Coherent Clutter Removal and Doppler Estimation

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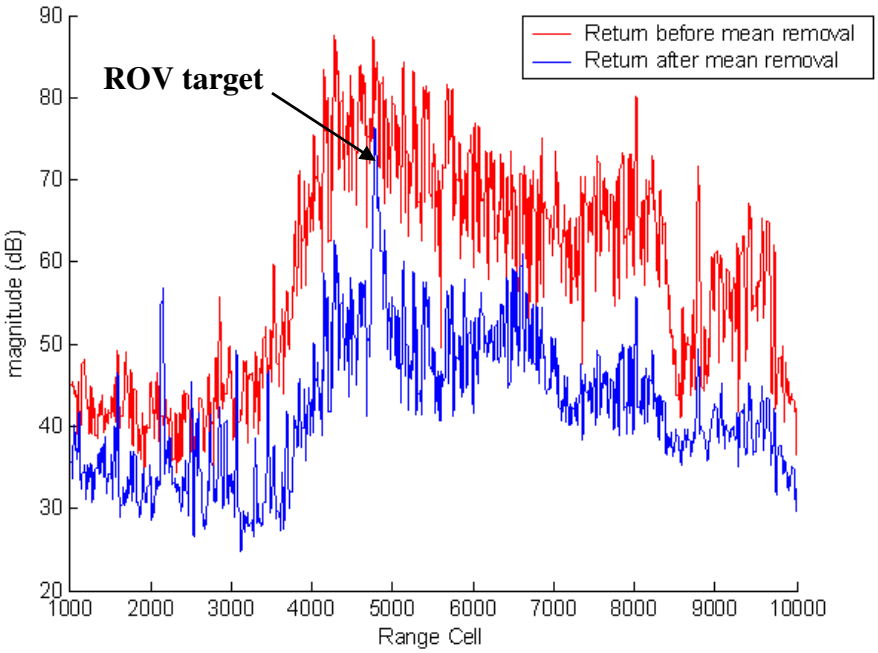
This research has two major thrusts: coherent clutter removal for improved slow target detection, and single ping Doppler estimation for target detection.

Coherent Clutter Removal

In situations where small, very slow moving targets are buried in bottom reverberation, it impossible to detect their presence with conventional backscatter thresholding techniques. However, if the sonar is mounted in a fixed position relative to the bottom coherent clutter removal techniques can be used to expose the presence of the targets.



The red curve in the figure above is backscatter level for each of the range cells represented by the x axis. At close ranges the level is consistent with backscatter picked up from surface reverberation and small water column targets. At approximately range cell 3500 backscatter from the bottom begins to arrive and grows to a maximum and then starts to decrease. Buried in the bottom backscatter is the backscatter return from a small ROV that is moving very slowly along the bottom. Just given the red curve it is impossible to detect the presence of the small ROV. However, once the coherent portion of the bottom backscatter is removed the presence of the small ROV is unmistakable. The blue curve is the data from the same ping but with the coherent portion of the backscatter removed and therefore the blue curve represents the diffuse portion of the backscatter. Hence the small ROV needs only to be detected against a background of

diffuse reverberation rather than the total reverberation. The increase in target detectability is approximately equivalent to the difference in dB between the diffuse and total reverberation levels, approximately 20 dB in this case.

With this kind of sonar is possible to build a coherent clutter map that then is employed to detect slow moving targets. An interesting alternative use for a coherent clutter map is to employ the variation in the map over time to investigate water properties that affect acoustic propagation.

Single Ping Doppler Estimation
This is one of our newer projects. The aim here is to use Doppler information to enhance target detection and bottom estimation. We are in the final stages of building a new research sonar that is capable of multiple pulse pings.

Commercialization

We are looking for partners who would like to help us in the research and commercialization of the coherent clutter removal technique for target detection water column properties measurement. In addition we seek support and commercial opportunities for our single ping multiple pulse Doppler processing research.