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Study on four-dimensional wide view imaging SONAR system -tank and fields tests-

四次元広角イメージングソーナーシステムの開発-水槽及び実海域試験について-

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1. Introduction

There is a concern for the imaging sonar for making to an underwater image for a long time. A lot of researches related to it are inside and outside the country [1-6]. In addition, some of them are really operated as a acoustic video [7, 8]. On the other hand, in engineering works usage, the visual check corresponds to a spatial grasp of the structure. Therefore, the sonar imaging would be effective in a wide-ranging three-dimensional space and real-time display. However, both examples were not seen as for the inside and outside the country.

Then authors have been developing an underwater three-dimensional and real-time (four-dimensional) imaging SONAR system with acoustic lens [9-11]. Prototype system had obtained wide- angle, three-dimensional and off-line video images [9], enhanced the system had achieved wide-angle, four-dimensional imaging and as same time surveying (4-DWISS) [10].

In this paper, we report an explanation of 4-DWISS and its survey and view results at field test in close to practical use [11] .

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2. 4-DWISS

Features of the system are 1) wide-angle and four-dimensional viewing images, which are close to vision sense of human, 2) surving structures at the same time. The system uses the frequency controlled beam steering method [12], and also has the new developed acoustic lens system (Fig.1). The method divided the received signals into two dimensions. The system has sources, whose beam is vertical wide and horizontal thin (Fig.2), and a two-dimensional reciever array (Fig.3). Then, depth

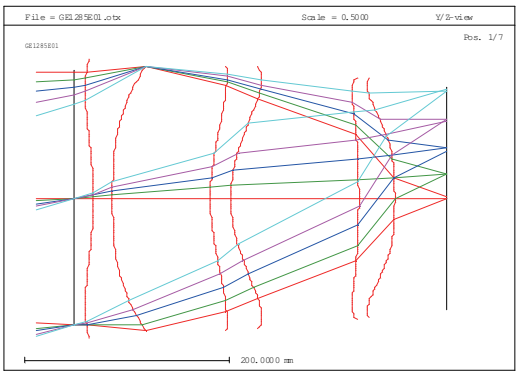

Fig.1 Triplet acoustics lens.

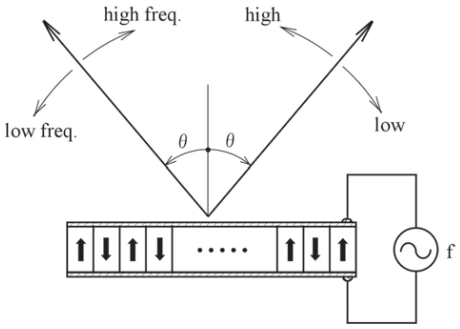

Fig.2 Schematic illustration of the transmitter.

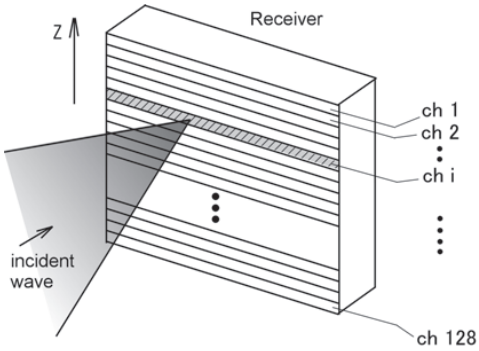

Fig.3 Schematic illustration of the receiver.

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was expressed according to the delay time. In

addition, the image is sequential updated, a four-dimensional underwater image was achieved.

3. Field test

The experiments were conducted around jacket structures. The objects are sacrificial anodes attached on a jacket, which is leg of truss structure piers. Photo 1 is the one of the target bridge. The views of sacrificial anodes were measured along the bridge airport side by 4-DWISS whose speed was approximately 3 knot. The range between 4-DWISS and the jackets, pan and tilt angles of 4-DWISS, and the recording mode were approximately 15~30 m, 30 deg and 10 deg, and quadruple speed, respectively.

An underwater acoustic image of the jacket is shown in Fig. 4. Recorded acoustic data is corrected by synchronously measured position, direction and sway. The figure is mosaic images and is colored in proportion to acoustic intensity. At left side in the figure, a wire frame of a four-sided pyramid shows the visible space at one shot.

Photo 1 The target bridge.

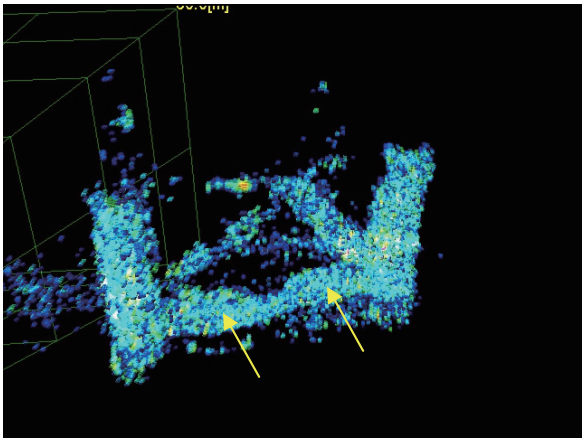

Fig.4 Bottom of the jacket, arrows point to sacrificial anodes.

From the figure, the jacket is clearly visible, and the truss structures correspond to the blueprint. And more rectangular ledges on the bottom of the jacket are observable, which are sacrificial anodes.

4. Summary

Three-dimensional and real time imaging SONAR system (4-DWISS) was developed. Three-dimensional and real time imaging SONAR system (4-DWISS) was developed. We conducted field tests, 4-DWISS has achieved to display and record four-dimensional acoustic video images which were truss structures and/or sacrificial anodes in this case.

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