Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

LES of the vortex wake developing behind a wing, also with initial velocity deficit due to friction drag[1] TIMOTHEE LONFILS, CEDRIC COTTIN, GREGOIRE WINCKELMANS, ROGER COCLE, UCL, Louvain School of Engineering (EPL) — LES of vortex wakes behind a wing with elliptical loading and at very high *Re* are presented. The efficient combination of the Vortex-In-Cell and the Parallel Fast Multipole methods is used (Cocle et al., J. Comput. Phys., in press). A realistic near wake model is used, taking into account both the induced drag (vortex sheet) and the friction drag (momentum deficit due to boundary layers). Most methods can usually only afford time-developing (T-D) simulations (i.e., assuming periodicity in axial direction). To quantify the relevance, or not, of such simplification, space-developing (S-D) simulations were also performed, down to ten wingspans. For both cases, short wavelength instabilities rapidly develop in the wake center part, due to the momentum deficit, and the flow rapidly becomes turbulent. Surrounding the rolling-up vortices, helical instabilities also grow and deform them. Yet, the two formed far wake vortices remain tight (small core) and with a significant residual axial velocity deficit in the core region (order of the max azimuthal velocity). In the S-D case, the deficit is further enhanced, due to the complex spiral roll-up; moreover, the flow becomes turbulent faster.

[1]T. Lonfils is supported by the FRIA of Belgium.

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Date submitted: 04 Aug 2008 Electronic form version 1.4