Towing sonar position determination on side scan sonar data processing

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In side scan sonar data processing, some of the more obvious difficulties occur in the sonar position owing that the sonar is not hull mounted but towed at the astern side. One method to determine the sonar position is proposed without any other additional sub-system to determine the actual sonar position, the underwater acoustic tracking or position link system, and the sonar attitude measuring device.

From each side scan sonar signal trace, the bottom return reflected firstly from sea-bottom is commonly used for the slant range correction, while the surface return reflected from sea-surface is very useful to determine the sonar position. Firstly the sunken depth of sonar from sea-surface is estimated by surface return, the horizontal offset distance (HD) from vessel is obtained by using the Pythagoreans theorem on the supposition that the deployed towing cable is not bendable. Secondly the point, where a circle of radius HD centered at vessel is crossed with an extension line connecting vessel to sonar position fixed at the just before step, is determined as a current sonar position, if one point is determined in this way, the next positions are fixed step by step such as a recursive manner. Here the problem of how to determine the sonar position of the very first beginning is left, it was statistically examined that it takes about 300 meters voyage distance for the sonar track to be settled at the reasonable position in case of 30 meters cable out.

At the sea-floor image mosaic map used the sonar track, we cannot find out any ambiguity or inconsistency of sea-bottom features and any blank area occurred owing to the swath data not well arranged on the across-track direction. There is an incidental effect from the sonar position determination processing, the towed direction of sonar can be oriented even though it is not a real heading, that is, this method makes the sonar track smoothed, consequently the swath pattern on the across-track direction becomes so stable.