

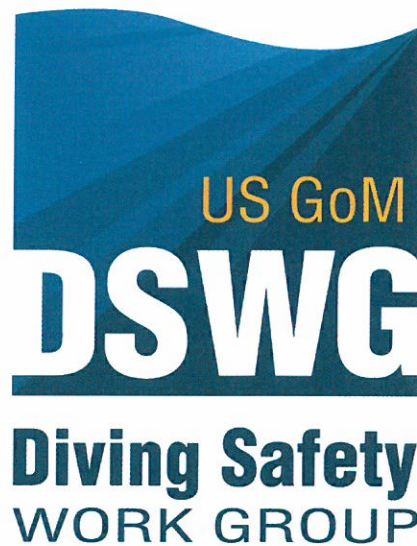
GOM Diving Safety Work Group

COMMITTEE WORK GROUP DOCUMENT

Live Boating

July 2013

Rev 0



DISCLAIMER

This US GOM DSWG document is not meant to be all-inclusive, and not every rule and regulation is contained herein. The US GOM DSWG does not issue policy or create regulations. The reader should consult additional resources and subject matter experts for more detailed information as required.

Live Boating

The GOM Diving Safety Workgroup is a US GOM focused, non-competitive and non-commercial group of oil and gas operators, transmission companies, commercial diving companies, supporting sub-contractors, organizations and industry stakeholders. The group will provide a unified voice to promote and improve diving safety, through the following:

- Identification and sharing of best practices
- Identify and seek solutions to industry challenges and issues
- Review and comment of existing and proposed standards and guidelines
- Provide input to the regulators and industry associations

Purpose of Committee

Stated Goal:

To review existing regulations and procedures to develop and document operation control recommendations to improve live boating safety. The US GOM DSWG as guidance has prepared this document for persons engaging in the method of diving known as live boating. The US GOM DSWG does not write policy or regulation, but provides this document for educational purposes and to promote sharing of best practices.

Committee Chairman	Allen Dyson
Executive Sponsor	John Herren

Committee Members (Names Only)	
Allan Palmer	Mike Willis
Scott Crook	
Maureen Bodron	
Robbie Champagne	
Steven Lambert	
Thomas Ulrich	

The document is divided into seven sections:

- **Part 1: Executive Summary**
- **Part 2: Definition**
 - Defines the activity that is being evaluated and provides definitions from regulatory or industry groups that are associated with the activity.
- **Part 3: Regulatory and Industry Gap Analysis**
 - Identifies regulatory and industry association requirements to perform the activity or operation and provides a visual aid to determine the consistencies between these groups as it relates to the activity
- **Part 4: Past Incidents**
 - Identifies past near misses, incidents, and fatalities and provides causal factors and the root cause of the incident in order to provide supporting documentation for the hazard analysis in Part 5.
- **Part 5: Hazard Analysis**
 - Identifies the hazards of the activity or operation, Identifies the risks associated with the hazards, and provides specific mitigation considerations for each hazard to reduce or eliminate risk
- **Part 6: Drills and Preparation**
 - Provide a list of drills that should be performed to prepare the crew members for possible emergency situations
- **Part 7: Appendix**
 - Please do not alter the template in order to maintain the consistency of the documents it relates to other committees, but please add additional documentation, reports, drawings, etc. in this section that may provide more depth or relevant information to the report.

Part 1: Executive Summary of Committee

The committee recognizes that Live Boating can be an effective method of diving in certain situations. However, live boating operations require experienced personnel, auditable assurance of equipment and careful attention to procedures, drills and methodology to be conducted safely.

Due to the inherent risks of live boating operations, all other means of diving operations should be considered if possible. If live boating has been determined to be the method of diving to be executed, the following items should be considered to ensure safe operations:

- Does the contractor perform a thorough risk assessment and mitigate risks to ensure safe operations?
- Does the client require and participate in Risk assessment and HAZIDs Performed?
- Does the contractor provide evidence to ensure that the vessel captain and vessel crew have experience in live boating operations. Ship's logs, previous projects history, etc.
- Does the contractor have auditable drills that test and prove the Emergency Shutdown Device is working properly?
- Does the contractor utilize a vessel with shaft rotation indicators? This is a relative simple mechanism to install on any vessel.
- Does the contractor ensure that a sufficient number of diving crew is provided even if the regulations allow a smaller crew size. Take into account the issues of the type of work being performed, the depth of water, and the communications available on the vessel. No regulation currently exists concerning the practical experience necessary to be considered "competent" in live boating. The US GOM DSWG recommends the following:
 - The Captain should have a minimum of 50-days of live boating experience.
 - The Diving Supervisor should have a minimum 3-years of experience with a minimum of 100-days of in-water live boat diving.
- Does the contractor Limit the SSE on live boating projects. The US GOM DSWG recommends Short Service Employees (SSE) is limited to no more than 20% of the crew, or a maximum of one Diver and one Tender.
- Does the contractor have an auditable system to ensure that the diving equipment is working properly and has been well maintained?
- Does the contractor have a physical barrier to prevent the diver or diver's umbilical from coming into contact with the vessel propellers? The dive tender should not be considered a physical means due to possible human error. A method to prevent the Diver's hose from potential entanglement in the vessels propeller is to limit the length of the Diver's umbilical. The US GOM DSWG recommends consideration of limiting the Diver's umbilical length to 15' shorter than the distance from the bow of the vessel to the propeller. The umbilical length for the Standby Diver would be 10' shorter than this distance. This technique is dependent on the water depth and length of the vessel.

Part 1: Executive Summary of Committee Continued

- Does the contractor limit live boating dives to no in-water decompression limits?
- Does the contractor ensure the dive supervisor has a clear line of sight of diver's umbilical entering water and divers bubbles?
- Does the contractor provide beacons for diver tracking on bottom?
- Does the contractor ensure that there are direct communications between captain, diving supervisor, stand-by diver and tender?
- Does the contractor conduct drills prior to executing project to include but not limited to:
 - Injured Diver Recovery to vessel and decompression chamber
 - Emergency Shutdown devices in wheel house
 - Loss of breathing gas drills
- Does the client support the contractor in the effort to making live boating a safer operation?

Part 2: Definition

- Live Boating is a diving technique where a single diver performs work underwater while his hose is being tended from a vessel underway.
- The vessel is maneuvered to follow or hold position on the diver's location using its engines and rudders.
- Diving from a DP (Dynamic Position) vessel is also considered as Live Boating by the USCG. **DP surface diving is not addressed in this document.**

Part 3: Regulatory and industry GAP Analysis

Item	Description of Item	IMCA	ADCI	USCG	OSHA	Comments
1	Live Boating Allowed	No	Yes	Yes	Yes	Restrictions Apply to ADCI/USCG/OSHA
2	Minimum personnel required	-	0 – 100 fsw 5 dive crew if vessel is > 33 Feet 101 – 170 fsw 6 dive crew	5 dive crew		Contractor should consider using a minimum of 7 dive crew (1 Supervisor, 3 Divers & 3 Tenders)
3	In-water decompression	-	None allowed	Must be < 120-minutes		Contractor should consider no in-water decompression
4	Depth Limit - Air	-	170fsw	190fsw, except that dives with bottom time less than 30-min can be conducted to 220fsw		
5	Depth Limit - Gas	-		<220fsw		
6	SCUBA allowed	-	No	Yes		
7	Bailout Required	-	Yes	Yes		
8	Limit on surface-supplied tool(s)	-	Limited to 1 tool	No limit		

Part 3: Regulatory and industry GAP Analysis Continued

9	Two way voice communications required between Supervisor and vessel master	-	Yes	No	Yes	
10	Dive Hose Must be tended	-	Yes	Yes	Yes	
11	Emergency Shut Down devices	-	Yes	Yes	No	
12	Specified diving during daylight hours		Yes	Yes	Yes	

Part 4: Past Incidents

Item	Incident Type (Near Miss / Incident / Fatality)	Description of Event	Root Cause	Comments
1	Near Miss	Vessel EMERGENCY SHUT DOWN failed to operate as designed.	Vessel maintenance program not in place. No testing prior to operations.	An audible preventive maintenance program shall be in place on all DSV
2	Near Miss	Dive hose fouled on hull anode.	No inspection of hull to identify hose fouling issues prior to operations.	A hull inspection shall be made for umbilical hangs prior to project start up.
3	Near Miss	Dive hose tends (leads) to stern of vessel near propellers.	No umbilical management plan in place. Vessel outpacing diver's progress. Environmental factors	Physical means shall be in place to prevent umbilical from reaching propellers.
4	Near miss	Vessel Clutch sticks in forward or reverse	Vessel maintenance program not in place.	An audible preventive maintenance program shall be in place on all DSV
5	Incident	Diver with DCS due to vessel failure and omitted decompression	Vessel maintenance program not in place. No emergency drills or audit of equipment to ensure reliability.	An audible preventive maintenance program shall be in place on all DSV
6	Near Miss	Vessel unable to hold station with diver	Incompetent vessel master. Lack of experienced diving supervisor. Environmental factors in excess of operational limits.	Auditable method to prove Vessel and Dive Crew's competence.
7	Near Miss	Diver fouled in underwater structure	No Risk assessment. Underwater hazard not identified. Lack of Diver umbilical awareness.	Auditable method to prove Vessel and Dive Crew's competence.

Part 4: Past Incidents Continued

8	Near Miss	Diver fouled in surface supplied tooling umbilical	No Risk assessment in place. Lack of Diver umbilical awareness. Vessel failed to keep adequate distance.	Auditable method to prove Vessel and Dive Crew's competence.
10	Incident	Injured diver (Shoulder) due to jumping from heights	No Risk assessment in place. Height to water exceeded safe limits.	Alternative entry methods Shall be considered.

Part 5: Hazard Analysis

Item	Hazard Identified	Risk Associated with Hazard	Mitigation Considerations (Be Specific)
	<u><i>VESSEL Failures</i></u>		
1	Vessel Component failure: Emergency Shut Down System	Entanglement of Diver or Diver's umbilical in propellers.	Emergency Shut Down shall be tested prior to the start of diving operations. Shaft rotation indicators installed to provide positive verification that the shaft /wheel movement has ceased.
2	Vessel attempting to operate in areas with high congestion	The vessel master could lose control of the vessel if he is distracted by encroaching traffic or working within the vicinity of anchor spread or structures	Hazid shall identify parameters that allow diving. Vessel traffic, weather and obstacles that prevent free movement of diver and vessel. The US GOM DSWG recommends NOT live boating within an anchor spread, and to always maintain a 500' distance from any anchored cable. Use of LRAD system for vessel traffic.

Part 5: Hazard Analysis Continued

3	Vessel not keeping station with diver	Diver pulled off bottom uncontrollably and or entangled in vessel propellers.	Auditable method to prove Vessel and Dive Crew's competence. A dedicated 'spotter' helps the Master know the divers location at all times. The active tender and the standby diver should have a clear sight of the umbilical entering the water and the diver's bubbles as well as the experience level to be able to instruct the Diver supervisor and vessel master on required vessel movements. The diver should be out ahead of the vessel, allowing good visibility of his bubbles and location. The divers hose should also lead forward, ahead of the vessel and away from the propellers. If the vessel is not maintained in proper station, the dive shall be aborted. Ensure that vessel master has experience with live boating operations and is comfortable with the scope of work. Good communications between the dive station and Vessel Master
4	Tooling umbilical and or down line fouled in Propellers	Vessel's limited ability to maneuver. Damage to tools, down line and vessel. Entanglement of diver in vessel propellers.	Proper vessel station must be maintained at all times. Hose management is critical. Emergency Shut Down must be operative.

Part 5: Hazard Analysis Continued

5	Diver's umbilical in vessel propellers	Diver fatality	An umbilical management program that physical prevents diver from reaching vessel propellers shall be in place. Emergency Shut Down must be operative.
6	Unable to recover injured Diver	Improper recovery of injured personnel, compounding injuries. Diver Fatality.	There must be a means to recover an injured diver. Diver Recovery Drills must be practiced to prove this equipment and method prior to its need. The drill should simulate back or neck injury and unconscious person.
7	Injured Diver due to jumping from heights	Jumping from heights can lead to diver injury and possible damage to diving equipment.	Alternative entry methods shall be considered. There must be a means to recover an injured diver. Diver Recovery Drills must be practiced to prove this equipment prior to its need. The drill should simulate back or neck injury and unconscious person.
8	Diving equipment failure	Injured diver Diver Fatality	An auditable system to ensure that the diving equipment is working properly and has been well maintained shall be in place.
9	Omitted Decompression	Compromised diver's health and increase exposure to decompression sickness.	This entire document covers this mitigation Limit dives to no in-water decompression

Part 5: Hazard Analysis Continued

12	Diver fouled in tooling, bottom structures and or bottom debris	Diver Injury Diver Fatality	Avoid penetration dives. A Risk Assessment prior to diving operations shall identify known hazards. Proper umbilical management. The US GOM DSWG recommends the Diver should not perform any type of 'penetration dive' while live boating. The Diver's hose should remain clear to the surface at all times.
13	Insufficient crew size for project or emergency procedures	The inability to safely operate equipment and provide personnel as may required for emergency situations.	Risks assess all work, contingences and emergency situations. Ensure no one person has two responsibilities or task in emergency situation. This committee determined minimum for any live boating operation is 7 personnel.

Part 6: Drills and Preparation

Provide a list of drills that should be performed to familiarize the crew with possible risks and hazards and provide specific preparations that can be made to reduce risk. Attach the drills if provided in the Appendix.

Item	Drill Name	Describe Drill
1	Diver Recovery Drill	Execute prescribed drill to remove an injured diver from the water to find gaps in the procedure, improve the procedure and determine the time associated with task. Drills provide excellent training to the personnel involved. The drill should simulate back or neck injury and unconscious person.
2	Loss of Gas Drill	This drill will provide training and experience for what the diver needs to do in the case of hat or breathing gas failure. The drill should demonstrate the use of the pneumo hose, line signals and bail out gas.
3	Emergency Shut Down Device	Test the Emergency shutdown devices in a controlled area to ensure that they are working properly.

Part 7: Appendix

Insert additional documentation, reports, drawings, etc. in this section that may provide more depth or relevant information to the report. List additional material in table and attach original to the back of this report.

Item	Appendix Item	Description of Item
1	LRAD System	Long Range Acoustic Hailing Devices
2	Diver Operations Safety & Measurement Tooling	Diver Tracking Device System



Vessel Security Solutions

SAVING LIVES THROUGH COMMUNICATION



The LRAD Advantage

- Clearly communicate and confirm security perimeters and stand-off distances to other vessels and personal watercraft at long distance.
- Implement an effective, appropriate and scalable response to potential vessel intrusions, using a safe response alternative.
- Avoid unintentional confrontations -- deter unintentional intrusions into your vessel's security space.
- Unambiguously establish intent to intrude using powerful deterrent tones and clear communication in host nation language.
- Overcome background noise – you will be heard.
- Deliver a focused directional beam to guarantee direct communication to the intended receiver.
- Choose from a range of scalable, portable systems readily mounted to existing vessel structures.
- **Only acoustic hailing device to meet stringent US Navy/US Army /JNLWD requirements.**



LRAD's unmatched acoustic performance comes in a rugged package that can be operated in the most harsh maritime conditions. Interfaces include a standard microphone as well as a rugged MP3 player designed for ease of use and operation.



Model	LRAD RX™	LRAD 1000Xi™	LRAD 500X™	LRAD 300X™	LRAD 100X™
Application	Vessels > 35 Meters	Vessels > 25 Meters	Vessels < 25 Meters	Vessels < 25 Meters	Handheld Solution
Max dB	153 dB	153 dB	149 dB	143 dB	137 dB
Max Range	3000+ Meters	3000+ Meters	2000+ Meters	1500+ Meters	700+ Meters
Weight	320 lbs	81 lbs* / 75 lbs*	44 lbs*	28lbs* / 25lbs*	15 lbs

* Without Accessories



Vessel Security Solutions

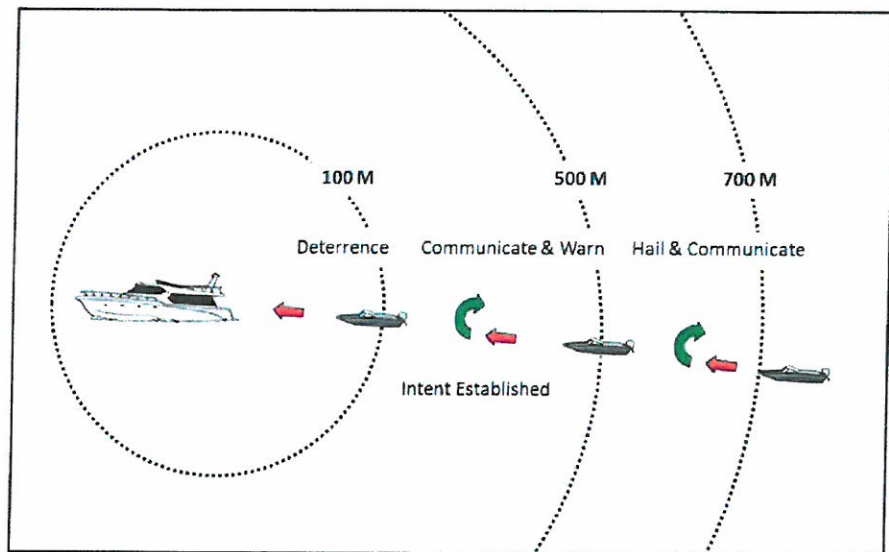
Peace of Mind

Protecting your high-value assets against piracy threats requires a military-tested shipboard protection device. The Long Range Acoustic Device® (LRAD®) has been successfully used against piracy threats on multiple occasions since the Seabourn Spirit incident off the coast of Somalia in November 2005.

LRAD is an easily transportable communication tool that overcomes background noise to clearly broadcast critical information, instructions and warnings up to 3000 meters away. Through the use of highly intelligible voice commands and powerful deterrent tones, LRAD can clearly communicate over long distances, create large safety zones and potentially resolve uncertain situations. The system can also transmit powerful deterrent tones (151 dB at one meter) to influence behavior or determine intent of a threat. The multi-lingual capability of LRAD also guarantees voice commands will be understood in any part of the world.



Upon detecting potential threats, LRAD systems create safety zones by hailing and warning approaching vessels at distances up to 3 kilometers. LRAD is used to determine the intent of unidentified vessels at distance and can be used to deter intruding vessels with a highly effective warning tone.



LRAD provides vessel operators the ability to determine the intent of a potential threat at the earliest possible moment and at the greatest distance allowing time to react accordingly.

Whether you're pleasure cruising or carrying freight, LRAD is a cost effective way to extend the security perimeter of your vessel and enable ship and crew to determine intent and demonstrate your preparedness at safe distance. When properly deployed, in most confrontations LRAD causes attackers to abort their assault and seek out less prepared vessels.

The message is clear. LRAD creates standoff and safety zones, supports the peaceful resolution of uncertain situations, and potentially prevents the use of deadly force.



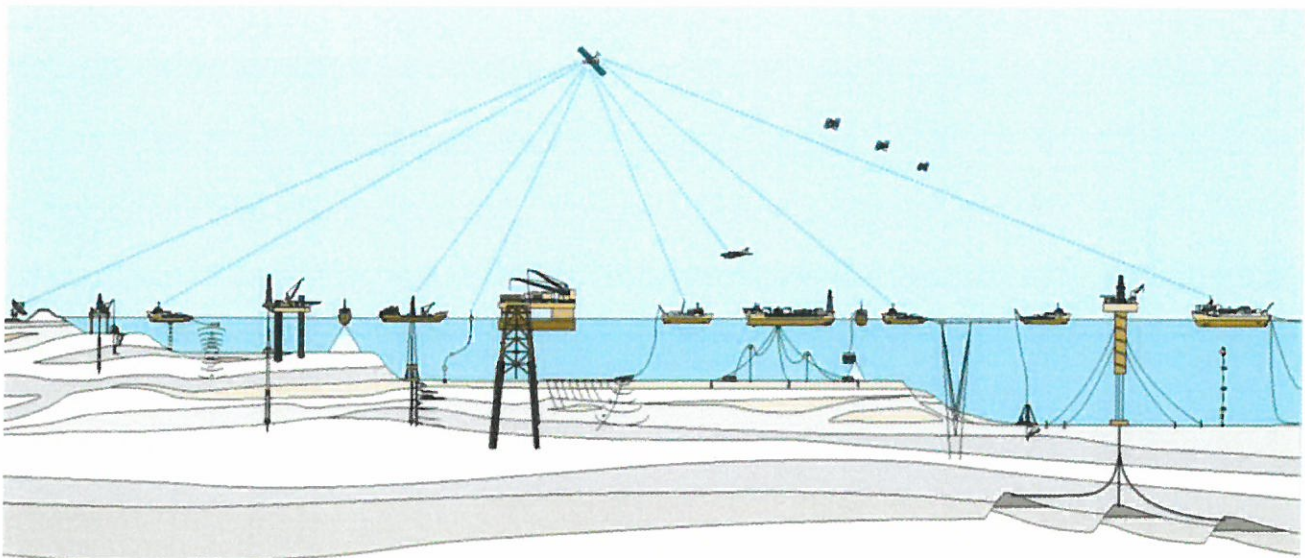
For more information and a free demo, please contact a representative.



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FUGRO CHANCE INC. DIVER OPERATIONS SAFETY & MEASUREMENT TOOLING



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USBL (Ultra-Short BaseLine)

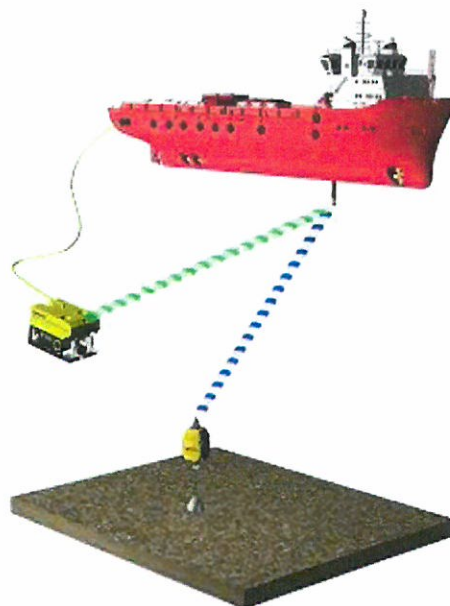
Ultra-Short BaseLine systems calculate the position of a subsea target by measuring the range (distance) and bearing from a vessel mounted transceiver to an acoustic transponder fitted to the target. This is combined with vessel attitude, heading and GPS sensor information.

The technique is widely used by the offshore and oceanographic industries as it offers high accuracy performance combined with ease of operation. Typical applications for the USBL technique include tracking ROVs, AUVs, Divers, and towfish or as a position reference input for vessels equipped with a Dynamic Positioning (DP) system. One of the main advantages of the USBL technique is that no other in-water acoustic equipment has to be deployed before underwater operations can commence. Only the targets being tracked need to be equipped with a transponder.

USBL Positioning Technique

An acoustic pulse is transmitted by the transceiver and detected by the subsea transponder, which replies with its own acoustic pulse. This return pulse is detected by the shipboard transceiver. The time from the transmission of the initial acoustic pulse until the reply is detected is measured by the USBL system and is converted into a range.

To calculate a subsea position, the USBL system calculates both a range and an angle from the transceiver to the subsea beacon. Angles are measured by the transceiver, which contains an array of transducers. The transceiver head normally contains three or more transducers separated by a baseline of 10cm or less. A method called “phase-differencing” within this transducer array is used to calculate the angle to the subsea transponder.



DIVER OPERATIONS SAFETY & MEASUREMENT TOOLING



**The following information has been derived from Kongsberg Maritime (www.kongsberg.com).*



DIVER OPERATIONS SAFETY & MEASUREMENT TOOLING

MS 1000 SCANNING SONAR Application Note

www.kongsberg-mesotech.com



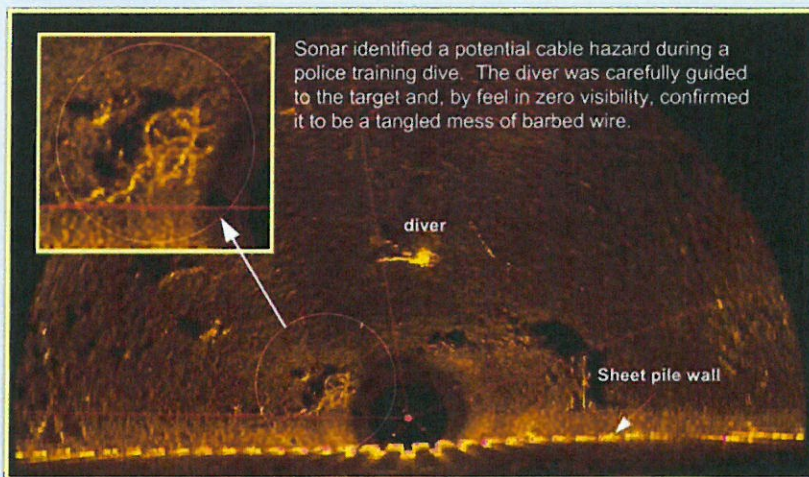
KONGSBERG

Diver Safety and Sonar

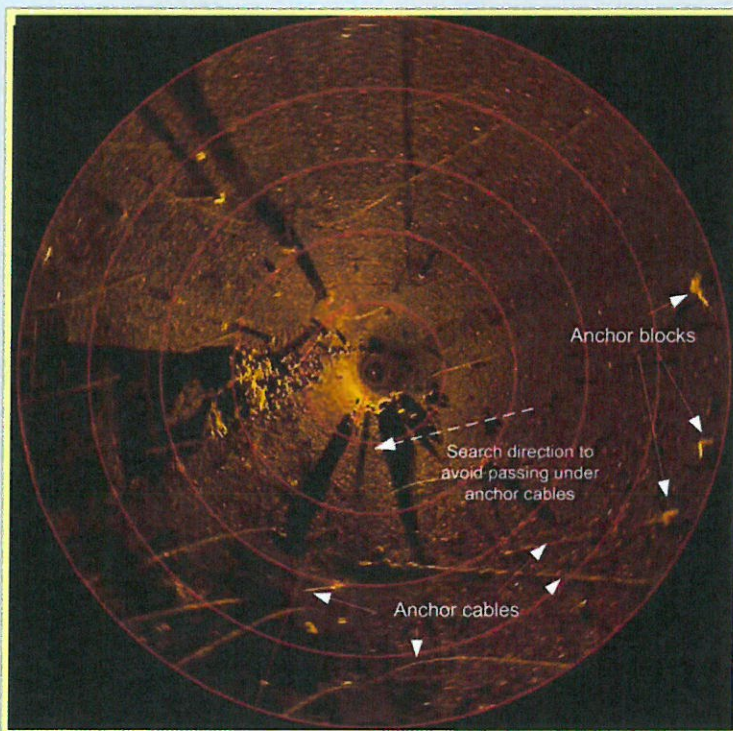
The safest place for a diver is on the surface. Utilizing scanning sonar before the diver descends can identify potential hazards and provide critical information for effective dive planning. The most efficient use of scanning sonar for directing divers is when surface supplied air and hardwire communications are used.



Checking "coms" before commencing the dive



Sonar identified a potential cable hazard during a police training dive. The diver was carefully guided to the target and, by feel in zero visibility, confirmed it to be a tangled mess of barbed wire.



Sonar scan prior to the dive to check the alignment of anchor cable entrapment hazards

In the lower left sonar image, anchor cables attached to floating dock slips at a marina were hazards identified during a body search. The dive was planned (and monitored in real time on the scanning sonar display) so there was never a risk of the tethered diver being entrapped by swimming under the anchor lines.



Surface supplied helmet and band mask with hardwire communications

THE FULL PICTURE

DIVER OPERATIONS SAFETY & MEASUREMENT TOOLING

MS 1000 SCANNING SONAR Application Note

www.kongsberg-mesotech.com



KONGSBERG

Sonar equipment configuration to direct divers in real time:

- Computer with MS 1000 PC-based Sonar Software
- "Splashproof" MS 1000 Interface Unit (operates with either a 120/240 VAC or 9-30 VDC supply voltage)
- Kevlar operations cable (75m-100m [255'-330'] recommended)
- 675 kHz High Resolution Scanning Sonar Head with fan beam transducer (or Multi Frequency High Resolution Sonar Head) with compass option
- Tripod
- Handcontroller



"Typical" MS 1000 System with a 100m (330') Kevlar operations cable used to direct divers.

Directing Divers:

"Scanning sonar remains the most suitable tool to guide divers in real time. Deploy the unit before the diver enters the water to identify potential targets and hazards. The sonar operator and diver should review the sonar data and decide how to efficiently investigate each target of interest.

With the sonar head stable and in a fixed position close to bottom, an accurate, relative position search can be conducted without having to utilize a subsea tracking system. In addition to detecting targets, scanning sonar can be used to track the search pattern of the diver to verify the area has been thoroughly examined.

It is a simple process to direct a tethered diver that has communication with the surface. All directions are given with the diver facing their umbilical. *The task is more efficient if the dive tender can hear directions given by the sonar operator. Instruct the tender to maintain tighter umbilical control than is generally done in commercial dive operations. Inform the tender when the diver is moving toward or away from their umbilical so that the appropriate amount of umbilical is provided. When the diver is instructed to move left or right, the tender has to secure the umbilical and allow the diver to use it as a pendulum.*"¹

Safe Diving Distances from Transmitting Sonar:

"There are potential health risks when a diver is working in close proximity to a transmitting acoustic source. The question of safety is most often, but not exclusively, encountered on military programs where high-powered naval sonars are of concern to anyone entering the water. An appendix in the *US Navy Diving Manual* is specifically dedicated to this topic. It is recommended this manual be in the personal library of every sport, commercial and public safety diver as it covers every imaginable diving topic.

The *US Navy Diving Manual* can be downloaded from the Internet. The section concerning sonar is found in Volume 1, Appendix 1A: Safe Diving Distances from Transmitting Sonar. Read this chapter!

The *US Navy Diving Manual* delineates low-frequency and high-frequency sonar (250kHz or greater), and details whether the diver is hooded, or using a dry diving helmet. Exposure time and SPLs are listed within the acceptable ranges. At the time of this writing, the manual states that hooded divers should not approach closer than two yards (1.9m/6.24') for a Personal Exposure Limit (PEL) of greater than 120 minutes to active sonar with a Sound Pressure Level (SPL) output of 215dB. There are no restrictions for high frequency sonars when the diver is using a dry helmet.

Immediately suspend diving operations if the diver feels any pain due to sound emitted from an active sonar or other sound source.

The above information on Safe Diving Distances from Transmitting Sonar is an overview interpretation from the *US Navy Diving Manual*. It is the responsibility of diving contractors, public safety dive teams, dive supervisors and divers to review current codes, regulations and standards, and adhere to those that deal with diving in close proximity to active sonar."²

1, 2 Quoted text courtesy *Echoes and Images, The Encyclopedia of Side-Scan and Scanning Sonar Operations*

THE FULL PICTURE

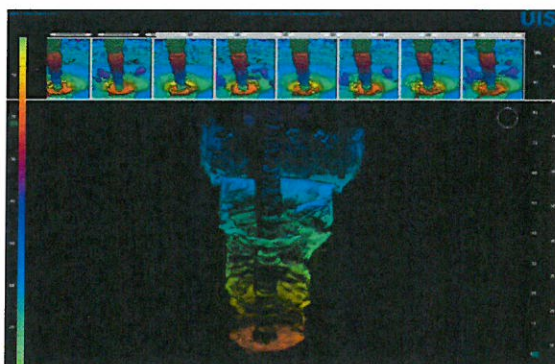
Echoscope® Real-Time 3D Imaging



Coda Echoscope® provides high resolution, 3D sonar images in real-time; offering a significant advantage over conventional subsea sonar systems.

Real-Time 3D Imaging Technology

The Coda Echoscope® Dual Frequency 3D Sonar is a unique sonar device using phased array technology. The Echoscope® generates over 16,000 beams simultaneously, producing instantaneous three-dimensional sonar images of both moving and stationary objects. Compact and portable, the system can be rapidly deployed on vessels or mounted on an ROV or AUV. It is easily operated in navigationally restricted environments.



Why Real-Time 3D is important for Subsea Visualization:

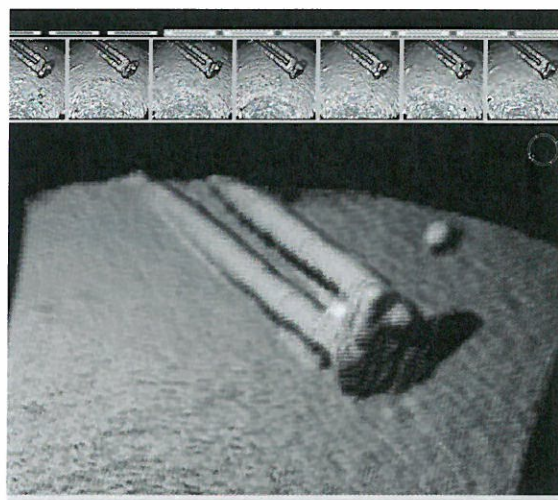
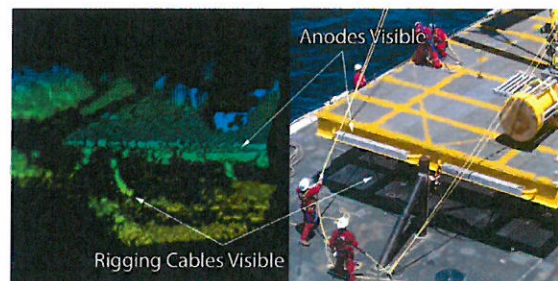
Real-time visualization means real-time decisions.

When certain operations kick sediment into the water column creating a little-to-no-visibility environment, Echoscope® can be a time-saving asset.

Echoscope® can be used in operations such as:

- Dredging
- Debris removal
- Clearance excavation
- Object placement
- Diver/ROV monitoring

Utilizing Echoscope® can save your project money and increase the safety of your personnel who need to make real-time, crucial decisions.





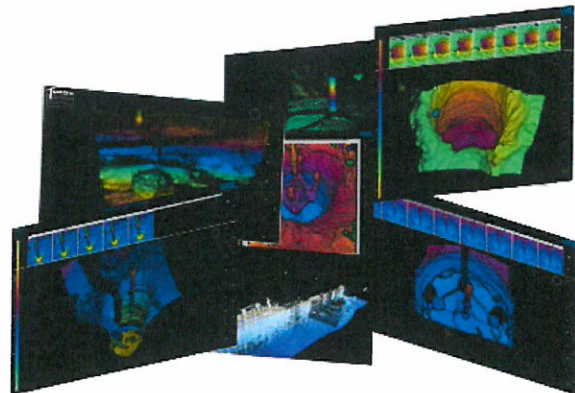
Echoscope® Real-Time 3D Imaging

Data Management

Due to its integration with various sensors, the unit is capable of providing XYZ coordinates for each and every individual ping that is returned. This enables real-time measurement and position identifications that can be geo-referenced into a real world coordinate system.

This type of capability enables offshore personnel to make safer, real-time decisions.

- Full XYZ export binned or RAW (any point cloud application)
- Direct interfaces with GPS and FineTrack T200 INS
- GIS compatible track and image data

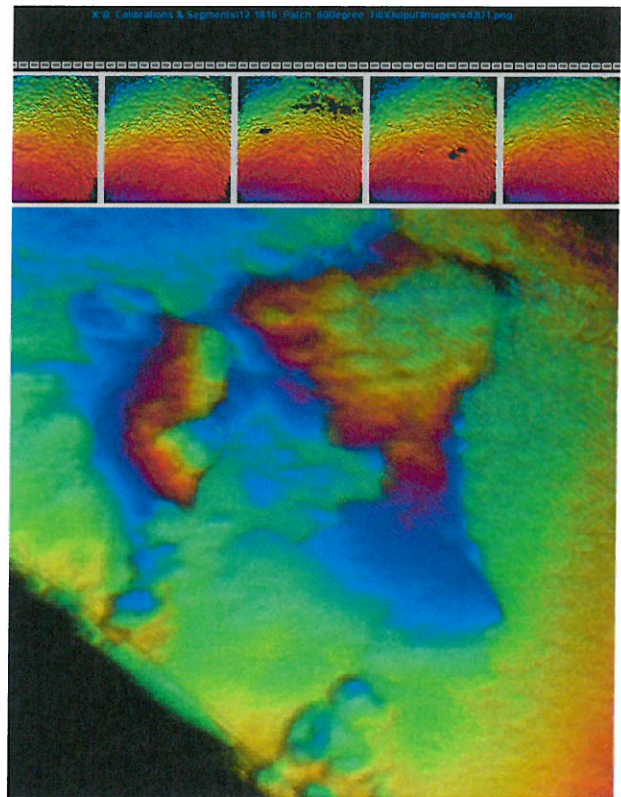


Why Echoscope®?

Offshore vessel time is expensive; as are personnel and equipment. The reduction of time spent on a project can lead to tremendous cost-reduction and greater ROI.

The Echoscope® has the ability to see beyond the haze of video cameras in zero visibility, and can create rich point clouds with endless post processing possibilities. Mosaicing capabilities provide a bigger picture with the ability to freeze a data sequence and take real-time measurements. The Echoscope® can be used in "camera mode" (no positioning data required) or in "mapping mode" (positioning data required). Unique filtering algorithms provide a wide range of tuning tools and over-redundant data enable users to remove acoustic noise; issues that can not be addressed in real-time when using traditional systems.

With an intuitive interface and a short learning curve, the Echoscope® is ideal when requiring real-time, underwater visualization in construction, dredging and rock dumping, monitoring, inspections and search and recovery. It is also an important service for monitoring divers in dangerous subsea environments.



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