OCE 311 Acoustics Laboratory (Extra Credit)

All of the laboratory measurements are carried out in the Acoustics Tank in Middleton Laboratory. Each team will carry out the measurements independently on a schedule to be determined. See TA Jon Merrill to schedule the measurements time. Links to data sheets and manuals have been provided for your information. Feel free to download them to your computer but please do not print them out on the department printers.

1. Beam Pattern Measurement

a. Equipment Used:

You will measure the beam pattern of the NAVMAN 2100 Depthsounder in the port-starboard orientation. The operations manual for the device can be found at http://www.oce.uri.edu/oce311.

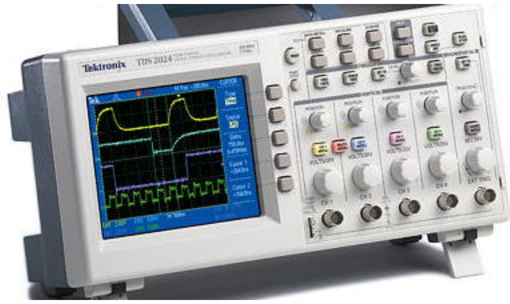
In this component of the laboratory assignment, you will a receive transducer (International Transducer Corporation Model ITC-1042), see http://oce.uri.edu/oce311 for the specification sheets)

ITC-1042 

Stanford Research Systems SR-560 Low-Noise Preamplifier

See http://www.thinksrs.com/downloads/PDFs/Catalog/SR560c.pdf or a data sheet and http://www.thinksrs.com/downloads/PDFs/Manuals/SR560m.pdf for a manual.

Tektronix TDS 2014 Digital Oscilloscope



See http://www.oce.uri.edu/oce311 for a manual.

See http://www.esssales.com/elenco/voltage-supplies.html for specifications.

c. Experimental Setup: NAVMAN 2100, 1042 Transducer, Pre-amplifier, and Oscilloscope

i. Confirm that the NAVMAN 2100 Depthsounder (mounted on the rotating transducer pole) is placed at a depth of about 6 ft. Confirm that the 1042 transducer is in the acoustic tank with a separation of 1-3 meters. Confirm the orientation of the transducer (bow direction is pointing up).

ii. Verify that the 1042 transducer BNC output to the Channel A input of the Preamplifier and connect the output of the pre-amplifier to channel 2 of the oscilloscope. Set the Preamplifier to 100. Set the high pass filter to 10 kHz and the lowpass filter cutoff to 300 kHz. Gain mode should be High Dynamic Reserve.

iii. Verify that the attenuator box is in series with the NAVMAN cable and 100:1 output is connected to channel 1 of the oscilloscope.

iv. Confirm that the Elenco DC Power Supply is off and disconnected from the NAVMAN. Turn on the DC Power Supply and verify that the DC voltage is set to 12 Volts. Connect the NAVMAN 2100 to the Elenco DC Power Supply. Confirm that the NAVMAN depth gauge is lit and producing reasonable depth (horizontal distance in our case because of the mount).

v. On the oscilloscope, push TRIG MENU and then select AC for Coupling, Source is CH1, Type is Edge, Slope is Rising, and Mode is Normal. You should see 350 μs long and amplitude of about 6 V peak-to-peak. Record the average value of the voltage in the middle of the ping on channel 2. It may be varying slightly but don't worry about that. Using the Remote Control Unit find the maximum value of the ping on the oscilloscope. The distance from the depthsounder transducer to the hydrophone should be indicated on the display. Record that distance. (The cable is a fairly good target and the sonar interprets the reflected signal as the bottom.)

vi. Using the Remote Control Unit, vary the angle between the normal to the NAVMAN transducer face and the direction of the 1042 hydrophone. Record the average of the middle of the ping every 5 degrees or less from -90 to 90 degrees with respect to the maximum response axis (MRA).

d. Data Analysis:

i. Compute the source level of the NAVMAN transducer in dB re 1 μPa @ 1m from the data in section 1.c.v the distance between the transducer and the hydrophone. Be sure to convert your data from 0-peak or peak-to-peak voltage to rms voltage.

ii. Compute the beam pattern of the NAVMAN transducer. Compare this beam pattern to that computed from an ideal rectangular weighted 1-dimentional aperture of the same width as the NAVMAN transducer. Plot the beam pattern in dB reference to the peak (The highest value should be 0 dB; you can achieve this by dividing the voltages values measured from the scope by the maximum value and then taking 20log the normalized values). Compute the 3 dB beamwidth of the NAVMAN, how does this compare to the theoretical value for the size of the aperture. Compute the amplitude in dB of the first sidelobe and compare to theory for the rectangularly-windowed aperture function.