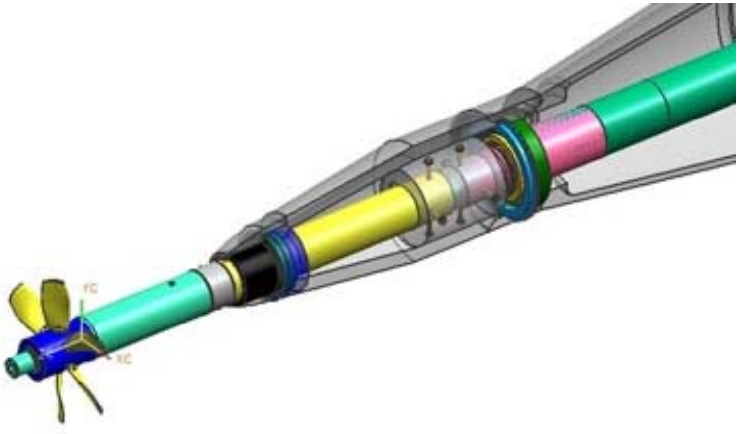
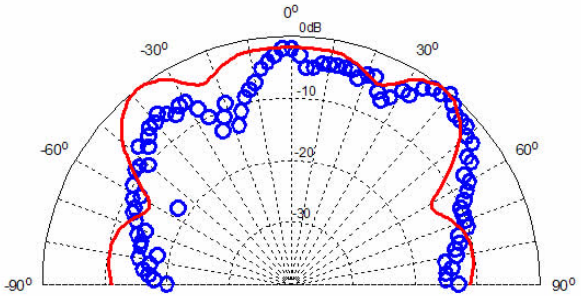
Penn State University Applied Research Laboratory
Unsteady Force Measurement through Dynamometry for Fatigue and Noise and Direct Noise Measurement

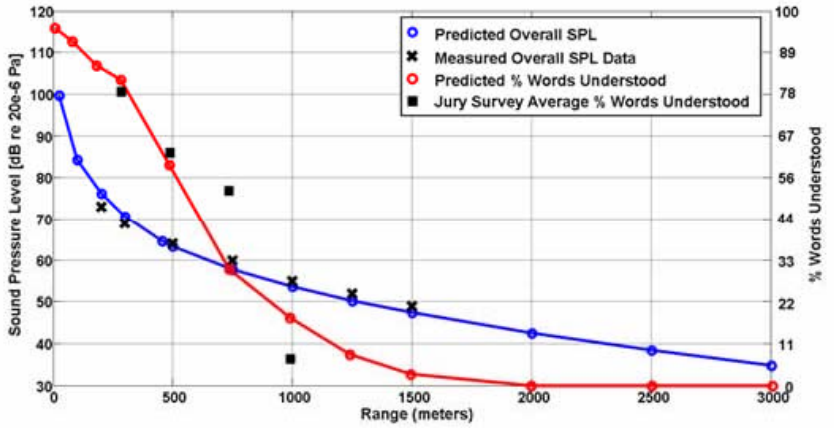
•Turbomachines, like propellers and pumps, make noise when they operate. The tonal noise generally comes from upstream spatial non-uniformities whereas broadband noise comes from upstream turbulence. Narrow band tones and broad-band are measured in ARL's state of the art water tunnel and wind tunnel test facilities. These low frequency noise measurements of turbomachinery in typical laboratory or industrial turbomachinery environments are often difficult, but the unsteady turbomachinery force measurement often provides the best means for determining the aerodynamic forcing function driving the radiated noise.
•Piezoelectric force gages and accelerometers are utilized to quantify both rotating and stationary force and moments. The figure below shows the typical unsteady force measurement configuration with our Downstream Dynamometer.



Example of a lateral directivity plot of a long range sound projector. The Blue circles are measured directivity and the red line is predicted directivity



Example measurements on a long range sound projector. Compared are predicted and measured results for both overall unweighted SPL and percent words understood by a listener in the presence of standardized background noise.



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