Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

The Implosion of Cylindrical Shell Structures in a High-Pressure Water Environment[1] C. IKEDA, C. ROTHER, J.H. DUNCAN, Department of Mechanical Engineering, University of Maryland — The implosion of gas-filled cylindrical shell structures was studied experimentally in a nearly spherical tank with a nominal internal diameter of 1.77 m. Models were made from two brass tubes with diameters of 1.67 cm and 2.54 cm (D) and wall thicknesses of 0.34 mm. The models were sealed with end caps and the lengths of the models were chosen to achieve the same internal volume (V) and implosion pressure (P_a), and, therefore, the same available energy (P_aV). Underwater blast sensors recorded dynamic pressure waves at 13 positions in the tank and a high-speed movie camera recorded the implosions. For both models, P_a was about 31.5 bar, while the small- and large-diameter cylinders imploded with mode two and three cross-sectional shapes, respectively. The dynamic pressure signals decrease when the implosion begins and then reach a sharp positive peak when the walls of the cylinder collide. The implosion times (Δt) when divided by the time scale for the implosion of a bubble ($T_b = 0.5\mathrm{D}(\ \rho\ /P_a)^{0.5}$ where ρ is the water density) for the small- and large-diameter models were similar, 1.57 and 1.66, respectively. However, the dimensionless peak pressures ($P_{max}/(P_a - P_{atm})$) were quite different, 0.345 and 0.166, respectively, for these models.

[1]Supported by the Office of Naval Research under grant N000140410701.

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Date submitted: 04 Aug 2008 Electronic form version 1.4