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Large eddy simulation of flow over axisymmetric hull at high Reynolds numbers[1] PRAVEEN KUMAR, WYATT HORNE, KRISHNAN MAHESH, Aerospace Engineering and Mechanics, University of Minnesota — Wall-modeled large eddy simulation is performed for flow over an axisymmetric hull geometry at Reynolds numbers (Re) of 1.1, 12 and 67 million, based on hull length and freestream velocity. The domain is chosen to minimize confinement effects and to capture the evolution of the turbulent wake. The no-slip wall boundary condition is replaced by a prescribed stress boundary condition (wall model) to alleviate stringent near-wall resolution requirements at high Re. The prescribed stress is obtained assuming that the near-wall streamwise velocity field satisfies Reichardts law. The boundary layer is tripped on the bow region of the hull to make it turbulent, similar to the experiment and the wall model is active throughout the hull, post-tripping. Simulations are performed using two grids, with nominal wall-normal grid resolution of 8 and 16 points respectively per boundary layer thickness in the mid-hull region. The predictive capability of the employed wall model is assessed using available data for the pressure and skin-friction coefficients on the hull, as well as the velocity profiles in stern and wake regions.

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