DNS OF PRESSURE FLUCTUATIONS INDUCED BY SUPersonic TURBULENT BOUNDARY LAYERS

Research Challenge
To advance fundamental understanding of the generic statistical and spectral features of boundary-layer-induced pressure fluctuations in wall-bounded turbulence, including the freestream acoustic radiation at supersonic speeds and their dependence on boundary-layer parameters such as the Reynolds number.

Methods & Codes
Direct Numerical Simulations that solve the compressible Navier-Stokes equations are conducted using an in-house, high-order finite-difference called HyperWENO (Weighted, Essentially Non-Oscillatory).

Results & Impact
A better understanding of pressure fluctuations is an important aspect of vibrational loading and potentially damaging effects of fatigue and flutter in aircraft. From a theoretical point of view, pressure is of fundamental importance to understanding the turbulent vorticity dynamics and to modeling the pressure-strain terms in the Reynolds stress closure.

Why Blue Waters
Computational demands increase with Reynolds Number, and the proposed research wishes to extend understanding into the regime of higher Reynolds Numbers, using extremely fine meshes and a large number of time steps.