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Multibeam sonar calibration techniques

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The acoustic calibration facility at the University of New Hampshire's Chase Ocean Engineering Laboratory has been used to calibrate several transducer arrays from multibeam sonars that operate at 100 kHz and above. In each case, we mount the transducer array on a rotating column and measure the array's transmit and receive characteristics with a reference transducers leased from the Naval Undersea Warfare Center, Newport RI. Our rotation angles are known to within 0.2° and our acoustic calibration measurements are repeatable to within 0.5 dB. After adjusting for measured impedance mismatches between the elements of the array, we determine the actual element separation as the ratio of physical spacing over acoustic wavelength, and we use this result to estimate the beam pointing accuracy of the sonar. The beamforming gain is then estimated for all beam directions from broadside to the full range of steering angles used by the sonar. This work is motivated by research efforts to obtain calibrated acoustic backscatter measurements from multibeam echo-sounder that are used for seafloor characterization applications or for detection and identification of targets in the water column.