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# The Application of Ultrasonics In Fishing Industry and Research

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## PART II

### Recent developments in active sonar systems

There are researches going on in the development of the existing sonar equipments for better performance as well as in the development of new techniques in the field.

### Multi frequency sonar

The frequency of the sound beam is related to the angle of the beam of ultrasonic waves and the range of transmission of the waves. As there are many controversial features between frequency, range and clarity of the echoes, it is not possible to obtain all the advantages in a single equipment of a particular frequency. The problem is solved by using transducers of different frequencies in a single set. According to the type of requirements, the transducer can be selected.

### Multi C. R. T. display

Western Marine Electronics, U.S. A. have developed an unusual sounder with facility for displaying the signals in two CRTS. The larger one displays the signals with white line facility while the smaller one shows the trace in scale expanded from, either on the bottom or in the mid-water.

### Luminous traces of fishes

Marconi International Marine Co. Ltd. has announced a completely new type of electro sensitive, carbon free recording paper. Unlike in the ordinary recording paper, the recordings are made on a black surface. The traces will be translucent and can be made luminous with the help of a light source at the back of the recording paper. This device makes the recordings more clear especially during night time.

### Multi stylus sonar

Koden Electronics Co. have developed an echo sounder with several recording stylus. With the help of this equipment, it is possible to record signals from several transducers at a time. This is particularly useful when the fish finder is used for measurements

of the various operating features of a fishing gear eg., the vertical opening, horizontal opening, the depth of operation of the net etc. which can be ously recorded.

**Survey of fishes by counting**

Recently 'Simard' has introduced an improved type echo sounder named 'scientific sounder system' for detection and simultaneous counting. This will be useful for oceanographic as well as for fishing vessels for making large survey of the fish population, easily and more accurately. The electronic counter used in the equipment counts the echoes and gives a quantitative information about the fish population.

**Underwater television using sonar**

Since light is not capable of illuminating objects under the sea, taking photographs of distant objects as well as televising them becomes impossible. Attempts were made by sonar engineers to develope an effective means of obtaining the instantaneous high definition picture of the body of the sea. The very low velocity (approx. 1500 metres per sec) of sound in water has been a limitation for the development of an efficient method of scanning underwater and led the scientists to resort to mechanical scanning. The first step towards the electronic scanning underwater was the method developed in the United States by which the direction of maximum sensitivity of a transducer array could be steered by electrical means. These systems were based on delay time technique and is called 'with in pulse' sector scanning sonar.

A more improved and efficient method later developed is what is called 'modulation scanning' developed in United Kingdom. Here all the signals processing required is carried out directly on the output signals of the array while a steady state is maintained throughout the equipment. Later 'multi-stage' modulation scanning was developed, which resulted in great economy in advanced scanning sonars.

**Sector scanning**

In this method a sector of midwater or bottom enclosed in a predetermined angle is made visible in a cathode ray tube. A transmitting transducer insonifies a sector of the sea with pulsed acoustic energy, while a separate transducer which is a combination of several small transducers with narrow beam sensitivity receives the same and builds up an acoustic structure of the sector with delineated range and bearing in a time interval that depends on only duration of the sound's journey to and from the extreme range of interest. Low pulse length and narrow beam width produce clear picture.

**Bifocal**

Admirality Research Laboratory has improved the sector scanning with an additional facility for further examining an object once detected. It is called bifocal, as it is the sonar equivalent of changing the focal length of a lens. Here the 10 degree sector at the centre of the 30 degree sector is scanned using a higher scan rate thereby enlarging a small required portion with increased clarity.

**Underwater mapping system using sonar**

This system developed by CBS laboratories combines holography and sonar techniques to produce images of objects

of underwater terrain. The experimental ' solography ' system was developed for the office of Naval Research and is still in its infant stage. The system consists of a laser tube along with an electron gun and a thermoplastic film. An array of 1000 barium titanate hydrophones in a 3 sq. ft. monitors acoustic waves reflected from the underwater object. The electron gun scans the sonic information and a steriophonic image pair is projected by the laser on the thermoplastic film at the rate of one or two times per second.

**Fishing gear performance studies using sonar**

For the engineering study of other trawls, the various parameters of the trawl in operation have to be measured. The horizontal opening, the vertical opening and the depth of operation are the three important parameters of the trawl net which can be measured using sonar. An approximate amount of the fish entering the net can also be obtained with the help of sonar equipments.

**1) Measurement of horizontal opening**

The horizontal opening of trawl net is measured very accurately using a fish finder. The transducer of the fish finder is fixed in one of the otter boards directing it to the other. Reflections from the other is received and sent to the echo sounder on board the vessel through shielded electric cable. It is also done with two transducers in parallel, and the transmissions from one number will be received in the other. A more sophisticated equipment named electronic spread meter MK 2 has been developed by the Electronics Department of Saunders Roe. This consists of two units named Recorder and Responder. The recorder transmits an ultrasonic pulse to the responder which it receives and retransmits in a different frequency to the recorder where it is recorded on ' teledoto ' paper together with the original transmitted signal. The rest of the portion is similar to an echo sounder. The same firm has made another one named 'Net mouth spread meter (MK1A)' which uses electric cable for synchronising the action. One unit transmits a signal while the other one receives it and records it on a paper.

**2) Measurement of depth of operation of fishing gear**

With the help of an ordinary echo-sounder the depth of operation is obtained. The transducer is fixed on the head rope using hydrofoils or special arrangements to keep it directed vertically downwards. As usual, the transducer is connected to the boat. Another transducer is used in the boat for measuring the total depth of water. The difference in the depths recorded by the two transducers gives the depth of operation of the trawl net. But an uneven ground or ground which is not paraellel to the water surface produces errors in the measurement, the magnitude of it becomes quite considerable often times. Koden Electronics Co. Ltd., Japan has made a sonar equipment named ' Net monitor ' for this measurement. Here the signals transmitted from an underwater wireless transmitter fixed on the head rope is reflected back and is transmitted to boat in a different frequency modulated by the reflected signals. The ' net sonde ' developed by Furuno Electric Co. works on a different principle. Here the length of the pulses produced changes according to the depth. The signals received in the boat are converted to depth in a recorder on an indicator.

### 3. Measurement of vertical opening

The vertical opening (also called net-height) can be measured with the help of a fish finder with its transducer fixed on the head rope and facing vertically downwards. But this measurement with an ordinary fish finder will not be sufficiently sensitive, since the long starting mark due to long pulse may hide the marks produced corresponding to the vertical opening. An equipment with a short pulse is necessary for the accurate measurement of this parameter of the net. Special sonar equipments are commercially available for this purpose.

### Detection of fish entering the net

A fish finder along with a transducer at the head rope can detect the fishes entering the net. But because of the draw-backs of an ordinary fish finder, explained earlier, a clear observation becomes difficult. New sonar equipments for this purpose have been developed and marketed recently. The 'Net monitor' developed by Koden Electronic Co. Ltd., and 'Net recorder' by Furuno Electric Co. are specially made equipments for detecting the fishes entering the net. They are fitted on the head rope and make ultrasonic transmission of the informations to the boat, instantaneously. Titran Electronics Co. Ltd., England has incorporated an electronic counter in their sonar equipment for detecting and counting the fishes entering the net. The equipment gives an approximate quantitative information about the catch in the net.