CENTER FOR FLUID MECHANICS
AND
THE FLUIDS, THERMAL AND CHEMICAL PROCESSES GROUP
OF
THE DIVISION OF ENGINEERING
SEMINAR SERIES

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Lessons from Six years in the Desert

Most practical flows in engineering take place at very high Reynolds number, while most existing scaling laws for wall-bounded turbulence are based on data obtained at low to moderate Reynolds numbers. Consequently, a long-standing challenge has been to understand if and how the scaling laws and fundamental mechanisms in wall-bounded turbulent flows change with increasing Reynolds number. Towards this aim, experiments have been conducted over the past six years in the near-neutral atmospheric surface layer at the SLTEST facility in Utah's western desert. Combined with complementary multi-plane PIV, and arrays of hot-wire anemometers in laboratory wind-tunnel facilities, instantaneous and statistically averaged quantities are compared over three orders of magnitude change in Reynolds number. Laboratory facilities include those at the University of Minnesota, and the high Reynolds number wind tunnel at the University of Melbourne, Australia.

The experiments show strong evidence for an increased influence, with increasing Reynolds number, of outer-scaled motions on the near-wall inner-scaled region, which is contrary to that predicted by classic scaling laws. Moreover, the outer-scaled motions are found to be dominated by very long streamwise structures, termed "superstructures". Their role and influence in turbulent boundary layers will be discussed.

TUESDAY – NOVEMBER 7, 2006
Barus & Holley, Room 190
3:00 pm