Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Toward Uncertainty Quantification in Turbulent Boundary Layer Shock Interactions GIANLUCA IACCARINO, Stanford University — The prediction of the interaction between shocks and turbulent boundary layers remains a challenge in computational fluid dynamics. The overall wall pressure and skin friction are typically misrepresented by conventional Reynolds-averaged approaches. Many modifications have been introduced to overcome model limitations: near wall behavior, turbulence anisotropy, response to compression, unsteadiness have been all identified as fundamental motivations for the incorrect predictions. This work attempts to clarify the relative importance of the various sources of errors in conventional two-equation turbulence models by introducing the concept of physics sensors. The first step is to determine the limitations of the various assumptions used in the model formulation. As an example the turbulence production across a shock is initially considered. It is well known that conventional models over predict the kinetic energy amplification. A sensor identifies the shock location and the turbulence production is locally modified by introducing a random variable representing the uncertainty is the precise amplification rate. Similarly the effect of turbulence anisotropy and near-wall treatment is considered. The corresponding stochastic problem is solved using a Monte Carlo technique and the solution envelope is compared to experimental data for the transonic flow over a bump.

Gianluca Iaccarino
Stanford University

Date submitted: 03 Aug 2008 Electronic form version 1.4