Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

High Resolution Direct Numerical Simulations of Compressible Isotropic Turbulence MARK PETERSEN, DANIEL LIVESCU, JAMALUDIN MOHD-YUSOF, SUMNER DEAN, Los Alamos National Laboratory — We present results from a systematic study of Direct Numerical Simulations of forced compressible turbulence. The simulations explore the M_t–χ parameter space where M_t, the turbulent Mach number, varies from 0.02–0.6, and χ, the ratio of dilatational to solenoidal energy, varies from 0.01–10, on up to 1024^3 meshes, with maximum Taylor Reynolds numbers of $R_\lambda > 300$. Thus, the study covers the weakly to moderate compressibility effects regime as reflected in the turbulent Mach number values, as well as the low to strong dilatational effects regime that may arise independently from the Mach number effects, e.g. due to exothermic reactions. The forcing method is designed to control the statistically stationary state values of the dissipation (thus the Kolmogorov scale) and the ratio of dilatational to solenoidal dissipation. This ensures that the simulations are both stable and well resolved. The DNS results are used to examine the spectral properties of the solenoidal and dilatational velocity fields and highlight changes in the turbulence properties due to compressibility and dilatational effects.

Mark Petersen
Los Alamos National Laboratory

Date submitted: 07 Aug 2009 Electronic form version 1.4