Preface

The eleventh biennial Summer Program of the Center for Turbulence Research was held during the period July 9th-August 4th, 2006. The number of participants continues to increase significantly from previous programs; this year there were 63 participants from ten countries. As in the past, the participants were selected based on their research proposals and the scientific interests at CTR. There has been considerable emphasis recently at CTR on prediction of complex multi-physics effects in turbulent flows, and this was clearly reflected in the technical venue of the 2006 Program.

This Proceedings volume contains 45 papers which were divided into six groups: Predictive Science, Multiphase Flows, Combustion, Magnetohydrodynamics, Flow Control and Acoustics. Brief summaries of the accomplishments of each group are provided in the overviews that precede the grouped papers. The first group of papers encompass several elements of the interdisciplinary field of Predictive Science including numerical analysis and verification of numerical accuracy, filtering in complex grids, subgrid scale modeling, generation and post-processing of DNS data for studying complex effects such as radiation and hypersonic transition, and multi-code and multi-physics integration for simulation of complex systems. Most of the projects in the Multiphase group were motivated by applications in turbulent combustion where liquid fuel is atomized and vaporized leading to chemical reactions. Of special interest was evaluation of Lagrangian and Eulerian numerical strategies for tracking particles or liquid drops in gaseous flows. The projects in the Combustion group included improved modeling of premixed combustion and combustion instabilities which are important in industrial burners, modeling detailed chemical kinetics which continues to be a pacing item in computational combustion, and prediction of soot formation, which is crucial for understanding and modeling of fires. The Magnetohydrodynamics group reports on fundamental studies of MHD such as dispersion of particles in MHD turbulence and control of turbulence with magnetic fields with application to material processing, MHD effects in nature and applications of MHD in, for example, fusion reactors. The Flow Control group took advantage of the recently developed numerical technology at CTR to study separation control and turbulence suppression using synthetic jet actuators. The Acoustics group focused on acoustics in complex flow configurations with a special emphasis on combustion related noise in gas turbine engines and fan noise.

One of the important traditions of the CTR Summer Programs are the weekly tutorials delivered by invited speakers. This year four tutorials were given in the general theme of the Summer Program, predictive science and complex effects in turbulence: *Radiation Hydrodynamics* (J. Castor), *Reentry Aerothermodynamics* (M. Wright), *Uncertainty, Sensitivity and Validation* (S. Ferson), and *Two-Phase Flow* (M. Herrmann). The final presentations of research accomplishments were attended by a number of colleagues from universities, NASA, DOE laboratories and industry. Early reports on some of the projects were presented at the 59th Annual Meeting of the Fluid Dynamics Division of the American Physical Society in Tampa, Florida, November 19-21, 2006.

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