Strong variability of sonic boom due to the atmospheric turbulence is known since the first test flight recordings in the 60’s. To simulate this, a laboratory scale experiment is conducted with ultrasonic shock waves in water at 1 MHz. The experiment is designed for an optimal 1:100,000 scaling with sonic boom. It includes single or multiple heterogeneities of varying sizes but comparable to the acoustical wavelength. Its deterministic aspect allows detailed comparisons with the results of a numerical model based on a nonlinear wide angle parabolic approximation. The experiments show the following features of the shock wave propagation: wavefront folding, local amplification (acoustical lens effect), increase of the rise time, strong variability of the time waveforms. All these features are in qualitative agreement with sonic boom observations. They are observed for a single heterogeneity provided this one is sufficiently large, but are amplified in case of multiple heterogeneities. Comparisons with results of numerical simulations show good agreement in various configurations. Improvements provided by the wide angle approach with respect to the standard parabolic approximation will also be discussed. Preliminary simulations for N wave propagation in a randomly heterogeneous medium will finally be presented.