not having an indicator for how much the unit is angled makes it very challenging to accurately understand and record what is occurring at what depths.

How easy to use while treading water?

We demoed this in still lake water, and it did not seem to be a significant concern, due to the user being able to stay mostly stationary. Having the user in still water in high wind conditions, or in moving water would have a significant impact on effectiveness of the scan and being able to interpret the data correctly to determine distances, as well as interpreting the ECHO information.

How easy / effective if holding the side of a boat with the user in the water?

Effective, though important that the boat be stationary (anchored) so that there is a good starting reference point for interpreting the data (i.e. distances, etc.).

Can it be used from the boat without jeopardizing the user (falling in) .

Same as above, effective, though boat should be stationary (anchored). We demoed the unit extensively in this scenario as this is the one that our team would likely use the most. We used inflatables, so the user was not leaning "over" the side, but rather laying in the boat and able to reach across the gunwale.

Heat map display of scanning area.

Learning curve?

Yes, the learning curve for the ECHO map is much larger than with the Xs and Os. Understanding what the ECHO map tells the user is so critical, to actually makes this unit more valuable to our particular team than the Xs and Os. There are many things that throw the algorithm off, and thus, ruled out.

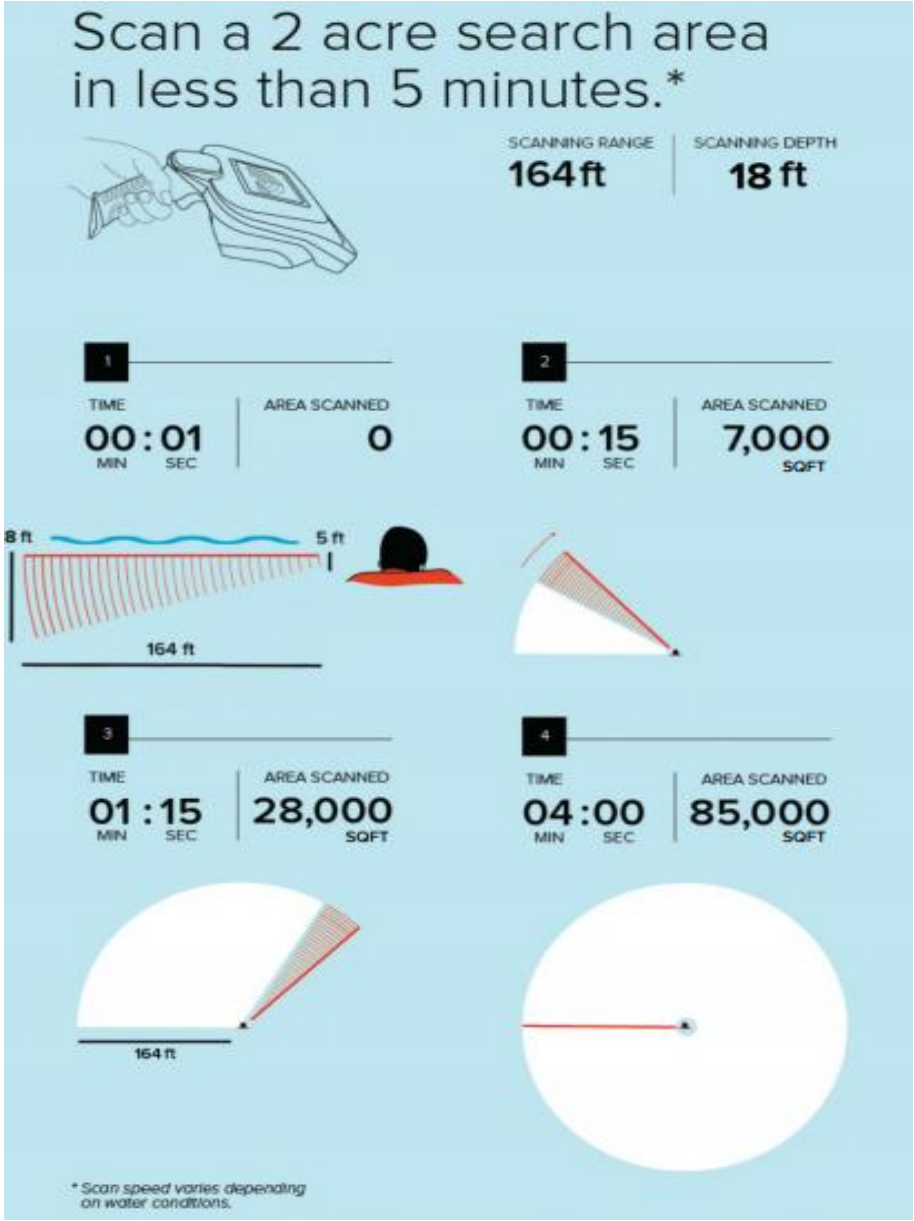
The algorithm is looking for something that has the density likely to be a body. This means it will rule out bridge piers, cars, large logs, etc. This would mean nothing on the Xs and Os screen.

However, on the ECHO map, there will be high intensity coloration. When we demoed this on a

bridge pier, there were no Xs due to it being too large for the algorithm to think it could be a body.

However, switching to the ECHO map, we saw a long straight high intensity (white) line. This would be the case for a car as well. There would be no Xs or Os, but a review of the ECHO map would show a long high intensity line. We also found this to be true when we sank a diver. It is likely that the material of the wetsuit impacted the scan. This was told to us when we were trained on the unit, that specific types of materials could confuse the algorithm.

At certain angles, the scan was also likely hitting the side where the diver's bubbles were. We were able to get an X for the diver around 60-70% of the time. However, we had a high intensity dot for the diver on the ECHO map 100% of the time.



Ease of interpreting?

It is critical to understand what the Xs and Os are telling you, why data might not be interpreted by the algorithm, and how to use that in conjunction with the ECHO map. I strongly believe that this is a critical determining factor in whether the unit is viewed as successful with any particular team. In the functionality aspect, in still water, with no significant variations in the bottom, or debris, it could be a pull directly out of the box, pull the trigger, and get an X that turns out to be the body.

However, in more complex settings, with more complexity in types of water, bottom contour and makeup, depths, and debris, a proportionately complex

understanding of the unit, the algorithm, and the ECHO map will make the unit a valuable addition to other technology.

Background differentiation?

See above comments

Does scan range effect heat map?

You cannot scan in ECHO. Scan is only done in the Xs and Os screen.

Surf Zone / Aerated water use?

The unit is not effective in aerated water. We have a low head dam in our first due that we were hopeful this could provide valuable information from a safe distance. However, the aeration of the boil impacts the functionality of the unit.

Section Scanning.

How necessary in low or no debris area?

Less necessary depending on size of low debris field.

How necessary in medium debris area?

More necessary, again depending on the size of the debris or debris field.

How necessary in high debris area?

Likely to be very necessary to ensure scanning behind debris depending on the size of the debris itself, though, a body entangled in it could be ruled out by the algorithm. It is looking for density that would likely be a body. Therefore, a body entangled or wedged against a large rock or log would be missed by the algorithm.

Repeating scans is recommended – how much time does it take to learn the proper angle, speed and heat map settings in order to get consistent results in different environments?

See previous comments. Ensuring complete scans is fairly easy, as the indicator gives you immediate feedback. If gaps are noted, it is easy to restart the scan. The absence of an up/down angle indicator makes using the unit a lot less accurate. For use in active investigations, more specific data and certainly is needed than the lack of this up/down angle indicator allows.

Unit only works in Line-of-Sight.

Is it apparent if there is something blocking the signal or does that require more learning curve?

This will not be discernable from the Xs and Os screen. It will take a high level of understanding the ECHO map and related technology/data to understand how the ECHO map can inform if there is an obstruction.

The recommendation is to move to a different location to "see" past an object. How much time does it take to determine the scan is blocked?

With the right degree of knowledge, one scan and review of the ECHO map would inform a user that there is an obstruction. A second scan to confirm

would be recommended and standard procedure for our department.

If the data is the same on both scans, we would determine there is an obstruction and we would scan from different angles – i.e., from shore outward, and from outward back in towards shore; pointed upstream, and pointed downstream.

If there are multiple objects, can the unit discriminate enough for the user to know how far to move?

If the objects are separate from each other, multiple Xs or Os will appear on the screen, as well as intensities on the ECHO map. Xs are able to overlay each other as well, indicating multiple objects in close proximity.

If necessary to move, does the display offer enough feedback to know which direction to move?

The display offers an indicator that moves as the unit moves from left to right. As long as the user remains stationary (again the importance of a user treading water or a boat to be stationary/anchored), then the user can move that indicator back to line up with the X or O, and determine distance out from the user.

There are some concerns that we expressed and requested modifications. The indicator moves in terms of angle, so from the user to the starting point (trigger pull) is 0 degrees; halfway scan is 90 degrees; full scan is 180 degrees. Since divers do not work in degrees, but rather with a compass, we have requested that the unit incorporate compass readings instead of degrees of angle to the user.
Until this upgrade occurs, our department will have the user wear a compass watch as they scan to relay compass readings rather than degrees of angle to divers.

We also requested GPS to be integrated so that we can use waypoints for starting position. Until this is upgraded, our department policy will be to use other technology to mark a waypoint prior to starting a scan, so that if we had to return to that spot, provide that information to the DA's office, etc., we could replicate it. Without that GPS data, without compass readings, and without an up/down indicator, it would be very difficult to replicate a scan exactly as before; and this is problematic from the perspective of our frequent collaboration with law enforcement during criminal investigations.

Other than drying it off and keeping it charged, are there any maintenance issues or storage issues that may need to be addressed?

Not that we are aware of.
In shallow water (within depth limits of the unit) can it be diver deployed and lead a diver to a target?

This is an additional area we requested modifications. Currently, the unit is one scan and done. Once you pull the trigger away, the data from the previous scan is lost; even an accidental bump of the trigger when handling the unit or passing it around would mean the

loss of valuable data; and requires visibility of the screen in order to interpret that data.

So, what does this mean for divers and scenes with a large command structure that wants to be involved in interpreting data? It means challenges. The current scenario… diver descends to 3 feet, no visibility, pulls the trigger one time; unit runs the algorithm. In low to no visibility, the diver would not be able to see Xs or Os that the unit initially captures while still holding the trigger, and then disappear once the trigger is released (allowing the algorithm to run). The diver would need to surface after every scan so that surface ops can review the data.

If something of interest, surface ops would have to go to shore each time the diver surfaces to allow command structure to review and determine a plan of action. You can understand the amount of time, energy, air, etc. would be needed to go back and forth, up and down, one scan at a time.

We were told there is an upgrade in works that would include the ability for the unit to recall the last 5 scans. This would definitely help reduce the amount of up and down by the diver and back and forth to shore from surface ops. There is also talk about integrating the unit with an extendible pole so that surface ops could read the screen/data even when the unit is down in reduced to no visibility; using comms with the diver.

What improvements could be made to the unit?

In summary, our big asks and what we believe would be significant upgrades to allow this unit to be successful in more challenging settings:

1- A more secure/locking charger that would allow the unit to be charged safely on a flat surface, rather than having to hang over the edge.

2- An up/down angle indicator so the user knows how much they are angling the unit for a much more accurate representation of what sections of the water column were completed during any given scan.

3- Compass headings rather than degree of angle for the position indicator.

4- GPS to mark the start point for ease of returning/replicating.

5- Save feature for recent scans to allow data to be reviewed for more than just most recent scan.

6- Integration with a surface ops monitor if being used in depth with no visibility**.**

Tony Reigle
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VRSR Type 2a Team Leader
Chairman of the Board
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"We'd rather save than search!"

AquaEye Response to PSDiver Questions

How easy to use out of the box?

Grab and Go?

AquaEye is designed to be a grab and go water rescue and recovery device.

Read ALL the instructions?

Quick glance at pics enough?

- All of our customers receive basic use training and resources for training support are available on-line (video's and photos). VodaSafe's customer success team is available to provide training to address common hazards found within our customers search area.

Out of the box preparation of unit

Ready to use?

AquaEye is shipped ready to use and does not require calibration or setup prior to use.

Has to charge up?

Shipped ~30%. VodaSafe recommends charging.

Assembly required?

No.

Between call storage

Able to set and charge in the back of the truck or trailer?

Yes, subject to temperature. Recommended storage temperate is between 50F to 95F

Separate power to charging station required?

The unit charges with a provided charging dock plugged into a standard 120V outlet.

Charge on 12v system?

The AquaEye does not come with a 12V charging converter, however a standard 12V charge in a truck ("cigarette lighter" 12V supply) can provide enough

Note from the Manufacturer:

As the manufacturer of AquaEye we are very pleased to receive such honest feedback from the safety diver community.

As a water rescue technology company, we strive to capture feedback from water rescue professionals and incorporate this into our future product designs.

We want to help transform water rescue and make technologies that help safety divers.

There are a few notes on Bluetooth connectivity throughout the reviews. We would like to provide clarity on Bluetooth.

AquaEye does contain Bluetooth connectivity; however, there is no current release for an application to link AquaEye to a device such as a phone or a tablet.

The feedback provided in these reviews is with our R&D team, who will strive to create the best product possible for current and future customers.

power to charge the AquaEye unit.

Will standard batteries work in a pinch?

No. Unit is sealed, batteries not accessible.

3 Range options.

Default is long range – how long is long range?

50 meters/164 ft.

Medium Range – what is the limit and does the range selection alter the view screen

20 meters /66ft– screen will read Medium range and adjust hash mark.

Short Range – Same as above

10 meters/33ft – screen will read Short range and adjust hash mark distances.

Sensor only works if the unit is fully submerged.

The sensor must be submerged to function.

Does the unit have to be level?

No, but the user must be aware of where they are pointing (down for deeper scans, flat for surface scans) to correctly identify the depth of the target.

How close does it need to be to the surface to be able to be seen?

Varies depending on water visibility, the screen is backlit for visibility in dark or murky environments.

How much does water turbidity affect the screen visibility at the surface?

Turbidity is the most significant factor in determining screen visibility. As a user gains experience with AquaEye they are able to perform scans without viewing the screen.

As it is recommended that AquaEye be submerged a

2+ inches deep, most scanners are sensitive to turbidity reducing visibility below 3".

In calm environments, more experienced users can get quality scans with the screen barely submerged, nullifying the effect of turbidity on screen visibility.

The unit scans with the trigger continuously held.

Correct

How much does the user speed effect results –

Greatly. The scanning feedback bar provides a visual scan pace guide to ensure the scanner is not moving too quickly and will produce gaps when the scanners pace is too fast. Observe feedback bar (and reference ou**r feedback bar gap explanation guide)**

Long Range Scan – one gap at 50m, **possibility of missing a person entirely.**

Medium Range Scan – one gap at 20m, ½ of a person

Short range scan? – one gap at 10m, ¼ of a person

Learning curve to get proper scan speed and angle?

30 minutes training (from a beachfront to get started)

Sonar angle effect from a beach

AquaEye's beam is shaped to cover most beachfronts in a single neutral scan. Beaches with a steep drop-off may require additional angled scans or for the user to reposition to ensure underwater line of sight (if for instance there are sand dunes or boulders blocking the sonar beam's path).

How effective at distance and sloping contour bottom?

Effective if operated by a trained user.

How effective with debris field in between unit and victim?

Debris can make scanning more difficult. Echo map can be used to identify alternative scan angles based on debris field.

Sonar angle from deep water.

How effective if used in deep water to scan deep or deeper water?

AquaEye is effective at identifying targets within its fan shaped beam. In deep water, multiple passes, at different angles, may be necessary to cover the full volume of water.

How easy to use while treading water?

See training video for scanning techniques. More difficult than standing or on a dock and requires more practice but is well within the capabilities of an experienced diver and AquaEye scanner.

How easy / effective if holding the side of a boat with the user in the water?

Likely more difficult then treading water due to motion of the boat. Also, in moving water, having one hand to scan AquaEye and the other to stabilize the unit can be advantageous.

Can it be used from the boat without jeopardizing the user (falling in)

This is boat dependent. Generally, if you can comfortably submerge your hand off the boat, you can operate AquaEye

Heat map display of scanning area

Learning curve?

The learning curve ranges from easy (environments with distinctive features, such as the straight edge of a dock or a series of pillars) to moderate (environments with irregular debris fields).

Ease of interpreting?

When used in conjunction with the target map display, the data can be interpreted very quickly with appropriate user training.

Background differentiation?

The Echo map can be used for background differentiation, especially when a user has scanned the target area previously.

Does scan range effect heat map?

The echo map is available up to the range that you originally scanned in: Ie. A medium range scan has visible medium and short-range echo maps, but no long-range

How necessary in low or no debris area?

How necessary in medium debris area?

How necessary in high debris area?

Section scanning (ie. Scanning only a portion of the 180-degree scan range) is not necessary in low-no debris areas. In medium and high debris areas or in moving water, a 60–90-degree sections may be preferable to full 180-degree scans.

Repeating scans is recommended – how much time does it take to learn the proper angle, speed and heat map settings in order to get consistent results in different environments?

30 minutes of training.

Is it apparent if there is something blocking the signal, or does that require more learning curve?

Echo map can indicate whether a large mass has been identified – user can assume there is a sonar shadow produced behind identified object and should re scan from a different location.

The recommendation is to move to a different location to "see" past an object. How much time does it take to determine the scan is blocked? If there are multiple objects, can the unit discriminate enough for the user to know how far to move?

Checking the Echo map for large objects will inform the user if they need to move. Within 2 minutes (or less for a 90-degree scan segment) echo map will identify objects blocking the sonar echo.

If necessary, to move, does the display offer enough feedback to know which direction to move?

Yes, the echo map will determine the location of the object that may be blocking the signal.

Other than drying it off and keeping it charged, are there any maintenance issues or storage issues that may need to be addressed?

Should not be stored outside temperatures of 10-30C, recommendation: room temperature is best.

In shallow water (within depth limits of the unit) can it be diver deployed and lead a diver to a target?

Yes.

Additional Questions:

Why does the unit have to be returned to Vodasafe to have the battery replaced? In your maintenance agreement, you estimate the lithium batteries will lose about 30% of the functionality through 100 cycles. Is there any reason to assume that the unit will require a replacement within your prescribed maintenance schedule?

Lithium batteries usually maintain 80% of their charge over 300 charge cycles. However, because this product is to be used in outdoor environments, and we also cannot ensure our customers will avoid extreme high or low temperature use cases, we are assuming the battery will undergo stress and are erring on the side of caution because AquaEye is a rescue device.

The maintenance program can continue for as long as the customer wishes or until we discontinue the product. The first 2 years are covered by $750. After that, customers can choose to continue with an annual fee of $750. We suspect that sometime around year 3 their battery may degrade to the point that a replacement will be needed. It will of course be up to the customer if they wish to have it replaced, but if we perform a battery test and report back that the unit will not sustain an 8-hour search for the next year of use, we will advise that the battery be replaced.

At 12 months are teams supposed to sent it back in for servicing?

Customers registered for maintenance will be notified every 12 months that they are due for servicing. If they wish to partake, they will be sent a loaner unit while their unit is serviced. Some customers operate only in summer months and will not require a replacement during servicing throughout the winter, but a loaner unit will be an option.

They have to pay you 750.00 for a maintenance plan fee to have servicing done or a flat 500.00 if they cannot afford or chose to not pay for a maintenance plan?

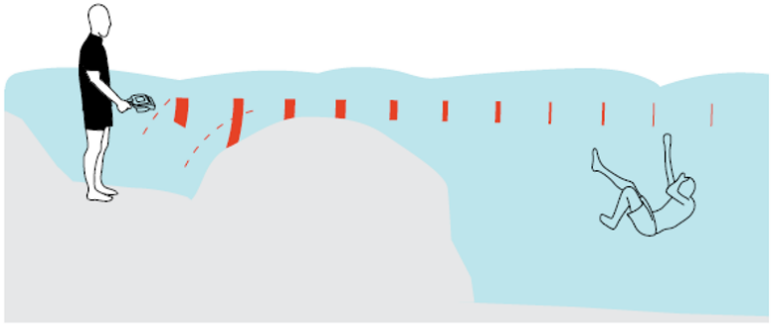
Customers can either pay $750 or opt out of the maintenance plan. The $500 flat rate is if they require MORE than the 1 servicing in 12 months. For instance, if we have already performed the annual servicing and they opted not to have a battery changed, or mistreated the unit and are looking to have something replaced, they can choose to pay for an additional servicing.

How often does a unit need to be calibrated? Why, if it is a sealed unit, would it have to be recalibrated annually?

AquaEye is a rescue aid, and because we cannot control how customers will treat their units (for instance, will they follow the storage temperature allowance?) we feel it would be good customer service to ensure calibration is correct. We want to help find targets and ensuring calibration settings are sound will help our customers do their jobs effectively. However, if customers do not wish to have a unit maintained they do not have to.

If you were to do ANY of the revisions that have been proposed by teams, it will make the 1.0 version obsolete. Not that I would expect any team to pay a continued maintenance fee year after year for a tool which I assume will be used infrequently by a Public Safety Dive Team, but if they did and their investment in the technology was no longer viable because of physical updates, would you offer any return / trade-in option?

We are a water rescue technology company and will continue to find solutions that help our customers. We will always support our customers and all customers will have access to customer loyalty programs when new technologies are deployed. This is typically delt with on a case-by-case basis – customer service is a priority for us.



SONAR CANNOT PASS THROUGH SOLID OBJECTS

Firmware updates are covered

under the maintenance agreement.

Am I reading the agreement correctly in that there is only a 7 day warranty and anything longer is via a paid maintenance agreement?

No, the warranty is for 1 year. The 7 days is a grace period, so the warranty is actually in effect for 372 days because we wanted to allow for shipping time from the date of purchase.

If the AquaEye quit working, it should be very apparent. Your "Schedule A" maintenance agreement offers:

Complete operational check - **If it was not working, we would know.**

Complete sonar performance test - **If it was not working, we would know.**

Perform minor repairs - **If minor repairs did not effect the function of the unit, we would not need it worked on.**

Complete calibration testing of orientation sensors and re-calibrate if needed - **Why or what could cause the sensors to require a factory recalibration?**

Check normal operation of all other sensors **- Why?**

Assess battery health - **Why? If your agreement says it will be replaced at a cost to the buyer - why simple assess it? for 750, I would think you could replace it.**

Perform full cycle charge test - ? Battery?

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Many lifesaving and safety equipment providers recommend (and even require) that customers regularly complete equipment maintenance and calibration. As AquaEye is grab and go and used in the field (in harsh conditions), we want to support our customers with a robust maintenance program to ensure heavy use in the field does not have an impact on AquaEye's ability to identify rescue targets. This program was built to address feedback many of our customers provided. Customers often feel more secure knowing that their safety equipment is maintained and serviced regularly to the manufacture's design standards.

As this is a rescue device, the maintenance plan is a way to ensure that field use (and at times abuse) does not impact the unit's functionality. As with all technology, heavy use in the field can cause minor

degradation in performance (which may not easily be detected through field tests), which can be corrected through a regular maintenance plan. It is highly possible that no maintenance will be required, but when it comes to rescue work and the safety of team, we feel it is best to recommend regular servicing.

Software Upgrades.

For version 1.0?

How many of the suggestions for 2.0 can be accomplished by software?

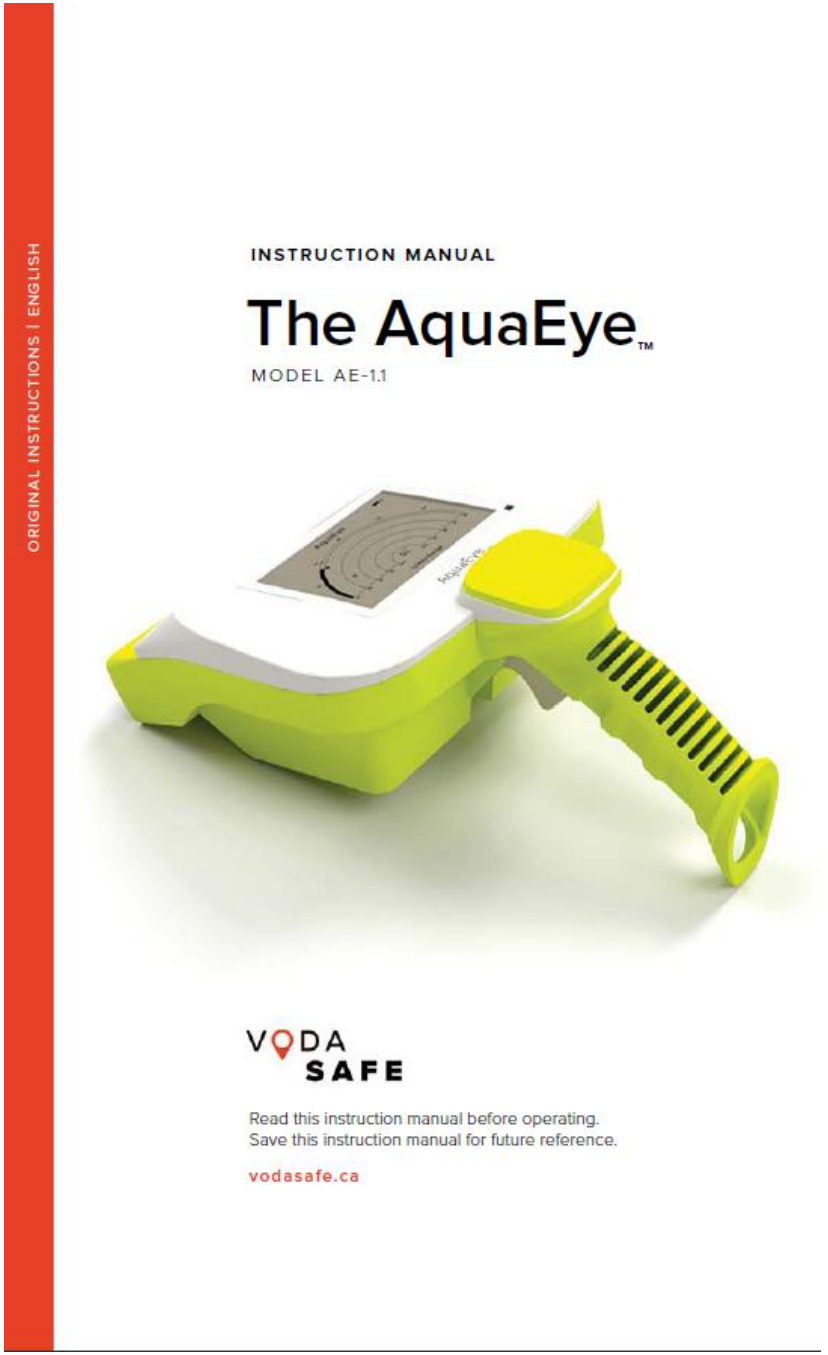
Would you release a 2.0 version or sit on it until the 1.0 version becomes obsolete or inventory is depleted?

What would be a reasonable expectation for a 2.0 version if it is to come?

We will have software upgrades for version 1.0. Many suggestions have come from customers that will be implemented into our current hardware.

As a technology company we always look to improve our current products as well as opportunities for future products. As mentioned before, all customers have access to customer loyalty programs for future purchases.

Thank You! to AquaEye and all who contributed to the AquaEye reviews!



④ Using the AquaEye™

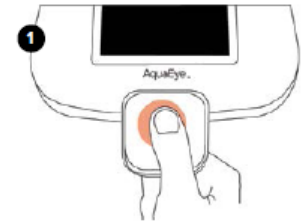
A. TRAINING STAFF AND PRACTICE

In order to use the AquaEye™ effectively, it is imperative that you incorporate its use into your existing emergency procedures and ensure that all staff are well trained on the use of the unit.

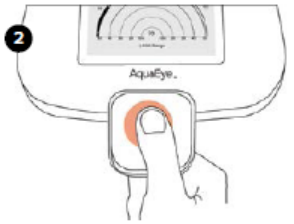
Practicing scenarios will better inform you of your underwater environment and will ensure greater success rates in finding missing persons quickly.

The *Heat Map Display Mode* will support your education of your underwater environment.

B. USE OVERVIEW

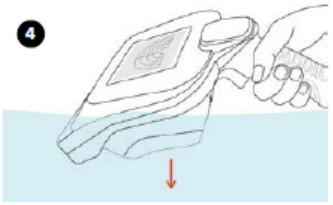


Turn on the AquaEye™

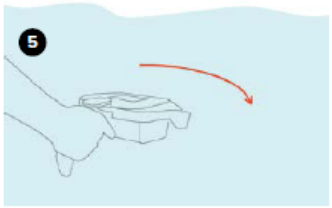


Select the range

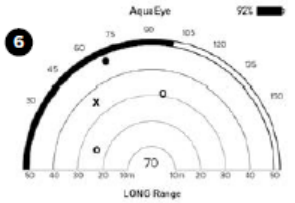
Position yourself in the water



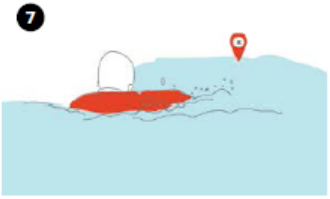
Submerge the AquaEye™



Scan the area of interest



Locate objects on screen

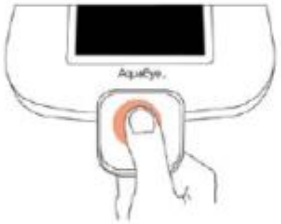


Navigate to located objects

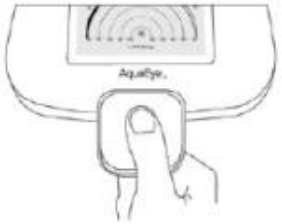
Submerge and recover

C. HOW TO OPERATE THE AQUAEYE™

1 Turn on the AquaEye™



Press the Power/Range button to power on the AquaEye™.



The screen will turn on.

2 Select the range

Press the power/range button to select the scanning range.

Cycle through LONG, MEDIUM, SHORT range options.

The AquaEye™ is set on LONG range as a default.

3 Position yourself in the water

Remain stationary as you hold the AquaEye™ underwater.

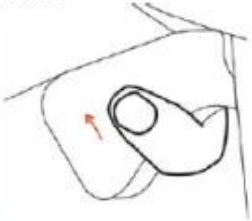
4 Submerge the AquaEye™

Fully submerge the AquaEye™.

5 Scan the area

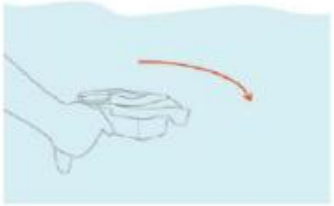
SENSOR SUBMERSION

Keep the unit upright. Ensure the sensor always remains submerged.



TRIGGER USE

Pull the trigger to start scanning. Release the trigger to end scan.



SCANNING DIRECTION

Perform scans from left to right.

INDICATIVE SCAN SPEEDS [PER 90° SCAN]

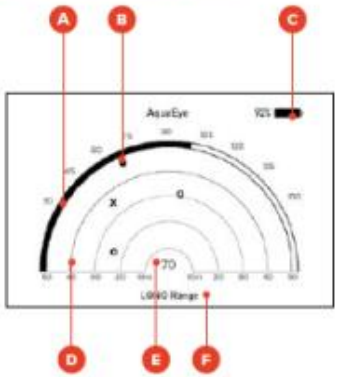
RANGE		TIME
SHORT	[10M]	5 SEC
MEDIUM	[20M]	15 SEC
LONG	[50M]	30 SEC

SPEED OF SCANS

Ensure you are scanning at an appropriate speed by following the feedback from the feedback bar.

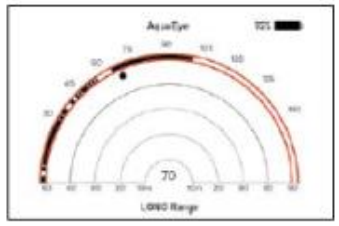
6 Read the screen

ELEMENTS ON SCREEN



A. FEEDBACK BAR
B. LIVE CURSOR
C. BATTERY LEVEL
D. DISTANCE MARK
E. ANGLE INDICATOR
F. RANGE SELECTOR
Long Medium Short

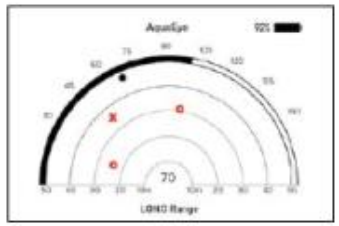
READING A SCAN



Feedback bar

The feedback bar provides feedback on the scan.

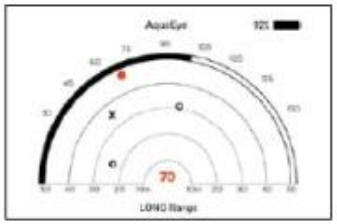
Gaps in the feedback bar show areas that were scanned unsuccessfully. A thorough scan will have a feedback bar fully filled.



X and O

"X" and "O" symbols indicate the locations of masses found in the water.

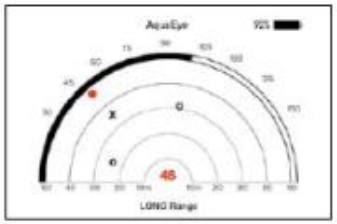
- **X** Has a strong likelihood of being a person.
- **O** Indicates lighter objects that are less likely to be a person.



Live cursor

Upon completion of a scan (by releasing the trigger) the cursor becomes live and acts as a compass.

7 Navigate Rescuer



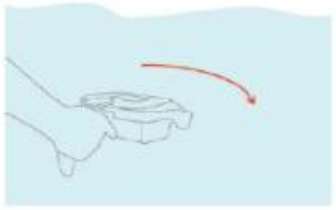
Live cursor alignment

Once the cursor has become live, rotate the AquaEye™ until the cursor aligns with the icon of interest.

Direction to navigate

Swim or navigate in the direction the AquaEye™ is pointing.

Use the distance marks to identify the distance to the object.

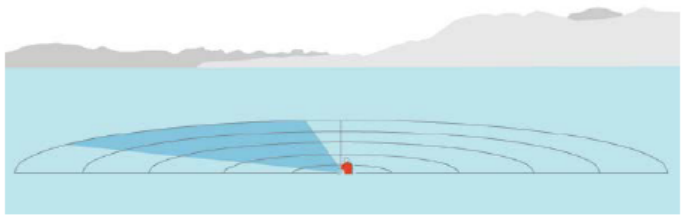


Re-scan as necessary

Re-scan if necessary to triangulate rescuer to object.

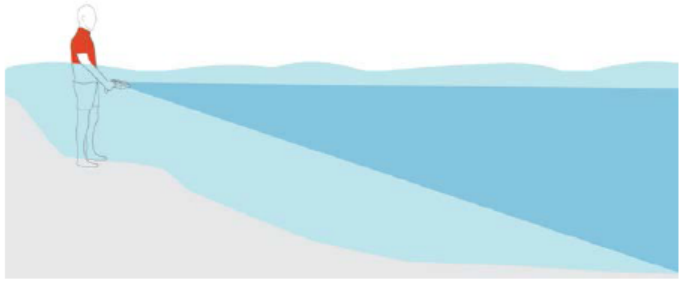
⑤ AquaEye™ Features

A. SONAR BEAMS



Sonar beam reach

The sonar beam reaches up to 50 meters out (in Long Range).



Sonar beam depth

The sonar beam extends approx-imately 5 meters down in neutral wrist position.

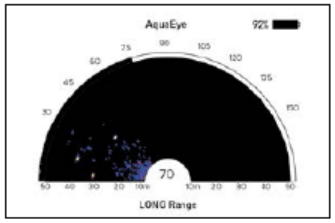
Greater depths can be scanned by tilting the wrist and pointing further down.

B. USING THE HEAT MAP DISPLAY MODE

Once a scan is complete, the display may be changed to *Heat Map Display*. This display mode supports your search in difficult environments by displaying your underwater environment in detailed views.

Switch between modes

Press and hold for two seconds to switch back and forth between *Scanning Mode* and *Heat Map Display Mode*.



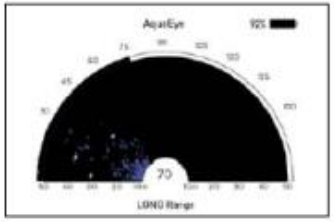
Heat map display

This mode can be used to display the sonar map created by your most recent scan. The intensity of the sonar signal is represented on a colour scale.

This mode is a display mode only. You cannot scan in this mode.

Colour legend

Colours range from black to white, from low intensity to high intensity.

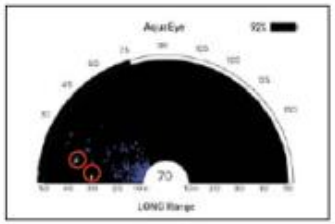


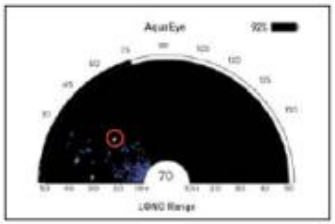
Locating obstacles

The display can teach you about underwater obstacles which may impede the AquaEye's performance.

It may be advantageous to perform scans from a particular location in your swim area based on the obstacles you have identified from the Heat Map Display.

(See "Change Location" P.21)

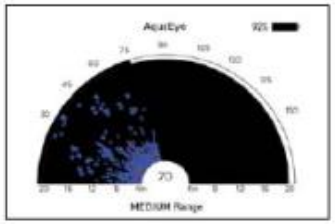




High intensity signals

High intensity signals could be permanent objects in your underwater environment.

If new high intensity signals are displayed at time of scan, they could be potential objects of interest.

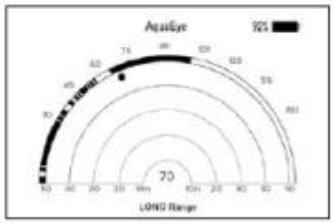


Working in shorter range

Switch to shorter range, as needed, to increase display resolution. This will help you investigate potential objects of interest and better understand your underwater environment.

⑥ Use Scenarios

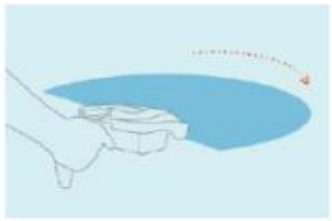
A. THE FEEDBACK BAR IS SHOWING WHITE SECTIONS



POTENTIAL CAUSES

- The user is scanning too fast.

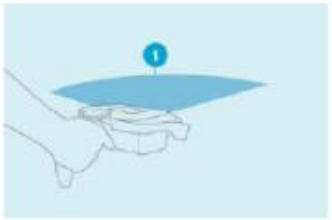
POSSIBLE SOLUTIONS



Scan slower

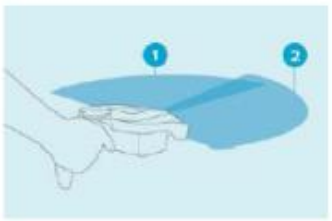
Reduce the speed at which you are scanning and ensure the feedback bar is fully filled.

(See "Feedback Bar" P14)



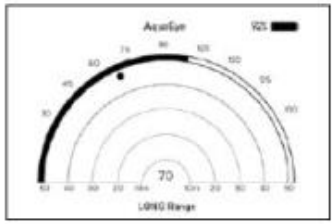
Scan in sections

If it is difficult to maintain the appropriate scanning speed when scanning the body of water, scan in sections.



Scan in sections, covering the same area over multiple scans.

B. THE FEEDBACK BAR IS FULL BUT KNOWN OBJECTS ARE NOT BEING DETECTED



POTENTIAL CAUSES

- The AquaEye™ is angled incorrectly (pointing too far up or down).
- The AquaEye™ is not properly submerged.
- The detection case is difficult.

POSSIBLE SOLUTIONS

Review scan angle

A scan with a poor scan angle (too far up or down) may show a perfectly filled feedback bar, but objects will not properly be detected.

Submerge unit deeper

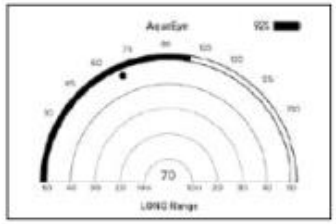
Submerge the AquaEye™ deeper to avoid any surfacing of the unit during a scan.

If the unit surfaces during a scan, objects may be missed.

Repeat scan

Repeat or scan the location of interest from a different location to increase the likelihood that a strong signal is collected and detection is possible.

C. KNOWN OBJECT IS NOT BEING DETECTED

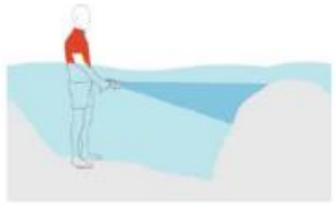


POTENTIAL CAUSES

- A large object is obstructing the AquaEye's line of sight.

  Objects behind large obstacles will not be detected.

POSSIBLE SOLUTIONS



Change location

Large obstacles will obstruct the AquaEye's line of sight. The AquaEye™ can only detect objects within its line of sight. (It will not see through large obstacles.)

Position yourself in another location as to avoid the object of obstruction in your scan.

AquaEye®
How to perform your first scan

To ensure you and your team get the most out of AquaEye®, start with a simple scenario to familiarize yourself with AquaEye's two data displays: Target and Echo Map.

VodaSafe recommends that you follow this guide and contact us if you need any support to get your team up and running.

WHAT YOU NEED

- 1 AquaEye®
- 2 People

WHERE TO SCAN FROM

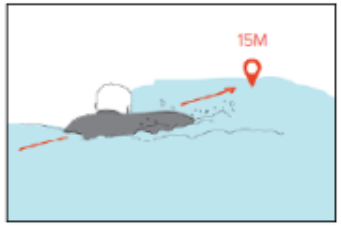
Scan from a dock or while standing waist deep in the water.

A stable environment will allow you to scan easily and observe results without fighting other outdoor elements such as swift water or the movement of a boat.

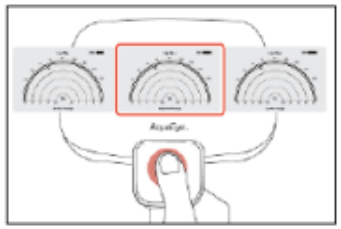
For support, contact VodaSafe at: support@vodasafe.ca

HOW TO SCAN

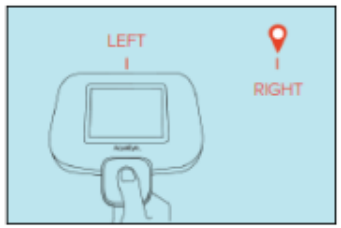
1. Designate one person as the scanner, the other as the test subject.



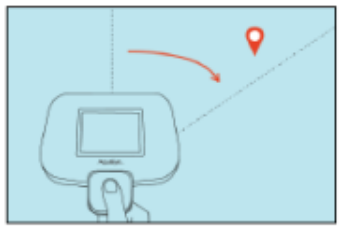
2. Have the test subject swim out 10-20 meters.



3. Turn on your AquaEye® and push the range button to meet MEDIUM Range.

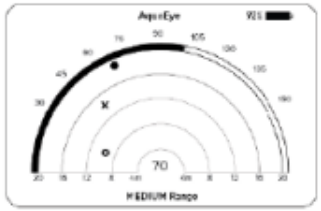


4. Aim to the left of the test subject.



5. Begin scanning left to right until you have passed over your test subject.

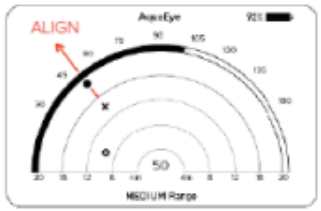
PSC



6

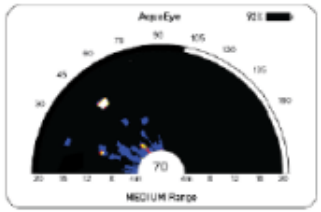
Release the trigger and observe your results. You should now have an icon "X" representing the subject on your screen.

If you don't see an icon on the display, see next section.



7

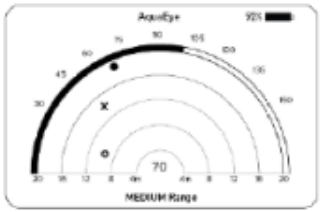
Move the AquaEye® to the left until the cursor aligns with the icon. Your hand and AquaEye® should now be pointing directly at your subject.



8

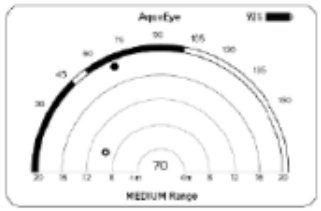
Switch to Echo Map display. *(Hold down the range button for 2 sec).* Observe your results to further understand your scan and your environment.

COMMON ERRORS

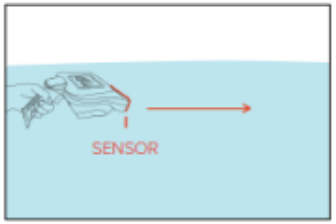


A

Ensure that you fill the feedback bar fully.

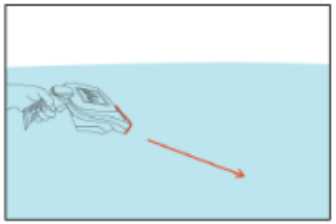


If you have any gaps in the feedback bar, especially at the point when you passed over your subject, you may not see an icon on the screen.



B

Ensure the AquaEye® sensor is pointing forwards.



If the AquaEye® sensor is pointing upwards or downwards, you might miss your target.

C

If your subject is wearing a PFD or other floatation device, they may be floating too high out of the water for AquaEye® to recognize them.

D

The sensor may have surfaced. Always ensure that your sensor stays fully submerged during the scan.

EXPLORE FURTHER!

If you see additional icons on the screen, and it is safe to do so, investigate them. Once underwater objects have been identified, they can be used in future scans to quickly orient to any new target.

Note that AquaEye® sensitivity to detecting other debris varies by environment.

Perform multiple scans, by repeating these steps with your subject in different locations: varying distances and submersion, until you feel confident in your understanding of both AquaEye® displays.

PSDiver ASE Workshop

(**A**utomobile **S**ubsurface **E**xtrication)

When a vehicle goes into the water, it is rarely an accident. Occupants are not always able to escape; sometimes they are *purposefully prevented* from escaping. If the entry is witnessed and there is a potential for rescue, this workshop includes how to perform a ***Hasty Recovery*** when recovery of the entire vehicle might be quicker that attempting to extract victims from the vehicle underwater.

If rescue is not an option, the workshop offers a range of methods to bring the vehicle to shore. Methods include utilizing traditional tow hooks and equipment to air bag rigging and deployment to lift the vehicle and pulling it to shore by hand.

It can be difficult for teams to learn these or similar techniques. Teams may only have the opportunity to perform these techniques on actual vehicle recoveries and that training potential for the team is almost always lost.

We Bring Our Own Car!

Depending on your location, we can solve that problem. We bring a specially designed and environmentally clean vehicle with us.

In the PSDiver ASE Workshop, teams will learn how to **choke, cinch and seize** ... Rigging and Lift Bags. This is an extraordinary team, department or regional training program.

PSDiver SURVIVAL Workshop

This workshop focuses on the individual diver, not the search and recovery of anything. We are not teaching divers how to dive. We are not teaching any *dive team* concepts or skills.

We are going to give you a new perspective on risk management. We will challenge your skills and teach you how to elevate your level of skills mastery.

We will teach you some skills you may have never considered possible and leave you with a new level of confidence and comfort in the water.

If you are tangled, out of air or unable to get air and at depth, how long do you have to make a decision, perform an action or multiple actions before you die? Will you make that discovery on your next dive? What are you willing to do to increase your odds of surviving an underwater emergency?

This workshop is focused on increasing your abilities to survive if a worst case scenario becomes reality. It is not a "sharks and minnows" program or a training agency specialty. It is the PSDiver SURVIVAL Workshop and is effective for any diver.

The entire workshop is focused on gaining time that could save your life– maybe *as little* or *as much* as 5 seconds. What if an additional 5 seconds was the time you needed to save your own life?

This workshop teaches you how to get that time!

Not all emergencies underwater are going to be life threatening but some will! Will you survive?
ARE YOU PROPERLY / ADAQUATELY PREPARED?

The PSDiver SURVIVAL Workshop will teach you how to turn some of those emergencies into manageable inconveniences.

We are working to take away your excuses and we understand the problems of being a volunteer and self-funded. With the help of our corporate sponsors, we have kept the cost of our workshops very reasonable for everyone!

For announcements, schedules and locations of the PSDiver SURVIVAL and ASE Workshops –

Follow our PSDiver Monthly Facebook Page
Join our Facebook Public Safety Divers - PSDiver Group -- or visit our web site www.PSDiver.com.

PSDiver Workshop Sponsors

If you would like information on becoming a sponsor or hosting a PSDiver Workshop, or becoming part of the PSDiver Magazine team, email Mark Phillips at Mark@PSDiver.com.

Additional Resources

DAN: Divers Alert Network - Scuba Diving and Dive Safety Association

Medical Information Line 1-919-684-2948

24-Hour Emergency Hotline 1-919-684-9111 to help divers in need of medical emergency assistance for all incidents

ChemTrec – Haz-Mat / Chemical Spill Information

1-800-424-9300.

Centers for Disease Control and Prevention

1600 Clifton Rd. Atlanta, GA 30333, USA

800-CDC-INFO (800-232-4636)

National Suicide Prevention Lifeline

Call 1-800-273-8255 Available 24 /365

NAMI: National Alliance on Mental Illness

Help Line 800-950-6264

First Responder Support Network

The mission of the First Responder Support Network is to provide educational treatment programs to promote recovery from stress and critical incidents experienced by first responders and their families.

THE CODE GREEN CAMPAIGN

We call code strokes, code STEMIs, and code traumas. It is time we called a code alert on our mental health.

Crisis Resources

IAFF RECOVERY CENTER

Treatment for successful recovery from substance abuse, PTSD and other co-occurring behavioral health

NOTES:

Sketch Area