Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Large-eddy simulations of a propelled submarine model[1] ANTONIO POSA, ELIAS BALARAS, The George Washington University — The influence of the propeller on the wake as well as the evolution of the turbulent boundary layers over an appended notional submarine geometry (DARPA SUBOFF) is reported. The present approach utilizes a wall-resolved LES, coupled with an immersed boundary formulation, to simulate the flow model scale Reynolds numbers ($Re = 1.2e+06$, based on the free-stream velocity and the length of the body). Cylindrical coordinates are adopted, and the computational grid is composed of 3.5 billion nodes. Our approach has been validated on the appended submarine body in towed conditions (without propeller), by comparisons to wind tunnel experiments in the literature. The comparison with the towed configuration shows profound modifications in the boundary layer over the stern surface, due to flow acceleration, with higher values of turbulent kinetic energy in the inner layer and lower values in the outer layer. This behavior was found tied to a different topology of the coherent structures between propelled and towed cases. The wake is also highly affected, and the momentum deficit displays a non-monotonic evolution downstream. An axial peak of turbulent kinetic energy replaces the bimodal distribution of the stresses in the wake, observed in the towed configuration.

[1]Supported by ONR Grant N000141110455, monitored by Dr. Ki-Han Kim

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Date submitted: 31 Jul 2015 Electronic form version 1.4