ACOUSTICS2008/2871
Modified amplitude and strouhal number scaling for correction of turbulent wall pressure fluctuations

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Pressure fluctuations were measured in an external turbulent boundary layer over a buoyantly propelled axisymmetric body of revolution. Data were measured for three cases, resulting in axial length Reynolds numbers of 6.88x10 , 4.27x10 , and 3.21x10 at the measurement locations. The fresh water measurements were made in a fully developed turbulent boundary layer, following natural transition, with a near zero (very mildly adverse) pressure gradient. The salt water measurements were made in a favorable pressure gradient following a flow trip to force transition. The momentum thickness Reynolds number was greater than 4400 for all measurements, and the data were scaled with outer variables.

The turbulence data were corrected using Corcos correction factors and then further scaled in both amplitude and frequency by the square root of (transducer radius/displacement thickness), in an attempt to resolve spatial resolution effects. This resulted in excellent agreement among the spectra to a modified Strouhal number of 1, which was the range of validity for the data. A second data set(constant freestream velocity and increasing displacement thickness with downstream measurement location), scaled somewhat better with the ratio of transducer radius to displacement thickness.