Model Based Array Element Localization for Single and Multiline Towed Arrays

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Overview

• Accurate **Array Element Localization** is needed to realize full performance gains - especially for adaptive processing and MFP

• **Nominal** array shapes may not be adequate – this depends on:
  – frequency range of operation - necessary accuracy is $O(\theta/20)$
  – complexity of the towed array system and ship maneuvers
  – existence of unknown forces such as ocean currents

• **Our approach** is to use a **3-D hydrodynamic model** for towed arrays as the system model for a **Kalman filter**

• We address both single and multiline arrays:
  – **Single line** – incorporate compass and depth measurements and use ship course and speed and ocean currents to drive model
  – **Multiline** – as for single line but we also incorporate pinger inter-array ranges
Summary

- For single lines the hydrodynamic model can be made to match depth and heading measurements reasonably well by adjusting weights and drags; i.e. the model itself is accurate.

- The Kalman filter is needed, however, to match the available data closely, especially during hard turns where drag coefficients become difficult to estimate, as well as for multiline arrays with vertical extent in a current field with significant vertical shear.

- We show typical single line Kalman filter results for the filtering of heading and depth sensors.

- The approach has yielded accurate AEL for single and multiline arrays as demonstrated via beamforming (see paper by Freese, Sperry and Votaw).