Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Osborne Reynolds' pipe flow: Direct computation from laminar through bypass transition to fully-developed turbulence XIAOHUA WU, Royal Military College of Canada, PARVIZ MOIN, Stanford University, RONALD ADRIAN, JON BALTZER, Arizona State University, JEAN-PIERRE HICKEY, Royal Military College of Canada — The most fundamental internal flow, smooth pipe from a slightly perturbed laminar inlet state continuously through bypass transition to fully-developed turbulence, has been computed using DNS over an axial domain length of 250 pipe radii. In the fully-developed turbulent region, mean and second-order turbulent statistics including the rate of viscous dissipation show excellent agreement with those obtained from an additional simulation using the conventional streamwise periodic boundary condition over an axial domain length of 30 pipe radii. Friction factor follows analytical solution prior to breakdown, and agrees with Moody's correlation after the completion of transition. During transition it exhibits an overshoot. Breakdown of the laminar pipe flow is characterized by the formation of large Lambda-shaped vortices pointing upstream, followed by their subsequent generation of small hairpin packets inclined towards the downstream direction.

Xiaohua Wu
Royal Military College of Canada

Date submitted: 03 Aug 2012 Electronic form version 1.4