



THE UNIVERSITY OF
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Melbourne School of Engineering Dean's Seminar Series

SEMINAR SERIES 2011

Professor Joe Klewicki

Department of Mechanical Engineering
The University of Melbourne

Tuesday 31st May, 3pm

Brown Theatre

Ground floor, Building 193
Electrical Engineering

Parkville

The Scientific Importance and Technological Challenges of High Reynolds Number Turbulent Boundary Layers.

MORE INFORMATION

For more Mechanical Engineering seminar
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The dynamics associated with the flow of fluids (such as air and water) in the immediate vicinity of a solid surface is of immense scientific and technological importance. When the flow is of sufficiently high speed, or develops a sufficient fetch along the surface, it undergoes instabilities leading to a chaotic turbulent state. The turbulent flow near a solid surface is generically called a turbulent boundary layer. This talk first provides a brief overview of the energy, environmental, and device performance applications that are critically dependent on turbulent boundary layers. More specifically, we focus on the class of flows in the high Reynolds number regime. Examples of high Reynolds number turbulent boundary layers are the atmospheric flow over the surface of the earth or at the air-sea interface, the flow of sea water over a submarine or the flow of air over a commercial airliner. Owing to the importance of the science and technologies associated with such flows, there is a strong need to understand their dynamics more fully, and in particular, more reliably characterize how these dynamics change with Reynolds number. The Reynolds number scaling problem is briefly outlined, and recent theoretical efforts aimed at addressing this problem are described. Theory validation and refinement, however, requires high accuracy data, of increasingly higher order quantities, in the relevant flow regime. Obtaining such data under controlled laboratory conditions has proven to be a daunting challenge. The primary technical issues underlying, and the means for overcoming, this challenge are described. "Solutions" to probing the details of the high Reynolds number turbulent boundary layer are discussed relative to specialized facilities and miniaturized sensors. Efforts pertaining to the development of these sensors and facilities are discussed.