Project Topic:
Underwater Acoustic Communication

Team Members:
Paul Krusell, Joseph Lee, and Bryan Werth

Project Description:
      We want to implement an underwater acoustic communication system in which data is modulated (probably via differential PSK) before being played through an underwater transducer and received by a hydrophone. We will then use MATLAB to interpret the recorded audio from the hydrophone. One of the most interesting parts of this project will be the channel equalization. The acoustic channel underwater is so bad that channel equalization is used to reduce inter-symbol interference rather than optimize for symbol rate. This equalization is typically implemented using some form of adaptive algorithm to estimate the frequency response of the channel and then adjusting the parameters of the system accordingly. For this project we plan to implement a Least Mean Square or LMS adaptive algorithm. We have a lot of options for possible extensions/stretch goals of this project including implementing error correction algorithms, exploring multiple approaches to channel equalization, exploring other adaptive algorithms, and exploring the tradeoffs between different modulation schemes for underwater acoustic communication. At a minimum, we can implement an over-the-air acoustic communication system to reduce the challenges associated with having an echoey/noisy/messy channel. We are targeting a bit error rate less than 10^{-2}. Obviously we will try for as high of a bit rate as we can, but because of the massive variability involved in the channel (and in reported bit rates in literature), we are not giving ourselves an explicit bit rate goal.