Source Localization in a Moving Sensor Field

In order to maintain U.S. naval dominance, there is continuing need to develop innovative approaches for near-real-time remote detection of underwater targets. Moving sensor fields can improve detection performance against stealthier targets by achieving large numerical apertures. These sensors are typically sonobuoys, drifting with the wind and the currents. In the past much attention in anti-submarine warfare (ASW) has focused on adaptive beam-forming. There, goals were to achieve robust direction-of-arrival (DOA) estimation. In this project, on the other hand, the focus is on determining the time difference of arrival (TDOA) of a source wave front between the sensors of the irregularly distributed array. Because of the absence of a timing reference for the source-to-be-located (e.g. target submarine), the most commonly used technique for TDOA estimation is cross correlation, since it enables synchronization of all the contributing sensors. In practice, one must compute the estimated TDOAs for each pair of sensors *n* and *m* from signals *xn*(t) and *xm*(t) measured at the corresponding sonobuoys. In fact, the cross correlation is computed from the cross-power spectral density of the data sequences acquired at each sensor, rather than using the conventional correlation formalism. Moreover, in order to sharpen the correlation peak the generalized cross correlation paradigm is adopted, where a frequency weighting filter is included prior to taking the inverse Fourier transform of the cross-power spectrum. These simulations are performed using synthetic sensor data, which show excellent agreement with analytically computed TDOAs.

Student Name:	**Shana L. Woods**
School Student Attends:	Alabama A&M University
Name(s) of Mentor(s):	**Dr. Jacob Barhen**
Division:	Computing & Computational Sciences
Program:	Research Alliance in Math and Science (RAMS)