Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Uncertainty Quantification for RANS Turbulence Model Predictions[1] TODD OLIVER, ROBERT MOSER, The University of Texas — We examine the application of a Bayesian uncertainty quantification (UQ) framework to Reynolds-averaged Navier-Stokes (RANS) turbulence model predictions. The UQ framework involves the solution of a statistical inverse problem, where probability density functions (pdfs) for the parameters of a chosen stochastic model are calibrated, and a statistical forward problem, where the uncertainty represented by the calibrated pdfs is propagated through the model to the quantity of interest (QoI). In the context of RANS models, which are deterministic, a significant challenge is the development of an appropriate stochastic extension of the deterministic physical model. This stochastic extension is required to enable the model structural uncertainty—i.e., the uncertainty in the form of the physical model—to be represented in the inverse problem and properly propagated in the forward problem. Multiple possible formulations of a stochastic extension of popular RANS models will be discussed, and preliminary results in modeling turbulent boundary layers will be shown.

[1]This work is supported by the Department of Energy [National Nuclear Security Administration] under Award Number [DE-FC52-08NA28615].

Robert Moser
The University of Texas

Date submitted: 07 Aug 2009 Electronic form version 1.4