

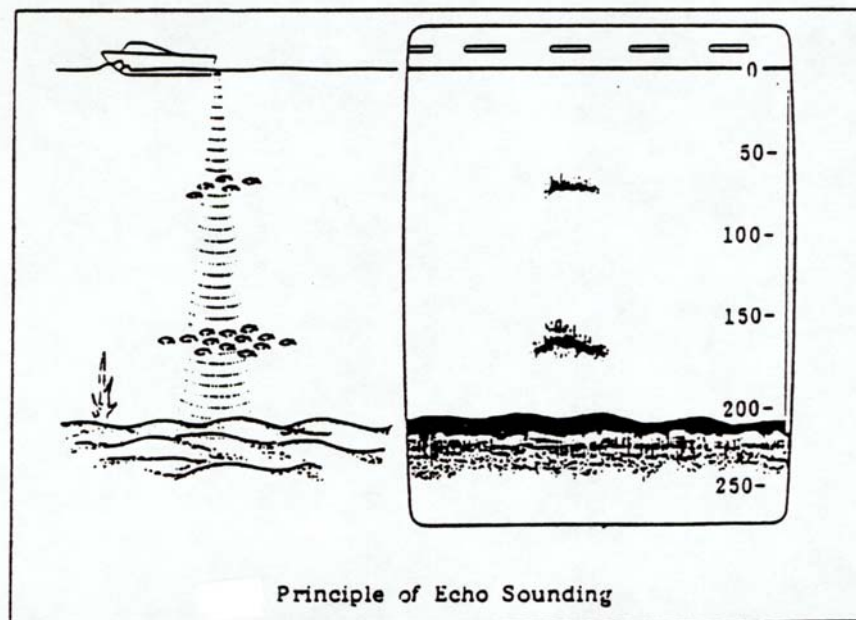
Electronics go hand and hand in Rescue and Recovery

Many times rescue teams have arrived on the scene and had witnesses give a general location of the victim or submerged object. In the early 1970's out dive team arrived on the scene and was told this is the lake and they could possibly be in this location. We were searching when a fisherman came over and showed us how he could pick up objects on the bottom with his fish finder. After working with the fisherman for three days we were convinced this was the way to locate victims and objects in the water. We have used and tested many different sonar units and found they were only as good as the operator. We use the color sonar units as people are conditioned to color, as most televisions are color. We have used the SiTex 106 for the last 10 years and found it to be very good.

How do they work? The US Navy has used sonar for years to track and locate submarines. The SiTex 106 color video sounder determines the distance between its transducer and underwater objects such as a body on a lake bottom or seabed and displays the results on a 6-inch color screen. It does this by utilizing the fact that an ultrasonic wave transmitted through water travels at a nearly constant speed of 4800 feet per second. When a sound wave strikes an underwater object such as a body or sea bottom, part of the sound wave is reflected back towards the source. Thus by calculating the time difference between the transmission of a sound wave and the reception of the reflected sound wave, the depth to the object can be determined. In a sense an echo sounder can be thought of as being an extremely sophisticated and quick timer, since it is capable of resolving time differences shorter than one thousandth of a second.

The entire process begins in the display unit. Transmitter power is sent to the transducer as a short pulse of electrical energy. The electrical signal produced by the transmitter is converted into an ultrasonic signal by the transducer and transmitted into the water. Any reflected signals from intervening objects (such as a body) are received by the transducer and converted back into an electrical signal. It is then amplified in the amplifier section, and finally, displayed on the screen.

The picture displayed by the SiTex 106 is made up of a series of vertical scan lines, one for each transmission. Each line represents a "snapshot" of what has occurred beneath the boat. The series of snapshots are accumulated side by side across the screen, and the resulting contours of the bottom and body between the bottom and surface are displayed. The amount of history of objects that have passed beneath the boat over a series of transmission varies from less than a minute to several minutes, depending on how you adjust the unit.



TRANSDUCER

Traditionally video sounders were offered in your choice of two frequencies – 50 KHZ and 200 KHZ. The SiTex 106 offers both frequencies in one unit. The 50 KHZ units read deeper and have a wider cone angle than the 200 KHZ. However, the 200 KHZ have better resolution (the ability to separate closely grouped targets).

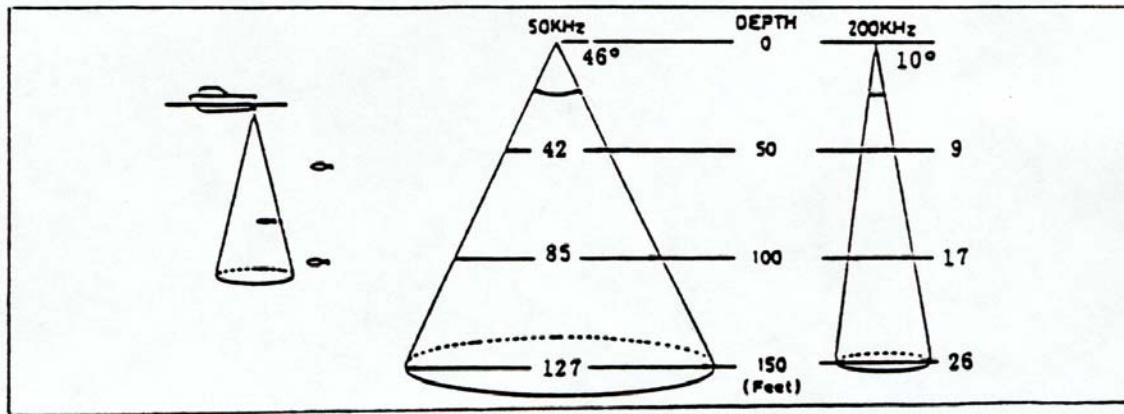
As mentioned before, both body echoes and bottom contour echoes are composed of a series of vertical scan lines moving right to left across the screen. It is possible for the same object to be recorded on the display in a variety of shapes - depending on the distance to the object, the angle at which the body is struck by the transmitted pulse, echo strength, etc.

DETECTING AREA

The detecting area varies depending on the main beamwidth of the transducer, as shown below. Objects out of the main beam but close to the beam will be presented less densely, smaller in size, and at a lower intensity.

With the SiTex 106, the operator has the choice of either 50 KHZ or 200 KHZ operation. There are advantages and disadvantages to both frequencies and you should select the frequency best suited to your needs.

Generally, beamwidth depends on transmission frequency; a narrower beamwidth is usually obtained at the higher frequency. For example, the 200 KHZ transducer has a “-3 dB” beamwidth of approximately 10 degrees, whereas the 50 KHZ transducer has a beamwidth of approximately 46 degrees.



Because the beamwidth of the 200 KHZ transducer is narrow, the operator has the advantage of higher resolution. In addition the effects of cruising noise and air bubbles are greatly reduced, since air bubbles resonate at a frequency between 15 and 100 KHZ. On the minus side, a narrow beamwidth transducer will display even the smoothest bottom contour in a sawtooth pattern if the boat is moving up and down due to pitching and rolling of the boat.

This makes discrimination of the body down close to the bottom difficult. Also, because of the limited coverage area, a narrow beamwidth tends to overlook the body at the sides of the boat. The maximum percent of depth covered on the bottom depth is 300 feet; the diameter of the coverage circle on the bottom would be only 52 feet. For rescue or body searching both frequencies should be used.

COLOR

The SiTex 106 is a new compact color video sounder with dual frequency transmitters using a single transducer. Steady, non-fading 8 color pictures are presented on a 6 inch CRT in accordance with the received echo strength. The 106 displays target and bottom strength with 8 different colors.

WEAKEST	0	Deep Blue
	1	Blue
	2	Light Blue
	3	Green
	4	Yellow
	5	Orange
	6	Red
Strongest	7	Reddish Brown

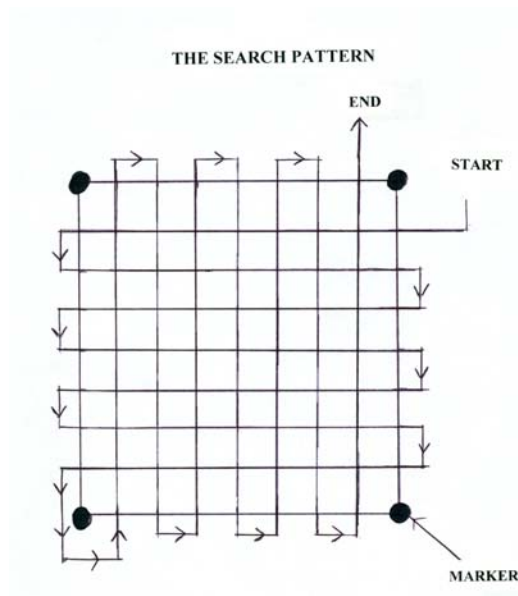
The 0-3 colors are the colors of a body as it shows up on the screen. For example, a hard rocky bottom displays in a red or reddish brown, a soft muddy bottom shows as yellow or green. This color chart applies to most color video sounders. Other than the bottom color, the rescuers should only look for the objects that reveal BLUE or GREEN and with a slight tinge of red-orange where the major body bones are located.

GAIN

Adjusting the gain control determines the units ability to pick up and displays echoes, pressing the + (plus) key increases the sensitivity of the unit, pressing the - (minus) key lowers the sensitivity. When using high gain settings, a second echo can appear. This is normal and it's caused by the returning signal reflecting off the surface of the water. Then it makes a second trip to the bottom and back. For body searching, set the gain at the $\frac{3}{4}$ level of at 12 on the SiTex 106.

THE SEARCH

Searching a lake or river for a victim should be accomplished as quickly as possible. Keep in mind the one hour golden rule as per the father of cold water near drowning Dr. Martin Nemiroff, M.D. The colder the water and the younger the victim better. Get the witness statement as quickly and accurately as possible. Searching will require the ability to set up marker, good navigational skills, reading a G.P.S., determining wind and currents and expert boat operation. The boat operator must know the transducer coverage chart. I recommend keeping a copy with the unit so it can be referred to by all rescue personnel. Keep in mind the rescue first.



Some things to consider when using the color sonar

1. Use a grid pattern as we have shown in the article.
2. Mount the transducer in front of the boat to cut down on aeration. They will not work in air. So using one in a low head dam will not work. About 100 feet below the dam they start to read again.
3. We found the large Tide detergent bottles work very well for marking the grid pattern. We use Tide because of the orange bottles, other plastic detergent bottles also work.
4. Time can be saved by using a Sea View drop camera to check out objects located in the water. This also saves divers too. You can also record from the Sea View camera to videotape.
5. A Global Positioning System (GPS) is very useful for locating positions in the water. If you see an object and want to return for a second look, it is sometimes very difficult without a GPS.
6. We operate our SiTex 106 with a 12-volt battery pack, which also provides power for a VCR and Sea View camera. Saves room in the boat and is easy to transport.
7. We have found that an electric trolling motor works best in some situations.
8. Marking buoys are necessary for marking locations or "hits".
9. The most important thing to remember is to train with the sonar frequently. The more you train, the more proficient you will be.

TRANSDUCER COVERAGE

diameter (in square feet) of circular area covered at various depths using different cone angles

Water Depth In Feet	8°	11°	16°	20°	32°	43°	50°	60°
10	1.4	1.7	2.8	3.3	5.7	7.9	8.7	10.0
15	2.0	2.5	4.2	5.0	8.6	11.8	13.0	15.0
20	2.8	3.3	5.6	6.3	11.5	15.8	17.3	20.0
30	4.2	5.0	8.4	10.0	17.2	23.6	26.0	30.0
40	5.6	6.7	11.2	13.3	22.9	31.5	34.7	40.0
50	6.7	8.3	14.0	16.7	28.7	39.4	43.3	50.0
60	8.4	10.0	16.9	20.0	34.4	47.3	52.0	60.0
70	9.8	11.7	19.7	23.3	40.1	55.1	60.7	70.0
80	11.1	13.3	22.5	26.7	45.9	63.0	69.3	80.0
90	12.6	15.0	25.3	30.0	51.6	70.9	78.0	90.0
100	14.0	16.7	28.1	35.0	57.4	78.8	86.7	100.0
150	21.0	25.0	42.0	53.0	85.8	113.0	130.0	150.0
200	28.0	33.3	56.2	71.0	114.7	157.6	173.3	200.0

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